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How Can Safety Nets Contribute to Economic Growth?

Harold Alderman and Ruslan Yemtsov

The paper provides an up-to-date and selective review of the literature on how social safety nets contribute to growth. The evidence is carefully chosen to show how safety nets have the potential to overcome constraints on growth linked to market failures, and is organized into four distinct pathways: i) encouraging asset accumulation by changing incentives and by addressing imperfections in financial markets caused by constraints in obtaining credit, and from information asymmetries; overcoming such failures helps households to invest into their human capital or productive assets; ii) failures in insurance markets especially in low income setting; safety nets are assisting in managing risk both ex post and ex ante; iii) safety nets are overcoming failure to create assets and other local economy complementary factors to household-level investments; iv) safety nets are shown to relax political constraints on policy. Safety nets have a dual objective of directly alleviating poverty through transfers to the poor and of triggering higher growth for the poor. However, the trade-off between the dual objectives of equity and growth is not eliminated by the potential for productive safety nets; this remains critical for designing social policies. JEL codes: I38, O12, O15, H53, P46

Experience has taught that when they are well designed, safety nets (SN) can both redistribute the gains from growth and, at the same time, contribute to higher economic growth. The various channels by which SNs influence growth can be broadly classified into four pathways: i) safety nets enable households to make better investments in their future addressing some of the imperfections in markets caused by constraints in obtaining credit, inputs, and insurance, and from information asymmetries as well as by changing incentives to invest in human capital of children; ii) assisting in managing risk; safety nets help households manage risk both ex post and ex ante; iii) creation of community assets and iv) relaxing political constraints on policy. As such, growth can be achieved both by increasing the efficiency of private and public resource allocation in the

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short run and by encouraging additional investments in physical and human capital achieving returns that may be realized over decades.

The role of safety nets, defined here as non-contributory transfers generally targeted to the poor, in addressing inequality by raising the consumption of beneficiaries is well known and is largely a function of targeting efficiency as well as the impact of receipt of public transfers on private remittances and on labor supply. While there is ample heterogeneity in both coverage and generosity of safety nets globally (Grosh et al. 2008; Monchuk 2013), they can contribute substantially to the resources of the beneficiaries. For example, Mexico’s oft studied cash transfer covered nearly a quarter of the population and provided an average increment of 20 percent over pre-transfer income to beneficiaries for an outlay of less than 0.5 percent of GNP in 2006 (Fiszbein and Schady). The potential to affect the lives of the poor then is widely documented; one decade into the 21st century, between 0.75 and 1.0 billion people in low- and middle-income countries were receiving cash support from their governments (DFID, 2011). There is less known about the contribution of SN to growth. Evidence is, however, rapidly accumulating and as it goes directly to the motivation of governments to allocate funding, this paper presents examples of the various means by which transfers can promote economic growth organized around the four broad pathways mentioned above. The goal is to illustrate ‘how’ growth may be enhanced, rather than to measure ‘how much’ a given instrument has achieved overall or in a specific context. We focus particularly on cash transfers and public works designed primarily as a means to increase the earnings of low income individuals. These are by no means the only instruments that governments use to address equity while encouraging investments - direct price subsidies to schooling and health come to mind – but the main point of this are easily extrapolated to these additional components of a broader social policy strategy.

This evidence supports the view that transfers are not merely a means to reduce current poverty as measured by consumption but also a potential means to invest for future poverty reduction. Such investments, of course, have costs,

1. This paper covers a very different set of studies compared to a paper on a similar topic by Barrientos (2012); most of these additional studies have just been published or are forthcoming; this shows how dynamic this area of research is.

2. These are presented to illustrate prospective pathways; the paper is not a comprehensive review of any instruments such as offered by Fiszbein and Schady (2009) for conditional cash transfers. This paper also does not aim to discuss the administrative details of an effective program, such as addressing the efficiency of targeting.

3. The World Bank’s recent Social Protection Strategy (World Bank, 2012) places safety nets as part of a system that also includes contributory social insurance and labor market programs that jointly address three goals, resilience, equity, and opportunity. See also, Alderman and Yemtsov (2012). There is not, however, a one to one mapping between these approaches and the goals; safety nets have the potential to contribute to realizing each of these, although most effectively as part of a system. In a like manner, Devereux and Sabates-Wheeler (2004) envision social protection as achieving four functions: protection, prevention, promotion and transformation. Relatively little is gained from compartmentalizing these or to assigning a single function to each social protection instrument.
both in terms of the fiscal and deadweight costs of financing them and the potential for disincentives for labor force participation. But many of these costs accrue in the course of designing any targeted poverty program and are widely recognized. The assets created, by these transfer programs, however, are more recently acknowledged. Thus, safety nets fit appropriately within the larger category of pro-poor growth.

I. SAFETY NETS AND HOUSEHOLD INVESTMENTS

Transfers can offset missing credit markets. This is particularly helpful in regards to health and education as credit for such investments is rarely available but even in the case of agriculture where credit is, in principle, available SN may encourage the purchase of inputs. For example, following the introduction of the North American Free Trade Agreement (NAFTA) Mexico introduced a transfer program, Procampo, a targeted program designed to compensate farmers when subsidies were removed as part of trade reforms. Sadoulet, de Janvry, and Davis (2001) estimate that by relaxing liquidity constraints the transfers which averaged roughly 8 percent of the average household income of recipients led to a net increase of income that was nearly twice the value of the transfer. In a different context Ardington, Case, and Hosegood (2009) show that South African households in which a member receives an old age pension – in this particular example, one that is not financed from past contributions – use a share of the funds to finance migration and job search.4

Gertler, Martinez and Rubio-Codina (2012) confirm that poor households save out of SN transfers using experimental evidence, also from Mexico. This study based on the initial randomized evaluations of the conditional cash transfer program, Progresa (now called Oportunidades), found that the beneficiaries of the transfers invested 26 percent of the cash received, increasing the value of animals owned as well as participation in micro-enterprises. The propensity to save observed in this study was consistent with a wider literature on saving rates among poor households, but offers a particular insight in that it confronts the presumption that SN are mainly used for current consumption. Similarly, a recent paper based on a carefully designed survey to evaluate Ethiopia’s Productive Safety Net Programme (PSNP), Berhane et al. (2011) find a persistent increase of livestock ownership as well as other assets among program participants.

Additionally, SNs are often designed to shift incentives, thus adding an additional spur to investments that goes beyond the relaxation of a credit constraint. This is motivated, in part, by the assumption that poor households under invest

4. In a related observation, Hoddinott et al. (2012) find that recipients of public works transfers in Ethiopia benefited more from other programs to enhance production than those who were only in the latter.
relative to a social optimum. This might be the case if there are information asymmetries\(^5\) or if there is a principal-agent problem in which the investor has a different incentive than the potential beneficiary as may be the case with girls who will leave the natal household (Das, Do, Ozler, 2005).\(^6\) This issue was raised in the first generation of conditional cash transfers (CCTs) (Fiszbein and Schady, 2009). But the objective in changing incentives may also reflect clear social externalities as with contagious illnesses; the recent generation of conditions for CCTs (at least at the pilot level) goes to a rather wide range of actions being incentivized including some health behaviors (preventing HIV/AIDS and sexually transmitted infections).

CCTs and school feeding programs are two of the best known transfer programs explicitly aimed at reducing the costs of investments to a household.\(^7\) There is evidence that even ‘soft’ conditions – actions that are advised as part of co-responsibility but which are not directly tracked to determine payments – can enhance the investments from these transfer programs relative to the impact of income in general. Still, firmer conditions to promote health seeking behaviors – those that both monitor and enforce compliance – should, in principle, have an additional impact. This is not based on a patronizing view that the poor do not know how to spend their money wisely as occasionally depicted. Rather, this comes from a simple expectation that lowering a price of a service increases the use of that service more than does an equivalent income transfer. But, the record keeping that provides a timely flow of information from the service providers to the registers for payment requires a smoothly running system. As it is not easy to set up such a system, especially for health care since it occurs on a less regular schedule than does schooling, a key question when choosing between a conditional and an unconditional transfer (UCT), then, is whether these expected gains are worth the appreciable costs of monitoring.

While there have been a number of studies quantifying the share of increased income that poor households devote to investments for their children, in effect paralleling the question addressed by Gertler, Martinez and Rubio-Codina,\(^8\) a

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5. The ability of fertilizer subsidies such as those in Malawi to increase profits for farmers is attributed to offsetting knowledge gaps as well as relaxing credit constraints. Recently, however, Duflo, Kremer, and Robinson (2011) have challenged these explanations for low use and offer an interpretation in terms of time inconsistency for budgeting and suggest a subsidy policy consistent with this interpretation. Additional evidence on input subsidies is presented by Bardhan and Mookherjee (2011) who show that such subsides were highly profitable in West Bengal, India, although this study did not investigate market failures.

6. Bursztyn and Coffman (2012) interpret the preference for conditional transfers over larger unconditional ones observed in a sample of families in urban Brazil to information asymmetries in the context of different incentives between parents and their children. In this example, parents were well informed about returns to schooling but not able to adequately monitor the behavior of their children. The conditions served as a means to obtain additional information on school attendance.

7. See Alderman and Bundy (2012) for a review of school feeding programs from the perspective of safety nets.

8. See, for example, Behrman and Knowles (1999) on schooling.
key question from the standpoint of SN design is how can a transfer program increase such investments. One issue that is common to both CCTs and UCTs is whether the recipient’s gender matters. This was noted by Duflo (2003), who found that pensions received by women in South Africa had a significant impact on the nutritional status of their grandchildren, while this was not observed for male pensioners. The practical implications of this observation for child development, however, are less than often claimed since only 46 percent of pensioners – either male or female-lived with their grandchildren and the impact was only observed if the woman’s grandchild was a girl. On the other hand, this result does support the view that women and men have different patterns of investment. Akresh, de Walque, and Kazianga (2012a) also find small gender differences in expenditures in randomized trial of CCTs and UTCs in Burkina Faso but caution that there is not a clear case that father’s under invest in children.

The amount of a transfer that is spent on human capital investments can also be enhanced by what is variously termed labeling (Kooreman, 2000) or social marketing. For example, Schady and Rosero (2008) found that household assigned randomly to an UCT, termed a social program, spent more on food than indicated in the expenditure patterns of similar households. It is, however, often difficult to distinguish the social marketing aspect of a transfer from the possibility that women have greater control of such labeled expenditures; Attanasio, Battistin and Mesnard (2012) note that both factors can contribute to the shift in the Engle functions for food they document in Colombia. Similarly, Macours, Schady and Vakis (2012) claim that one or both of these effects contributed to the outcomes in a cash transfer in Nicaragua. In particular, the role of social marketing likely accounts for the fact that impacts on child development did not fade out two years after the transfers ended. Similarly, the fact that households that were not eligible for a CCT in Indonesia also increased their health seeking behavior may also be due to the social marketing that accompanies such programs (World Bank, 2011).

CCTs go beyond labeling or social marketing to the degree that they strictly enforce compliance with conditions. Schady and Araujo (2008) report on a randomized transfer in Ecuador in which beneficiaries were told there was a schooling requirement but the condition was not strictly enforced. Those that believed there were co-responsibilities had higher enrollments than the other cash recipients. De Brauw and Hoddinott (2011) also investigated the additional impact of conditions over the transfer by looking at a subset of beneficiaries of Progresa that did not receive the forms necessary for monitoring program compliance. This group had lower enrollments than other CCT beneficiaries.

Both these studies verify that the differential impacts are not due to self or community selection. Moreover, their conclusions are bolstered by two recent randomized trials designed to test the impact of conditions over a similar unconditioned transfer. In a study of young women in Malawi Baird, McIntosh and Ozler (2011) found that both UCTs and CCTs reduced school dropout after two years but the reduction among UCT recipients was less than half of the reduced...
drop out when the students received CCTs. Akresh, de Walque, and Kazianga (2012b) also found that conditional transfers had a different impact on schooling than unconditioned transfers in a randomized trial in Burkina Faso. However, there results were nuanced in that there were no appreciable differences among core students, that is, among most primary school age children as among well higher ability children. In contrast, CCTs were more effective than UCTs in improving the enrollment of younger children and girls as well as children with lower ability. CCTs also performed better than UCTs in improving attendance and achievement scores.

To summarize this section, low income households use transfer programs to invest as well as to augment consumption. This investment can be enhanced through social marketing as well as by promoting a range of behaviors as a condition for eligibility. Initial studies on CCTs focused on changes in enrolment and health participation, with mixed evidence on the outcomes of this increased participation. More recent programs have broadened the activities to be encouraged – including participating prenatal and preschool programs as well as prevention of sexually transmitted diseases. Newer studies have also broadened the range of research regarding the heterogeneity of impacts and the manner in which programs can be designed. For example, evidence that the schooling response to a small CCT is not that much different than one to a larger CCT (Baird, McIntosh, and Ozler, 2011; Filmer and Schady, 2011) has practical implications as well as provides results that shed light on the role of social marketing. Nevertheless, both CCTs and UCTs are primarily aimed at stimulating demand for investments in health and education; their contribution to asset accumulation depends on the returns to those investments. The increase in demand does not always map to measurable impacts on either learning (Filmer and Schady, 2009) or nutritional status (Ruel and Alderman, 2013). In the latter case, Ruel and Alderman point to issues with the quality of service delivery as well heterogeneity of program beneficiaries; greater benefits have been noted for those who were more malnourished at the outset.9

II. Safety Nets and Risk

The ex ante role for the contribution of safety nets to growth is a fairly standard extension of the costs of income smoothing; risk averse farmers and entrepreneurs under-invest in a risky environment (Binswanger and Rosenzweig, 1993; Christiaensen, and Dercon, 2011; Elbers, Gunning, Kinsey 2007). The potential role for transfers to improve allocative efficiency is largely another aspect of missing or incomplete markets, in this case insurance as well as credit. However, while the potential for addressing this problem directly is attractive, market penetration of agricultural insurance in low income countries is still modest (Mahul

9. The bulk of evidence on CCTs comes from Latin America where undernutrition rates are far lower than in Africa or Asia.
and Stutley, 2010). There are obstacles to insurance stemming from high costs and thus limited interest from private providers and low take-up on the part of farmers. Even when insurance is based on an easily observed rainfall index, thus reducing the well-known problems of moral hazard and asymmetric information that increase the cost of marketing insurance, low income households appear to be reluctant to purchase insurance (Gine, Townsend, and Vickery, 2008).

Mahul and Stutley (2010) point out that subsidies for insurance can enhance market development by making private provision more attractive and achieving scale economies. Subsidies can also assist in making insurance serve a role of safety nets. While Mahul and Stutley (2010) note many improvements in the provision of agricultural insurance in low income settings since Hazell’s 1992 review found that payments far exceeded the premiums collected in many countries, they found that a few countries including India still have loss ratios greater than 100 percent. Given the substantial outlays for subsidies on insurance at least two questions are important. First, how well are subsidies targeted and, second, does insurance influence decisions taken by small farmers. Mahul and Stutley offer evidence on the former, finding that subsidies levels are often capped and occasional explicitly targeted to small and marginal farmers.10 Regarding the response of producers, a recent randomized trial in south India confirms that when provided with rainfall insurance farmers substitute production activities towards more profitable, but riskier, cash crops (Cole, Gine, and Vickery, 2011). Similarly, Cai et al (2010) observe that farmers in China raised more pigs when provided access to insurance. They also note that trust appears to be a limiting factor in take up, a conclusion also supported by field trials in India (Cole et al. 2013).

A safety net that households are able to view in advance as reliable can serve a similar function in allocative strategies as insurance does. However, any such program would likely also address credit constraints. Thus, it is a challenge to design a study that could isolate the specific pathway that contributes to any increased investments that might be observed. Bianchi and Bobba (2012) finesse this problem by comparing the effect of current transfers in Progresa on entrepreneurship with the effect of the amount of transfers expected for the future. They find that the latter has a larger impact on entrepreneurial activity implying that risk, more than liquidity constraints, had previously restricted occupational choices.11

It is somewhat easier to document the ex post role that a safety net can serve to protect household assets after an economic shock. While households employ a

10. This is a distinct approach from the use of index insurance or insurance principles to finance safety nets run at a national or regional level (Alderman and Haque, 2006). Under this approach the payout from insurance goes to an agency and is used to undertake public works or similar SN programs. This has been tried on a pilot basis but with the exception of a municipal drought program in Mexico, the approach has not been implemented as a pillar of national safety net programs.

11. Additionally, a general equilibrium effect of large and reliable safety nets might be a change of aggregate consumption stemming from a reduction in precautionary savings.
range of strategies to smooth consumption in the wake of a setback, informal sharing arrangements tend to fall short for the poor in most circumstances as well as for the general population in times of covariate shocks (Bhattamishra and Barrett, 2010). For example, households cannot draw down liquid savings to meet all circumstances as savings cannot be negative; there are similar limits to credit access. Other strategies such as selling assets when prices are low or reducing investment in nutrition or schooling can contribute to poverty traps (Carter and Barrett, 2006). Some programs that have successfully protect investments have been designed explicitly as a response to shocks such as Indonesia’s scholarship program designed in the wake of the 1997–1998 economic crisis (Cameron, 2009) or that country’s efforts to protect nutrition (Giles and Satriawan, 2010). But other programs that are more broadly designed to address chronic poverty may also protect assets or investments. For example, de Janvry et al. (2006) observe that children in families that received Progresa transfers were less likely to drop out of school should an adult in their family become unemployed. Similarly, beneficiaries of Ethiopia’s PSNP had fewer distress sales and had a statistically larger increase of assets over time (Devereux et al. 2005; Berhane et al. 2011).

While these examples are from poverty targeted programs, Sumarto, Suryahadi, and Pritchett (2007) indicate that a public employment program in Indonesia that was not sharply focused on the poor also served a significant insurance role for households from the middle of the distribution of expenditures or income. They argue that this program served as what they term a safety rope. While a safety net is intended to prevent consumption from falling below a minimum, in contrast, a safety rope is aimed at preventing a proportional loss of income or assets. A safety rope, then, can make a dynamic contribution to poverty prevention in times of crisis.

To recapitulate, poor households often trade off income gains against risk reduction and thus stay below the production possibilities of their assets. Moreover, they sometimes need to sell resources, or forego investments to smooth consumption fluctuations. Governments have attempted to address the absence of accessible insurance by directly providing or subsidizing insurance. The alternative means of insurance though the provision of safety nets has been shown to reduce disinvestment in the light of income shocks, but the contribution towards efficient investments by households depends on the perception of the authorities’ ability to mount prompt and fair response after a shock. There is limited evidence that measures the degree to which efficiency gains are achieved in this manner.

III. SAFETY NETS AND COMMUNITY ASSETS

The most direct contributions to community assets come in the form of outputs from productive public works (Subbarao et al. 2013). In particular, many rural public works contribute to land management, which includes environmental and
agricultural projects involving irrigation, afforestation, soil conservation, and watershed development. The example of PSNP in Ethiopia shows that over time local irrigation projects change the water available for agriculture (Subbarao et al., 2013). Less commonly, a public works project can also provide services that contribute to human resources. For example, the Jefes and Jefas program in Argentina supported child and elderly care, health program support, and community and school kitchens (Kostzer 2008). That program also permitted individuals to obtain training from outside providers as part of their participation, although the impact of this feature has apparently not yet been evaluated. However, while some public works programs seek to directly impart marketable job skills to their participants there is little evidence that this training goal has been achieved. Rwanda also allows participants in its public works to opt to have their wages deposited in a bank account. Their savings record can then be presented to micro-finance in the event that the participant seeks to set up an enterprise when the public works are completed. However, this also has not yet been evaluated.12

Labor intensive public works are not likely to be the most cost effective means to create the desired assets.13 Nevertheless, when non-wage inputs as well as engineering expertise are included in the planning process of a public works program this will enhance their asset creation impacts, but, within a fixed budget, will reduce the share of the program going to the direct beneficiaries as transfers. Whether this shift is justified in terms of the objectives of the transfer program is both an empirical and a policy question. Indeed, it is because public works trade off cost effectiveness in production against income support motives that they can be considered SNs as opposed to a more narrowly defined infrastructure investment. Public asset building in poor areas if properly done provides necessary complementary factor to household investment. Analysis of local economy effects from safety net transfers (as in Davies and Davey 2008 and Taylor et al., 2013 building on earlier work by Lewis and Thorbecke 1992) argues for positive effects on growth through the relaxation of demand constraints. Cash transfers often represent a significant share of household income and can be expected to help households overcome the obstacles that block their access to credit or cash. Households that were previously operating outside the cash economy become consumers with steady demand for goods and services. Transfer recipients become able to purchase daily necessities, assets, and

12. Linking transfers to savings encouragement – as is implicit in some alternative models of CCTs (Barrera-Osorio, 2011) – increases the potential to contribute to growth and blur the assignment of transfers to the category to consumption.

13. It is occasionally argued that in the absence of price distortions favoring capital, more projects would chose labor intensive works. There is limited evidence as to where and at what scale such projects are, given the real costs of managing a work force. We assume that in many circumstances labor intensive projects remain inside the production frontier and that in those circumstances clear trade-offs exist. Coady 2004 provides a detailed review. Adato and Haddad (2002) provide evidence that public works in South Africa have the same management tensions as private sector projects.
livestock from local farmers and businesses. Most importantly, if safety nets are regular they have a stabilizing effect due to consumption smoothing in the face of seasonal and economic cycles. This, in turn, can increase productive and other income-generating investments in local economies.

While the short term effect on growth of such local stimuli is empirically demonstrated in multiple studies, the overall macroeconomic and longer term impact are less clear. First, the liquidity that is injected must come from somewhere as a tax with associated deadweight costs. In the long run the effects will be positive only if economy-wide permanently higher productivity growth is achieved. Otherwise, as noted by Barro (1976), the Ricardian equivalence effect may prevail (whereby households change their behavior in anticipation of future higher taxes to pay for government spending and as a result, offset the short run benefits of fiscal expansionary policies). However, Atkinson (1999) notes that the very existence of a welfare state is due to the imperfections of real world economies. In these second best situations the possibility that a safety net may stimulate a local economy is indeterminate; it may have positive or negative impact on economic performance depending on a host of factors.

Safety nets can overcome constraints on growth stemming from community-level factors, such as poor or absent local infrastructure or scarcity of local liquidity and trade; such effects are believed to be strongest in the case of localized “poverty traps” (Barrientos 2012). Evidence that safety net programs change income growth directly in the affected areas is available for China (Ravallion and Chen 2005) and Mexico (Angelucci and de Georgi 2009) and is being increasingly sought in Africa, East and South Asia. This is clearly one of the “growth poles” in research on safety nets. However, when the focus moves from micro- (household) to meso- (community) level it becomes clear that safety nets provide just an element of a broader development policy effort, and their specific contribution is hard to disentangle, especially when economy-wide effects are taken into consideration.

IV. Political Dimensions

Safety nets facilitate the introduction of beneficial reforms by providing some compensation to offset the costs of these reforms to low income households. Additionally, since safety nets have an immediate impact on inequality and extreme poverty (valued in its own right) they contribute to social cohesion.

One illustration of the contribution that SNs make towards the acceptability of reforms can be found in the timing of the introduction of Procampo in Mexico. This program was introduced in 1994 as the North American Free Trade Agreement (NAFTA) was taking effect. The government recognized that small producers would be affected as domestic prices were reduced to reflect import parity of grain from the United States and Canada. Although based on area planted prior to the program (and thus regressive) Procampo also provided cash to farmers who had previously not had a market surplus and thus were not
beneficiaries of the price supports that had been phased out. Transfers averaged $329 per beneficiary in 1997 and contributed to the political acceptability of NAFTA as well as provided the multipliers via the cash used for inputs (Sadoulet, de Janvry and Davis, 2001).

Similarly, Indonesia was able to reduce fuel subsides by $10B in 2005 without social unrest, in part, because a safety net program was introduced at the same time. Its approach included the inauguration of a targeted unconditional cash transfer program that utilized roughly a quarter of the savings in fuel subsidies. Additionally the government increased block grants to schools, health care and village improvement by an amount similar to the transfer program. Not only did the reform contribute to the government’s overall financial position by providing $5B to general revenues after both these new programs were funded, it contributed to economic efficiency by moving domestic prices for kerosene and gasoline closer to the cost of importing that Indonesia – formerly a net exporter – had been paying (Grosh et al. 2008).

Both NAFTA and Indonesia’s fuel price reforms assisted in aligning domestic prices – in one case for producers and in the other for consumers -closer to the real resource costs and thus were clear contribution to efficient allocation of resources. Other safety net reforms can also be viewed as efficiency enhancing in that they can adapt the social transfer system in a manner that reduces the costs of achieving social ends. The introduction of Progresa served both roles. It facilitated the removal of food subsidies and their inherent distortions of price signals. Moreover, it consolidated various programs in diverse ministries – replacing them, rather than adding to them (Levy, 2006). This transformation of the administrative system is a second best welfare increasing reform – since it reduced the outlay required to meet an existing social goal – but by itself did not directly increase the assets or investments of low income households.

Safety nets may also contribute to growth on a national scale by reducing inequality and by increasing social cohesion (World Bank 2006). If, for example, there is an inequality trap via inequality of opportunity that reduces economic growth, then to the degree that SNs address asset accumulation through programs such as CCTs, fee waivers, or school feeding they can contribute to growth. A different pathway from equity to growth is also postulated, one in which inequality of outcomes influences the path of institutional development and sets up conditions which foster rent seeking. The theoretical underpinnings for this channel were initially formulated by Sala-i-Martin (1997) and later developed further by Mehlum, Moene, and Thorvick (2005) in a model in which positive growth effect is due to the deterrence of investment-reducing crime through safety nets.

Hard empirical evidence for this effect is difficult to come by, but this role for SNs is supported by the observation that safety nets often cultivate social reintegration in post conflict countries (such as Liberia and Sierra Leone), where public works have been offered to disaffected or potentially socially disruptive groups including former soldiers. Similarly, the public works program in El Salvador
(PATI) directly targeted potentially delinquent youth and developed a scheme (combining transfers and training) that increased opportunity cost for participation in criminal activities (Subbarao et al. 2013).

There is less evidence on these potential avenues by which safety nets can contribute to growth via social capital for a variety of reasons. For example, it is difficult set up field trials on the impact of inequality on growth similar to those used to accumulate causal evidence of programs such as cash transfers. In addition, whether employing micro or macro level data it is a challenge to distinguish the effect of levels of assets from that of its distribution. Moreover, when looking at national data as in the claim of Boeri and Terrell (2002) that public assistance contributed to the speed of transition in Eastern Europe, programs that are generally contributory such as social insurance (unemployment insurance and pensions) are often aggregated with safety nets.

However, it is also possible that SNs distract from cohesion rather than enhance it, depending in part on how the majority of the population reacts to any approach to redistribution and to targeting. While both the mechanics of targeting and deadweight costs of financing endogenous SN budgets are beyond the goals of this review, it is worth raising the issue of whether SNs raise political divisions. One perspective, illustrated by Gelbach and Pritchett (2000), is that support for SNs depends on providing a share of benefits to the middle class. Their inquiry is about sustainability; an early version of the cited paper asked if more for the poor meant less for the poor. However, the core question their model addresses can be paraphrased in terms of whether SNs are socially divisive. This is, of course, hard to test empirically. However, another perspective argues that society values fairness and thus better targeting is rewarded politically. This view has been tested in the context of Bolsa Escola, a transfer program in Brazil (now absorbed into a successor). de Janvry, Finan, and Sadoulet (2012) found that mayors with better performance in targeting had a higher likelihood of reelection. A final point on the possible link between political acceptance of safety nets and their contribution to economic growth returns to the issue of

14. Baez et al. (2012) use regression discontinuity to show that CCTs in Colombia increase voter participation. While this may be considered enhancing social capital, the authors also claim that since the participation favors the incumbents that promoted the program, it also risks encouraging patronage (although they do not provide a definition that distinguishes patronage from responsiveness, possibly the same action presented in a different light). See also, Manacorda, Miguel and Vigorito. (2011).

15. Ravallion (2003) reviews some evidence on aggregate growth being higher when inequality is lower, although the direct role of safety nets is seldom traced in this literature. To the degree that these results are generalizable they hold for various dimensions of pro-poor growth and not just safety nets. Thus, this aspect of Ravallion’s review looks at the rate of growth and potential trade-offs; this is an additional theme that differs from the question of ‘how’ the contribution comes about – though other aspects of his review do address this as well.

16. Alesina and Giuliano (2010) present theoretical models of the preference for redistribution as well as data from the World Values Survey that document inter-country differences in this preference, with Eastern Europe and Latin America have higher than average preference. They also note that it is hard to separate redistribution and social insurance empirically.
investments; regardless of the value society places on fairness, non-beneficiaries are more likely to support transfer programs if they are linked to prospects of graduation (the avoidance of dependency). Graduation, in turn, depends on the link of SNs to investments.

The political dimensions, then, covers two distinct pathways that have the potential to contribute to growth. First, whenever a SN makes a reform that removes economic distortions more likely there is a quantifiable economic benefit. The second category of gains are less easily measured; arguably social cohesion is a welfare improvement in itself but from the standpoint of economic gains, the benefits come from increased investments or more effective policy choices prompted by this social capital. While there is evidence that SNs may contribute to social cohesion in some circumstances (and be divisive in others) it is beyond the scope of this paper to review the literature on how such social capital augments economic growth.

V. Measuring Net Impact

This review has illustrated a range of impact on economic growth or on asset accumulation that can be attributed to safety nets. However, even if these examples are typical of the wider set of studies – and, as mentioned, the review is not intended as an exhaustive survey – there is still a major obstacle to quantifying the economic return to safety sets as an investment. The measurement of single dimension of the outcomes of a safety net program-say increased enrollment - as is often done in cost effectiveness studies biases the economic contribution of SNs downwards since it ignores the full range of outcomes.

Even if one could reasonably estimate the returns to the type of investments attributed to a safety net, transfer programs often have a dual objective of raising current consumption while simultaneously promoting investments. This makes it difficult to compare outcomes of a safety net with direct investments. The full social value of transfers does not easily aggregate with outputs in a benefit cost assessment. For one thing, such a summation requires a quantification of the weight society puts on consumption of the poor relative to that of the average citizen. Absent this calculation, a direct comparison of direct investments, say in education or health, with a SN does not put both categories of expenditures on the same metric. A cost benefit analysis or a cost effectiveness comparison within a sector generally assumes away the redistribution value of the transfer or ignores the benefits outside the sector being considered. Unfortunately, even though most societies place a value on redistribution, at least in their public statements, this value is not directly observable. However, excluding it from estimates of returns implicitly assumes this to have no value whatsoever.

There is another measurement problem that bedevils impact evaluation of SN: many assessments are designed to track the flow of services (such as enrollment or clinic visits) when the outcomes of interest for growth, such as learning or physical growth of children, is a measure of stock that is best assessed in the long term.
While there are many possible explanations for increases in school attendance that do not translate into learning or in participation rates in child growth promotion that leaves malnutrition rates unchanged, one reason may be that the question is posed too soon (King and Behrman, 2009). Fortunately, there is increased interest in collecting data on panels of households or individuals and improved means for reducing attrition and for addressing it econometrically.

An additional gap in assessing the contribution of safety nets for growth as well as for equity is the challenge of assembling cost data and comparisons of modality of delivery. If, as implied above, one needs to consider the long run process of asset creation, then one needs both the costs of targeting and delivery as well as the continuing costs of the public investment to calculate a benefit cost ratio. This not only requires understanding delivery costs and assessing how to assign shares of fixed costs such as targeting to any cohort (Caldes, Cody, and Maluccio, 2006), it also requires understanding the marginal costs of, say, additional schooling induced by the increased investment in human capital.

Costs also include any labor disincentives. While these may be a substantial concern in programs that have an effective clawback that decreases transfers proportional to increases in income, such fine tuning is rare in low income settings. One example of the influence of targeting on labor allocation in a middle income country comes from a study by de Brauw et al. (2013). They note that even though Bolsa Familia had no disincentive effects on aggregate labor supply, it did prompt a reallocation from formal to informal activities, presumably as the latter were not a focus of means-testing. Whether this affects long term growth depends on the relative productivity in the sectors. Levy (2008) points out that the safety net system in Mexico has a class of benefits for formal sector employees and another set of informal sector employees. This sets up disincentives for entering the formal wage sector. Even beneficiaries’ of Progresa-Oportunidades, which does not have a targeting mechanism linked to employment status and for which Levy claims the evidence does not show a direct impact on labor-leisure choice or labor participation, appear to be reluctant to change labor status as they are embedded in a matrix of programs which incentivize informal sector employment.

While these examples reflect the targeting mechanism, an additional potential cost to growth might come from increased demand for leisure. Empirical evidence, however, finds that reductions in overall adult labor supply attributable to SNs is minor (Skoufidias and Di Maro, 2007; Alzua, Cruces and Ripani, 2012; Berhane et al. 2011, Grosh et al. 2008). Moreover, it is arguable whether similarly small reductions in child labor are a cost or a benefit stemming from the transfers. Likewise, Abdulai, Barrett and Hoddinott (2005) find that after controlling for the endogeneity of placement, there are no observed disincentives to agricultural labor or production attributable to food aid in Ethiopia.

Several carefully done studies from South Africa find an opposite effect among adults in participating households: workers in households receiving social grants look for work more intensively and extensively and find employment more
successfully than do workers in comparably poor households that do not receive the grants (Samson and Williams, 2007). The availability of transfers may, however, shift intra-household labor choices. For example, South Africa’s generous old age pension is associated with reduced work among prime age family members living with the recipients (Bertrand, Mullainathan, and Miller, 2003) offset by increased labor of household members who have migrated for job search (Ardington, Case, and Hoseggood, 2009).

Social transfers, especially relatively generous unemployment compensations (formally classified as social insurance but de facto paid from general revenue) were a key factor of maintaining social peace during transition to market economy in Eastern Europe. They also had well documented effects on labor market behavior by recipients: increased duration of unemployment and reduced search efforts by recipients (Sanchez-Parramo, 2002; van Ours and Vodopivec, 2006) although the quality of job matching was not negatively affected (van Ours and Vodopivec, 2006). The level of support via unemployment insurance is, however, much larger relative to consumption than most other safety nets (up to 100 percent of formal sector wages over long period of time, measured by years in some cases) and this may explain the difference in observed labor impacts.

A different cost from shifting labor incentives has been noted for public works; since labor is shifted from other activities to the workfare, even if leisure is not affected, forgone earnings from these activities need to be subtracted from the wage benefits for public works (Ravallion, 1999). In a more general equilibrium context, however, to the degree than the foregone work was casual labor and that job specific skills and search costs are small, other workers will fill that labor demand providing a modest spillover to additional low income households. The various requirements necessary for qualifying for CCTs also affect labor or leisure or both with implicit costs of meeting these requirements often falling disproportionally on women.

Labor disincentives and reallocation are not the only responses that are grouped under disincentives in the literature. Transfers may also induce excess risk taking; however, as it is generally argued that risk aversion leads to poverty traps, not all shifting of risk to the state can be considered a social cost. A different form of distortion attributable to SNs may come when transfers are in terms of food. Is such circumstances the presence or absence of market distorting costs of the program follow from the rather context specific examples in the food aid literature (Barrett and Maxwell, 2005).

17. See the discussion in WFP (2006) and references in that paper. That review points out that there is a form of dependency that reflects needs – post disaster or life cycle related – as well as a cluster of disincentives that come under what the paper refers to as negative dependency. These cover a range of measurable economic concepts; however; dependency itself is often more a political category than a precise economic concept.
VI. Conclusion

Recent literature reveals a rich and fast-growing field of evidence on the mechanisms by which SNs affect growth. Still, even though there is clearly a positive contribution from safety nets programs to economic growth, the return on investment in safety nets cannot justify by itself the claim for limited public funds. It is the combination of their direct effect on poverty reduction along with their contribution to growth that jointly justifies investments in safety nets. That is, the growth argument in favor of safety nets is secondary to (and cannot fully displace) the equity argument. However, the social value is the sum of these two dimensions and thus the evidence on the contribution of safety nets to growth enhances the overall calculation of benefits.

However, there are tradeoffs on these two dimensions. For example, programs targeted to the elderly have (at best) only indirect productivity effects compared to allocating similar funds to children. Conversely, prioritizing funds towards programs linked to human capital investment or to public works has a recognizable investment potential but may exclude labor poor households or those that cannot take up opportunities for child investments. Thus, while consideration of the productive potential of SN reorients their role in the policy dialogue it does not eliminate the need to consider twin priorities of equity and efficiency.

References


This paper studies the effect of political regime transitions on public policy using a new data set on global agricultural and food policies over a 50-year period (including data from 74 developing and developed countries over the 1955–2005 period). We find evidence that democratization leads to a reduction of agricultural taxation, an increase in agricultural subsidization, or both. The empirical findings are consistent with the predictions of the median voter model because political transitions occurred primarily in countries with a majority of farmers. The results are robust to different specifications, estimation approaches, and variable definitions. JEL codes: D72, F13, O13, P16, Q18

Across the world, agricultural and food policies distort incentives for farmers and food consumers. Historically, governments in wealthy countries have subsidized farmers, whereas governments in poor countries have taxed farmers and subsidized food consumers (Anderson and Hayami 1986; Krueger et al. 1988; Anderson 1995). These observations have puzzled economists and other social scientists and triggered a series of studies in the 1980s and 1990s on “the political economy of agricultural policies” (see de Gorter and Swinnen 2002; Swinnen 2010 for reviews).

A recent global study on policy distortions in agriculture concludes that although policy distortions remain important, since the 1980s, the antiagricultural...
policy bias in developing countries and the proagricultural bias in high income countries have declined substantially (Anderson 2009). Interestingly, this was also the period during which important political reforms occurred in many countries. For example, the fall of the Berlin wall triggered democratic transitions across Eastern Europe in the early 1990s. Furthermore, several developing and emerging countries have become more democratic in recent decades. In Eastern Europe, political reforms induced radical economic liberalizations in the food system. In contrast, in the absence of major political reforms in East Asia, gradual economic liberalization was introduced, including the reduced taxation of farmers (Swinnen and Rozelle 2006).

Thus, the question arises whether and to what degree political reforms have affected agricultural and food policies worldwide. Political economy studies have demonstrated the importance of a variety of factors, such as economic structural factors and resource endowments, but the role of political institutions and reforms has received less attention. A few studies have attempted to analyze this issue, but the evidence on the impact of political reforms on agricultural and food policies is not clear because of problems with the data (see section II for references and details).

This paper employs a novel data set on agricultural distortions that was recently developed by the World Bank (see Anderson and Valenzuela 2008). This data set offers consistent and comparable protection indices for a large number of countries over a 50-year period. Employing this data set allows us to take advantage of not only cross-country variation but also within-country variation in the data and thus to overcome the strong identification assumptions that characterize previous cross-country studies.

Because the relationship between democracy and public policy may conceal potential feedback effects, we also study the reverse causality problem and exploit the timing of democratization. To control for potential nonlinearities and to better address unobserved heterogeneities, we estimate both linear specifications and semiparametric models. Specifically, we study the effects of democratic reform using the difference-in-difference (D-in-D) technique combined with propensity score matching methods, as in Persson and Tabellini (2008).

By studying agricultural and food policies, our analysis contributes to a broad body of literature on the impact of political reforms on economic policies (see Rodrik and Wacziarg 2005; Giavazzi and Tabellini 2005; Eichengreen and Leblang 2008).

The remainder of this paper is organized as follows. Section I presents stylized facts on trends in agricultural and food policies over time and across political regimes. Section II discusses conceptual issues and summarizes previous findings linking political reforms to public policies. Section III presents our empirical strategy. Section IV presents the data and key variables. In section V, the empirical results are presented and discussed, and in section VI, we test the robustness of our findings. Finally, section VII concludes.
I. Policy Indicators and Stylized Facts

We employ two different indicators of agricultural and food policies: the nominal rate of assistance (NRA) to agriculture and the relative rate of assistance (RRA), both from the World Bank’s agricultural distortions database (see Anderson and Valenzuela 2008, for calculation details). This database reports the most consistent and comparable estimates of agricultural protection across countries and over time. In our econometric analysis, we use a sample of 74 countries, comprising yearly data from 1955 to 2005 (see table S.1 in the supplemental appendix, available at http://wber.oxfordjournals.org/). The average number of observations per country is 35. We work with an unbalanced panel with more than 2,600 observations.

The NRA measures total transfers to agriculture as a percentage of the undistorted unit value. The NRA for agriculture is obtained as a weighted average of the NRA at the product level, using the undistorted value of production as a weight. The NRA is positive when agriculture is subsidized, negative when it is taxed, and zero when net transfers are zero. The NRA includes both the assistance provided by all tariff and nontariff trade measures applied to agricultural products and any domestic price-distorting measures.\(^1\) The price equivalent of any direct intervention regarding inputs or outputs is also included.\(^2\)

To account for the protection of manufacturing sectors, which is an important source of indirect taxation on agriculture, especially in developing countries, we use both the NRA and the RRA, which is calculated as the ratio of agricultural NRA to nonagricultural NRA.\(^3\) The RRA is a useful indicator for international comparisons of anti- or proagricultural policy regimes. There are fewer observations for the RRA because the country and time-series coverage is smaller than for the NRA. Specifically, the RRA data contain five fewer countries (69 instead of 74).

Table 1 summarizes the NRA and RRA for democracies and autocracies (see below for definitions). The table indicates that autocracies are associated with negative levels for both NRA and RRA, whereas democracies have positive levels. Moreover, the differences are significant. The average NRA (RRA) is

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1. This includes implicit trade taxes related to government intervention on the domestic market for foreign currency and support for public agricultural research (Anderson et al. 2009).
2. Note that the heterogeneous nature of agricultural protection in both developing and developed countries may cause an aggregation bias in measures such as the NRA (see Aksoy 2005). To attenuate this potential aggregation bias, in the empirical analysis presented below, we also work with data at the commodity level.
3. Specifically, \( RRA = 100[(1 + \text{NRA}_{\text{ag}}/100)/(1 + \text{NRA}_{\text{nonag}}/100) - 1] \), where \( \text{NRA}_{\text{ag}} \) is the nominal assistance to agriculture, and \( \text{NRA}_{\text{nonag}} \) is the nominal assistance to nonagricultural sectors. Note that because of the computational complexity of this index, the NRA to nonagricultural sectors is only based on distortion owing to tariff protection at the border.
Although these statistics demonstrate that the average NRA and RRA values are much higher in democracies than in autocracies, they say nothing about the potential causal effect of democratization on agricultural policies. To obtain further insight on this issue, we examine the NRA and RRA values of countries in the data set that have experienced a political transition from autocracy to democracy. Specifically, figures 1 and 2 present the average NRA and RRA values in the predemocratization and postdemocratization periods for 23 countries that have experienced permanent democratization, as defined by Papaiannou and Siourounis (2008). 4

The figures reveal interesting patterns. First, both the average NRA and RRA values are relatively stable during the decade prior to a democratic transition, approximately −5 percent for NRA and approximately −13 percent for RRA. Second, the average NRA and RRA values are significantly higher following democratic reform. The average NRA in the decade after democratization is 13 percent, or 18 percent higher than in the decade before democratization. For the RRA, the increase is 16 percent (from −13 percent to +3 percent). Third, the figures suggest that there is both an immediate effect

4. See section III for more detail on the definition and measures of “democratization.” Depending on the time period covered and the year of democratization, the average at each point in time in figures 1 and 2 is based on different samples of countries.
at about the time of democratization and an additional increase approximately five years later.

In summary, these descriptive statistics indicate interesting correlations between agricultural policies and political regimes, both across countries and over time. In the remainder of this paper, we use econometric methods to analyze whether there is a causal relationship.

II. CONCEPTUAL ISSUES AND LITERATURE

There is a substantial body of literature on how political reforms influence government policies (Mulligan et al. 2004). However, theory does not provide a simple prediction of how democratic reforms affect agricultural protection. In democracies, the distribution of political power is typically more equal than the distributions of income and wealth. Consequently, median voter models predict that democracies tend to redistribute from the rich to the poor, and this effect is stronger with greater income inequality because the middle class has a greater incentive to form coalitions with the poor (Alesina and Rodrik 1994; Persson and Tabellini 1994). Similarly, democratic regimes may lead to

![Figure 1. Average NRA and the Timing of Political Reforms](image-url)

Source: Own calculations based on data from the World Bank’s agricultural distortions database and the Polity IV database.
economic policy reforms if these reforms create more winners than losers (Giavazzi and Tabellini 2005).

Empirical studies have attempted to test this prediction using data on democracy and economic liberalization. An area that has attracted substantial interest is trade policy. Overall, the existing literature suggests a positive impact of democracy on economic (trade) liberalization (e.g., Banerji and Ghanem 1997; Milner and Kubota 2005; Giavazzi and Tabellini 2005; Eichengreen and Leblang 2008; Giuliano et al. 2011). Some studies, however, have argued that this effect is not generally true but depends on a country’s resource endowment (e.g., O’Rourke and Taylor 2007; Kono 2006).

There are several methodological critiques of these studies, such as the problem of spurious correlation between democracy and economic reforms (Eichengreen and Leblang 2008) or the existence of potential feedback effects (Giavazzi and Tabellini 2005; Milner and Mukherjee 2009). An additional problem is that most existing studies have examined the relationship between democracy and trade policy using aggregate trade indices, such as the trade to GDP ratio or the Sachs and Warner (1995) openness index (e.g., Giavazzi and Tabellini 2005; Milner and Kubota 2005; Persson 2005; Eichengreen and Leblang 2008; Tavares 2007). Studies have only rarely employed direct indicators of trade policy, such as tariffs. Moreover, aggregated trade policy

![Figure 2. Average RRA and the Timing of Political Reforms](source: Own calculations based on data from the World Bank’s agricultural distortions database and the Polity IV database.)
indicators may be misleading because different (and possibly offsetting) effects may occur at a disaggregated level (Anderson and Martin 2006). Thus, an examination of disaggregated policies, such as agricultural and food policies, could yield additional insights.

Empirical studies have estimated the impact of political institutions on agricultural policies. Lindert (1991) was the first to document a positive impact of democracy on agricultural protection. Beghin and Kherallah (1994) examine the impact of different political systems (no-party, one-party, dominant party, and multiparty systems) on agricultural protection. They find that political institutions are important and that their effect is nonmonotonic: protection peaks with dominant party systems and then becomes nonincreasing despite further democratization. A nonmonotonic relationship between democracy and protection is also found by Swinnen et al. (2000), who uses the Gastil index of political rights. Specifically, they demonstrate that moving from low to medium levels of political rights reduces protection, but any further increase in democratization does not necessarily result in substantial effects on agricultural protection. However, this nonlinear behavior runs in the opposite direction of that found by Beghin and Kherallah. Olper (2001) finds that the level of democracy per se does not seem to matter, but the quality of institutions that protect and enforce property rights is important.

Although these studies highlight a number of interesting aspects, they should be interpreted with caution. The studies all have potential problems of reverse causality and omitted variable bias because they rely predominantly on the between-country variation in the data. Their data sets do not allow for the exploitation of time series variation. To date, the only study to investigate the relationship between democracy and agricultural protection by employing a long time series is the study by Swinnen et al. (2001), which examines agricultural protection patterns in Belgium between 1877 and 1990 and uses detailed indicators of political reforms. Their paper demonstrates that only those political reforms that generate a significant shift in the political balance toward agricultural interests (e.g., the extension of voting rights to small farmers in the early 20th century) induce an increase in agricultural protection. This result provides a logical interpretation of the democracy-protection nonlinearity discussed above and highlights the importance of drawing inferences from autocratic-democratic regime changes to improve understanding of the impact of democratization on agricultural protection.

An additional problem is that the absence of representative information on the preferences of autocratic rulers complicates predictions of the effect of democratization. The insulation of decision makers means that they can follow their private preferences to a large extent when selecting policies. However, this argument has little predictive power in the absence of information on autocrats’ preferences. The preference of rulers is a key variable, but there are
major data and measurement problems. For example, quantitative data exist on ideologies, but these data are limited to democracies.\textsuperscript{5,6}

Assuming that rulers’ preferences are randomly distributed,\textsuperscript{7} the median voter model predicts that the impact of democratization is conditional on the structure of the economy. The share of farmers (or the rural population) in the economy differs significantly between rich and poor countries. The factors that make it difficult for farmers to organize politically in poor countries (such as their large number and substantial geographic dispersion; see Olson 1965) render them potentially powerful in electoral settings because they represent a large share of the votes (Bates and Block 2010; Varshney 1995). Therefore, \textit{ceteris paribus}, one would expect that democratization is more likely to benefit farmers in poor countries.

In our data set, the vast majority of transitions from autocracy to democracy occur in poorer countries with a large number of farmers.\textsuperscript{8} In fact, the average share of agriculture in total employment at the time of political transition is 65 percent, whereas the average share for all countries and time periods in the data set is 25 percent. This finding implies that the measured effect of

\textsuperscript{5} Olper’s (2007) study of a cross-section of countries found that, on average, right-wing governments are more protectionist with respect to agriculture than left-wing governments. Furthermore, although left-wing governments support agriculture to a lesser extent, they tend to support farmers more in unequal societies. This finding is consistent with qualitative evidence from Bates (1983), who argues that socialist rulers in Africa tax farmers (by imposing low commodity prices), and from Tracy (1989), who found that right-wing governments in Europe (such as those dominated by Catholic and conservative parties) tend to support farm interests and protectionism.

\textsuperscript{6} There are other problems in empirically assessing the impact of rulers’ preferences. First, applying a simple left-wing/right-wing model to agricultural policy is not straightforward because increases to food costs through agricultural protection hurts both urban workers (left-wing interests) and industrial capitalists (right-wing interests). Thus, rulers who support either labor or capital should oppose agricultural protection, as they did historically in Europe (Kindleberger 1975; Schonhardt-Bailey 1998; Findlay and O’Rourke 2007). Second, economic development may change rulers’ preferences. As their economies developed, Communist autocracies shifted from taxing to subsidizing agriculture, as was the case in democracies. Communist dictators of poor countries, such as Stalin in Russia, Mao in China, and Hoxha in Albania, heavily taxed agriculture. However, farmers were subsidized at higher incomes, such as in the Soviet Union under Brezhnev and in most Eastern European Communist countries in the 1970s and 1980s (Swinnen and Rozelle 2009). Third, rulers’ preferences are not restricted to ideology; they may also reflect regional interests. Bates and Block (2010) show that the regional backgrounds of leaders in Africa significantly affected their policy preferences. Leaders who drew political support from cities and semiarid regions (as in Tanzania and Ghana) seized a major portion of revenues generated by the export of cash crops (coffee and cocoa), whereas in countries where leaders came from regions where cash crops were important sources of income (such as in Kenya and Ivory Coast), they imposed few taxes on coffee and cocoa exports.

\textsuperscript{7} Olper (2007) finds more variation in policy choices, \textit{ceteris paribus}, under dictatorial regimes than under democracies. This result is consistent with the argument that dictatorial leaders are less constrained in setting policies and that government responses to pressure from interest groups are stronger in democracies.

\textsuperscript{8} Of the 42 democratic transitions (see table S.1 and the discussion below) included in the data set, only five occurred in countries that are currently members of the OECD (Spain, Portugal, Mexico, South Korea, and Turkey), and these transitions occurred at times when they had considerably lower incomes than at present.
democratization on agricultural policies in our data set should be in favor of farmers (i.e., a positive impact on NRA and RRA) because of the structural “bias” of political reforms. The move from autocracy to democracy primarily occurs in countries where farmers constitute the majority of the population, and the median voter model predicts that this situation should induce a pro-farmer policy effect.

III. Empirical Methodology

To address the problems of omitted variable bias and reverse causation in the analysis of the effect of political institutions on policies and to make use of both cross-country variations and time variations in the data, we use a D-in-D strategy, as in recent studies (e.g., Giavazzi and Tabellini 2005; Rodrik and Wacziarg 2005). To analyze the robustness of our results, we combine the standard D-in-D approach with semiparametric matching methods, as in Blundell et al. (2004) and Persson and Tabellini (2008).

Following Giavazzi and Tabellini (2005), we define regime changes as a “treatment” experienced by some countries but not by others. Then, we estimate the effect of the treatment through a D-in-D regression. In this way, we are able to exploit both the time series and cross-sectional variation in the data. We refer to countries that experience a regime change in the observed period as treated countries and to countries that do not experience a regime change as control countries. In the regressions, we compare agricultural policies in the treated countries before and after the treatment with agricultural policies in the control countries over the same period.

More formally, we run panel regressions with the following specification:

\[ y_{it} = \beta D_{it} + \rho X_{it} + \alpha_i + \theta_t + \epsilon_{it} \]

where \( y_{it} \) denotes our measure of interest, namely, agricultural policies measured by NRA and RRA; \( \alpha_i \) and \( \theta_t \) are country and year fixed effects, respectively; \( X_{it} \) is a set of control variables; and \( D_{it} \) is a dummy variable that takes the value one for democracy and zero otherwise (see section IV). The parameter \( \beta \) is the D-in-D estimate of the regime change effect. It is obtained by comparing the average protection after a regime change, minus protection before the transition in the treated countries, to the change in protection in the control countries over the same period. Here, the control countries are those that do not experience a transition into or out of democracy—that is, those that have either \( D_{it} = 1 \) or \( D_{it} = 0 \) over the entire sample period.

Estimates obtained from the standard D-in-D procedure are based on several restrictive assumptions (see Abadie 2005; Persson and Tabellini 2008). First, it

9. For a discussion of the relationships among various estimators in the context of panel data, see Mundlak (1978) and Mundlak and Larson (1992).
is assumed that, absent any regime change, the average growth in protection in the treated countries should be the same as in the control countries. Second, the estimates do not take into account the (potential) heterogeneity of regime change effects on agricultural policies. Finally, the estimates may suffer from omitted variable bias due to time-varying (country-specific) covariates correlated with both democracy and policies.

To address the latter problem, in addition to the traditional controls, we include in our specifications several time-varying, country-specific variables. Furthermore, given our specific concern for (omitted) time-varying factors, we add continent-year interaction effects in some specifications. This process takes into account that changes in agricultural policies may be due to general developments in geographical clusters. Finally, we check the robustness of our results by running dynamic panel models.

To circumvent the heterogeneity of regime change effects, the existing literature interacts the political reform dummy with other characteristics of reforms, such as specific electoral rules or forms of government implemented by the new democracy (see Persson 2005; Olper and Raimondi Forthcoming). However, the problem with this approach is that the potential interactions or nonlinearities are too numerous compared with the regime transitions in the data. Therefore, we use semiparametric methods to address these problems; that is, we combine a D-in-D methodology with a propensity score matching method, following the approach discussed by Smith and Todd (2005) and Abadie (2005) and applied by Blundell et al. (2004) and Persson and Tabellini (2008). This method has two main advantages over the standard D-in-D estimator. First, it ensures that the pretreatment characteristics that are thought to determine the outcome variable are balanced between the treated and untreated countries. Thus, this method relaxes the strong identifying restriction of the standard approach (Abadie 2005). Second, it relaxes linearity assumptions by allowing for heterogeneous impacts of democratic transitions on agricultural policies.

Our matching cum D-in-D strategy is implemented in two steps. First, to avoid confounding the effect of political regime transition with that of factors that determine this shift and because we cannot observe what would have happened if a democratic country had remained an autocracy, an estimate of the counterfactual is constructed. Conditional on the number of observable characteristics, the probability of regime change is calculated for each country (i.e., the propensity score). Based on this estimate, the next step involves an evaluation of the difference in the evolution of agricultural policies between countries with and without a regime change. Because matching relies on comparing

---

10. This restriction is partially addressed by adding several covariates in the vector $X_{i,t}$ to increase the similarity between treated and control countries.

11. See Ashenfelter (1978) and Ashenfelter and Card (1985) for a general discussion of this subject.
countries with similar propensity score values, the inferences are not distorted by counterfactuals that differ substantially from the treated observations.

The average estimated effect of regime transitions that we compute (the so-called average treatment on treated, \( ATT \)) can be presented as follows:

\[
ATT = \frac{1}{I} \sum_i \left( a_i - \sum_j w_{ij} d'_j \right)
\]

where \( I \) stands for the number of treated observations within the common support; \( a_i \) is the difference between the average level of agricultural protection before and after the transition in the treated country \( i \); \( d'_j \) is the difference between the average level of agricultural protection in the control country \( j \) over the periods before and after the transition in the treated country with which it is matched; and \( w_{ij} \) (\( w_{ij} > 0 \) and \( \sum_j w_{ij} = 1 \)) are weights based on the propensity score that depend on the matching estimator (Sianesi 2001). We use Epanechnikov kernel and Gaussian kernel estimators (Fan 1992; Heckman et al. 1998).

IV. Political Reform Indicators and Control Variables

To study how a regime transition toward democracy affects agricultural and food policies, we need data on democratization episodes. Unfortunately, although various democracy data sets exist, none of these data sets provides a specific coding of regime transitions. Therefore, we follow the same strategy as recent studies that have investigated similar questions at the aggregate level by relying on the Polity2 index from the Polity IV data (Marshall and Jaggers 2007). The composite Polity2 index assigns a value ranging from \(-10\) to \(+10\) to each country and year, with higher values associated with better democracies on the basis of several institutional characteristics, such as the openness of elections or constraints on the executive branch. Following Persson (2005) and Giavazzi and Tabellini (2005), we code a country as “democratic” in each year that the Polity2 index is strictly positive, setting a binary indicator called \( \text{democracy} \) to one (zero otherwise). A reform into (or out of) democracy occurs in a country-year when this democracy indicator switches from zero to one (from one to zero).

A potential shortcoming of this definition of political reform is that being near any particular divide may differ from being far from the divide. Indeed, the threshold of zero for Polity2 corresponds to a generous definition of

12. Polity IV has a longer time series and therefore includes more usable political reforms than other existing democracy indices. For example, in addition to its shortcomings due to classification bias (see Papaioannou and Siourounis 2008), the use of the Freedom House data strongly limits the number of usable transitions because the information only begins in 1972. For a critical discussion of democracy indices, see Munck and Verkuilen (2002).

13. We thank an anonymous referee for focusing our attention on this issue.
democracy. However, as emphasized by Persson and Tabellini (2008) and others, this definition has the important advantage that many large changes in the Polity2 score are clustered around zero, an important property given our identification strategy based on the within-country variation in the data. Consequently, using a higher threshold for the definition of democracy has the shortcoming of including very (small) gradual changes that are only poorly related to significant regime changes in democratic transitions.14

Applying these criteria to our 74-country data set, we obtain 67 regime changes, of which 42 are transitions into democracy and 25 are transitions into autocracy (see table S.1). The distribution of these reforms is uniform over time (53 percent before 1985) but not across continents: approximately 50 percent of the reforms are in Africa, 28 percent are in Asia, and 18 percent are in Latin America.

To avoid the use of very brief reform episodes, we introduce the criterion that the dependent variable must be observed for at least four years before and after each regime transition. Under this rule, the effective number of reform episodes decreases to approximately 40. As a robustness check, we relax this criterion to only two years of observable outcomes; this period includes nearly all of the reform episodes reported in table S.1.

To check the robustness of our results, we use a distinct definition of regime transitions. Specifically, we use the recently developed data set by Papaioannou and Siourounis (2008) to define regime changes. These data are based on a more complex procedure than that applied above. Specifically, to identify the precise timing of each regime change, Papaioannou and Siourounis (2008) rely not only on the Polity2 index and the Freedom House democracy index but also historical evidence derived from numerous political archives and election databases. Using this procedure, the authors identify “full” or “partial” democratization episodes. However, because their analysis focuses solely on permanent democratization, the use of their coding applies to a lower number of transition episodes (23) in our data (see table S.1).

**Control Variables**

In the empirical specification, we include additional controls that are likely to affect agricultural and food policies, as suggested by many previous studies (e.g., Anderson 1995; Beghin and Kherallah 1994; Swinnen et al. 2000; Olper 2007). Specifically, our basic D-in-D specification always includes the following structural controls: the level of development, measured by the log of real per capita GDP; the share of agricultural employment in total employment; the log

14. It is important to note that the use of the “continuous” Polity2 index, instead of a discrete index, does not affect our qualitative conclusions; a higher Polity2 score increases the level of agricultural protection. These additional results are not reported to conserve space, but they may be obtained from the authors upon request.
of agricultural land per capita; and the log of total population. All of these variables are computed from World Bank (WDI), FAO, or national statistics.

We also test the robustness of our findings by controlling for several other (macro) covariates, such as different indicators of (aggregate) openness, government expenditures, and economic and political crises (wars and conflicts). Openness indicators (the trade to GDP ratio and the Sachs and Warner (1995) index) and government expenditures are obtained from Wacziarg and Welch (2008)\(^{15}\) and the Penn World Table, respectively. War and conflict year dummies are based on the UCDP/PRIO Armed Conflict Dataset Version 4-2008 (see Gleditsch et al. 2002).

For our matching strategy, we use a limited number of covariates that are likely to influence both regime change and agricultural and food policies. As discussed previously, a shift in agricultural policy may require political reforms of sufficient size (Swinnen et al. 2001). Therefore, in our model, we include a variable, \(\text{initial polity2}\), that takes the value of our democracy index at the beginning of the sample. This variable is included to take into account that countries with Polity2 values close to zero are more likely to have a political regime change.

To control for the fact that the sample period varies in length across countries and that the length of the sample may be correlated with the probability of changes in the political regime, we include the variable \(\text{length of sample}\) (measured in years). This variable is designed to account for the possibility that democratization may require time to have an impact. Furthermore, to control for the fact that changes in both agricultural policy and political regime may be related to economic development, we include the variable \(\text{relative gdp}\), which measures each country’s per capita income at the beginning of the sample relative to U.S. per capita income in the same year. Finally, to control for the possibility that the change in political regime may be related to the occurrence of conflicts (both domestic and international), we include the variable \(\text{conflict years}\), which measures the share of conflict years over the total length of the period for which policy data are available.

V. Estimation Results

Table 2 reports D-in-D econometric results with the \(\text{NRA}\) and \(\text{RRA}\) as dependent variables. Columns 1 and 5 report “unconditional” democracy effects by adding only the level of development to the vector of covariates \(X\) to control for the well-known positive correlations between per capita GDP and both democracy and agricultural protection. In columns 2–4 and 6–8, we analyze

\(^{15}\) The Sachs and Warner index, based on the recent update by Wacziarg and Welch (2008), is equal to one when a country is considered open and zero otherwise on the basis on the following criteria: an aggregate tariff rate greater than 40 percent, a nontariff barrier covering more than 40 percent of trade, a black market exchange rate of less than 20 percent relative to the official exchange rate, and a state monopoly in major exports.
<table>
<thead>
<tr>
<th>Estimation Regression</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
<th>(7)</th>
<th>(8)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent variable</td>
<td>NRA</td>
<td>NRA</td>
<td>NRA</td>
<td>NRA</td>
<td>RRA</td>
<td>RRA</td>
<td>RRA</td>
<td>RRA</td>
</tr>
<tr>
<td></td>
<td>(.001)</td>
<td>(.001)</td>
<td>(.003)</td>
<td>(.005)</td>
<td>(.006)</td>
<td>(.016)</td>
<td>(.036)</td>
<td>(.016)</td>
</tr>
<tr>
<td>Log GDP per capita</td>
<td>32.919</td>
<td>48.717</td>
<td>42.461</td>
<td>45.935</td>
<td>34.518</td>
<td>39.014</td>
<td>35.076</td>
<td>41.540</td>
</tr>
<tr>
<td></td>
<td>(.011)</td>
<td>(.000)</td>
<td>(.002)</td>
<td>(.001)</td>
<td>(.004)</td>
<td>(.008)</td>
<td>(.005)</td>
<td>(.000)</td>
</tr>
<tr>
<td>Employment share</td>
<td>-88.857</td>
<td>-94.180</td>
<td>-61.086</td>
<td>-65.281</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>(.107)</td>
<td>(.082)</td>
<td>(.324)</td>
<td>(.276)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Land per capita</td>
<td>-2.392</td>
<td>-2.484</td>
<td>-1.180</td>
<td>-1.292</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>(.097)</td>
<td>(.125)</td>
<td>(.371)</td>
<td>(.348)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.410)</td>
<td>(.340)</td>
<td>(.931)</td>
<td>(.622)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trade policy reform (Sachs-Warner)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(.002)</td>
<td></td>
<td></td>
<td>(.000)</td>
</tr>
<tr>
<td>Trade openness</td>
<td>-0.065</td>
<td></td>
<td></td>
<td></td>
<td>-.053</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.278)</td>
<td></td>
<td></td>
<td></td>
<td>(.390)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Government consumption</td>
<td>-0.213</td>
<td></td>
<td></td>
<td></td>
<td>0.616</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.583)</td>
<td></td>
<td></td>
<td></td>
<td>(.176)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment</td>
<td>All</td>
<td>All</td>
<td>All</td>
<td>All</td>
<td>All</td>
<td>All</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Time fixed effects</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Country fixed effects</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Continental trends</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Countries</td>
<td>74</td>
<td>74</td>
<td>74</td>
<td>72</td>
<td>69</td>
<td>69</td>
<td>69</td>
<td>67</td>
</tr>
<tr>
<td>Observations</td>
<td>2,664</td>
<td>2,664</td>
<td>2,565</td>
<td>2,502</td>
<td>2,394</td>
<td>2,394</td>
<td>2,314</td>
<td>2,253</td>
</tr>
<tr>
<td>$R^2$ (within)</td>
<td>0.184</td>
<td>0.323</td>
<td>0.338</td>
<td>0.359</td>
<td>0.230</td>
<td>0.339</td>
<td>0.351</td>
<td>0.387</td>
</tr>
</tbody>
</table>

Notes: $p$ values based on clustered standard errors at the country level in parentheses. Year and country fixed effects as well as interaction effects between continents (Africa, Asia, and Latin America) and year dummies are included as indicated. The democracy variable is based on the Polity2 index (see text).

Source: Own calculations based on the data described in the text.
the democratization effect using regressions controlling for both the standard
determinants of agricultural protection and macroeconomic and trade policy.
In all regressions, the standard errors are clustered at the country level, allow-
ning for arbitrary, country-specific serial correlation (see Bertrand et al. 2004).16
Because the fixed effects and other covariates are correlated, we only report the
fixed effects results (Mundlak 1978; Mundlak and Larson 1992).17

All specifications yield positive estimates of the democracy coefficient. The
significance varies between the 1 percent and 5 percent levels. The magnitude
of the democracy variable in column 1 suggests that a transition from autocrac-
cy to democracy induces a strong effect: the NRA increases, on average, by
18.6 percentage points. In column 2, we add a set of continent-year interaction
effects to control for both differences in regional protection dynamics and the
nonstationary nature of the democracy dummy.18 Although their inclusion
slightly reduces the democracy coefficient, it remains significant at the 1
percent level. Columns 3 and 4 test the robustness of our findings by including
a set of covariates normally found to be significant determinants of agricultural
protection (in column 3) and the share of government consumption expendi-
tures in GDP19 and two different openness variables: the trade to GDP ratio
and a trade policy reform index based on Sachs and Warner (1995) (in column
4). The democracy effect is still estimated with strong precision ($p < .01$). The
magnitude of the estimated effect is very similar in both equations and slightly
lower than in columns 1–2. The effect on NRA is now approximately 14 per-
centange points. These results suggest that the positive effect of a regime change
on the NRA is very robust. The estimated coefficients of the other variables are
consistent with expectations from the agricultural protection literature.20

16. An alternative means of correcting for the potential problem of inconsistent standard errors
would be to follow a residual-aggregation procedure, as suggested by Bertrand et al. (2004). In our case,
where we consider approximately 40 reform episodes, this could be problematic because the power of
this procedure is quite low and diminishes rapidly with sample size.

17. Hausman tests also confirm this correlation. Please note that in the random effects model the
key result (i.e., the effect of democratization on the NRA and RRA) is positive and strongly significant
and is virtually identical in magnitude to the results reported in table 2 (additional results are available
upon request).

18. As emphasized by Papaioannou and Siourounis (2008), the democracy indicator behaves as a
trend because countries that switch to democracy seldom revert to autocracy.

19. We use total government consumption instead of government spending owing to data
limitations. For our broad country sample and the 1955–2005 time period, this is the most widely
available measure of government spending.

20. See de Gorter and Swinnen (2002) for a survey. A positive impact of GDP per capita is in line
with the so-called development paradox. A negative impact of agricultural employment is in line with
Olson's (small) interest group story and the reduced per capita tax costs of subsidizing a declining
sector. A negative impact of land per capita is in accordance with the notion that countries with a
comparative advantage in agriculture are less protected (Anderson 1995; Swinnen 1994). Moreover, this
variable may capture collective action problems due to the heterogeneity of the farm group. This latter
interpretation draws on the observation that countries with more abundant land tend to consistently
have a more unequal distribution of land (Olper 2007).
Columns 5–8 are analogous using the RRA as the dependent variable. The results are similar, but the sizes of the effects and the precision of the estimates are somewhat smaller. The magnitude of the estimated effect of reforms into democracy on the RRA is 10–13 percentage points, depending on the model. The small difference (4 percentage points) between the NRA and RRA regressions suggests that the bulk of the democracy effect comes from changes in agricultural policies.21

An interesting hypothetical question is what the level of agricultural protection would be if all countries were democracies.22 In our sample, autocracies are only present in Africa and Asia at the end of the data period. The issue is most relevant for Africa because 10 out of 22 countries were still autocracies, whereas only 3 out of 11 were still autocracies in Asia. A simple prediction based on average effects (an increase from 14 percent to 18 percent for NRA) and the use of 2000 as the base year (the year for which we have the largest recent country sample) yields the following: with an average NRA of −15 percent in Africa in 2000, ceteris paribus, a hypothetical democratization wave would induce a reduction in the average level of taxation of 6 to 8 percentage points, resulting in an average NRA of −7 percent to −9 percent and effectively halving agricultural taxation. In Asia, the average effect of hypothetical democratization is smaller because fewer autocracies remain. The effect depends on whether a simple average or a weighted average is used; China is one of three remaining autocracies in the data set. The simple average effect on NRA is an increase of between 4 and 5 percentage points for Asia, whereas the population weighted average protection effect is an increase of 7 to 9 percentage points (from a weighted average NRA of approximately 9 percent).

VI. Extensions and Robustness Checks

To further test whether our results capture a causal effect of democratization on agricultural policies, we run several extensions of the model and robustness checks. Specifically, in this section, we analyze how the results are affected by considering or using (a) disaggregated commodities, (b) different indicators to capture the timing of political reforms, (c) alternative estimation models (matching, dynamic panels, feedback effects), (d) alternative definitions of regime changes, and (e) additional indicators of economic and political crises. For brevity, some of these additional regression results are reported in the supplemental appendix.

21. This is consistent with the fact that running a regression using the nominal rate of assistance to nonagricultural products, NRA_{nonag} (i.e., the denominator of the RRA), as the dependent variable means that the democracy reform dummy is never significant, irrespective of specification. These additional results are available from the authors upon request.

22. We thank a referee for this suggestion.
Disaggregated Commodities

The results reported in table 2 are based on an aggregated measure of protection. However, various sectors are taxed and subsidized differently for a number of reasons, including differences in demand and supply conditions and because these sectors are characterized by different market structures (e.g., small vs. large farms), which influences rent-seeking behavior. The heterogeneous nature of agricultural protection may also cause an aggregation bias in measures such as the NRA (see Aksoy 2005). To investigate potential heterogeneity in the political reform effects across different groups of commodities, table 3 reports regression results by separating importing and exporting sectors (columns 1 and 2) and four commodity groups (columns 3–7).

The disaggregated regressions demonstrate that democratization increases the NRA for all subsectors, but the magnitude of the estimated effect differs: it is higher (approximately 17.4 percentage points) for import-competing sectors than for exporting sectors (6.8 percentage points). Similarly, the democratization effect is positive for the four different product groups, but it is much higher for grains and tubers (17 percent) and oilseeds (31 percent) than for livestock products (5 percent) and tropical crops (7 percent).

Timing of Political Reforms

A potential shortcoming of our findings is that we have constrained the democratization effect to be monotonic (Papaioannou and Siourounis 2008). Relaxing this assumption could yield additional insights into the dynamics of this effect. Following Giavazzi and Tabellini (2005) and Wacziarg and Welch (2008), we investigate these issues by studying the timing of the reform effects. To do so, we replace the variable democracy with three nonoverlapping dummies: a dummy equal to one in the three years preceding the regime change (3 years before), a dummy equal to one in the year of the reform and in the three following years (years 0–3), and a dummy equal to one from the fourth year after the regime change and onward (years 4 and after). The 3 years before dummy aims to account for potential positive changes in agricultural protection before the democratic transition. For example, it is possible that an autocratic government may implement protectionist policies to gain legitimacy and remain in power.

Table 4 presents the results for the NRA and RRA. The estimated effect of the 3 years before dummy is negative, except in column (2), but it is never significant. This finding suggests that agricultural policies do not change prior to democratization. Thus, our results do not support the hypothesis that the

23. The compositions of the groups are as follows: grains and tubers (e.g., rice, wheat, maize, cassava, barley, sorghum, millet, and oats), oilseeds (e.g., soybean, groundnut, palm oil, rapeseed, sunflower, and sesame), livestock products (e.g., pigment, milk, beef, poultry, egg, sheep meat, and wool), and tropical crops (e.g., sugar, cotton, coconut, coffee, rubber, tea, and cocoa).
anticipation of the democratization process is reflected in changes in agricultural protection.

The estimated coefficient of the variable *years 4 and after*, which captures the long-term effect of regime change, is positive and strongly significant for both the NRA and RRA. The estimated values are similar to the values in columns 4 and 8 of table 2. The results imply a long-run democratization effect of approximately 16–19 percentage points for NRA and 13 percentage points for RRA.24 For both the NRA and RRA, the short-term effect, captured by the *year 0–3* dummy, is always positive but is smaller in magnitude than the long-term effect. For the RRA, in particular, the short-term effect is small and not significant.

The results in table 4 are consistent with the descriptive evidence reported in figures 1 and 2. After a democratization episode, there is an immediate increase in agricultural protection. Then, policies appear to be stable for some years. After a few years of democracy, we observe an additional increase in agricultural protection. Thus, it appears that it takes time for democratization to fully exert its influence on agricultural policy.

24. Not surprisingly, the magnitudes of these reform effects are similar to those in the regressions that consider only permanent reforms. See the regressions in columns 3 and 6 in table S.5 in the supplemental appendix.
Matching

We now use a semiparametric analysis (i.e., a matching approach) to at least partly relax the strong identifying assumptions in the D-in-D approach. The results of the matching procedure are presented in table 5. Given that the estimates are less efficient and less precise owing to fewer usable observations, the matching results are consistent with the results obtained from the standard D-in-D method. The effect of a transition to democracy is strongly positive and statistically significant and is of the same order of magnitude. As in the D-in-D regressions, the effect of democracy is larger on the NRA than on the RRA.

Dynamic Panel Methods

Next, we estimate the effect of democratization on protection using dynamic panel models. Specifically, we employ a dynamic D-in-D regression to control

---

Table 4. Timing of Political and Agricultural Policy Reforms

<table>
<thead>
<tr>
<th>Estimation Regression</th>
<th>D-in-D regressions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
</tr>
<tr>
<td>Dependent variable</td>
<td>NRA</td>
</tr>
<tr>
<td>3 years before democratic reform</td>
<td>-1.371</td>
</tr>
<tr>
<td></td>
<td>(.640)</td>
</tr>
<tr>
<td>years 0–3 after democratic reform</td>
<td>6.962</td>
</tr>
<tr>
<td></td>
<td>(.028)</td>
</tr>
<tr>
<td>years 4 or more after democratic reform</td>
<td>16.360</td>
</tr>
<tr>
<td></td>
<td>(.000)</td>
</tr>
<tr>
<td>Time fixed effects</td>
<td>Yes</td>
</tr>
<tr>
<td>Country fixed effects</td>
<td>Yes</td>
</tr>
<tr>
<td>Continent-year dummies</td>
<td>No</td>
</tr>
<tr>
<td>Controls</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>2,565</td>
</tr>
<tr>
<td>Number of countries</td>
<td>74</td>
</tr>
<tr>
<td>$R^2$ (within)</td>
<td>0.246</td>
</tr>
</tbody>
</table>

Notes: $p$ values in parentheses based on robust and clustered standard errors, respectively. Controls include log per capita GDP, employment share, land per capita, log of population, and year and country fixed effects included in every regression.

Source: Own calculations based on the data described in the text.

25. Table S.2 in the supplemental appendix presents the coefficients of the Probit models that were used to calculate propensity scores. Although our model is not ideal for the prediction of shifts toward democracy, the selected covariates provide some explanation for a regime change (pseudo $R^2$ equal to 0.23 – 0.24). Table S.3 in the supplemental appendix compares the distribution of observed covariates between the countries in the treatment and control groups. The matching performed well in terms of removing significant differences between the treatment and control countries, although the treatment and control groups were not particularly different prior to matching. Matching reduces the difference in means for several variables, such as the dummy for Africa, relative GDP, and conflict years.
<table>
<thead>
<tr>
<th></th>
<th>NRA</th>
<th>RRA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Std. error lower bound</td>
<td>(.062)</td>
<td>.076)</td>
</tr>
<tr>
<td>Std. error upper bound</td>
<td>(.070)</td>
<td>(.085)</td>
</tr>
<tr>
<td>Estimation technique</td>
<td>Matching Kernel Epanechnikov</td>
<td>Matching Kernel Gaussian</td>
</tr>
<tr>
<td>No. of treated countries</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>No. of control countries</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>No. of controls with repetitions</td>
<td>79</td>
<td>100</td>
</tr>
</tbody>
</table>

Notes: *p* values in parentheses. In the upper row, they are estimated assuming independent observations, whereas in the lower row, they are estimated assuming perfect correlations of repeated observations in control countries.

Source: Own calculations based on the data described in the text.
for the well-known persistence of agricultural protection. However, because the lagged dependent variables in a fixed effects specification are mechanically correlated with the error term for \( N > T \), we also use a first difference Generalized Method of Moments (GMM) estimator (see Arellano and Bond 1991). The inclusion of a lagged protection variable on the right-hand side may help to attenuate omitted variables bias because it captures accumulated (unobserved) factors that affect actual protection.

To reduce bias due to the contemporaneous presence of both fixed effects and the lagged dependent variable, we do not include countries for which fewer than 20 years of data are available in the dynamic D-in-D regressions. In addition, to render the regressions more comparable across dynamic estimators, the dynamic D-in-D specification does not include the continental-year interaction terms used in the static D-in-D regressions.\(^26\)

The results of these additional regressions are reported in table 6. They are consistent with our previous findings. The democratization dummies are

\(^26\). Adding these continent-year interaction terms in the GMM equations induces a strong increase in the number of instruments, rendering it difficult, if not impossible, to have fewer instruments than groups and thus to respect the “rule of the thumb” when running GMM models (see Roodman 2009). However, note that cross-country differences in protection dynamics are now largely subsumed in the autoregressive coefficient.

### Table 6. Robustness Check: Dynamic Panel Model of the Effect of Democratization on Policy Reforms

<table>
<thead>
<tr>
<th>Estimator</th>
<th>D-in-D regression with ( T &gt; 20 ) years</th>
<th>GMM difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Dependent variable</td>
<td>NRA</td>
<td>RRA</td>
</tr>
<tr>
<td>Democratic reform</td>
<td>4.972</td>
<td>4.002</td>
</tr>
<tr>
<td></td>
<td>(.001)</td>
<td>(.002)</td>
</tr>
<tr>
<td>Lagged NRA (RRA)</td>
<td>0.771</td>
<td>0.775</td>
</tr>
<tr>
<td></td>
<td>(.000)</td>
<td>(.000)</td>
</tr>
<tr>
<td>Log per capita GDP</td>
<td>13.655</td>
<td>11.308</td>
</tr>
<tr>
<td></td>
<td>(.000)</td>
<td>(.001)</td>
</tr>
<tr>
<td>Controls</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Number of countries</td>
<td>61</td>
<td>55</td>
</tr>
<tr>
<td>Observations</td>
<td>2,364</td>
<td>2,151</td>
</tr>
<tr>
<td>( R^2 ) (within)</td>
<td>0.695</td>
<td>0.707</td>
</tr>
<tr>
<td>No. of GMM Instruments</td>
<td>52</td>
<td>52</td>
</tr>
<tr>
<td>Hansen test for over-id. (( p ) value)</td>
<td>.858</td>
<td>.920</td>
</tr>
<tr>
<td>AR2 test (( p ) value)</td>
<td>.279</td>
<td>.605</td>
</tr>
</tbody>
</table>

**Notes:** \( p \) values based on clustered standard errors in parentheses. Controls include log per capita GDP, employment share, land per capita, log of population, and year fixed effects included in every regression. GMM first difference based on xtabond2 in Stata, with instrument lag structure (2 4) and collapse option to control for instrument proliferation and using forward orthogonal deviations instead of first differencing (see Arellano and Bover 1995).

**Source:** Own calculations based on the data described in the text.
consistently estimated with strong precision \((p < .01)\). As expected, the magnitudes of the estimated effects are lower than with the static model because we are now capturing only the short-term effect of democratization on agricultural protection. Moreover, the magnitudes of the democratization effects in the GMM first-difference regressions are even higher than those using the least-squares dynamic estimator.

**Feedback Effects**

To further assess the problem of potential simultaneity bias, we regress the Polity2 democracy index on the level of protection in period \(t - 1\). Specifically, we estimate the following democracy regression:

\[
d_{it} = \alpha d_{it-1} + \phi NRA_{it-1} + X_{it-1} \beta + \mu_t + \delta_i + \epsilon_{it}
\]

where \(d_{it}\) is the Polity2 democracy index of country \(i\) in period \(t\). The lagged value of this variable on the right-hand side is included to capture the persistence of democracy. The parameter \(NRA_{it-1}\) is the lagged value of the protection level in agriculture. Other covariates are included in the vector \(X_{it-1}\). The parameters \(\mu_t\) and \(\delta_i\) denote full sets of year and country fixed effects, respectively, and \(\epsilon_{it}\) is an error term capturing all other omitted factors.

For the same reason given above, the model in equation 3 is estimated using D-in-D\(^27\) and first-difference GMM estimators. Moreover, because democracy is a persistent variable, we run a system GMM regression (see Arellano and Bover 1995). We find that the lagged protection coefficient is always insignificant in these additional regressions (see the results in table S.4 in the supplemental appendix). Thus, these results suggest that there is no feedback effect of agricultural protection on the transition to democracy.

**Definition of Regime Change**

The evidence presented thus far has been obtained from approximately 40 political reform episodes based on the Polity2 index. We have checked whether our results are driven by the specific definition of our political reform variable. We have employed three alternative approaches: (a) defining a democracy variable using all of the 67 reform episodes from Polity2; (b) using the data from Papaioannou and Siourounis (2008) and including only 23 (permanent) democratization episodes; and (c) only considering permanent transitions from Polity2, namely, those that lasted at least eight years. These democratization dummies differ in terms of not only the number of regime transitions considered but also the timing of the reform episodes (see table S.1).

\(^{27}\) We use a sample that excludes countries for which fewer than 20 years of data are available to reduce bias resulting from the contemporaneous presence of both fixed effects and the lagged dependent variable.
The results are presented in table S.5 in the supplemental appendix. The results remain robust using these different measures of democratic transitions. Moreover, the additional regression results suggest that permanent transitions are most important. In line with the dynamic results discussed above, temporary democratization episodes (i.e., in countries that revert to dictatorships after a brief democratization episode) have a significantly lower effect on agricultural protection.

Economic and Political Crises

As noted in the recent political economy literature, the implemented policies may be related to both economic and political (in)stability (see North et al. 2009; Besley and Persson 2009 among others). Therefore, we complement our earlier specifications with three variables designed to capture the effect of economic and political crises. An economic crisis is measured with a dummy equal to one for every year that the real GDP per capita growth rate from the Penn World Table is negative (zero otherwise). A political crisis is measured with two dummies equal to one in every year a country is involved in a domestic war or international conflict (zero otherwise). All three variables are used in the regressions with several lags.\(^{28}\) The effect of democratic reform on policy outcomes is very robust to the inclusion of these additional covariates (see table S.6).

VII. Conclusions

In this paper, we investigate how democratization affects agricultural and food policies. On the basis of the unique data set collected by the World Bank, we empirically analyze the impact of political regime transitions on agricultural taxation and subsidization.

We find a significant positive (negative) effect of a democratic transition on agricultural protection (taxation). The transition to democracy increases agricultural protection by 10 to 18 percentage points, depending on the indicator and the model employed. This measured effect primarily reflects changes in poor countries, where the vast majority of the transitions from autocracy to democracy occurred and where farmers constitute a large share of the population. In the data set we used, the average share of agriculture in total employment at the time of the transition from autocracy to democracy was 65 percent (whereas the average share for all countries and time periods was 25 percent).

Our results are consistent with the predictions of the median voter model suggesting that the impact of democratization is conditional on the structure of

28. As correctly noted by a referee, these variables can serve as imperfect proxies, at best, for shocks in policy or world markets or variations in world prices. Nevertheless, they seem to be the best proxies available. Note that by using a dynamic panel model, as in table 6, we implicitly account for potential spurious correlations between democratization and protection due to (unobserved) policy shocks.
the economy, which determines the share of votes of farmers among all voters. The median voter model predicts that in poor countries where a large share of the population is involved in farming, democratic reforms induce a profarmer policy effect. The factors that make it difficult for farmers to organize politically in poor countries (such as their large number and substantial geographic dispersion) render them potentially powerful in electoral settings. Thus, our results suggest that democratization has benefited farmers in poor countries.

We also find that the short-term effects are smaller than the long-term effects. The effect of democratization on agricultural policies is strongest four to five years after a change in political regime. This finding suggests that time is needed to arrive at a new equilibrium in economic and political institutions.

An important question related to an empirical analysis such as ours is whether the relationship that we document is causal. We cannot rule out the possibility of spurious correlation due to various shocks that may have occurred over the past 50 years. We ran a number of extensions of the model and robustness checks to account for this possibility to the greatest extent possible. Our tests demonstrate that the results are robust to using different levels of commodity aggregation, different indicators to capture the timing of political reforms, alternative estimation methods, alternative definitions of regime changes, and additional variables.

References


In times of highly volatile commodity markets, governments often try to protect their populations from rapidly rising food prices, which can be particularly harmful for the poor. A potential solution for food-deficit countries is to hold strategic reserves that can be called on when international prices spike. But how large should strategic stockpiles be, and what rules should govern their release? In this paper, we develop a dynamic competitive storage model for wheat in the Middle East and North Africa region, where imported wheat is the most significant component of the average diet. We analyze a strategy that sets aside wheat stockpiles, which can be used to keep domestic prices below a targeted price. Our analysis shows that if the target price is set high and reserves are adequate, the strategy can be effective and robust. Contrary to most interventions, strategic storage policies are counter-cyclical, and when the importing region is sufficiently large, a regional policy can smooth global prices. Simulations indicate that this is the case for the Middle East and North Africa region. Nevertheless, the policy is more costly than a procyclical policy similar to food stamps that uses targeted transfers to directly offset high prices with a subsidy. JEL codes: F1, O13, Q11, Q18

High and volatile food prices and their consequences for the poor have revived concerns about food security and reinvigorated the debate over the role of strategic storage. For the second time in three years, food prices on international markets spiked in 2011, driven in part by rising wheat prices. For the first time in
over a decade, the real price of U.S. wheat exports (adjusted to 2000 prices) breached the $200/ton threshold in July 2007 on its way to a high of $352/ton in March 2008. International food prices declined sharply near the close of 2008, wheat prices among them. By June 2010, wheat prices fell to $131 per ton, only to double within the year. Estimates suggest that the 2011 spike in food prices drove 44 million people into poverty (Ivanic and Martin 2008). Hardest hit were countries that imported most of their food and the poor, whose diets rely heavily on staple grains.

This is the case for many countries in the Middle East and North Africa (MENA) region. Diets there are highly dependent on wheat, which is largely imported (Table 1). For example, between 2005 and 2007, Libya imported 98 percent of its wheat, and wheat generated 40 percent of the calories in the average Libyan diet. In Algeria, the comparable numbers were 69 and

Table 1. Selected Wheat Statistics, Average 2005–07

<table>
<thead>
<tr>
<th>Country</th>
<th>Net trade (thousands of tons)</th>
<th>Domestic consumption (thousands of tons)</th>
<th>Trade share of domestic consumption (%)</th>
<th>Share of total calories from wheat (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algeria</td>
<td>5,405</td>
<td>7,883</td>
<td>69</td>
<td>46</td>
</tr>
<tr>
<td>Bahrain</td>
<td>27</td>
<td>27</td>
<td>100</td>
<td>—</td>
</tr>
<tr>
<td>Egypt</td>
<td>7,569</td>
<td>15,267</td>
<td>50</td>
<td>35</td>
</tr>
<tr>
<td>Iran</td>
<td>510</td>
<td>15,200</td>
<td>3</td>
<td>43</td>
</tr>
<tr>
<td>Iraq</td>
<td>3,772</td>
<td>6,209</td>
<td>61</td>
<td>—</td>
</tr>
<tr>
<td>Jordan</td>
<td>848</td>
<td>830</td>
<td>102</td>
<td>38</td>
</tr>
<tr>
<td>Kuwait</td>
<td>294</td>
<td>294</td>
<td>100</td>
<td>23</td>
</tr>
<tr>
<td>Lebanon</td>
<td>313</td>
<td>450</td>
<td>69</td>
<td>30</td>
</tr>
<tr>
<td>Libya</td>
<td>1,430</td>
<td>1,455</td>
<td>98</td>
<td>40</td>
</tr>
<tr>
<td>Morocco</td>
<td>2,673</td>
<td>7,075</td>
<td>38</td>
<td>41</td>
</tr>
<tr>
<td>Oman</td>
<td>147</td>
<td>147</td>
<td>100</td>
<td>—</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>85</td>
<td>2,500</td>
<td>3</td>
<td>27</td>
</tr>
<tr>
<td>Syria</td>
<td>−556</td>
<td>4,306</td>
<td>−13</td>
<td>39</td>
</tr>
<tr>
<td>Tunisia</td>
<td>1,596</td>
<td>2,933</td>
<td>54</td>
<td>48</td>
</tr>
<tr>
<td>United Arab Emirates</td>
<td>514</td>
<td>514</td>
<td>100</td>
<td>29</td>
</tr>
<tr>
<td>Yemen</td>
<td>2,166</td>
<td>2,311</td>
<td>94</td>
<td>38</td>
</tr>
<tr>
<td>MENA</td>
<td>26,793</td>
<td>67,404</td>
<td>40</td>
<td>—</td>
</tr>
<tr>
<td>RoW</td>
<td>−26,793</td>
<td>548,788</td>
<td>−5</td>
<td>—</td>
</tr>
</tbody>
</table>

Source: Estimates of the share of daily calories derived from wheat are taken from FAO (2011). The remaining data are from USDA (2011).

1. For the purposes of this paper, the MENA region includes Algeria, Bahrain, Egypt, Iran, Iraq, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Saudi Arabia, Syria, Tunisia, United Arab Emirates, and Yemen.
46 percent. Consequently, spikes in international wheat prices create hardships for the region’s poor and strain the resources of the public and private institutions that constitute the region’s social safety net. To make matters worse, associated bouts of market volatility have made it difficult for households and governments to plan ahead.

The recent periods of high and volatile food prices have prompted proposals for policies that use commodity storage as an instrument. For example, former French President Nicolas Sarkozy, when presenting an agenda for the French presidency of the G20, suggested that subsidized storage might be a means of mitigating volatile food prices (Hall 2010). During his tenure as Director General of the International Food Policy Research Institute, Joachim von Braun promoted the use of real and virtual food inventories to dampen food price volatility (von Braun and Torero 2009). Moreover, in a Financial Times Op-Ed piece, former World Bank President Robert Zoellick urged the establishment of small, strategic food reserves in disaster-prone areas (Zoellick 2011). The build up of strategic reserves is also a key topic in MENA (Lampietti et al. 2001; Wright and Cafiero 2011).

Just as wheat is an important commodity for the region, MENA is an important region for the global wheat market. Between 2008 and 2010, more than 29 percent of all exported wheat was destined for the region. In recent decades, MENA countries have increased their grain storage capacities, and wheat stocks have grown along with populations and demand. Precautionary policies also led to an increase in the stock-to-use ratio, concentrating a greater share of global stocks in the region. From negligible levels in 1970, the region held over 13 percent of global wheat stocks between 2008 and 2010, an amount equivalent to 15 percent of global wheat trade and 52 percent of MENA imports (USDA 2011). Consequently, decisions taken in the region about strategic stores of wheat are of increasing importance for global markets. Moreover, with production constrained by available land and water resources and given the significant population growth projected in MENA, the region’s presence in global wheat markets is expected to grow.

In this paper, we examine whether stockpiles of wheat in the region could be used strategically to ameliorate the effects of sharp run ups in international wheat prices. Although public storage policies have been extensively studied in a closed economy, they have received less attention in the context of an open economy. Using a numerical model of competitive storage under rational expectations, we examine a strategic storage rule designed to insulate the region from the most severe price spikes, those that fall in the top 10 percent of the range of simulated prices. We find that the strategy can reduce the variability of domestic wheat prices and blunt the domestic impact of increases in global prices. In contrast to most policy approaches that countries use to insulate themselves from offshore price disturbances, the strategy has positive spillover effects, reducing global price variability rather than increasing it. However, the strategy will sometimes fail, when large or consecutive negative supply shocks occur and
MENA inventories are dissipated. The frequency of failure declines as larger inventories are held, but costs increase as well. By comparison, a procyclical relief program that targets up to 40 percent of the population is a less expensive alternative.

I. Background

Poverty is at the core of the region’s concerns about food security. About one-quarter of the population of MENA countries is poor, and about three-quarters of poor people live in rural areas. Poor households in the region spend between one-third and two-thirds of their income on food, so they are hardest hit by food-price shocks. In addition, since a relatively high share of the population lives on incomes near the poverty line, small increases in the cost of living can have a large impact on the incidence of poverty (World Bank 2009).

The combination of diets heavily reliant on wheat and wheat supplies dependent on imports means that events in global wheat markets play an outsized role for welfare outcomes in the region, and this link between international markets and domestic welfare will likely strengthen with time. Population growth in MENA is projected at 1.7 percent per year, significantly higher than the world rate of 1.1 percent (World Bank 2009). At the same time, the potential for expanding supplies on irrigated land is severely constrained; per capita water availability is projected to fall by half by 2050, with serious consequences for the region’s already stressed aquifers and natural hydrological systems (World Bank 2007). As a consequence, projections of the region’s food balance indicate that imports will increase by nearly 64 percent over the next 20 years (World Bank 2009).

When price shocks occur, governments often intervene. In MENA, the interventions take many forms, but consumer subsidies are the most favored instrument (Lampietti et al. 2011). For example, in Tunisia, Jordan, Morocco, Egypt, Syria, and Iraq, where disaggregated data are available, food subsidies averaged 1.6 percent of GDP in 2009 and totaled $8.1 billion (World Bank 2011b). Since then, many governments have expanded consumer subsidies in response to high commodity prices and popular uprisings.

At the same time, government capacity to shore up safety net programs against high food prices differs among countries in the region (World Bank 2009, 2011b). All else equal, countries with large fiscal deficits and high cereal import dependency are least able to absorb a wheat price shock. These are mostly the oil importers (Jordan and Lebanon) and the region’s developing oil exporters (Yemen, Iraq and Syria). In contrast, the Gulf Cooperation Council countries (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates) have ample budgetary resources to absorb higher costs despite being entirely dependent on international markets for their wheat. Moreover, in these
countries, rising food import bills are frequently offset by rising export revenue because of the positive correlation between energy and food prices. Egypt and Morocco do not have the luxury of ample fiscal capacity to absorb sustained higher prices, although their higher domestic production levels help to cushion price shocks.

Despite the preponderance of consumer subsidies, the evidence suggests that international food price shocks are transmitted to domestic food prices throughout the region to various degrees (World Bank 2011b). Over the five-year period ending in February 2011, domestic food prices rose, on average, by more than 10 percent annually in Egypt, Iran, and Yemen and by nearly 5 percent or more in Djibouti, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, and the United Arab Emirates. Rising international prices have been a major factor in increases in domestic food prices, typically explaining some 20 to 30 percent of the variation in domestic prices (World Bank 2011b). International price changes have been particularly strong drivers of food inflation in Iraq and in the West Bank and Gaza, accounting for more than 50 percent of food inflation, followed by Egypt, Djibouti, and the United Arab Emirates (over 40 percent of food inflation). The pass through is smaller but still sizable, varying between 0.2 and 0.4 percent, for a large group of MENA countries, including Morocco, Jordan, Syria, Iran, Yemen, and all Gulf Cooperation Council countries other than the United Arab Emirates.

Shared Policy Elements and Effects

Over the past 50 years, most countries have come to depend on private markets for the physical distribution of food (Akiyama et al. 2001). However, this is less true for countries in the MENA region where food policies rely heavily on state interventions. With the exception of Yemen, wheat imports, marketing, and storage are managed by public or semipublic entities. Moreover, with the exception of Libya, where policies are in flux, all MENA governments provide consumer subsidies for wheat flour or bread.

Along with managed supplies, strategic inventories are a crucial element of food security strategies in the region. As mentioned above, one consequence is that a large share of global wheat inventories is held in the region. In 2011, storage capacity in the region was sufficient to cover six months of average consumption, and estimated ending stocks stood at five months of average consumption (World Bank and FAO 2012). Although it is difficult to distinguish strategic storage from working stocks, it is worth noting that global wheat ending stocks stood at 3.6 months of global consumption for the 2010/11 crop year and 3.4 months for 2011/12 (USDA 2012). Moreover, under current plans, inventory levels in the region will grow. For example, wheat agencies in Oman, Bahrain, and Qatar plan to more than double their storage capacities. When the plans are fully implemented, agencies in those countries as well as Syria and Saudi Arabia
will have the capacity to store enough wheat to meet consumption needs for 13 to 17 months (World Bank and FAO 2012, p. 14). Planned expansions in Jordan, Algeria, Tunisia, and Morocco will increase capacities in those countries to more than six months of consumption.

Although MENA countries differ with respect to the management of wheat supply chains, supply chain costs are generally high relative to the costs in benchmark countries. This is true even though the dry climates of MENA countries help to limit spoilage and hold down physical storage costs. In fact, the average monthly cost of storing wheat in the region ranges between $1.5 and $3.5 per metric ton, which compares favorably with storage costs in the Netherlands and the United States, both large handlers of traded grain (World Bank and FAO 2012). Still, because stocks are held for long periods, total storage costs are high. Other components of import supply are also costly compared to benchmark countries. Recent analysis suggests that the total costs of port logistics, storage, inland transport (to the mills), and management are, on average, $42 per metric ton of wheat or 12.5 percent of the cost of a ton of wheat at current prices. Moreover, there are significant differences among the countries, with supply chain costs in some countries that are four times those of the Netherlands (World Bank and FAO 2012, p. 28).

In this paper, our focus will be on the first two elements of food policy in MENA, the use of subsidies and strategic storage to address high and volatile wheat prices. But before proceeding, it is worth noting that policy changes and public investments could also be brought to bear to address high supply chain costs. In particular, the funds spent on strategic stores that lessen the negative consequences of price spikes could also be spent on improvements to roads or ports that reduce average prices.

II. Commodity Stabilization Policy Experience

Early interest in the use of storage to stabilize commodity prices centered on macroeconomic considerations. In a gold-standard world, volatile export earnings and import costs arising from volatile commodity prices created challenges for managing exchange rates. Moreover, low commodity prices were perceived as an exacerbating factor during the Great Depression. Consequently, commodity stabilization schemes and commodity-based currency rules were promoted by economists as diverse as Keynes (1938) and Hayek (1943). Subsequently, Massell (1969) introduced the notion that commodity price stabilization could generate welfare benefits for the sector as a whole, which could be shared among producers and consumers.

Between 1954 and 1980, treaties among major producing and consuming countries resulted in five international commodity agreements with price stabilization components, three of which (tin, cocoa, and rubber) relied on managed buffer stocks to smooth international prices. National governments launched
domestic stabilization programs as well. The European Union, Japan, and the United States all employed government-controlled inventories to help manage commodity prices, and buffer stock schemes were launched in Bangladesh, India, Indonesia, the Republic of Korea, Mexico, and the Philippines. In 1969, the IMF established a Buffer Stock Financing Facility to provide lending support to the stabilization efforts. The Common Fund for Commodities was established to provide liquidity to international stabilization programs under a UN initiated Integrated Program for Commodities established to stabilize the prices of 10 core commodities in 1975 (Larson et al. 2004; Knudsen and Nash 1990).

During this period, a series of conceptual and empirical studies emerged to suggest that average welfare gains from stabilization were small relative to changes in price levels (Newbery and Stiglitz 1981; Anderson et al. 1981; Myers and Oehmke 1988). Williams and Wright (1991) explored the interactions of public and private stocks in a series of pioneering papers, summarized in a 1991 volume. Their work and related studies showed that because of resource limits, stabilization schemes are prone to eventual bankruptcy, even when they are rationally priced and fully hedged in financial markets (Wright 1979; Wright and Williams 1982, 1988; Larson and Coleman 1993). Other writers noted that selecting the appropriate price to defend is a technical challenge made more difficult in practice by political economy incentives to convert stabilization programs into programs that benefit dominant interest groups (Bauer and Paish 1952; Bardsley 1994).

Perhaps most convincing for policy makers were the insurmountable practical difficulties of implementing the stabilization mandate once policies were in place. Even well-run stabilization schemes strained budgets, and many failed, sometimes spectacularly, creating disruptions in the markets they were designed to stabilize (Yamey 1992; Bardsley 1994). By the 1990s, the stabilization components of the international commodity agreements were no longer in force. Gilbert (1996) penned an obituary notice.

As evidence mounted showing that the theoretical benefits of stabilization were low on average and that the policies themselves were difficult to manage, a separate literature emerged showing that the consequences of commodity risks were nonetheless significant for particular groups, especially vulnerable households and poor children. This large literature centered on how risk mitigation and adaptation were central to rural livelihood strategies, influencing agricultural production choices and spawning a variety of formal and informal insurance mechanisms. Larson et al. (2004) and Dercon (2005) provide reviews. With respect to policy, this strand of the literature often promoted instruments designed to mitigate the harsh consequences of commodity price volatility rather than instruments meant to change the distribution of prices.

When once-stable crop prices spiked in 2008, price stability and poverty were again linked in the minds of policy makers as prices pushed the near poor into poverty. In response, governments intervened in markets, and price stabilization policies received renewed interest (Brinkman et al. 2010; Wodon and Zaman 2010).
The speed with which food exporters raised export taxes or banned exports in response to rising prices encouraged food importers to reconsider policies that would maintain strategic stores of food within national borders (Abbott 2012; Liefert et al. 2012; Martin and Anderson 2012).

Still, while precautionary public stores are often a key component of food security programs, there are surprisingly few empirical studies that examine the cost tradeoffs between strategic storage and alternative policies. This omission leaves a knowledge gap for policy makers because other forms of investment can be viewed as complete or partial substitutes for investments in public storage. In this application, we focus on a comparison of the cost of holding strategic food stores versus targeted assistance, a frequently used alternative. However, the model could also be used to analyze the effects of irrigation investments or varietal improvements that reduce domestic supply variations or investments in trade corridors that reduce transaction costs and average consumer prices.

### III. The Model

In this section, we describe the model used to assess the effects of strategic storage policy on domestic prices in the MENA region and the rest of the world (RoW). The intuition behind the model is that the equilibrium price of physical storage sits at the cusp of spatial and temporal arbitrage possibilities. Said differently, decisions about selling for consumption or trade today must be balanced against the expected profitability of storing. Expectations about the future value of stored goods are conditional, and all things equal, price outcomes are expected to be higher and more volatile when carryover inventories are low. This is because when stocks are low, it becomes more likely that production shortfalls will be rationed through high prices rather than buffered through stock drawdowns.

A key feature of this class of models, including the model presented here, is the need to form a rational set of numerical conditional price expectations to value carryover inventories and future production. Specifically, the model employs a set of spatial and temporal price arbitrage conditions, together with assumptions about demand, supply, and the distribution of supply shocks to model the distributions of price and consumption outcomes. Using these as a baseline, policies are introduced that are designed to change price outcomes, and the consequences of the policy interventions on the distribution of prices and consumption are evaluated. It is worth emphasizing that the model is not a forecasting tool but rather a means of evaluating the effects of strategic storage rules on price and consumption levels and volatility.

2. Exceptions include Srinivasan and Jha (2001), Brennan (2003), and Gouel and Jean (2012).

3. The trade-and-storage model was developed in Williams and Wright (1991, Ch. 9) and analyzed in Miranda and Glauber (1995) and Makki, Tweeten, and Miranda (1996). Early work on rational inventory pricing includes Gustafson (1958) and Gardner (1979).

4. Stockouts (Wright and Williams 1982), convenience yields (Makki, Tweeten, and Miranda 1996), and risk premia (Larson 2007) are sufficient to generate this feature.
To make the numerical model tractable, we treat the region as a common market operating under a unified policy. This is a necessary abstraction, but not an altogether unreasonable one. As discussed above, countries in the region pursue similar polices, and the shared borders among the MENA countries, which are otherwise isolated from other regions by water or desert, means that potentially different market outcomes generated by differences among the policies are most likely muted through illicit trade. More to the point, an important collective outcome of the separate national policies has been a significant increase in the share of global wheat inventories held in the region, which, in turn, are primarily managed by parastatal agencies. Because this share is large, the set of similar policies has an aggregate effect on global markets. By collapsing the numerous similar policies and markets into representative ones for modeling purposes, we are able to capture this important aspect in our analysis. Indeed, the capacity to quantify the collective spillover effect of the similar policies implemented by countries in the region is a key innovation of the model. We also abstract from the technical and political economy obstacles to the implementation of the policy that we simulate.

It is worth noting that trade corridors remain available during our simulations despite the constraints on the capacity to restock strategic stores. This feature sidesteps a concern occasionally voiced by policy makers that trade corridors will shut down. Still, although it is possible to imagine scenarios in which governments have the capacity to distribute strategic stores of wheat but import supply chains are severed, real world instances have been few in recent times and brief in duration. More common are political events or acts of nature that disrupt deliveries from contracted suppliers and drive import prices higher. Our modeling approach is consistent with the latter set of events, but not with the former. Potentially, the model could be modified to include discontinuities in trade if reasonable probabilities of such events could be formulated. Since we have not done so, any benefits ascribed to strategic stores as a precaution against discontinuous trade are omitted.

Model Equations

Formally, the model is characterized by the following relationships. Current consumption in region \( i \), where \( i \in \{ \text{MENA, RoW} \} \) is given by a downward sloping function of the current price:

\[
D^i(P_t^i) = a^i - b^i P_t^i
\]  

(1)

where \( P_t^i \) is the price of wheat in period \( t \) and region \( i \).

5. For example, unrest during the Arab Spring led to supply disruptions at ports in Egypt, Libya, Syria, and Yemen and contributed to food shortages (World Bank and FAO 2012).
In each region, there is a representative storing agent that acts competitively and incurs the following cost for storing an amount $S^i_t$ from period $t$ until $t+1$:

$$K(S^i_t) = (1 + r)(kS^i_t + P^i_t S^i_t)$$

(2)

where $k \geq 0$ is the net unit cost of physical storage services and $r$ is the interest rate; both are assumed to be identical in the two regions. Accounting for the non-negativity constraint on storage, the first-order condition of the storer’s problem yields the following complementarity condition:

$$S^i_t \geq 0 \perp P^i_t + k - E_t P^i_{t+1}/(1 + r) \geq 0$$

(3)

where $E_t$ denotes the mathematical expectations operator conditional on information available at time $t$. This implies that storage occurs when there is an expectation that the returns to storage, net of the time value of money and physical storage costs, are positive. It should also be emphasized that the evaluation is based on an expected price for period $t+1$. The formulation of this expectation is a key aspect of the numerical model.

Production is uncertain in the model. Representative producers make their production decisions and pay for inputs one period before bringing output to market. We represent that choice, made in period $t$, as planned production, $\bar{H}^i_t$. Actual and realized production differ by a multiplicative, exogenous disturbance term, $\varepsilon^i_{t+1}$, such that stochastic revenue is defined as $P^i_{t+1} \bar{H}^i_t \varepsilon^i_{t+1}$. The producer’s decision is based on information and input prices in period $t$ and can be written as

$$\max_{\bar{H}^i_t} E_t \left( P^i_{t+1} \bar{H}^i_t \varepsilon^i_{t+1} \right)/(1 + r) - \Psi^i(\bar{H}^i_t)$$

(4)

where $\varepsilon^i_t$ is normally distributed with a mean of 1 and a variance of $\sigma^2_i$; $\Psi^i(\bar{H}^i_t)$ is the production cost corresponding to the planned production. The solution to this problem is the following equation:

$$E_t \left( P^i_{t+1} \varepsilon^i_{t+1} \right)/(1 + r) = \Psi^i(\bar{H}^i_t).$$

(5)

Note from equation (5) that, contrary to storing agents, producers do not base their production plans on price alone but also consider marginal expected revenue, which includes an expectation about prices and the likelihood of price-correlated production surpluses or shortfalls.

6. The “perp” notation ($\perp$) used in the complementarity condition means that the expressions on either side of the sign are orthogonal; hence, if one equation holds as a strict inequality, the other side holds as a strict equality.
Differences between production, consumption, and storage in either location are balanced by trade. We assume that wheat is a homogeneous product so that trade is decided by the spatial arbitrage condition:

\[ X_i^t \geq 0 \Leftrightarrow P_i^t + \theta \geq P_j^t \text{ for } j \neq i \quad (6) \]

where \( X_i^t \) is the export from region \( i \) and \( \theta \) is the per-unit transaction cost, inclusive of transport costs. For the problem at hand, we assume that transaction costs are constant over the relevant time horizon and that they do not depend on the direction of trade.\(^7\) Hence, prices in MENA fall within a moving band that is defined by the Ro\(W\) price and trade costs:

\[ P_i^t - \theta \leq P_i^t \leq P_i^t + \theta \text{ for } j \neq i. \quad (7) \]

At any point in time, three predetermined variables per country determine the state of the model: carry-in stocks, \( S_{i-1}^t \); planned production, \( H_{i-1}^t \); and the period shock, \( \epsilon_i^t \). The last two variables determine actual production, and all three variables can be combined in one state variable, private availability, \( A_i^t \), the sum of production and private carryover:

\[ A_i^t = S_{i-1}^t + H_{i-1}^t \epsilon_i^t. \quad (8) \]

Hence, market equilibrium can be written as

\[ A_i^t + X_j^t = D_j^t(P_j^t) + S_j^t + X_i^t \text{ for } j \neq i. \quad (9) \]

To summarize, the numerical problem has two state variables, \( \{A_{i}^{\text{MENA}}, A_{i}^{\text{Ro\(W\)}}\} \), and eight response variables, \( \{P_i^t, S_i^t, H_i^t, X_i^t\} \), for \( i \in \{\text{MENA, Ro\(W\)}\} \). Solutions follow a dynamic path since stocks are carried over from one period to the next.

**Calibrating the Model and Obtaining a Numerical Solution**

The parameters for the model are selected such that, at the nonstochastic steady state, the equilibrium reproduces the physical trend of the world wheat market in 2011 (table 2). From the center panel of the table, we can see that the MENA region is a significant net importer, with imports accounting for approximately 47 percent of its consumption. To calibrate the steady-state prices, we decided not to rely on 2011 values, which, as discussed above, are high by historical standards, since it is unlikely that the steady state is associated with extreme values. Instead, we calibrate the Ro\(W\) price at $176/ton, the average U.S. export price in

\(^7\) In practice, the MENA region does not export wheat, so the assumption of symmetric trade costs is innocuous.
2005–2007, a period prior to the high prices of the food crisis but during a time when prices had risen above prevailing prices at the beginning of the decade. The steady-state MENA price is defined by assuming that the price difference between the regions reflects transport costs, which is set at $35.55/ton based on a recent survey (World Bank 2012).

Selecting appropriate elasticities is a challenge given the large variation in the elasticities reported in the literature. As a guide, we follow the literature on commodity price dynamics, which shows that observed price volatility is consistent with relatively low demand elasticities (Roberts and Schlenker 2009; Cafiero et al. 2011), and we assume the demand elasticity to be equal to –0.12, which is toward the lower end of the range of commonly used elasticities. We consider a

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**Table 2. Model Calibration Values**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Economic interpretation</th>
<th>MENA</th>
<th>RoW</th>
</tr>
</thead>
<tbody>
<tr>
<td>$a_i$</td>
<td>Intercept of demand curve</td>
<td>84.336</td>
<td>664.048</td>
</tr>
<tr>
<td>$b_i$</td>
<td>Slope of demand curve</td>
<td>0.043</td>
<td>0.404</td>
</tr>
<tr>
<td>$c_i$</td>
<td>Intercept of marginal cost function</td>
<td>–805.905</td>
<td>–670.476</td>
</tr>
<tr>
<td>$d_i$</td>
<td>Slope of marginal cost function</td>
<td>25.059</td>
<td>1.335</td>
</tr>
<tr>
<td>Std($\varepsilon_i$)</td>
<td>Standard deviation of production shocks</td>
<td>0.070</td>
<td>0.030</td>
</tr>
<tr>
<td>$r$</td>
<td>Interest rate (%)</td>
<td>5.00</td>
<td></td>
</tr>
<tr>
<td>$k$</td>
<td>Physical storage cost ($/ton)</td>
<td>22.40</td>
<td></td>
</tr>
<tr>
<td>$\theta$</td>
<td>Trade cost ($/ton)</td>
<td>35.55</td>
<td></td>
</tr>
</tbody>
</table>

**Calibration target at steady state**

<table>
<thead>
<tr>
<th>Consumption (millions of tons)</th>
<th>MENA</th>
<th>RoW</th>
</tr>
</thead>
<tbody>
<tr>
<td>75.30</td>
<td>592.90</td>
<td></td>
</tr>
<tr>
<td>Production (millions of tons)</td>
<td>40.20</td>
<td>628.00</td>
</tr>
<tr>
<td>Price ($/ton)</td>
<td>211.55</td>
<td>176.00</td>
</tr>
<tr>
<td>Demand elasticity</td>
<td>–0.12</td>
<td></td>
</tr>
<tr>
<td>Supply elasticity</td>
<td>0.2</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Coefficient of variation (%)</th>
<th>MENA</th>
<th>RoW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price</td>
<td>16.36</td>
<td>19.63</td>
</tr>
<tr>
<td>Exports</td>
<td>—</td>
<td>8.58</td>
</tr>
<tr>
<td>Demand</td>
<td>1.98</td>
<td>2.38</td>
</tr>
<tr>
<td>Production</td>
<td>7.01</td>
<td>3.04</td>
</tr>
</tbody>
</table>

**Notes:** Consumption, production, and price in RoW targets are determined as the trend values in 2011 after applying a Holdrick-Prescott filter (smoothing parameter of 400) on the underlying data. RoW consumption is adjusted to ensure global market equilibrium. The MENA price target is defined by adding transport cost to RoW price. Simulated statistics are calculated over 100,000 sample observations from the asymptotic distribution.

**Source:** Consumption and production data are from USDA (2011), and price data are from World Bank (2011a).

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8. Average annual prices are for U.S. hard red winter wheat, as reported by the World Bank (2011a).
supply elasticity of 0.2, in line with commonly used supply elasticities for wheat.\(^9\) The cost function is assumed to be quadratic, making the marginal cost function linear. We express the marginal cost function as

\[
\Psi_i^d(H_i^t) = c_i + d_i H_i^t.
\]

The parameters \(c_i\) and \(d_i\) determine the supply elasticity (see table 2) under the assumption that the marginal cost at steady-state production equals the steady-state price.

We specify two sets of uncorrelated supply shocks, \(\varepsilon^i \sim N(1, \sigma^2_i)\). On the basis of historical production data, we derive an estimated distribution of supply shocks where production is more volatile in MENA than in the RoW. Annual interest rates and per unit storage charges are assumed to be the same for each region, at 5 percent and $22.40 per ton based on a recent World Bank study on wheat markets in MENA (World Bank 2012).

The rational expectations storage model lacks a closed-form solution so solutions must be approximated numerically. The algorithm that we use is based on a projection method inspired by Miranda and Glauber (1995) and described in detail in Gouel (2013).

### Calibrated Model Behavior

Recall that the model is calibrated around a set of prices and quantities together with two distributions of supply shocks upon which the model randomly draws in simulation. Because of this structure, the mean values of the simulated series will be near their calibrated values. However, the variations in the simulated variables are affected by the sets of randomly drawn supply shocks. Because these distributions are not specified directly, we use the ex post variability in the simulated distributions of price, demand, supply, and trade to test the validity of the aggregate consequences of our ex ante parameter selections. With this background, the simulated and historical coefficients of variation are reported in the bottom panel of table 2. As the table makes clear, the historical and simulated distributions are of similar orders of magnitude.

Before moving to a discussion of alternative policies, two points should be made regarding the trade and storage outcomes in the baseline model. First, given the large gap between production and demand in MENA, the simulated model never generates an outcome in which wheat is exported from the region. This is consistent with expectations, since MENA has not been a net exporter of wheat in the last 50 years.

The second point has to do with speculative storage—that is, storage held in order to profit from expected temporal price changes. Reported data series,
including the data used to calibrate the model, contain all forms of storage: spec-
ulative storage, public storage, and pipeline storage that is needed to keep ship-
ping and processing operations running smoothly. It is impossible to isolate
speculative storage in the data; however, it is speculative storage that is key to the
model’s pricing mechanics. Conceptually, when one country is a perpetual im-
porter, speculative storage will always take place in the exporting country,
absent physical impediments to trade, large differences in physical storage
costs, or changing transfer costs (Gouel and Jean 2012). This is because an im-
porting speculator pays interest on the costs of importing in addition to interest
on the price of the commodity, a cost that a speculator in an exporting country
does not incur. Unless there is an offsetting benefit to storing locally, competi-
tion will result in adjustments in trade rather than storage in response to
changes in availability in the importing country.10 This general finding applies
to our model outcomes as well, and speculative private storage always takes
place outside MENA.

Strategic Storage

In this section, we describe a regional cooperative strategy in which strategic in-
ventories of wheat are held in MENA as a hedge against high global prices. In
keeping with our earlier discussion, the objective of the cooperative strategy is
to mitigate the consequences of price spikes—that is, brief periods of exception-
ally high prices such as those experienced in 2008 and 2010. Government
interventions are designed to be rare in order to manage the costs of the
program, which include the effects associated with government storage displac-
ing private storage.

As discussed, there is no speculative storage in the MENA region in the bench-
mark model. However, we assume that MENA governments hold strategic re-
serves, which are not directly available for consumption unless released by
managers of the strategic reserves, who follow strict rules. Furthermore, we
assume that the goal of the strategy is to stabilize domestic prices rather than to
directly influence global prices; a practical implication is that exports are prohib-
ited when stocks are released.

Three interrelated components are needed to fully define the public interven-
tion. The first concerns the maximum domestic price the strategy hopes to
defend. As discussed, most programs designed to stabilize domestic or interna-
tional prices through the build up and release of strategic stocks are prone to
failure because they set out to defend unrealistic price goals. Moreover, even
when goals are set reasonably, inventories are depleted when rare but eventual
combinations of events occur, such as consecutive bad harvests. With this in
mind, we have chosen a conservative strategic reserve objective for our simula-
tion. Using the benchmark model, we simulated the range of MENA price

10. This result arises because we compress an annual cycle into a single period in the model. If trade
takes time, it is rational to store while awaiting shipments (Coleman 2009).
outcomes and, from the resulting distribution of prices, selected the starting point for the highest decile—that is, the minimum price that is above 90 percent of the simulated price outcomes. This works out to be $263 per ton. By choosing to intervene at the 90th percentile, the policy insures that interventions will be rare. Moreover, because the policy targets a thinning portion of the probability density function, most price outcomes above the trigger are expected to cluster near the target price. To summarize, choosing the 90th percentile means that most strategic interventions will occur when prices are slightly above the target price and, conversely, that large gaps between world prices and the target price will be rare.11

A second decision sets the desired size of the strategic reserve, the target storage goal. This decision affects the robustness of the strategic policy because, when high prices do occur, domestic prices can only be lowered if there are sufficient supplies of wheat to be released from storage. When stocks are exhausted, domestic prices can rise above the target level. In other words, the program fails less frequently as the size of the government’s strategic reserve increases.

The third decision relates to how aggressively MENA wants to build toward its target storage goal. When the domestic price is below the price threshold and strategic inventories are below the target storage goal, MENA will add inventories at a given rate. Logistical capacity constraints will likely limit the rate of build up, and there may be additional factors to consider as well, for example, a desire to spread the cost over multiple fiscal years. A larger build-up rate reflects a more aggressive storage strategy and results in a faster recovery when stocks are drawn down. A lower rate spreads out the buying and build up of stocks over a longer time period and diversifies price risk.

The decision rules can be written more formally as follows. The rules to build stocks or release them can be summarized by the following complementarity equation:

\[
0 \leq S_t^G \leq \tilde{S}^G(S_{t-1}^G) \perp P_t^{MENA} - P^C
\]

(11)

where \( S_t^G \) is the public storage level in MENA, \( P^C \) is the price ceiling, and \( \tilde{S}^G(S_{t-1}^G) \) is a capacity constraint in period \( t \) that public storage cannot exceed. This public storage behavior is accounted for by other agents and affects their expectations. Accordingly, we must modify some equations from the previous model to accommodate public storage. In contrast to equation (9) in the benchmark model, market equilibrium in this situation takes the following form:

\[
S_{t-1}^G + A_t^{MENA} + X_t^{RoW} = D^{MENA}(P_t^{MENA}) + S_t^{MENA} + \tilde{S}_t^G.
\]

(12)

11. Note that “high prices” are defined by the model; that is, stochastic supply shocks are used in conjunction with the calibrated model to generate a consistent baseline distribution of domestic prices absent government intervention.
As discussed previously, wheat exports never emanate from MENA in the benchmark model, even though they are not explicitly constrained. This helps us simplify our equilibrium specifications in the strategic reserve model. To prevent released strategic reserves from being exported, we suppress the MENA export equation (equation (6) for \( i = \text{MENA} \) in the benchmark model) and MENA exports from the RoW market equilibrium.

At every period, restocking cannot exceed the quantity \( \alpha \bar{S}^G \), where \( 0 \leq \alpha \leq 1 \) is the build-up rate and \( \bar{S}^G \) is the targeted size of the strategic reserve. Because public stocks cannot exceed \( S \), the restocking rule can be expressed as

\[
\bar{S}^G(S_{t-1}^G) = \min \left( \bar{S}^G, \alpha \bar{S}^G + S_{t-1}^G \right).
\]  

(13)

The previous-period public storage level enters the model as a state variable, since it affects the current-period equilibrium. Consequently, the public intervention problem has three state variables, \( \{A_t^{\text{MENA}}, A_t^{\text{RoW}}, S_t^G\} \), and eight response variables, \( \{P_t, S_t, H_t, X_t^{\text{RoW}}, S_t^G\} \), for \( i \in \{\text{MENA, RoW}\} \).

**IV. Simulation Outcomes**

As previously discussed, the intervention price is set high and is designed to protect against the highest 10 percent tail of the expected price distribution. Choices about the targeted size of the reserve and the rate at which it is replenished determine the robustness of the policy. For the analysis reported in this section, the model is simulated 100,000 times for each of three buying strategies (10, 50, and 100 percent replenishment rates) and a range of target inventory levels from no strategic reserves (the benchmark model) to a target reserve equivalent to 70 percent of steady-state consumption, which is equivalent to 1.5 years of steady-state imports. For a given starting point, the outcomes depend on the realized supply shocks, and probable outcomes only merge to an expected trajectory after simulating several possible sequences of shocks.

Still, it is worth emphasizing that it is the infrequent and extreme price events that most concern policy makers. In particular, the model simulations reveal that when global prices are high enough to trigger a release of inventories, the gap between the domestic price and the target price is frequently small, and a partial release of stocks is sufficient to drive down both domestic and international prices\(^{13}\). However, a large shock can deplete reserve stocks completely, allowing prices to exceed the target price. If an unfortunately timed second negative shock occurs before stocks can be rebuilt, the safeguard policy fails again. This

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12. When stocks in MENA are released, imports into MENA are displaced. When prices are only slightly above the trigger prices, small displacements are sufficient to bring international prices to a point where domestic prices are at the trigger price.

13. When stocks in MENA are released, imports into MENA are displaced. When prices are only slightly above the trigger prices, small displacements are sufficient to bring international prices to a point where domestic prices are at the trigger price.
illustrates two seemingly contradictory results that are nonetheless intrinsic characteristics of strategic reserves: strategic reserve policies are capable of successfully defending a target price for many years but fail eventually, even when reserve levels are large and the target price is set high.

**Stabilization Results**

The tradeoffs among the strategic storage rules are illustrated in figure 1. Ranges of targeted reserve levels are reported along the horizontal axes of the figure’s panels, and the variables of interest are reported on the vertical axes.

Turning first to the upper left-hand-side panel, the simulation results suggest that the strategic reserve can be effective in reducing the overall variation in domestic prices and that the efficacy of the policy increases as the level of strategic stores is set higher. For example, at a restocking rate of 10 percent, a targeted reserve rate of 20 percent of consumption, and a target price at the 90th quantile, the strategy reduces the coefficient of variation (CV) for MENA wheat prices from 16.4 to 15 and reduces the CV of domestic consumption from 1.98 to 1.81. Increasing the restocking rate from 10 to 50 percent increases the robustness of the policy because the probability of a stockout falls from 3.4 to 2.3 percent.
This, in turn, boosts the performance of the strategic reserve policy, further reducing domestic price and consumption volatility to 14.8 and 1.79 percent.

An important result of the model is that the strategic reserve policy, which is designed to protect domestic consumers, also reduces the volatility of prices in the RoW. Indeed, a comparison of the upper and lower portions of the first panel of figure 1 shows that because of trade, the CV of price in the RoW evolves in a similar manner as the CV in MENA. By design, there are periods when the stocks released under the strategy are sufficiently large to completely displace imports into MENA. However, this occurs infrequently, partly because the targeted price is set high and is rarely breached. In fact, the full displacement of MENA imports occurs less than 0.1 percent of the time and only occurs at target storage levels of at least 30 percent of normal consumption. In very rare instances, the correlation between local and RoW prices is also reestablished when the trigger is breached, but stocks are insufficient to insulate domestic consumers.

As discussed, an aggressive strategy of restocking reserves reduces the likelihood that sequential periods of high prices will deplete the reserves. However, while supply shocks may be uncorrelated, high prices are not since low inventory levels can persist, setting the stage for sequential periods of high prices. An aggressive restocking rate means that the reserve manager is more likely to add additional reserves when international availability is tight and prices are high. Consequently, the relationship between the CV of price and the build-up rate is not monotonic. For low reserve targets, prices are less volatile with a higher build-up rate, but the opposite is true for high target reserves. As the size of the reserve builds, the probability of a stockout falls significantly, even at low restocking rates. Consequently, a more aggressive restocking policy becomes destabilizing since larger interventions reduce the quantities available for consumption and private storage but yield only small increases in the capacity of the policy to withstand sequential periods of high prices. Therefore, they generate small marginal reductions in price volatility.

Before proceeding to a discussion of program costs, two additional consequences of MENA’s adoption of a strategic storage policy on global markets should be mentioned. First, because wheat imports are sped up during periods of stock accumulation and are displaced when public inventories are released, the effect of the policy on trade is unambiguous and generates increased trade volatility. For example, the CV of trade increases from 8.6 to 12.2 percent for a 20 percent target reserve with a 10 percent build-up rate. Public storage also has an effect on private storage, through two channels. First, by decreasing price volatility, public storage decreases the profit opportunities from speculation and the incentive to store privately. Second, public reserves follow a predictable storage rule that can be exploited by speculators, either by running on the public stocks

14. For non-oil exporters in the region, food imports can affect exchange rates and have macroeconomic consequences. For many years, the IMF issued loans to address trade shocks from high grain prices. See IMF (1996) for an instance involving Algeria.
or by strategically dumping private reserves into the program. In the policy that we examine, a run on public reserves (as in Salant 1983) is unlikely since the intervention price is quite high. In the scenarios that we simulate, the level of global stock increases because of the policy, but this is accomplished partly at the expense of speculative storage. Moreover, in a strategic reserve program, private storage begins to accumulate stocks at much higher availability levels when the release of public stocks is less likely.

**Program Costs**

The direct costs of the strategies are provided in the fourth panel of figure 1, based on the following:

\[
[1 - 1/(1 + r)] E_0 \sum_{t=0}^{\infty} (1 + r)^{-t} \left[ (P_{t}^{MENA} + k)S_{t}^G - P_{t}^{MENA}S_{t-1}^G \right] \tag{14}
\]

where the discount rate used to calculate costs is the same rate used to discount storage costs. It should be kept in mind that the calculation is strictly one of costs and not net benefits, which ultimately depend on assumptions about risk aversion in MENA and the RoW.

The annual average cost of the strategic reserve program evolves almost linearly with the targeted size of the strategic reserve. For a 10 percent build-up rate and a target of 20 percent of normal consumption, the annual cost of the policy is $373 million. Program costs increase rapidly as the target storage goal increases, climbing to $1,319 million for a target equivalent to 70 percent of annual consumption. As discussed, the marginal market effects of increasing reserves fall quickly once the reserve target moves beyond 40 percent of consumption (87 percent of trade). A more aggressive restocking rule raises the average purchase price for the strategic reserves, and this drives up program costs as well. Depending on the restocking rate, the gains to increasing the target storage level flatten out and little is gained, even while program costs continue to rise in a linear fashion (figure 1). For example, a strategy that sets a reserve target of 40 percent of annual consumption with a restocking rate of 10 percent achieves nearly the same reduction in price volatility as do more expensive alternatives with higher reserve targets. The strategy reduces domestic price volatility from 16.4 to 14.5 percent, reduces international price volatility from 19.6 to 17.5, and reduces demand volatility from 1.98 to 1.75. The program is expected to fail 0.58 percent of the time and to cost $782 million per year to maintain. While the failure rate is low overall, keep in mind that because the trigger price is set at the high end of the price distribution, no intervention is required 90 percent of the time. Consequently, a less sanguine interpretation of this result is that the policy will fail, completely or partially, about 5.8 percent of the time interventions are needed. Beyond this point, program costs continue to rise without significantly increasing the robustness of the program.
Targeted Transfers

Often governments find it more cost effective to target the most vulnerable for assistance. The basic notion is that some portion of society can rely on its own resources even in times of high food prices, and excluding them from safety-net programs lowers program costs. With this in mind, we consider an alternative food security policy in which only a targeted group is protected during high-price periods. The alternative policy allows domestic prices to fluctuate as markets dictate but provides direct assistance in the form of food coupons to a targeted group, permitting them to purchase wheat at the targeted price. In contrast to a storage policy, there are no physical inventories, and the targeted program does not fail as long as the government is willing and able to fund it. Because public inventories are not stored in support of the program, costs are only incurred when prices breach the targeted price.

Before continuing, it should be noted that there are alternative ways of structuring targeted food safety nets. There are also alternative ways to finance safety net programs, drawing on financial risk-management instruments, including options, weather insurance, and catastrophe bonds (Alderman and Haque 2006; Mahul and Ghesquiere 2007; Skees et al. 2005). However, for our purposes, cash-equivalent transfers, in which the program’s cost falls to the government, serve as a realistic, useful, and simple benchmark for the comparison of program costs.

In the context of the model, the market equilibrium equation for MENA under the new policy is

\[
A_t^{\text{MENA}} + X_t^{\text{Row}} = (1 - \lambda)D_t^{\text{MENA}}(P_t^{\text{MENA}}) + \lambda D_t^{\text{MENA}}(\min(P_t^{\text{MENA}}, P^C))
\]

\[+ S_t^{\text{MENA}} + X_t^{\text{MENA}}
\]

(15)

where \(\lambda\) represents the share of households covered by the policy. The costs associated with identifying and targeting qualifying households are excluded, even though the costs may be consequential. The cost of this policy is given by

\[
[1 - 1/(1 + r)]\lambda E_0 \sum_{t=0}^{\infty} (\frac{1}{1 + r})^{-t} [\max(P_t^{\text{MENA}} - P^C, 0)D_t^{\text{MENA}}(\min(P_t^{\text{MENA}}, P^C))].
\]

(16)

The simulation results show that because the trigger price is at the 90th quantile, payouts occur infrequently. Moreover, because the program covers the thin tail

15. Cash transfers are increasingly used in developing countries, in part because of new technologies that lower implementation costs (Ahmed 2005). However targeted and self-targeted food transfers are still frequently used. Moreover, there are reasons for preferring food transfers to income transfers when food markets perform poorly (del Ninno, Dorosh, and Subbarao 2007; Sabates-Wheeler and Devereux 2010; Cunha, De Giorgi, and Jayachandran 2011). Magen et al. (2009) explore transfer programs in the context of food crises.
of the price probability distribution, prices that would warrant payouts are clustered near the trigger, and this keeps typical payouts low. In turn, these features result in average program costs of $53 million per year when 40 percent of the population is covered, well under the cost of a strategic storage program. The cost of the program expands linearly with the share of the population covered. Even when targeting is dropped and the program is extended to the entire population, average program costs are low at $142 million per year.

Nevertheless, the average cost of the program masks rare events that may strain budgets and threaten the sustainability of the program. In our simulation, the maximum payouts for a program-coverage rate of 40 percent of the population were $3.78 billion—nearly 70 times average costs. However, this value was extreme, and 99 percent of the payouts were under $1.34 billion (about 25 times the average cost).

The policy is designed to allow vulnerable households to consume at levels consistent with lower prices when wheat prices are high. For some households, the benefits are large and lasting because the capacity to purchase additional food precludes the long-term consequences of even temporary periods of poverty and malnutrition. However, this also means that for the covered portion of the population, price does not ration demand. Specifically, when the market price reaches the ceiling price, protected consumers face a constant price, and their demand becomes perfectly inelastic to market prices. Consequently, the program creates an added cost for most consumers because less adjustment in demand leads to greater price volatility, both in MENA and in the RoW. Quantitatively, the simulations suggest that the average effect of the policy on volatility is small. The CV of global prices increases marginally from 16.36 to 16.60 percent, even when the program is extended to all households in MENA.

**Sensitivity Analysis**

In the sections above, we considered variations in target storage levels and the restocking (build-up) rate on price outcomes and then compared the costs of the strategic storage policy to an alternative program that provides targeted relief to the most vulnerable when prices are high. Implicit in the analysis is the assumption that the parameters in the calibrated model are sound. In this section, we report results based on alternative assumptions about supply and demand elasticities and interest rates. The sensitivity analysis shows that these basic model assumptions influence the quantitative results but do not affect any particular conclusion. To manage the number of alternative results that we report, we dispense with multiple restocking scenarios and focus exclusively on the case in which inventories are immediately replenished. These results are summarized in figure 2.

**Interest Rate.** We considered two interest rates, 3 and 8 percent, whereas the benchmark used in the paper was 5 percent (figure 2, left panel). A lower (higher) interest rate makes storage for speculation more (less) profitable by
decreasing (increasing) the opportunity cost of storage. The effect on price volatility is limited because a lower interest rate of 3 percent decreases the CV of price by less than one point. The policy effects are not sensitive to the interest rate; the results are simply translated with respect to the effect of the interest rate on volatility in the absence of a policy. In other words, the benchmark results are affected by interest assumptions, but the effects of the policy on benchmark volatility are limited.

**Demand Elasticity.** We consider two alternative demand elasticities: a very inelastic demand curve with an elasticity of \(-0.05\) and a more elastic one with an elasticity of \(-0.40\). The benchmark value is \(-0.12\). The results are shown in the second panel of figure 2. With a more inelastic demand function, the benchmark price CV in MENA increases to 26 percent, significantly higher than the global rates observed and simulated in our baseline model (recall table 2). Consequently, a higher target stock level is needed for the reductions in price volatility to level out, since price plays a smaller role in rationing demand. The opposite is true with a more elastic demand function; prices are already very stable (with a price CV of 6 percent) and rarely spike. Consequently, the policy has negligible impacts because public stocks are rarely sold. Nonetheless, it should be noted that the coefficients of variation under the alternative demand elasticities are inconsistent with the price distributions observed historically.

**Supply Elasticity.** We consider supply elasticities of 0.05 and 0.40, with a benchmark equal to 0.20. The overall effects of changing the supply elasticity are
limited. As expected, with lower (higher) supply elasticity, price volatility is higher (lower), but not substantially so; price volatility in the absence of intervention does not change by more than 0.5 percent (third panel of figure 2). As with interest rates, the primary effect of changes in the calibration of supply elasticity are on benchmark price volatility rather than the way price volatility declines as public stock targets are increased.

V. Conclusions

In this paper, we describe a rational expectations model of competitive storage and trade based on wheat markets for MENA and the RoW. We use the model to quantify the effects of a strategic inventory policy designed to protect consumers in the region from very high prices. We find that with a modest protection goal, the program can effectively shield consumers in MENA against steep price spikes and, by doing so, lowers price volatility in the region. Moreover, because MENA is a large importer, releasing stocks when international prices are high lowers international prices, since the released stocks displace MENA imports. Theory and practical experience suggest that strategic reserve programs fail when a series of rare but eventual adverse events occur. The model suggests the probability of the program’s failure can be reduced by holding greater reserves. A more aggressive restocking of spent reserves reduces failure risk as well, but the strategy can be destabilizing since larger purchases are made when international supplies are tight. Sensitivity analysis shows that these findings are robust to changes in how the model is calibrated.

Making the strategic reserve program robust to failure drives up the program’s costs. In practice, targeted assistance through cash or in-kind transfers, work programs, and other channels are often used to address food vulnerability, and there is a growing body of knowledge on how best to implement them. Simulations show that a targeted consumer subsidy program that insulates the most vulnerable from the upper range of price increases is a much less expensive alternative on average. The simulations also show that financing targeted transfers in MENA requires planning, since subsidy expenditures are also subject to eventual spikes that could undermine the policy when peak expenditures are not hedged. From a global market perspective, procyclical transfer programs add slightly to price volatility. Transfer programs also rely on continuous trade, and while physical disruptions to trade are infrequent and brief, governments that rely on transfers rather than strategic stocks should have contingency plans.

A complementary policy of investing in trade corridors is a promising area for future study. Policy changes and public investments that lower transaction costs in MENA to benchmark levels would confer immediate benefits in the form of lower average consumer prices and, to the extent they lead to robust or redundant supply channels, could address concerns about potentially debilitating supply disruptions.
REFERENCES


Jaime de Melo and Alberto Portugal-Perez

The least developed countries rely on preferential market access. To benefit from these preferences, proof of sufficient transformation must be provided to customs in importing countries by meeting the rules of origin requirements. These rules of origin are complicated and burdensome to exporters in least developed countries. Since 2001, under the U.S. Africa Growth Opportunity Act (AGOA), 22 African countries that export apparel to the United States have been able to use fabric of any origin (single transformation) and still meet the criterion for preferential access (the so-called Special Rule). In contrast, the EU has continued to require yarn to be woven into fabric and then made into apparel in the same country (double transformation). Panel estimates for the 1996–2004 period exploit this quasi-experimental change in the design of preferences. Estimates show that this simplification contributed to an increase in export volume of approximately 168 percent for the top seven beneficiaries, or approximately four times as much as the 44 percent growth effect from the initial preferential access under the AGOA without single transformation. This change in design was also important for diversity in apparel exports because the number of export varieties grew more rapidly under the AGOA special regime. JEL codes: F12, F13, F15

Throughout the Doha negotiations, the least developed countries (LDCs) have objected to the lack of attention to the loss of market access in developed-country markets, which is the result of complicated requirements that exporters must...
meet to qualify for preferential access. These requirements mean that exporters must satisfy rules of origin (RoO); that is, they must prove that products that benefit from preferential access have sufficient domestic content. These RoO are cumbersome and complicated. For example, in the case of NAFTA, Cadot et al. (2005) estimate that one-third of the increase in the border price of Mexican textile and apparel exports to the United States is to compensate for the costs of complying with NAFTA’s RoO. They also estimate that NAFTA raised the price of intermediates sold by U.S. firms to Mexico by 12 percent. Ultimately, NAFTA’s RoO halved the gains from duty-free market access for Mexican exports of textiles and apparel. Many feel that the design of these requirements is costly and reduces the intended market access that is supposed to be granted by preferences (see a summary of estimates in Cadot and de Melo (2007)). Based on the quasi-natural experiment provided by the U.S. duty-free access to African exporters of textiles and apparel under the Africa Growth Opportunity Act (AGOA), this paper estimates the costs in terms of lower export growth and less product diversity due to restrictive technical requirements.

Meeting RoO requirements is the core implementation tool in all preferential schemes. Typically, RoO have two components: (i) economy-wide rules that apply to all products receiving preferences (i.e., roll-up for materials that serve as input in the subsequent transformation can be considered as originating from the appropriate country); and (ii) numerous product-specific RoO that are usually defined at the four- or six-digit level of aggregation in the Harmonized System (HS-6 or HS-4) (e.g., technical requirements in the production of the textiles and apparel sector examined here). A growing body of literature concludes that the requirements necessary to prevent trade deflection (i.e., importing via the low tariff partner and then reexporting duty-free within the preferential area) serve as protectionist devices that ultimately impede market access for the intended beneficiaries.

This evidence is based on two factors: (i) the utilization rates of preferences (at the tariff-line level) or the share of imports entering a market under preferential access from paying duties below MFN rates allows LDCs to obtain a higher price for their exports than MFN competitors. The Generalized System of Preferences in place since 1971 and the more recent EU Everything But Arms initiative and the U.S. Africa Growth Opportunity Act are the major nonreciprocal preferential access channels available for LDCs. In his last attempt at salvaging the Round in July 2011, Pascal Lamy called for a plan B, dubbed the “LDC plus” package. The package failed to be approved in December 2011. The core of the package was duty-free quota-free market access and simplified rules of origin for LDCs.

2. Any preferential trading scheme falling short of a full-fledged Customs Union, such as “reciprocal” Free-Trade-Areas or “nonreciprocal” preferential schemes granted by industrial countries to developing countries such as the Generalized System of Preferences, require the satisfaction of RoO to prevent trade deflection (i.e. to import through the low tariff partner and reexport to other higher-tariff partners in the area with little or no transformation of the product). Estevadeordal and Suominen (2006) provide a thorough description of RoO around the world.

3. See Estevadeordal and Suominen (2006) for a detailed description of both sets of rules. For example, the EU has over 500 different product-specific RoO (Cadot and de Melo 2007).
access and (ii) synthetic ordinal indexes, based on simple observation rules intended to capture in a single ordinal index the restrictiveness of multiple and complex product-specific RoO (for example, a change of tariff classification combined with a technical requirement is more restrictive than only a change of tariff classification requirement).

Repeated analyses of disaggregated data show a positive correlation between the extent of preferential access and the value of the constructed restrictiveness indexes (a higher value of the index indicates a more restrictive product-specific RoO). The data also show a tapering off or decline in utilization rates as preferential margins increase, presumably because it becomes more costly to satisfy increasingly complex rules. These correlations have led researchers to conclude that RoO may be “made-to-measure” protectionist devices. With a large share of North-South trade occurring with preferential status, obtaining a better grasp of the effects of RoO is a first-order priority for improving our understanding of the overall restrictiveness of trade policy.4

The difficulty with the available evidence is the presumption that variation in utilization rates is a plausible indicator of the costs of an RoO regime. The data often show high utilization of preferences for tariff lines with zero most favored nation (MFN) tariffs, although compliance costs are estimated at approximately 2–3 percent of the product price (see, for instance, Manchin (2006) and François, Hoekman, and Manchin (2006)). To give an example using data from this study, between 90 percent and 97 percent of qualifying African exports of apparel enter the United States and EU under their respective preferential regimes, the AGOA for the United States and Everything But Arms or Cotonou preferences for the EU (see table 1). Yet, as shown here, export patterns of textiles and apparel to the two destinations have differed drastically in recent years (see figure 1).

When the origin requirement was drastically simplified under the AGOA, despite remarkably similar average preferential margins in the United States and the EU (U.S. MFN tariff of 11.5 percent in 2004 and EU preferential margin of 11.0 percent), apparel exports to the United States took off, whereas apparel exports to the EU remained flat. Thus, assessing the restrictiveness of RoO only by inspecting utilization rates would suggest low costs while ignoring the fact that export growth rates to the two destinations diverged at about the time when origin requirements to one market, the United States, were relaxed.

Thus, it is desirable to go beyond the inspection of utilization rates and indices of restrictiveness to isolate the effects of meeting origin requirements. This paper isolates the costs of meeting these origin requirements by exploiting a relaxation of the “yarn forward” rule for textiles and apparel applied by the United States in its preferential trade policies. In the early stages of the AGOA, the United

**Table 1. Apparel Exports of Countries Benefiting from the AGOA’s Special Rule in 2004**

<table>
<thead>
<tr>
<th>Country</th>
<th>Share to EU 2004</th>
<th>Utilization Rate</th>
<th>Share to US 2004</th>
<th>Utilization Rate</th>
<th>Date of entry into force of AGOA SR (year, month)</th>
<th>Export growth to the United States (yearly rate)</th>
<th>Before AGOA SR</th>
<th>After AGOA SR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lesotho</td>
<td>0.50%</td>
<td>24.49%</td>
<td>32.92%</td>
<td>98.18%</td>
<td>01.apr(01)</td>
<td>21.23%</td>
<td>34.32%</td>
<td></td>
</tr>
<tr>
<td>Madagascar</td>
<td>85.77%</td>
<td>96.83%</td>
<td>23.34%</td>
<td>97.27%</td>
<td>01.mar(01)</td>
<td>77.62%</td>
<td>31.07%</td>
<td></td>
</tr>
<tr>
<td>Kenya</td>
<td>1.54%</td>
<td>92.53%</td>
<td>20.01%</td>
<td>97.94%</td>
<td>01.jan(01)</td>
<td>12.77%</td>
<td>58.55%</td>
<td></td>
</tr>
<tr>
<td>Swaziland</td>
<td>0.53%</td>
<td>1.75%</td>
<td>12.90%</td>
<td>98.34%</td>
<td>01.jul(02)</td>
<td>29.15%</td>
<td>53.88%</td>
<td></td>
</tr>
<tr>
<td>Namibia</td>
<td>0.05%</td>
<td>72.95%</td>
<td>5.68%</td>
<td>96.50%</td>
<td>01.dec(02)</td>
<td>-</td>
<td>837.93%</td>
<td></td>
</tr>
<tr>
<td>Botswana</td>
<td>6.01%</td>
<td>74.67%</td>
<td>1.46%</td>
<td>99.44%</td>
<td>01.aug(02)</td>
<td>2.85%</td>
<td>26.55%</td>
<td></td>
</tr>
<tr>
<td>Malawi</td>
<td>0.06%</td>
<td>94.52%</td>
<td>1.93%</td>
<td>95.17%</td>
<td>01.aug(02)</td>
<td>54.90%</td>
<td>38.27%</td>
<td></td>
</tr>
<tr>
<td>Ghana</td>
<td>0.07%</td>
<td>82.22%</td>
<td>0.53%</td>
<td>96.26%</td>
<td>02.mar(02)</td>
<td>23.00%</td>
<td>214.41%</td>
<td></td>
</tr>
<tr>
<td>Uganda</td>
<td>0.00%</td>
<td>9.48%</td>
<td>0.29%</td>
<td>100.00%</td>
<td>01.oct(02)</td>
<td>-</td>
<td>576.03%</td>
<td></td>
</tr>
<tr>
<td>Ethiopia</td>
<td>0.34%</td>
<td>97.24%</td>
<td>0.24%</td>
<td>99.80%</td>
<td>01.aug(02)</td>
<td>-66.55%</td>
<td>400.08%</td>
<td></td>
</tr>
<tr>
<td>Cape Verde</td>
<td>2.43%</td>
<td>99.77%</td>
<td>0.22%</td>
<td>95.03%</td>
<td>02.aug(03)</td>
<td>111.26%</td>
<td>35.75%</td>
<td></td>
</tr>
<tr>
<td>Tanzania</td>
<td>1.80%</td>
<td>99.53%</td>
<td>0.18%</td>
<td>99.00%</td>
<td>02.feb(02)</td>
<td>-72.17%</td>
<td>618.97%</td>
<td></td>
</tr>
<tr>
<td>Mozambique</td>
<td>0.08%</td>
<td>94.70%</td>
<td>0.16%</td>
<td>85.15%</td>
<td>02.feb(02)</td>
<td>-16.70%</td>
<td>131.84%</td>
<td></td>
</tr>
<tr>
<td>Sierra Leone</td>
<td>0.38%</td>
<td>4.04%</td>
<td>0.11%</td>
<td>0.00%</td>
<td>04/apr(04)</td>
<td>86.91%</td>
<td>80.57%</td>
<td></td>
</tr>
<tr>
<td>Cameroon</td>
<td>0.17%</td>
<td>23.10%</td>
<td>0.02%</td>
<td>0.00%</td>
<td>02.mar(02)</td>
<td>30.88%</td>
<td>0.10%</td>
<td></td>
</tr>
<tr>
<td>Nigeria</td>
<td>0.04%</td>
<td>1.67%</td>
<td>0.01%</td>
<td>1.37%</td>
<td>04/jul(04)</td>
<td>3.70%</td>
<td>-54.16%</td>
<td></td>
</tr>
<tr>
<td>Zambia</td>
<td>0.00%</td>
<td>100.00%</td>
<td>0.00%</td>
<td>78.67%</td>
<td>01.dec(02)</td>
<td>-1.22%</td>
<td>-49.65%</td>
<td></td>
</tr>
<tr>
<td>Mali</td>
<td>0.03%</td>
<td>10.49%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>03.dec(04)</td>
<td>34.97%</td>
<td>-86.35%</td>
<td></td>
</tr>
<tr>
<td>Senegal</td>
<td>0.17%</td>
<td>93.90%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>02.apr(02)</td>
<td>-30.47%</td>
<td>-27.65%</td>
<td></td>
</tr>
<tr>
<td>Niger</td>
<td>0.03%</td>
<td>82.09%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>03.dec(04)</td>
<td>-10.94%</td>
<td>-37.70%</td>
<td></td>
</tr>
<tr>
<td>Benin</td>
<td>0.01%</td>
<td>41.97%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>04.jan(04)</td>
<td>2.92%</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Rwanda</td>
<td>0.00%</td>
<td>30.23%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>03.mar(03)</td>
<td>-</td>
<td>21.2%</td>
<td>34.3%</td>
</tr>
</tbody>
</table>

**Note:** AGOA SR indicates the AGOA’s Special Rule.

a The value of total exports from these 22 countries to the EU [United States] is 209.6 [1385.1] Mio USD in 2004.

b The utilization rate of preferences is defined as the percentage of imports entering into a country on a preferential basis with respect to total imports. The figure on utilization rates for EU preferences in 2004 was obtained from EUROSTAT. Utilization rates for U.S. preferential schemes were obtained from the U.S. International Trade Commission.

c Average over the period.

d The Special Rule is assumed to enter into effect in the calendar year, if it is prior to July 1 (the year is indicated in parenthesis in the column).

**Source:** Authors’ calculations using data from COMTRADE. Countries ranked by decreasing order of combined total apparel exports to the United States.
**Figure 1(a). Apparel Exports of 22 Countries Benefiting from the AGOA Special Rule by 2004**

Notes: Yearly data from 1996 to 2004 are presented. The 22 sub-Saharan countries benefiting from the AGOA Special Rule by 2004 as well as ACP are Benin, Botswana, Cameroon, Cape Verde, Ethiopia, Ghana, Kenya, Lesotho, Madagascar, Malawi, Mali, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, Swaziland, Tanzania, Uganda, and Zambia. The top seven exporters are Botswana, Cameroon, Ghana, Kenya, Lesotho, Madagascar, Namibia, Nigeria, and Swaziland.

Source: Authors’ calculations on data from COMTRADE.

**Figure 1(b). Apparel Exports to the United States from Top Seven African Exporters**

Notes: Vertical lines indicate year of entry of the AGOA and of the Special Rule. The year of entry into effect of the AGOA is 2000 for all countries (full line). The year of entry of the Special Rule for Kenya, Lesotho, and Madagascar is 2001 (dotted line). The year of entry of the Special Rule for Botswana, Malawi, and Swaziland is 2002 (dashed line).

Source: Authors’ calculations on data from COMTRADE.
States introduced a special regime, the “third-country provision,” which consists of allowing the use of fabric from any origin in the making of apparel (rather than requiring U.S. fabric originating domestically or from the United States). In contrast, the unchanged environment of EU preferential regimes still required European or locally produced fabric. To our knowledge, this is the first such estimate.

Controlling for other factors, estimates show that relaxing RoO by allowing the use of fabric from any origin increased apparel exports to the United States by approximately 168 percent for the top seven (out of 22) qualifying African exporters in the group. We attribute the lack of supply response in the other countries receiving the AGOA’s Special Rule to institutional weakness. These estimates are based on product-level exports at the HS-4-digit level for knitted apparel (Chapter 61) and nonknitted apparel (Chapter 62) over the 1996–2004 period, when the United States relaxed the origin requirement for African apparel with the Special Rule, to be described shortly. In addition to this increase in exports, a higher rate of new products was exported to the United States than to the EU at the HS-6-level during this period.

The paper proceeds as follows. Section 2 describes the conditions for preferential access of African apparel to the U.S. and EU markets and the introduction of the Special Rule under the AGOA. Section 3 describes the timing of the introduction of the Special Rule and the evolution of aggregate exports of textiles and apparel. The remaining sections examine estimates at the disaggregate level (HS-4 or HS-6 levels) to capture the effects of technical requirements defined at the HS-4 level in textiles and apparel. Section 4 presents the data and the econometric strategy to address the many zero observations in the sample. Section 5 reports the results of disentangling the effects of the Special Rule from those following from the reduction in tariffs in the U.S. market. Section 6 studies the evolution of new apparel varieties during the period using a count model. Section 7 concludes.

I. Qualifying for Preferential Market Access under EU and U.S. Preferences in Textiles and Apparel

What follows is a brief description of origin requirements under EU and U.S. preferential regimes granted to African exporters of apparel.

5. Strong response to a reduction in fixed costs associated with meeting origin requirements is also obtained by Cherkashin et al. (2010), who study the effects of granting preferences with and without RoO for exports of woven apparel from Bangladesh. Their study is of a cross-section of 200 Bangladeshi firms (data collected over the 1999–2004 period) exporting woven textiles to the EU and U.S. markets under much the same assumptions as ours: all production is for exports, and exports are destined to either the EU or the U.S. market, or both. They estimate that a $1 reduction in fixed costs would generate an increase in exports in the range of $10–40, and they conclude that easy-to-obtain preferences, reduction in fixed costs, or both may have a catalytic effect and that preferences need not divert trade from other markets, as predicted in a setting with no fixed costs. Although the methodology is different and they do not study the costs of RoO in a dynamic context panel like this study, the magnitude of their estimates are in line with ours.
Market Access to the EU: Apparel under the Generalized System of Preferences and Everything but Arms

Since 1971, the Generalized System of Preferences has provided nonreciprocal preferential access to the EU market. For textiles and apparel, the product-specific RoO required that apparel should be manufactured from qualifying yarn (i.e., yarn originating in the country or in the EU). Production from yarn requires that a double-transformation process (yarn → textile → apparel) must take place in the beneficiary country, with the yarn being woven into fabric and then the fabric being cut and made into clothing.6

Market Access to the United States: Apparel under the AGOA

Operational since the second semester of 2000, the AGOA provides tariff-free access for a group of 22 African countries, a nonnegligible market access because many goods are excluded from the United States (Generalized System of Preferences) (e.g., watches, footwear, handbags, luggage, work gloves, and apparel). Thus, unlike beneficiaries of U.S. Generalized System of Preferences, the AGOA beneficiaries do not pay the U.S. MFN tariff of 11.5 percent. Initially, RoO for apparel under the AGOA applied the triple-transformation process used for NAFTA and other U.S. preferential schemes. That is, apparel had to be assembled in one or more AGOA-eligible countries from U.S. fabrics (or African-country fabrics up to a specified percentage), which were made from U.S. yarn in the “yarn-forward” rule. The Special Rule for 22 African countries (mostly LDCs), starting in 2001 for most countries (see table 1 below for the date of entry into force), relaxed this triple-transformation rule (cotton → yarn → textile → apparel) by conferring duty-free access to apparel regardless of the origin of the fabric (cotton, yarn, textile) used to produce it. In effect, meeting origin requirements under the AGOA’s Special Rule only required the application of a single-transformation requirement (fabric → apparel).

II. The Special Rule and Export Trends

Average MFN tariffs for apparel7 for the United States (11.5 percent) and the EU (11.0 percent) were very close throughout the 1996–2004 period. Thus, the preferential margins (equal to the height of the MFN tariff because African exporters had duty-free access to EU and U.S. markets) were very similar once the AGOA became operative. By the end of 2004, 22 countries benefited from the Special

6. Under the EU’s “Single List” (also called “PANEURO”), in operation since 2000, the EU Generalized System of Preferences accepted bilateral cumulation between the EU and a beneficiary country (cumulation provisions allow contracting parties to use intermediate goods from each other without losing origin status). Similar rules were applied for Everything But Arms and Cotonou regimes, leading us to combine EU imports under both schemes in table 1 (see de Melo and Portugal-Perez (2008) for details).

7. Two categories of apparel are considered: (i) knitted apparel (HS-61) and (ii) nonknitted apparel (HS-62).
Rule under the AGOA. The list of AGOA beneficiaries is presented in table 1, which also reports the utilization rate of preferences across apparel products for each of these 22 countries when exporting to the EU (under Everything But Arms or Cotonou) and when exporting to the United States under the AGOA. Countries with an important volume of exports to either destination have a high rate of utilization of preferences. Therefore, taking the 22 countries as a group, the utilization of preferences was 97.6 percent for the AGOA and 91.2 percent for Everything But Arms or Cotonou.

Export volumes, growth rates of exports, utilization of preferences, and the year of entry of the Special Rule are all indicated in table 1 in descending order of the market share to the United States in 2004. Not surprisingly, the ranking of exporters to the United States is different from the ranking of exporters to the EU. The differences partly reflect the importance of language in trade. For exports to the United States, they also reflect that English-speaking countries accepted the AGOA opportunity earlier. Except for Madagascar, the growth rate of exports to the United States has increased for all of these major exporters. Note also that the seven major exporters are among the early recipients of the Special Rule, with three major exporters benefitting from it in 2001. Growth rates for countries with market shares in the United States below 1 percent fluctuate significantly.

Yet, despite these high utilization rates under both schemes, export volumes evolved quite differently across the two destinations. Figure 1(a) shows the evolution of export volumes for the 22 AGOA beneficiaries and for the top seven exporters, the focus of our estimates. Figure (1b) shows the evolution of apparel exported to the United States by each of the top seven exporters. The data are aggregated over a potential of 111 knitted (CH-61) and 118 nonknitted (CH-62) apparel products defined at the HS-6-digit level. Trends for knitted and nonknitted apparel were similar for both countries, with U.S. imports of knitted apparel (less sensitive to the double-transformation rule) growing more rapidly (not reported in the figures) Figure 1(b) shows the sharp increase in apparel exports starting at about 2000 (the year the U.S. tariff was set to zero for AGOA beneficiaries) and 2001 (the year the Special Rule entered into force for Kenya, Lesotho, and Madagascar, the three largest exporters of apparel to the United States; see table 1). Figure 1(b) also shows a large drop in exports from Madagascar in 2002, a year of political turmoil following a contested presidential election.

Two trends are apparent in the raw data. First, prior to 2000, the paths of African apparel exports to the United States and the EU are alike. As shown in figure 1(a) and especially in figure 1(b), apparel exports to the United States increased substantially, with the timing of the change in the growth path coinciding with the entry into force of the AGOA in 2000 and of the Special Rule in 2001. By contrast, the value of exports to the EU for this same group of countries remained relatively flat from 1996 to 2000 and then declined, mainly because of the political crisis that hit Madagascar, the largest exporter to the EU at the end
of 2001. Second, exports to both markets are dominated throughout by the seven large exporters, who follow quite similar trends in both markets. The lack of export response by the other countries is discussed later.

Because this paper seeks to estimate the effects of moving from the triple-transformation rule to the single-transformation rule, it is important to attempt to disentangle the relative importance of removing tariffs alone from subsequently moving to the single-transformation rule. Initially, the log of the aggregate exports apparel (HS-61 and HS-62) is regressed on a time trend, country fixed effects (FE), and two dummy variables, one taking the value of one starting in 2000 when the United States removed the MFN tariff on apparel exports from the AGOA beneficiaries and the other taking the value of one starting the year the single-transformation rule was adopted in the country. The time trend coefficient estimate is significant and shows an average growth of 22 percent per year over the period for the 22 countries. Unfortunately, but not surprisingly, the results were disappointing because significant estimates for the coefficients on the dummy variables capturing the effects of the AGOA (with the triple transformation) and of the passage to the special rule could not be obtained. Two reasons account for this. First, the time series for each country only spans nine years. Second, there are large year-to-year fluctuations, especially for the less significant exporters (see the average growth rates of exports in the last column of table 1).

In any event, these estimates do not take into account that RoO vary across products, nor do they take into account exports to the EU, the change in preference margins in the U.S. market (which was different across products), or other changes in the EU and the U.S. markets. Data permitting, a satisfactory approach might be to develop a fully structural model in which heterogeneous firms decide whether to enter the textile market and then select a destination (i.e., the EU, United States, or both) and finally decide under which trade regime to export (i.e., under a preferential regime with fixed costs associated with proving origin or under MFN with no fixed costs).9

8. In both the United States and the EU, apparel imports from AGOA countries as a share of all apparel imports were small, constituting less than 0.1 percent throughout the period. Indeed, AGOA apparel imported by the EU as a share of all its apparel imports decreased by half, from 0.012 percent in 2000 to 0.006 percent in 2004. However, AGOA apparel as a share of all apparel imported by the United States more than tripled, from 0.027 percent in 2000 to 0.090 percent in 2004.

9. This is the route followed by Cherkashin et al (2010). They rely on cross-sectional data only for estimation, which does not allow them to directly address the effects of change in RoO, as we do here. Their identification relies on assuming (rather than estimating) that costs associated with meeting origin requirements increase unit production costs by 15 percent, that obtaining a quota license to sell to the United States under the MFA costs 7 percent, that decisions about entry into each market are made separately, and that expenditures for Bangladeshi goods come entirely at the expense of expenditures from other exporters. In any case, to fit a structural model to the exports of apparel by several African countries to the EU and U.S. markets would require firm-level data that was collected by the authors of the Bangladesh study but that are not available for any of the AGOA beneficiaries.
The alternative to a structural model is to “let the data speak” in a less ambitious framework. In de Melo and Portugal-Perez (2008), we sketch such a model, in which a representative apparel producer sells all its production to either the U.S. or the EU market or to both under preferential status (these are the two main export destinations for AGOA beneficiaries). The producer sells differentiated products (or, because we do not have firm data, heterogeneous firms sell a homogenous product to both markets with fixed entry costs to each market). The firm uses textiles as an input and faces a downward-sloping demand curve in each of the two destination markets. Under the single-transformation (“third-country provision”) rule introduced by the Special Rule, the firm chooses its textiles from the low-cost suppliers, whereas under the double- or triple-transformation rules, it is forced to purchase textiles from the high-cost partner. The comparative statics of the model show that export sales to a market respond positively to (i) a fall in tariffs (i.e., an increase in preferential access under the AGOA to the United States) and (ii) a relaxation of the rule of origin, which lowers its production costs.

III. Data and Econometric Strategy

After describing the specification, this section presents our data and our econometric strategy.

**Specification**

The model sketched above suggests that, after controlling for idiosyncratic factors in each market, export sales of individual apparel products to EU and U.S. destinations should depend on changes in preferential access, measured by changes in the preferential margin \( tmar \), and changes in the RoO. For the EU and the United States, RoO in textiles and apparel are defined at the HS-4 level. They include the double- and triple-transformation criteria described above along with other value-content (VC) requirements. Because only a subset of apparel varieties is exported, the sample is censored. The following log linear relationship is estimated:

\[
\ln(a_v + X_{i,t}^{j,k}) = \beta_1(tmar_{i,t}^{j,US})(TT_{i,t}^{j,US}) + \beta_2(tmar_{i,t}^{j,US})(SR_{i,t}^{j,US}) + \beta_3(VC_{i,t}^{j,EU}) + \beta_4D_{i}^{Mad-02} + \sum_{j \in J} \sum_{k \in K} \delta_{j,k}(D_{i}^{j} \times D_{k}^{k}) + e_{i,t},
\]

\( j \in J = \{7(\text{or 22) African exporters}\} \)
\( k \in K = \{\text{EU, US}\} t = 1996, \ldots , 2004 \)
\( i = 1, \ldots , 34 \in (\text{CH61 - CH62}) \)
where $X_{i,t}^{j,k}$ are exports of apparel variety $i$ from African country $j$ to market $k$ (EU or United States) in year $t$. $a_V$ is a parameter used to avoid truncation of the dependent variable to be estimated (see below); $tm_{i,t}^{j,k} = \frac{tn_{i,t}^{j,k} - tp_{i,t}^{j,k}}{1 + tm_{i,t}^{j,k}}$ is the preferential margin for country $i$ on product $j$ sold in market $k$ in year $t$. In the EU, African exporters obtained duty-free access, so $tp_{i,t}^{j,k} = 0$ and $tm = tm_{i,t}^{j,k} / (1 + tm_{i,t}^{j,k})$ for 1996–2004. In the United States, African exporters of apparel paid the MFN tariff over the 1996–1999 period, $tp_{i,t}^{j,k} = tm_{i,t}^{j,k}$ and $tm = 0$, and then obtained duty-free access starting in 2000, so $tp_{i,t}^{j,k} = 0$ and $tm = tm_{i,t}^{j,k} / (1 + tm_{i,t}^{j,k})$ over the period 2000–2004. Here, $\beta_1$ captures the effects of preferences on exports of variety $i$ under the triple-transformation rule until the date when countries qualify for the Special Rule under the AGOA. For the EU, because the preferential margin is virtually unchanged and is equal to the MFN rate throughout the period, the only change in preferential access to be considered comes from a relaxation of the value content rule (see below). $TT_t^{j,US}$ is a dummy variable that is set to one when exports of country $j$ are subject to the triple-transformation rule of the AGOA. $SR_t^{j,US}$ is a dummy variable that is set to one when the single-transformation rule becomes operative for country $j$’s exports and replaces the triple-transformation rule (starting in 2001 for three countries and in 2002 for four countries; see table 1). Here, $\beta_2$ captures the reduction in export costs from moving to the Special Rule on exports of variety $i$ from country $j$. Interaction with the $tm$ variable allows for the elimination of the triple transformation on export growth to depend on the height of the preferential margin. $VC_t^{j,EU}$ is a dummy variable accounting for the change in RoO under EU preferences, which consisted of a less restrictive cumulation rule for some nonknitted apparel (HS-62) allowed from 2000 onward. It takes the value of one if variety $ii$ is subject to an alternative (or optional) less restrictive regional VC rule allowing apparel that does not qualify for cumulation, provided that its value does not exceed 40 percent (or, in some cases, 47.5 percent) of the product price in year $t(\geq 2000)$ when exporting on a preferential basis to the EU, and zero otherwise. Here, $\beta_3$ captures the reduction in costs for exports to the EU from moving to a less restrictive RoO. $D_{i,t}^{Madag-02}$ is a dummy taking the value of one for Madagascar’s export loss in 2002 provoked by its political crisis. $D_{i}[D_t]$ is a dummy variable controlling for unobserved time-invariant FE by exporter $i$ [importer $k$], such as distance or a common language (due to multicollinearity, export- or import-specific dummies cannot be included in the model). $\varepsilon_{i,t}^{j,k}$ is the error term.

The expected signs for the coefficients are $\beta_1 > 0$, $\beta_2 > 0$, $\beta_3 > 0$, and $\beta_4 < 0$. In addition, the effect on exports of the single transformation is expected to be larger than the effect of the triple transformation, that is, $\beta_2 > \beta_1$. 
Data

The model is estimated for 34 varieties of apparel at the HS-4-digit level for two samples, one for the seven major exporters and another for all 22 beneficiaries. The panel covers the 1996–2004 period, which coincides with the removal of quotas set at the end of the Agreement on Textiles and Clothing on January 1, 2005. Although the choice of the period was constrained by data availability, the episode is convenient because there is no need to control for the removal of quotas at the end of the Agreement on Textiles and Clothing. In a postquota world, U.S. and EU markets are expected to be flooded by apparel from larger exporters, such as China and India, which were previously bounded by quotas. Export data and tariff data were compiled from IDB-WTO and TRAINS/WITS at the HS-6-digit. The discussion paper version (de Melo and Portugal-Perez, 2008) provides details and descriptive statistics for the sample. However, because 95 percent of the volume of apparel exports is accounted for by the seven major exporters, we report results of estimates on this reduced sample where data quality is arguably superior not only because there are positive aggregate exports by each country every year but also because these countries export a larger number of products.

Econometric Strategy

Two constraints guided our estimation strategy. First, a lack of plausible instruments at the detailed product level precluded us from implementing a two-stage procedure in which a decision to export a specific apparel product to a given destination is made in a first step, and then a decision is made on volume in a second step.10 Second, we were confronted with a large number of zero exports (or zeroes) in the data disaggregated at the HS-6 level: 95 percent were zero observations for the whole sample of 22 exporters; and 86 percent, for the reduced sample of the top seven exporters. However, the product-specific RoO under the AGOA were defined at the HS-4 level, and the VC rule under EU preferences was defined at the HS-4 level. This led us to aggregate data at the HS-4 level. As a result, the number of zero trade flows was reduced to 60 percent of observations for the top seven exporters.

Because this is still a large number of zero observations, we address it by contrasting several estimators in table 2. Two benchmark estimates are reported. Column 1 reports ordinary least squares (OLS) estimates \( \ln(X_{ik}^{L}) \) the dependent variable, which considers observation of positive-only exports,11 and

10. Ideally, one would want to implement a two-stage procedure in which a decision to export a specific apparel product is made in a first step, and then, in a second step, a decision is made about volume and destination. To satisfy the exclusion restriction in such a two-stage Heckman estimation method would require an appropriate exogenous instrument that would influence only the decision to export in the first stage and not the volume of exports in the second stage. Such an instrument is not available at this level of disaggregation.

11. Another benchmark (reported in de Melo & Portugal-Perez, 2008) is to shift all export values up by one unit (i.e., fixing \( a_i = 1 \) in equation (1)) before applying the logarithmic transformation and proceeding with OLS (see, for instance, Frankel et al. (1997)). The results are close to those reported in column 1 of table 2. Although this approach has the advantage of including all observations, it does not solve the problem of the inconsistent resulting estimates.
column 2 reports Tobit estimates. To overcome the sensitivity of estimates to the arbitrary choice of the parameter $a_v = 1$ in the standard Tobit, column 3 reports estimates from the maximum likelihood estimator proposed by Eaton and Tamura (1994). This estimator endogenizes the choice of the $a_v$ parameter (this is referred to as the ET-Tobit estimator). Thus, the dependent variable will be censored at the value $\ln(a_v)$.

However, estimates from Tobit models rely on assumptions of normality and homoskedasticity of errors, which are rejected by statistical tests in our data and model (see below), so the estimates are inconsistent. One solution is to resort to the increasingly popular Poisson Pseudo Maximum Likelihood (PPML) estimator proposed by Santos Silva and Tenreyro (SS-T) (2006). The PPML estimator addresses heteroskedasticity in constant-elasticity models and is found to perform well in gravity models where there are zero flows. Using Monte Carlo simulations, SS-T show that that the PPML estimator produces estimates with the lowest bias for different patterns of heteroskedasticity for a data-generating process relying on a cross-section. Results with the PPML are reported in column 4.

However, the PPML has not been tested in a panel data context, and it has shortcomings. For example, Martin and Pham (2008) have noted that the data-generating process used by SS-T did not produce zero values properly. When correcting the data-generating process to obtain a sample with an important number of zero-value observations (a situation closer to ours), Martin and Pham find that the ET-Tobit estimates have a lower bias than those obtained with the PPML estimator.

Thus, we implement the trimmed least absolute deviations (LAD) estimator for limited dependent variable models with FE proposed by Honoré (1992), maintaining $\ln(a_v + X_{i,t}^{j,k})$ as the dependent variable. This estimator has the advantage of being consistent and asymptotically normal. Therefore, it is not necessary to assume a parametric form for the errors (such as normality) or to assume homoskedasticity, both of which are rejected by the data. Given the large number of zeroes in the data and the rejection of the usual assumptions about the errors, it would appear that, on a priori grounds, the LAD estimator is the preferred estimator. In our case, it also produces the most plausible coefficient estimates. For example, although the PPML produces an estimate of the Special Rule coefficient that is closest to the one estimated by the trimmed LAD method, some of the other coefficient estimates do not have expected signs or reasonable magnitudes. For these reasons, the results in column 5 with the trimmed LAD estimator are retained as the preferred set of estimates. Additional estimates in table 3 are based on this estimator.

12. As discussed below, the value of estimated coefficients is very sensitive to the choice of $a_v$, especially $\beta_1$ and $\beta_2$.

13. In their simulations, SS-T (2006 and 2011) do not assess the performance of the PPML in either a panel context or in the presence of omitted variable bias, measurement error, or both. In addition, the Trimmed LAD estimator for Tobit models used here is not considered a contender to the PPML estimator in the simulations reported by SS-T.
<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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<tr>
<td>Estimated sign</td>
<td>ln(X(&gt;0))</td>
<td>ln(1 + X)</td>
<td>ln(a_v + X)</td>
<td>lnX</td>
<td>ln(a_v + X)</td>
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<td>Regressors&lt;sup&gt;a&lt;/sup&gt;</td>
<td>OLS</td>
<td>Tobit</td>
<td>ET-Tobit</td>
<td>PPML</td>
<td>FE Tobit</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(Trimmed LAD)&lt;sup&gt;c&lt;/sup&gt;</td>
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<tr>
<td>$TT_{US}^{US} \times tmar_{i,t}^{US}(&gt;0)$</td>
<td>0.06</td>
<td>0.4</td>
<td>0.14</td>
<td>0.06 [0.01]&lt;sup&gt;***&lt;/sup&gt;</td>
<td>0.04</td>
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<tr>
<td></td>
<td>[0.02]&lt;sup&gt;***&lt;/sup&gt;</td>
<td>[0.08]&lt;sup&gt;***&lt;/sup&gt;</td>
<td>[0.03]&lt;sup&gt;***&lt;/sup&gt;</td>
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<tr>
<td>$SR_{EU}^{US} \times tmar_{i,t}^{US}(&gt;0)$</td>
<td>0.15</td>
<td>0.88</td>
<td>0.33</td>
<td>0.15 [0.01]&lt;sup&gt;***&lt;/sup&gt;</td>
<td>0.16</td>
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<td>[0.02]&lt;sup&gt;***&lt;/sup&gt;</td>
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<tr>
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<td>0.03</td>
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<tr>
<td></td>
<td>[0.26]&lt;sup&gt;*&lt;/sup&gt;</td>
<td>[0.61]</td>
<td>[0.17]</td>
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<td>$D_{Madag}^{02}(&lt;0)$</td>
<td>−0.23</td>
<td>−1.45</td>
<td>−0.61</td>
<td>−0.65 [0.20]&lt;sup&gt;***&lt;/sup&gt;</td>
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<td>[0.11]&lt;sup&gt;**&lt;/sup&gt;</td>
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<td>$a_v (&gt;0)$</td>
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<td>0.001</td>
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<td>898.8]&lt;sup&gt;***&lt;/sup&gt;</td>
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<td>0.027</td>
<td>0.649</td>
<td>0.001</td>
<td>0.186</td>
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<td>4284</td>
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</tr>
<tr>
<td>$R^2$&lt;sup&gt;b&lt;/sup&gt;</td>
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<td>0.34</td>
<td>0.35</td>
<td>0.09</td>
<td>0.37</td>
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<tr>
<td>Approx. change in exports due to TT at $tmar_{i,t}^{US} = 11%$</td>
<td>66%</td>
<td>440%</td>
<td>154%</td>
<td>66%</td>
<td>44%</td>
</tr>
<tr>
<td>Approx. change in exports due to the Special Rule at $tmar_{i,t}^{US} = 10.5%$</td>
<td>158%</td>
<td>924%</td>
<td>347%</td>
<td>158%</td>
<td>168%</td>
</tr>
</tbody>
</table>

<sup>a</sup> Expected signs from estimated coefficients are in parenthesis.

<sup>b</sup> $R^2$ values are the square of the correlation between the fitted and the actual value of the dependent variables.


<sup>d</sup> $p$ values reported here. Low $p$ values (e.g., below 0.1) indicate misspecification.

<sup>*</sup> significant at 10 percent; <sup>**</sup> significant at 5 percent; <sup>***</sup> significant at 1 percent.

Notes: See equation (1) for definition of regressors. Standard errors in brackets are clustered at the exporter-importer-year level. The dependent variable is $X = X_{i,t}^{k}$ exports of apparel variety $i$ at the HS-4 level of aggregation from $j$ (top seven AGOA exporters) to $k$ (United States or EU) in year $t$. All regressions include exporter dummies as well as interaction terms between exporter dummies and EU dummies. TT indicates the triple transformation.

Source: Authors’ analysis based on data described in the text.

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IV. Results

Table 2 presents the main results of estimating equation (1) with the last two rows reporting the estimated change of exports to the triple transformation at an average preferential margin of 11 percent and to the introduction of the single rule at an average preferential margin of 10.5 percent for each estimator. Column 1 reports the truncated OLS method. Not all coefficients have the expected sign: the coefficient of VC is negative and nonsignificant. Switching from the triple to the simple transformation rule is estimated to boost apparel exports from 66 percent to 158 percent.

Columns 2 and 3 report estimates for the “standard” Tobit (with \( a_v = 1 \)) and the ET-Tobit, which account more appropriately than OLS for corner solution outcomes of the dependent variable. The overall fit for the models summarized in the likelihood-ratio values and the \( R^2 \) values (at the bottom of the table) are reasonably good. All coefficients now have the expected sign and are significant, but the estimated values of \( \beta_1 \) and \( \beta_2 \), which are very sensitive to the choice of \( a_v \) used to avoid truncation, are implausible. Indeed, estimates for \( \beta_1 \) and \( \beta_2 \) become smaller as \( a_v \) increases. ET-Tobit estimates reported in column 3 include an estimate of the value of \( a_v \) that best fits the data. As observed by comparing the results in columns 2 and 3, the “quick fix” approach should be avoided, at least when there are many zero values for the regressand. All coefficient signs are as expected. Although the parameter values are more plausible, they are still on the high side.

Recall that Tobit models (columns 2 and 3) rely on the assumptions of normality and homoskedasticity of errors. Unfortunately, statistical tests reject normality and homoskedasticity of errors in both models. Column 5 reports estimates when applying the PPML to address heteroscedastic errors. Adopting the single-transformation rule is now estimated to increase exports to 158 percent. There is, however, a sign reversal for the VC coefficient.

Finally, column 5 reports the LAD estimates that do not require normality of errors or homoskedasticity. All the coefficients have the expected sign, are statistically significant, and have plausible values, including the estimates for \( \beta_1 \) and \( \beta_2 \). Moving from the triple- to the single-transformation requirement increases imports from 44 percent to 168 percent. The presence of the alternative VC

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14. Pooled Tobit models are estimated. Their hypothesis is that the structure of the error term is uniform across exporters and years. This assumption is defensible insofar as African exporters in our sample arguably have a similar structure. Moreover, as discussed by Woodridge (2002), the Tobit is flexible and can accommodate many categories of independent variables, such as time dummies, interactions of time dummies with time-constant or time-varying variables, or lagged dependent variables.

15. The standard Lagrange multiplier tests of homoscedasticity and normality of errors for Tobit models are used here. See Cameron and Trivedi (2009) for more details on how to implement the tests in Stata. The \( p \) values of the Lagrange multiplier tests for both Tobit (column 2, table 2) and ET-tobit (column 3, table 2) are small (values of about 0.001). Thus, the tests reject homoscedasticity and the normality of errors.
### Table 3. Additional Estimates and Robustness Checks

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>1 Temporal ln(a_v + X) FE Tobit&lt;sup&gt;c&lt;/sup&gt; (Trimmed LAD)</th>
<th>2 Country-specific ln(a_v + X) FE Tobit&lt;sup&gt;c&lt;/sup&gt; (Trimmed LAD)</th>
<th>3 Alternative Special Rule ln(a_v + X) FE Tobit&lt;sup&gt;c&lt;/sup&gt; (Trimmed LAD)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Independent variables</strong></td>
<td>1a Coeff.</td>
<td>1b Approx. change in exports for an average tmar.</td>
<td>2a Coeff.</td>
</tr>
<tr>
<td>$SR_{t,i}^{US} \times tmar_{t,i}^{US}$</td>
<td>0.1</td>
<td>105%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.01]&lt;sup&gt;***&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$SR_{2,i}^{US} \times tmar_{t,i}^{US}$</td>
<td>0.05</td>
<td>53%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.01]&lt;sup&gt;***&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$SR_{3,i}^{US} \times tmar_{t,i}^{US}$</td>
<td>0.05</td>
<td>53%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.01]&lt;sup&gt;***&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$SR_{4,i}^{US} \times tmar_{t,i}^{US}$</td>
<td>0.03</td>
<td>32%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.01]&lt;sup&gt;***&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$D_{Bot}^{k} \times SR_{t,i}^{US} \times tmar_{t,i}^{US}$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$D_{Ken}^{k} \times SR_{t,i}^{US} \times tmar_{t,i}^{US}$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$D_{Bot}^{k} \times SR_{t,i}^{US} \times tmar_{t,i}^{US}$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$D_{Mad}^{k} \times SR_{t,i}^{US} \times tmar_{t,i}^{US}$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$D_{Nam}^{k} \times SR_{t,i}^{US} \times tmar_{t,i}^{US}$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$D_{Swa}^{k} \times SR_{t,i}^{US} \times tmar_{t,i}^{US}$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$ASR_{t,i}^{US} \times tmar_{t,i}^{US}$&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.15</td>
<td>158%</td>
<td></td>
</tr>
<tr>
<td>$ATT_{t}^{US} \times tmar_{t,i}^{US}$</td>
<td>0.04</td>
<td>44%</td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>4,284</td>
<td>4,284</td>
<td>4,284</td>
</tr>
<tr>
<td>R&lt;sup&gt;2&lt;/sup&gt;&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.37</td>
<td>0.38</td>
<td>0.37</td>
</tr>
</tbody>
</table>

*significant at 10 percent; ** significant at 5 percent; *** significant at 1 percent.

**Notes:** The specification also includes all the variables included in regressions in table 2, which are not reported here to save space. All estimates include exporter dummies as well as interaction terms between exporter dummies and EU dummies and the other regressors in table 2 (not reported to save space). Bootstrapped standard errors are in brackets. Standard errors in brackets are clustered at the exporter-importer-year level.

<sup>a</sup> R<sup>2</sup> values are the square of the correlation between the fitted and the actual value of the dependent variables.

<sup>b</sup> $ASR_{t,i}^{US} = 1$, for $t \geq t^*$, where $t^* = 2001$ for Madagascar, Lesotho, and Kenya and $t^* = 2002$ for Swaziland, Namibia, Botswana, and Malawi; $ASR_{t,i}^{US} = 0$ otherwise.

<sup>c</sup> Trimmed LAD estimator (see table 3).

**Source:** Authors’ analysis based on data described in the text.
requirement for some nonknitted apparel is associated with an increase in exports of 35 percent.

These estimates may still appear to be on the high side. However, African exports to the United States were very low before the Special Rule, accounting for less than 0.001 percent in both the EU and U.S. markets. This low base must have contributed to the large elasticity responses. Regarding the different estimates reported in table 2, in addition to yielding more reasonable estimates, the R² value for the Trimmed LAD estimator is higher than for the PPLM and passes Ramsey’s RESET test for model misspecification. In sum, the Trimmed LAD estimator outperforms the PPML, at least for this panel data set, where there many zero values and the estimates are likely to be contaminated by the presence of omitted variable bias, measurement error, or both.16

Additional Estimates and Robustness Checks

Table 3 presents the cumulative effects of the AGOA Special Rule on exports by including three additional dummy variables (SR_{2,i,t}^{US}, SR_{3,i,t}^{US} and SR_{4,i,t}^{US}) interacted with the preferential margins to equation (1). These variables capture the supplementary or cumulative effects on exports of each additional year under the Special Rule program. Thus, SR_{2,i,t}^{US} is equal to one if country j is at least in the second year after being entitled to the Special Rule, and zero if not. The same applies for SR_{3,i,t}^{US} and SR_{4,i,t}^{US}. Then, the coefficient of SR_{i,t}^{US} no longer captures the average effect on exports of benefiting from the Special Rule, but only the effect of being in the first year under this program. To save space, coefficient estimates for VC and for the dummy for Madagascar are not included in the table because they are similar to baseline estimates.

Column 1b reports the approximate increase of exports computed from estimates of the dummy coefficients in column 1a evaluated at an average preferential margin of 10.5 percent. The largest change in exports is registered during the first year, suggesting that preferential exports increased immediately after the implementation of the Special Rule. This result is what one would expect in clothing, where fashion changes rapidly from season to season and input requirements change constantly, so relaxing input requirements has an immediate effect on exporters. A country reaching the second year under the Special Rule has an average additional increase in exports of 53 percent. Countries reaching the third and fourth years under the Special Rule further increase their exports under the AGOA by an additional 53 percent and 32 percent, respectively. Notice that according to these estimates, the total effect on exports of benefiting from the Special Rule for four years is 242 percent, a figure larger than the average effect of 168 percent

16. At the end of their answer to Martin and Pham (2008), Santos-Silva and Tenreyro (2010) affirm, “The PPML estimator can certainly be outperformed in some situations, and we very much welcome the scrutiny of our results.” Simulations using data-generating processes in SS-T (2006 and 2010) fail to assess the performance of the PPML in a panel context and in the presence of omitted variable bias, measurement error, or both and do not consider the Trimmed LAD estimator for Tobit models. We conclude that this justifies the approach used here.
estimated in column 5 of table 2 because only three exporters in our sample make it to the fourth year.

Columns 2a and 2b show the differential effect of the single-transformation rule across the seven exporters. The effect for all countries is positive. The effect of the Special Rule on exports from Kenya, Madagascar, and Swaziland are found to be the largest. The different performance among receivers of the Special Rule begs the following question: why were some African countries so much more successful at taking up preferences and experiencing higher export growth in apparel? A possible explanation lies in the business environment of a country that may be more conducive to attracting foreign investment in apparel plants and to diminishing trading and other fixed costs, which can be proxied by a country’s rank in the World Bank “Doing Business” (DB) indicator.17 Figure 2 presents the DB18 ranking of African countries benefiting from the Special Rule and their apparel export growth during the AGOA (measured by the difference of exports (in logs) at 2004 and at the beginning of the AGOA). On average, countries that are highest ranked along the DB indicator experience higher growth in apparel exports during the AGOA, and the correlation coefficient ($r = -0.55$) is highly significant.

Recall that the Special Rule dummy is set equal to one if a country benefits from the rule for at least nine months. Botswana and Malawi were eligible for the Special Rule from August 2001, whereas Swaziland was eligible from July 2001, so the effect may already be reflected in the export data from 2001 onward. Column 3 reports the export elasticity estimate at an average preferential margin when the dummy, $R_{A_j, k}^{i, t}$, is equal to one from 2001 onward for Botswana, Malawi, and Swaziland and remains unchanged for other countries. Compared to the baseline estimates, the estimated impact of the Special Rule on exports decreases slightly, from 168 percent to 158 percent.

Finally, the results hold for the following robustness checks (available upon request). First, the estimations reported in table 2 are replicated for two samples: a sample of 16 countries with positive aggregate exports for each year and the full sample of 22 countries. With few exceptions, the estimates are globally close to those in table 2. As expected, the dummy for turmoil in Madagascar in 2002 loses significance when all 22 countries are

17. The indicator, available in the form of a ranking for 178 countries, is a simple average of the regulations affecting ten stages of a business’ life: starting a business, dealing with licenses, employing workers, registering property, getting credit, protecting investors, paying taxes, trading across borders, enforcing contracts, and closing a business. Because it is quantitative rather than subjective, the indicator is less subject to bias than the more widely used indicators of governance.

18. DB data for 2008 released on June 1, 2008, are used because they include more African countries in the sample than reports in previous years. For instance, DB 2006 coverage is limited to six out of the 22 African countries. However, for these six countries, the relative ranking of DB 2008 does not change significantly with respect to DB 2006.

19. In other words, $R_{A_j, k}^{i, t} = 1$ for $t \geq t^*$ where $t^* = 2001$ for Madagascar, Lesotho, and Kenya and $t^* = 2002$ for Swaziland, Namibia, Botswana, and Malawi; $R_{A_j, k}^{i, t} = 0$ otherwise.
included in the sample. However, more surprisingly, the coefficient value of the VC dummy is now larger than the one for the Special Rule, which might reflect the inclusion of a large number of small countries that were not successful in adopting preferential market access under the Special Rule context. Second, unobserved year-specific effects are controlled for by adding time dummies to the model. None of their coefficients was significant, as if no unobserved effect specific to a single year was left unexplained by all other dependent variables. Third, we checked for the possibility that omitted variable bias and measurement error could have led to our large estimated values. Thus, separate estimates are performed for knitted (Chapter 61) and nonknitted apparel (Chapter 62). Because the paths of knitted and nonknitted apparel were very similar, it is not surprising that a dummy variable distinguishing between the two was not significant. A variable to capture the effects of fluctuations in the dollar-to-Euro real exchange rate was also added. The estimated coefficient was insignificant despite the strong depreciation of the dollar to the Euro during the period.

**Figure 2. Apparel Export Growth and the Business Environment**

*Notes:* A higher indicator value in the DB rank indicates a less favorable environment. Fitted values for the regression line in the figure are (standard errors in parentheses)

\[
\text{Ln(exp04)} - \text{Ln(exp01)} = 5.86 - 0.37(\text{DB_rank}).
\]

(1.61) (0.12)

Number of observations: 21; Adjusted \(R^2 = 0.28\).

*Source:* Authors’ analysis based on data from DB and COMTRADE.
To further explore the effect of the Special Rule on the growth of apparel exports at the extensive margin (i.e., exporting new products rather than expanding the volume of existing export products at the intensive margin), the number of apparel varieties is computed at the HS-6-digit level exported by country $i$ to country $j$ at time $t$, $h_{ij}^t$. We begin by assuming that, conditional on a matrix of regressors $X = [X_{it}]$, the count $h_{ij}^t$ follows a Poisson distribution with parameter $\lambda_{it} = \exp (X_{it} \beta)$. The set of regressors, $X$, includes the preferential tariff in market $k$, $t^k_{it,mfn}$, the Special Rule dummy, $R_{i,k}^{j,t}$, and income in market $k$, $Y_t^k$.

Figure 3 displays the estimated kernel densities of exported varieties when observations are broken down along market destination and along the date of entry into force of the AGOA’s Special Rule, with the exclusion of the outlier Madagascar (including Madagascar does not change the general pattern, except for a longer tail). The kernel is right skewed, suggestive of a Poisson distribution. As expected, the mass of the distribution is displaced to the right when the Special Rule entered into force, implying that more varieties were exported, on average, to each market. However, this transfer is more accentuated for varieties exported to the United States than for varieties exported to the EU. Although we are not able to attribute these patterns to firm entry into the market, they are in accordance with those reported in Cherkashin et al. (2010), where a reduction in fixed costs leads to the entry of firms into the market.

There are two problems with estimating the log-likelihood function associated with the Poisson regression model. First, it is likely that there is heterogeneity across countries, which can be handled by using FE or random effects. Second, the Poisson requires that the mean and variance of the count be equal, or there is overdispersion. This is not the case in our data (see the results from the overdispersion test in table 4). Thus, Poisson regression model estimates are robust but inefficient, with downward-biased standard errors. This inefficiency can be corrected by using the negative binomial regression model (NBRM). Hence, the estimates from pooled FE and random effects with the NBRM are reported in table 4.20

With the exception of $\ln(\text{GDP})$ in the export market, which is insignificant, all coefficients have the expected sign and are significant. According to these estimates, the percentage increase in the number of apparel varieties exported following the implementation of the AGOA’s Special Rule ranges from a minimum of 39 percent ($= \exp(0.33) - 1$) to a maximum of 61 percent ($= \exp(0.48) - 1$). Because the number of varieties exported by these African countries is small

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20. The NBRM generalizes the Poisson model by reparametrizing the parameter in the Poisson regression model as a random variable following a gamma distribution. Expressions for the log-likelihoods are given in Cameron and Trivedi (2009). Results from the Poisson regression model that are more robust can be retrieved as a special case of the NBRM. Because they are very similar to those obtained with the NBRM model, they are not reported here to save space, but they are available upon request.
compared to the total universe of varieties that can be exported, these counterfactual estimates appear plausible.

VI. CONCLUSIONS

If preferential market access requires preferences in the first place, actual market access depends on the design of the preference scheme. This paper has explored the effects of loosening a particularly costly product-specific rule of origin for apparel, the so-called “triple-transformation” rule. This rule requires that apparel must be produced from qualifying yarn, which is essentially yarn from the preference grantor (i.e., the United States), implying a triple transformation in the beneficiary country because the qualifying yarn first must be woven into fabric, and then the fabric must be cut and made into clothing. As explained in the introduction, the relaxation of this rule by the United States to the single-transformation rule, called the Special Rule under the AGOA for a group of African countries, provides a “quasi-natural” benchmark against which the effects of a change in this RoO can be evaluated. This benchmark is particularly welcome because RoO are extremely complex, are rarely modified, and vary across HS product lines within the same product category, and the utilization rates of preferences do not follow the expected pattern of an increase in utilization as preference margins increase. In this context, a “quasi-natural” experiment such as the change to single transformation (Special Rule) under the AGOA presents a unique opportunity to study the costs of RoO requirements. The results in this paper confirm earlier (see Cadot and de Melo 2007) and more...
### Table 4. Count Estimates: Negative Binomial Model

<table>
<thead>
<tr>
<th></th>
<th>1 Pooled</th>
<th>2 Pooled</th>
<th>3 Pooled</th>
<th>4 FE</th>
<th>5 RE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dependent variable</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$R_{i,t}^{k,j}(&gt;0)$</td>
<td>0.33</td>
<td>0.36</td>
<td>0.4</td>
<td>0.48</td>
<td>0.47</td>
</tr>
<tr>
<td>$t_{i,j}^{k,mfn}(&lt;0)$</td>
<td>[0.15]**</td>
<td>[0.08]***</td>
<td>[0.12]***</td>
<td>[0.09]***</td>
<td>[0.09]***</td>
</tr>
<tr>
<td>ln ($Y_{i,j}^{k}(&gt;0)$)</td>
<td>[0.01]***</td>
<td>[0.01]***</td>
<td>[0.01]***</td>
<td>[0.01]***</td>
<td>[0.01]***</td>
</tr>
<tr>
<td><strong>Constant</strong></td>
<td>2.93</td>
<td>1.56</td>
<td>7.15</td>
<td>1.97</td>
<td>2</td>
</tr>
<tr>
<td><strong>Observations</strong></td>
<td>396</td>
<td>396</td>
<td>396</td>
<td>396</td>
<td>396</td>
</tr>
<tr>
<td><strong>Number of groups (importer-exporter pairs)</strong></td>
<td></td>
<td></td>
<td></td>
<td>44</td>
<td>44</td>
</tr>
<tr>
<td><strong>Fixed exporter-specific effects</strong></td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td><strong>Test of overdispersion [H0 : $\theta = 0$ (no overdispersion)]</strong></td>
<td>$\chi^2$</td>
<td>6,522.81</td>
<td>749.56</td>
<td>748.99</td>
<td></td>
</tr>
<tr>
<td><strong>p value</strong></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

* significant at 10 percent; ** significant at 5 percent; *** significant at 1 percent.

Notes: Standard errors are presented in brackets. RE indicates random effects.
Source: Authors’ analysis based on data described in the text.

* * *
recent (Cherkashin et al. 2010) work suggesting that RoO represent high fixed costs for exporting firms.

First, taking advantage of this quasi-natural experiment setting in which African exports to the EU and the United States benefited from the same preferential margin of approximately 10 percent in both markets under Everything But Arms and the AGOA and controlling for other factors, estimates show that the AGOA’s Special Rule was associated with an increase in apparel exports from the seven main exporters of approximately 168 percent. This is nearly four times as much as the estimate of the effects of the tariff removal on sub-Saharan African exports to the United States, estimated at a 44 percent increase in exports. None of the coefficients for unobserved year-specific effects or time-dummies was significant, suggesting, at first sight, the absence of misspecification. These large estimates reflect the very low starting base for all AGOA beneficiaries.

Although the split in export increase between the Special Rule and tariff reduction effects is large and cannot be expected to have been estimated with precision because of the quality of the data, it is nonetheless noteworthy because a more standard evaluation, based solely on the high utilization rates of preferences, would erroneously conclude that the special (“triple transformation”) requirements for textiles and apparel had minimal effects because utilization rates remained high for exports to both destinations. For those who argue that there is little preferential access for OECD countries to grant to LDCs because average tariffs barriers are already low, the results suggest a potential multiple effect of relaxing a commonly used RoO in apparel with export growth for the receiving countries (by a factor of four, in this case study).

Second, the detailed analysis at the product level revealed that less restrictive RoO are associated with an expansion of the range of exported apparel in the 30–60 percent range. Indeed, under preferential market access, more lenient RoO diminish costs for exporters and may encourage export diversification (i.e., export growth at the extensive margin). Although export diversification also occurred for sales to the EU market, it was less than to the U.S. market. To our knowledge, this is the first evidence suggesting that restrictive product-specific RoO are likely to hamper export diversification.

Third, the study notes learning effects and a differential impact across countries. With respect to the dynamic effects of the AGOA’s Special Rule, there is evidence that the uptake of preferences is gradual over time, occurring during the first three years a country benefits from this special regime.

Finally, the impact of the AGOA’s Special Rule differed across countries. Because the Special Rule was not introduced in the same year for all countries, these results are strongly suggestive that differences in RoO accounted for differences in performance. However, because we could not control for factors that might have influenced supply response (e.g., the quality of infrastructure, political and social stability, governance, fiscal policies aiming to attract foreign investment), we could not account for the uneven effects of the single-
transformation rule across countries, although there is suggestive evidence that the supply response was conditioned by the business environment (at least as captured by the DB indicator of the World Bank).21

To conclude, studies on the effects of preferential market access should focus as much on design as on preferences. Indeed, strict RoO have often been justified as a means to support more processing in developing countries by encouraging integrated production within a country or within groups of countries through various cumulation schemes, as in the case of textiles and apparel. However, at least in the case of apparel produced by the low-income African countries, the double-transformation requirement by the EU has discouraged the development of exports at the intensive and extensive margins.

Development-friendly policies consistent with the spirit of preferential access to low-income countries would benefit from implementation schemes that would begin by relaxing the stringency of RoO requirements. It is encouraging that the EU has relaxed the double-transformation requirement when negotiating the Economic Partnership Agreements with African Caribbean Pacific countries. Rapidly growing middle-income countries such as China that are granting preferential access to LDCs should also consider designing simple RoO.

REFERENCES


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21. For instance, Lesotho, one of the successful exporters, managed to attract foreign investment in the textiles industry by offering a low corporate tax and further tax concessions for locating factories in towns outside Maseru, the capital. Furthermore, the political and social environment was considered by foreign investors to be more stable after a period of political instability. The result was a sudden increase in foreign investment, mainly originating from Asia, and Lesotho became one of the largest exporters to the United States of the countries eligible for the AGOA’s Special Rule. For an early account of the successful case of Lesotho, see “Lesotho seen as gateway to US market: Trade agreements have eased access for investors and helped diversify employment opportunities for locals,” Financial Times, August 23, 2001.


Network Proximity and Business Practices in African Manufacturing

Marcel Fafchamps and Måns Söderbom

Patterns of correlation in innovation and contractual practices among manufacturing firms in Ethiopia and Sudan are documented. Network data that indicate whether any two firms in the utilized sample do business with each other, buy inputs from a common supplier, or sell output to a common client are used for the analysis. Only limited support is found for the commonly held idea that firms that are more proximate in a network sense are more likely to adopt similar practices. Indeed, for certain practices, adoption decisions appear to be local strategic substitutes: if one firm in a given location uses a certain practice, nearby firms are less likely to do so. These results suggest that the diffusion of technology and new business practices may play a more limited role in spurring growth in Africa’s manufacturing sector than is often assumed in the present policy discussion. JEL codes: O1, D2, D4.

Although technological upgrading and institutional innovation are critical for growth, these factors are particularly critical in Africa, where productivity has remained low. This fact begs the question of why productivity-enhancing innovations have not diffused equally to different countries or regions (Parente and Prescott 1994). Since Griliches (1958), the dominant model of technology adoption is one in which information about a more productive technology diffuses through the economy, and the new technology is subsequently adopted by individual firms. In this model, obstacles to the circulation of information, such as...
social or economic segmentation, delay technology adoption. Delays may also arise because of funding constraints or adoption costs, such as learning by doing, experimentation, and adjustment costs. As a result, pockets of backward technology may remain.

This general view pervades much of the economic discourse on growth and development. A form of diffusion externality is either built into or hidden in all of the endogenous growth models in which technological innovation fuels growth (Parente and Prescott 1994; Romer 1990; Grossman and Helpman 1991; Aghion and Howitt 1992). The literature on the Industrial Revolution and the rise of the Western world describes how innovations in technology and business practices diffuse to neighboring enterprises, towns, and countries (North 1973; Mokyr 1990). Similarly, the literature on agglomeration effects ascribes a key role to the diffusion of innovative technology and business practices to nearby firms (Jacobs 1969; Fujita, Krugman and Venables 1999; Muendler, Rauch, and Tocoian 2012). Analogous ideas underlie much of the literature on the productivity benefits from FDI and international trade (Casella and Rauch 2002; Tybout 2000). Supplier-client relationships are considered one important channel of diffusion among firms (Jacobs 1969; Rauch and Casella 2003). Another channel is competition between firms in the same market, especially foreign firms (Kraay, Soloaga and Tybout 2002).

Another strand of the economics literature has examined the diffusion of innovations within countries and regions. A shared assumption that underlies much of this literature is that by interacting, firms learn from each other about technological and institutional innovations that raise productivity. Although there is a rigorous body of research on technology diffusion among farmers (Griliches and Lichtenberger 1984; Young and Burke 2001), much of the existing literature on manufacturing firms in developing countries remains descriptive and relies principally on case studies (Sutton and Kellow 2010; Sutton and Kpentey 2012; Sonobe and Otsuka 2011).

In this paper, we offer statistical evidence on the diffusion of innovations among manufacturing firms in Ethiopia and Sudan.¹ Our approach is to examine whether innovative business practices are correlated more strongly between firms that are relatively close in a network or a market sense. We find some evidence for a correlation in business practices, but the evidence is less convincing than one would expect if the diffusion effects were strong. Furthermore, we find evidence that along some dimensions (principally geographical distance), firms are more similar to distant firms than to nearby firms. This observation suggests that some adoption decisions are local strategic substitutes: if some firms adopt a certain practice, the incentive for other firms to adopt it appears to be reduced. This phenomenon is partly confirmed by noting that the practices for which we

¹. The Sudanese data used in this paper were collected in 2007. We began work on this paper in 2009, before South Sudan seceded from Sudan in July 2011. Thus, our sample includes firms in what is now South Sudan. Throughout the text, “Sudan” means Sudan prior to the secession.
find evidence of strategic substitution, namely, R&D and vocational training to workers, are the very practices that are the most vulnerable to free riding by other firms. Overall, the evidence for diffusion and complementarities is weaker than one might expect given the emphasis in much of the current policy discussion on diffusion and agglomeration economies as a source of improved firm performance in Africa (Collier 2007; Page 2012).

This paper is organized as follows. Section 2 discusses the conceptual framework and some key methodological issues, section 3 describes the econometric testing strategy, section 4 provides information about the data, section 5 presents the econometric results, and section 6 concludes.

I. Conceptual Framework: Diffusion in Networks

Consider two economic agents, $i$ and $j$, in a network. The diffusion of a practice along the network means that $i$ is more likely to adopt the practice if $j$ has adopted it. This statement is equivalent to the assertion that the adoption decisions of $i$ and $j$ are strategic complements. To formalize this observation, let $g_{ij} = \{0, 1\}$ denote a network link between two agents $i$ and $j$ and define the network matrix as $G = [g_{ij}]$, where $g_{ii} = 0$. Suppose that there are $N$ agents. We follow Liu et al. (2012) and Bramoulle and Kranton (2011) in writing the payoff of agent $i$ as follows:

$$\pi_i = \alpha_i y_i + \gamma g_{ii} y + \rho y_i g_{ii} y - \frac{1}{2} y_i^2,$$

where $y_i$ denotes the action of agent $i$, $y = [y_1, \ldots, y_N]$ is a vector of the actions of all of the agents, $g_i = [g_{i1}, \ldots, g_{iN}]$ is a vector of the neighbors of $i$, the Greek letters are parameters, and the final term represents the cost of taking action $y_i$, which is assumed to be quadratic for the sake of simplicity. Each agent chooses $y_i \geq 0$ to maximize the payoff $\pi_i$. The first-order condition for an interior solution is

$$y_i = \alpha_i + \rho g_{i} y.$$

The parameters $\alpha$, $\gamma$, and $\rho$ are now straightforward to interpret: $\alpha_i$ is a profitability parameter; $\rho$ indicates whether the actions are strategic complements ($\rho > 0$), strategic substitutes ($\rho < 0$), or neither complements nor substitutes ($\rho = 0$); and $\gamma$ indicates whether there are positive externalities ($\gamma > 0$), negative externalities ($\gamma < 0$), or neither positive nor negative externalities ($\gamma = 0$). Note that it is possible for the externalities to be negative ($\gamma < 0$) even if the actions are strategic complements ($\rho > 0$) and vice versa.

2. A network consists of links between the nodes in a finite collection of nodes (for example, firms). See Jackson (2009).
The equilibria are action vectors \( y \) that solve the system of Kuhn-Tucker conditions, which combine the first-order conditions (1) with \( y_i \geq 0 \ \forall \ i \in N \). The interior solutions \( y \) satisfy

\[
y = (I - \rho G)^{-1} A
\]

where \( A = [\alpha_1, \ldots \alpha_N] \). When the actions are strategic complements (\( \rho > 0 \)) and \( \alpha_i \geq 0 \) for all \( i \), a sufficient condition for an interior equilibrium is that \( \rho \) is smaller than the largest eigenvalue of \( G \). \(^3\) If \( \alpha_i \leq 0 \) for all \( i \in N \), then there exists an equilibrium with \( y = 0 \), but there may be other equilibria as well. \(^4\)

Bramoulle and Kranton (2011) characterize the equilibria that arise in network games with strategic substitutes (\( \rho < 0 \)) and show that the equilibrium configuration ultimately depends on the lowest (that is, most negative) eigenvalue of \( G \). With strategic substitutes, most equilibria have some agents choosing \( y_i = 0 \), and (some of) their neighbors choose a strictly positive \( y_i \) (that is, the actions of neighbors tend to be dissimilar). In contrast, when actions are strategic complements, the actions of neighbors reinforce each other; thus, they tend to be similar (see also Jackson 2009).

These observations form the basis of our testing strategy: let \( \tilde{y} = y - E(y) = (I - \rho G)^{-1} \tilde{A} \) where \( \tilde{A} = A - E(A) \). The covariance matrix of \( \tilde{y} \) is

\[
\text{Cov}(\tilde{y}) = E\left((I - \rho G)^{-1} \tilde{A} \tilde{A}' (I - \rho G)^{-1}\right)
\]

(2)

where the \( \alpha_i \)s that enter matrix \( A \) are unobserved by the researcher. If the \( \alpha_i \)s are independent and identically distributed, \( E\left( \tilde{A} \tilde{A}' \right) = \sigma^2 I \) and the above expression can be simplified as follows:

\[
\text{Cov}(\tilde{y}) = \sigma^2 E\left((I - \rho G)^{-1} (I - \rho G)^{-1}\right).
\]

When the matrix \( G \) is sparse (that is, when few \( g_{ij} = 1 \)), the \( ij \) elements of the matrix \( E[(I - \rho G)^{-1} (I - \rho G')^{-1}] \) that correspond to the existing links (\( g_{ij} = 1 \)) are approximately proportional to \( \rho^2 \). Other elements are functions of higher powers of \( \rho \) and are much smaller than the elements that correspond to the linked pairs \( ij \). In contrast, if \( \rho = 0 \) and the \( \alpha_i \)s are independent and identically distributed, then \( \text{Cov}(\tilde{y}) \) is a diagonal matrix, and \( \text{Cov}(\tilde{y}_i, \tilde{y}_j) = 0 \) for \( i \neq j \). Therefore, it is possible to test whether \( \rho \neq 0 \) by determining whether the values of \( y \) are more or less similar for linked pairs than for unlinked pairs. However, if

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3. For this statement to be true, it is sufficient that \( \rho \) is smaller than one over the maximum degree of any agent (Jackson 2009).

4. To illustrate the point, let \( N = 2 \), \( \alpha = -1 \) and \( \rho = 2 \). If \( y_2 = 0 \), then the \( y_1 \geq 0 \) constraint is binding and \( y_1 = 0 \). If \( y_2 = 1 \) then \( y_2 = -1 + 2 \times 1 = 1 \). Thus, we have two equilibria: \((y_1, y_2) = (0, 0)\) and \((1,1)\).
$E(\tilde{\mathbf{A}}\tilde{\mathbf{A}}')$ is not a diagonal matrix (that is, if the $\alpha_i$s are correlated), it is possible that $\text{Cov}(\tilde{y}_i, \tilde{y}_j) \neq 0$ even when $\rho = 0$. This possibility is an important caveat to keep in mind when interpreting our results; similar practices could be due either to strategic complementarity $\rho$ or to a correlation between the $\alpha_i$s (that is, a correlation in the profitability of taking action $y$ between linked firms). Manski (1993) calls such correlations contextual effects. By similar reasoning, dissimilar practices may be due to strategic substitution or a negative correlation in the $\alpha_i$s.

Strategic complementarity may arise for a variety of reasons. For example, the desire to imitate others or to conform to a social norm may be reinforced by peer pressure (Young and Burke 2001) and may result in complementarity. Another possibility is that the adoption of an innovation by others lowers the output price, which forces agent $i$ to adopt the same innovation to remain competitive. In contrast, strategic substitution would arise if agent $j$ takes action $y_j$ and the incentive for individual $i$ to take the same action weakens. For example, the possibility of free riding has long been recognized in experimentation; agents may wait for their friends and neighbors to experiment with a new technology before deciding whether to adopt it themselves (see Foster and Rosenzweig [1995] for an application to farming). The training of workers is another possible area where strategic substitution may be important: if firm $j$ decides to train its workers, firm $i$ may decide to try to poach them instead of training its own workers. In addition, a desire to avoid competition may be a driving force of strategic substitution. For example, if firm $j$ decides to design its products for a high-end market, it could be optimal for firm $i$ to tailor its products to a low-end market.

**Diffusion Dynamics**

If information diffuses between linked agents, then, in the long run, we expect all of the connected agents to have the same information. The connection may be direct, whereby the agents are linked to each other, or it may be indirect, which implies that the agents are linked through others. This insight was initially formalized in the context of epidemiologic models on networks (see Jackson [2009] and Vega-Redondo [2006] for excellent summaries of this literature). It follows that when information has had time to percolate through the network, adoption patterns within a giant component depend exclusively on the distribution of the benefits from adoption, namely, the $\alpha_i$s, and on the local strategic complements and substitutes $\rho$. If agents have dissimilar $\alpha_i$s or if $\rho < 0$, we expect sporadic adoption of business technology and practices, in which some agents adopt these things but others do not, although they all have the same information. In contrast, if agents have sufficiently similar $\alpha_i$s and $\rho \geq 0$, we expect all of the agents in the same giant component to adopt similar technology and practices irrespective of whether they are directly linked. However, the latter expectation is not true in the short run. If information circulates slowly, adoption decisions are more likely to be similar among agents who are directly linked.
Thus far, we have discussed strategic complements and substitutes in general terms. Here, we briefly discuss specific business practices for which we have data, and we speculate about whether they are more likely to be strategic complements or substitutes for manufacturing firms in a developing country.

1) **Technology**: The adoption of more advanced equipment and machinery is likely to be a strategic complement within a given sector and region. Because regional firms in the same sector compete with each other, they must keep up with each other in terms of productivity. However, some firms may strategically choose to focus on niche products and markets that are poorly served by other firms to avoid competition (Fafchamps 1994). Such behavior may lead to differences rather than similarities in the technology decisions of firms in the same location.

2) **Internal organization**: Innovations in the internal organization of a firm should follow similar logic. If other firms gain a competitive edge by adopting a better organizational structure, competitors should follow suit. However, this maxim may not apply to firms that eschew competitive pressure by focusing on niche markets and products (see the previous item).

3) **R&D**: If firms compete through innovation, high R&D by some firms will induce others to invest in R&D as well. Therefore, we expect R&D to be a strategic complement unless firms can act as free riders by imitating the innovations of other firms or by choosing R&D strategically to avoid competition.

4) **Vocational training of workers**: If better-trained workers raise productivity, competition between firms will lead them to train workers if new recruits are insufficiently qualified. However, firms may free ride and hire workers who have been trained by other firms instead of providing their own training. Thus, vocational training may be a strategic complement or a substitute.

5) **Contractual practices**: Because contractual practices involve other firms by definition, strategic complementarities in this area are likely to be stronger. For instance, if one firm imports from abroad or subcontracts part of its production, other firms may find it easier to import or subcontract in the same way. However, we cannot a priori rule out strategic substitution, such as if firms purchase inputs from the importing firm rather than importing these inputs themselves.

6) **Reputational sanctions**: Because reputation sanctions contain a strong public-good component, they are very likely to exhibit strategic complementarity. Indeed, the threat of exclusion from future trade has the strongest deterrent effect if all of the firms in the industry participate. Hence, the incentive to adopt a reputational sanction is highest when most other firms have already adopted it.

The above discussion suggests that different types of proximity may have different effects. In principle, the strategic complementarities that arise from
information exchange apply to all of the practices listed above. If information pertaining to technological, organizational, and contracting innovations circulates through supplier-client relationships, we expect such proximity to matter. The strategic complementarities that arise from competition should generate the strongest similarity among firms that share the same market, such as firms in a given sector and location. This observation is most relevant for technology, internal organization, and R&D because other channels of adoption diffusion are expected to be less important in these areas. If upstream and downstream firms face different competitors, which is probable, the strategic complementarities that are driven by competition are expected to be smaller between firms that are located at different levels of the value chain. It follows that if we use geographical proximity as a proxy for competition, supplier-client proximity, which identifies different points on the value chain, may be associated with less similar practices.

Thus far, we have discussed the adoption of practices. It is also possible to investigate payoffs directly, such as by analyzing firm performance and growth. In section 1 in the online appendix, we derive an expression for the covariance in profits across firms.\(^5\) We show that if \(\gamma \neq 0\) (that is, if externalities are present), then positive externalities manifest as proximate firms that have similar performance. In contrast, negative externalities imply dissimilar performance. Furthermore, we show that even in the absence of externalities, firms’ performance may be similar because of a correlation in firm-specific conditions \(a_i\) and \(a_j\); these correlations are the so-called contextual effects. The potential presence of these contextual effects precludes the interpretation of correlated firm performance as evidence of externalities.

**Diffusion across Heterogeneous Firms**

Firms are heterogeneous, and diffusion patterns across firms are likely to depend upon enterprise characteristics.\(^6\) For example, the scope for the diffusion of innovations between sectors may be limited if these sectors use technologies that are very different. Similarly, organizational practices that are suitable for large corporations may not be useful for microenterprises.

In the model, this discrepancy is captured by differences between firms in the profitability parameter \(\alpha_i\). If the adoption of new technologies and innovations is dichotomous, the likelihood of adopting can be expressed as \(\lambda(\alpha_i + \rho g_i y)\), where \(\lambda(.)\) is a logit or probit function. Whereas firms with a low \(\alpha_i\) are unlikely to adopt irrespective of what neighboring firms do (that is, irrespective of \(\rho g_i y\)), firms with a high \(\alpha_i\) are likely to adopt regardless of what others do. Thus, strategic complements and substitutes are very relevant for firms with intermediate values of \(\alpha_i\); for these firms, adoption may only be beneficial if neighboring firms

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5. The online appendix can be obtained at [http://soderbom.net/Fafchamps_Soderbom_Online_Appendix_2013.pdf](http://soderbom.net/Fafchamps_Soderbom_Online_Appendix_2013.pdf) and at [http://wber.oxfordjournals.org](http://wber.oxfordjournals.org).

6. Heterogeneity across firms has increasingly been recognized in the recent literature; see, for example, Melitz (2003) and Melitz and Ottaviano (2008).
adopt (if adoption decisions are strategic complements) or do not adopt (if these decisions are strategic substitutes).

It is reasonable to assume that once they have been informed of an innovation, firms with a high $\alpha_i$ would adopt it first and other firms would adopt it later owing to $\rho_{xy}$ effects. Therefore, we expect to observe the network-driven diffusion of innovation only among firms that are somewhat different, but the firms cannot be too different.

Hence, the extent to which practices and technologies diffuse may vary, depending on the heterogeneity across firms. For instance, if all of the firms in sector A share a high $\alpha_A$ for a particular innovation and the firms in sector B have a lower $\alpha_B$ but a large $\rho$, we expect all of the firms in sector A to adopt new innovations and technologies irrespective of whether they are linked. In contrast, we expect the firms in sector B to be more likely to adopt the same practices if they are linked to the sector A firms. In this example, although the correlation in adoption between firms within the same sector is not affected by network proximity, the correlation in adoption between firms in different sectors is stronger if these firms are linked. It is also possible that firms are heterogeneous within sector A, whereas some firms may have a high $\alpha_i$ and adopt new innovations and technologies, others may have a lower $\alpha_i$ and adopt if and only if they have an adopting neighbor. Similarly, the firms in sector B may all have a low $\alpha_i$ and may not adopt regardless of whether they are linked. As these two contrasting examples illustrate, it is not entirely clear a priori what makes firms too similar or too different for network effects to affect diffusion.

The economic importance of diffusion across heterogeneous firms is potentially high. For example, if $\rho$ is small in dissimilar firms, the diffusion of innovations will be more difficult in economies that are populated by very heterogeneous firms (much of sub-Saharan Africa has this characteristic). In such a context, not much should be expected from social networks and their ability to speed the diffusion of new ideas. Heterogeneity is also important from a methodological point of view because if we fail to take heterogeneity into account, we will underestimate the importance of networks for the subset of firms in which diffusion is occurring. As a result, we could erroneously accept the null hypothesis that networks play no role, and we must remember this point when we interpret our regression results.

II. Testing Strategy

In this section, we outline the testing strategy that follows from the above reasoning. Each enterprise is a node, and we observe whether an enterprise $i$ has adopted a practice $y_i$. The vector $g_{ij} = (g_{1ij}, g_{2ij}, \ldots, g_{Mij})$ represents the supplier-client links between two enterprises $i$ and $j$, and $d_{ij}$ represents the geographical distance between them. We want to test whether two enterprises $i$ and $j$ are more likely to have a similar practice $y$ if they are close in a network and geographical sense—that is, whether some or all of the elements of $g_{ij}$ are equal to one or if $d_{ij}$ is small.
For this purpose, we estimate models of the following form:

$$|y_i - y_j| = g_{ij} \theta + \omega d_{ij} + |x_i - x_j| \beta + u_{ij}$$

(3)

where \( \theta = (\theta_1, \theta_2, \ldots, \theta_M) \) is a vector of coefficients that are associated with network links, \( \omega \) is a coefficient that reflects the relationship between the geographical distance and the outcome similarities, \( |x_i - x_j| \) is a vector of absolute differences in the control variables \( x \) that is included to reduce omitted variable bias, \( \beta \) is a vector of parameters, and \( u_{ij} \) is an error term. A negative \( \theta_m \) in (3) means that \( y \) is more similar when firms \( i \) and \( j \) have a link \( g_{mi} = 1 \). For the geographical distance \( d_{ij} \), the interpretation of the sign of \( \omega \) is exactly the opposite of the interpretation of the sign of \( \theta_m \). Conversely, a positive \( \theta_m \) or a negative \( \omega \) would mean that linked or nearby firms are more dissimilar. If \( y \) is more similar in proximate firms, then this occurrence is consistent with a situation in which adoptions by different firms are strategic complements; in contrast, if \( y \) is dissimilar in proximate firms, then adoption by different firms may be a strategic substitute. A positive \( \beta \) means that firms that share a similar \( x \) tend to have a more similar \( y \).

A negative \( \theta_m \) does not by itself imply network diffusion because firms \( i \) and \( j \) may have correlated technology and contractual practices for reasons other than network or geographical proximity, such as because they are subject to similar contextual effects \( \text{corr}(\alpha_i, \alpha_j) > 0 \) that are not adequately controlled for by the quantities \( |x_i - x_j| \). If these unobserved contextual effects were more strongly correlated in linked firms, they would bias \( \theta_m \) below 0. Hence, if we find a significantly negative estimate of \( \theta_m \), the reason may be either diffusion or unobserved contextual effects. However, if \( \theta_m \) is positive or not significantly different from zero, the net effect of the diffusion and the contextual effects is likely to be positive or zero.

There are two possible exceptions to the above scenarios. The first exception is when diffusion is rapid and all firms belong to a single connected network. In this case, our identification strategy will fail because the similarity of firms will depend exclusively on their \( \alpha \)'s and not on the distance between them. Hence, we will observe a zero \( \theta \) even though diffusion across network links is taking place. The second exception is when the strategic complementarities and substitutes precisely offset each other. Although it is possible, this situation seems unlikely. If unobserved contextual effects can only generate positive correlations in technology and business practices, which is likely, then a nonsignificant \( \theta \) indicates that the network diffusion is zero, and a positive \( \theta \) suggests that the presence of

7. There are two reasons to estimate (3) in terms of its absolute deviation and not in a covariance form as in (2). First, most of the outcome variables we investigate are binary; as a result, the only information they contain is whether \( y_i = y_j \). In this case, (3) boils down to a linear probability model because \( |y_i - y_j| = 1 \) if \( y_i \neq y_j \) and 0 otherwise. Second, in the more general case when \( y \) is continuous, model (3) captures the main idea behind (2) but offers the advantage of being more robust with respect to outliers compared to using \( (y_i - \bar{y})(y_j - \bar{y}) \) as the dependent variable.
strategic substitution affects adoption decisions. However, we cannot completely rule out the possibility that a negative correlation between practices could be the result of a negative correlation in the profitability of adoption $\alpha_i$. For instance, if an innovation such as subcontracting is profitable for upstream firms but not for downstream firms, then firms that are linked as suppliers and clients will have negatively correlated practices because suppliers, by definition, are upstream relative to their clients.

Equation (3) is a dyadic regression. The dependent and independent variables are defined for every pair of firms $i, j$ in the data, which implies that there are $n \times (n - 1)$ observations that underlie the regression ($n$ denotes the number of firms). Dyadic observations are not independent because the residual $u_{ijk}$ is correlated with $u_{ijk}$. To compute standard errors that are robust with respect to the correlation in the error term across firms, we use the bootstrapping procedure that is described in section 1 in our online appendix.

III. Data

To implement our testing strategy, we use detailed firm-level data that were collected under the leadership of the World Bank in Ethiopia and Sudan. Virtually the same questionnaire and sampling strategies were used in the two countries. The data on the Ethiopian firms were collected as part of the Ethiopia Investment Climate Survey, which was implemented by the Ethiopian Development Research Institute in mid-2006. The survey covered 14 major cities located in seven regions of Ethiopia, and 42 percent of the observations came from Addis Ababa. The survey included firms with at least five permanent employees in four sectors: furniture, wood, and metal; food and beverages; leather and leather products; and textiles and garments. In all, 360 manufacturing firms were surveyed. The data from the Sudanese firms were collected as part of the Investment Climate Survey, which was launched in November 2007 and conducted by H&H Consultancy. This company is a Sudanese management consulting firm with expertise in conducting complex surveys. Thus, the data were collected before South Sudan seceded from Sudan in July 2011; therefore, our sample includes firms in what is now South Sudan (see note 1). The survey covered 432 manufacturing firms in eight states, and most of these firms were private. The capital city of Khartoum accounted for 52 percent of the sample observations. No sector represented more than 20 percent of the sample; hence, the survey was diverse in terms of sector. The largest sectors were food and beverages (18 percent) and fabricated metal products (16 percent). Microenterprises were not covered. After deleting the observations that had too many missing values,

we obtained a sample of 304 firms for Ethiopia and 401 firms for Sudan.\textsuperscript{10} This subset of the observations formed our baseline sample.\textsuperscript{11}

Summary statistics are shown in table 1, and the variables that constitute our control vector are presented first. More mature firms and firms with higher-quality management should be more adept at recognizing the value of new technologies and business practices. Female ownership is included because female-headed businesses have been shown to be less growth oriented (de Mel, McKenzie and Woodruff 2009; Fafchamps 2003). We also include firm size, which is represented by the (log of the) total firm employment. The average log employment is 3.37 in Ethiopia (which corresponds to 29 employees) and 2.91 in Sudan (which corresponds to 18 employees).

Next, we report information on firm practices. Initially, we focus on the variables for which strategic complementarities across firms are a priori thought to be less strong, such as innovation. We end by considering the variables for which strategic complementarities are likely to be the strongest, such as reputation mechanisms. Within each category, adoption by a given firm may be correlated across individual practices, and this correlation may be positive or negative (if some practices are partial substitutes for each other). In this case, examining each practice separately yields inefficient inferences. To guard against this possibility, we follow the approach suggested by Kling, Liebman, and Katz (2007) and summarize the available information within each category using factor analysis. Thus, we construct an additional dyadic dependent variable from the first principal components. The factor loadings for each category are reported in table 1.

The first variable that we consider is a dummy variable that indicates whether a firm introduced a new product in the year preceding the survey. Between one-third and one-half of the surveyed firms responded positively to this question. Approximately one-half of the firms invested in plants and equipment in the previous year in both countries. A nonnegligible proportion of the surveyed firms had spent money on R&D: 13 percent for Ethiopia and 23 percent for Sudan. In addition, we note some usage of information technology (IT), mostly in the form of email. At the time of the surveys, few manufacturing firms in Sudan or Ethiopia had a website.

Information on labor management and investment in human capital is presented next. We find a higher ratio of nonproduction workers to total employment in Sudan than in Ethiopia, which suggests that Sudanese firms are less able to manage their workforce with a small number of clerks and managers.\textsuperscript{12}

\textsuperscript{10} Maps of the survey locations are shown in section 3 in the online appendix.

\textsuperscript{11} For some of our outcome variables, there are missing values in the baseline sample. Therefore, some of our regressions will be estimated on a smaller sample than the baseline sample.

\textsuperscript{12} Fafchamps and Söderbom (2006) argue that the ratio of nonproduction workers to total employment indicates the ease with which firms manage their labor force. They show that many African firms have a high ratio of nonproduction workers to total employment despite the relative simplicity of their production processes.
### Table 1. Summary Statistics

<table>
<thead>
<tr>
<th></th>
<th>Ethiopia</th>
<th></th>
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<th>Sudan</th>
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<tbody>
<tr>
<td></td>
<td>Obs.</td>
<td>Mean</td>
<td>Std. dev.</td>
<td>Loadings</td>
<td>Obs.</td>
<td>Mean</td>
</tr>
<tr>
<td>1. Firm characteristics</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Firm age (years)</td>
<td>304</td>
<td>17.93</td>
<td>16.1</td>
<td>401</td>
<td>15.21</td>
<td>14.1</td>
</tr>
<tr>
<td>Education of top manager (a)</td>
<td>303</td>
<td>2.71</td>
<td>1.20</td>
<td>399</td>
<td>2.92</td>
<td>1.25</td>
</tr>
<tr>
<td>Experience of top manager (years)</td>
<td>304</td>
<td>14.5</td>
<td>9.77</td>
<td>395</td>
<td>17.2</td>
<td>12.9</td>
</tr>
<tr>
<td>Any female owner? (b)</td>
<td>304</td>
<td>0.23</td>
<td>1.23</td>
<td>382</td>
<td>0.15</td>
<td>1.14</td>
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<tr>
<td>Log(firm employment)</td>
<td>304</td>
<td>3.37</td>
<td>1.66</td>
<td>399</td>
<td>2.61</td>
<td>1.14</td>
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<tr>
<td>2. Innovation and R&amp;D</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Did the firm introduce a new product last year? (b)</td>
<td>304</td>
<td>0.35</td>
<td>0.70</td>
<td>391</td>
<td>0.48</td>
<td>0.58</td>
</tr>
<tr>
<td>Did the firm invest in plants &amp; equipment last year? (b)</td>
<td>304</td>
<td>0.52</td>
<td>0.67</td>
<td>400</td>
<td>0.46</td>
<td>0.70</td>
</tr>
<tr>
<td>Does the firm conduct any R&amp;D? (b)</td>
<td>304</td>
<td>0.13</td>
<td>0.72</td>
<td>388</td>
<td>0.23</td>
<td>0.74</td>
</tr>
<tr>
<td>IT usage (0 = nothing, 1 = email, 2 = website)</td>
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<td>0.59</td>
<td>0.76</td>
<td>401</td>
<td>0.45</td>
<td>0.78</td>
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<tr>
<td>3. Human capital and labor management</td>
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<tr>
<td>Ratio of nonproduction workers to total employment (c)</td>
<td>304</td>
<td>0.27</td>
<td>0.17</td>
<td>398</td>
<td>0.42</td>
<td>0.30</td>
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<tr>
<td>Any in-house training of staff last year? (b)</td>
<td>304</td>
<td>0.28</td>
<td>0.83</td>
<td>397</td>
<td>0.27</td>
<td>0.80</td>
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<tr>
<td>Staff sent to formal training course last year? (b)</td>
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<td>0.28</td>
<td>0.84</td>
<td>398</td>
<td>0.12</td>
<td>0.80</td>
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<tr>
<td>4. Contractual practices</td>
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<tr>
<td>Any direct imports of inputs? (b)</td>
<td>304</td>
<td>0.31</td>
<td>0.67</td>
<td>401</td>
<td>0.51</td>
<td>0.74</td>
</tr>
<tr>
<td>Do you sell on credit? (b)</td>
<td>304</td>
<td>0.53</td>
<td>0.65</td>
<td>401</td>
<td>0.64</td>
<td>0.73</td>
</tr>
<tr>
<td>Does firm subcontract production? (b)</td>
<td>302</td>
<td>0.12</td>
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<tr>
<td>5. Reputation mechanism</td>
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<tr>
<td>If you have a dispute with a customer, will other customers find out? (d)</td>
<td>304</td>
<td>1.049</td>
<td>0.948</td>
<td>0.47</td>
<td>400</td>
<td>0.808</td>
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<tr>
<td>If another firm has a dispute with a customer, will you refuse to deal with that customer? (d)</td>
<td>304</td>
<td>0.457</td>
<td>0.815</td>
<td>0.67</td>
<td>401</td>
<td>0.783</td>
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<td>If you have a dispute with a customer, will other firms refuse to deal with that customer? (d)</td>
<td>304</td>
<td>0.474</td>
<td>0.717</td>
<td>0.43</td>
<td>401</td>
<td>0.788</td>
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<td>If you have a dispute with a supplier, will other suppliers find out? (d)</td>
<td>304</td>
<td>0.914</td>
<td>0.926</td>
<td>0.46</td>
<td>401</td>
<td>0.783</td>
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<td>If you have a dispute with a supplier, will other firms refuse to deal with that supplier? (d)</td>
<td>304</td>
<td>0.398</td>
<td>0.682</td>
<td>0.47</td>
<td>401</td>
<td>0.656</td>
</tr>
</tbody>
</table>

(a) 1 = less than secondary, 2 = secondary, 3 = vocational, 4 = university.
(b) 0 = no, 1 = yes.
(c) Nonproduction workers include professionals, managers, administrators, and sales personnel.
(d) 0 = no, 1 = maybe, 2 = yes.

Source: Authors’ computations based on data described in the text.
In both countries, a substantial minority of firms had provided in-house or external training to their workers, but the majority had not.

The next panel of table 1 covers contractual practices. Firms were asked whether they imported inputs directly from abroad. Although buying directly from abroad requires trust, it is likely to improve the quality of the raw materials that are used in a firm’s production process. We find a difference between the two countries: landlocked Ethiopia lagged behind Sudan. Firms were also asked whether they sold on credit to any of their customers. A majority of manufacturing firms sell on credit to at least some of their customers, but a large minority does not. The data also show that subcontracting part of a firm’s production to other firms is rare.

Next, we examine the extent to which the surveyed firms rely on reputation to enforce contracts with suppliers and clients. The respondents were asked five closely related questions: (i) If you have a dispute with a customer, will other customers find out? (ii) If another firm has a dispute with a customer, will you refuse to deal with that customer? (iii) If you have a dispute with a customer, will other firms refuse to deal with that customer? (iv) If you have a dispute with a supplier, will other suppliers find out? (v) If you have a dispute with a supplier, will other firms refuse to deal with that supplier? For each of these questions, we code $y = 2$ for “yes,” $y = 1$ for “maybe/do not know” and $y = 0$ for “no.” Hence, high values correspond to stronger reputation effects. The summary statistics presented in table 1 suggest that news about a dispute often travels to customers and suppliers. These statistics also suggest that the reputational sanction imposed on the customers and suppliers that are involved in a dispute is not severe; firms typically continue to deal with customers and suppliers that have been involved in a dispute. Similar results have been reported by Bigsten et al. (2000) and Fafchamps (2004) for African manufacturing.

A key module of the survey contains information about the names of the firms’ trading partners and their approximate geographical locations. The respondents were asked to name up to three clients and three suppliers. Using the information from this module, we construct simple measures of network proximity between the firms in the two samples. Summary statistics for these measures are reported in table 2.

We begin by constructing a dyadic dataset of unique firm pairs. For instance, because there are 304 firms in the Ethiopian sample, there exist $304 \times 303/2 = 46,056$ unique enterprise pairs $(i, j)$ in that sample. For each pair $(i, j)$, we construct dummy variables that capture the different concepts of network proximity. When two firms are close in that network, we consider them to be linked. The most direct network proximity measure that we use is whether $i$ and $j$ buy or sell

13. Because the majority of firms (approximately 70 percent) list three names, there is truncation in the observed network because some existing links are not recorded. This problem may cause a downward bias in the estimated network effects.
from each other. We are only able to identify a small number of such links in our data: 60 in Ethiopia and 5 in Sudan. The fact that there are so few upstream and downstream links among the sample firms is partly driven by the focus of the surveys on light manufacturing because clients are seldom manufacturers. We also construct dummy variables that indicate whether \( i \) and \( j \) have a common supplier or a common client. These types of links are more common: there are 481 supplier-based links and 273 client-based links in the Ethiopian data and 171 supplier-based links and 678 client-based links in the Sudanese data. These network proximity variables constitute the core of our vector \( g_{ij} \). The last proximity dummy is the distance \( d_{ij} \), which is defined as the log of the distance between \( i \) and \( j \) plus one.

### IV. Empirical Analysis

Our objective is to test whether the outcomes and practices that are related to technology, human capital, contracting, and reputation are more similar among firms that are close to each other, either in a network sense or geographically. To that end, we estimate the parameters of model (3). Our estimation technique is linear regression (ordinary least squares), and standard errors are bootstrapped to make them robust with respect to heteroskedasticity and correlation in error terms across firms. We refer to the presented results as baseline results. Additional results are available in the online appendix.

**Innovation and R&D**

We begin by investigating the association between geographical and network proximity and innovation and R&D. We construct dyadic dependent variables from dummy variables that measure whether firms introduced a new product in the previous year, invested in plants and equipment in the previous year, or conducted any R&D. A fourth outcome variable is constructed based on a firm-level measure of the extent of IT usage; the value of this variable is zero if IT is not
used at all, one if the firm uses email, and two if the enterprise has a business website. The dyadic regression results are shown in table 3, columns [1]–[4] for Ethiopia, and columns [6]–[9] for Sudan. In columns [5] and [10], we report results in which we use the first principal component of all four categories to construct the dyadic dependent variable.

The estimated network proximity coefficients differ in the two countries. For Ethiopia, the dummies that track whether \( i \) and \( j \) trade with each other, have a common supplier, and have a common client are statistically nonsignificant. For Sudan, we obtain a negative and statistically significant coefficient of trade in the R&D regression (column [8]), and we obtain negative and significant coefficients (at least at the 10 percent level) of having a common supplier in the regressions for investment (column [7]), R&D (column [8]), IT usage (column [9]), and the first principal component (column [10]). Hence, network proximity seems to be associated with a more similar approach to innovation and R&D throughout the firms in Sudan, but not in Ethiopia. Some of these estimated effects are large; for example, the likelihood that firms report the same answer (yes or no) to the question about whether money was spent on R&D is 34 percentage points higher for firms that trade with each other than for firms that do not trade with each other. However, because of the small number of direct links in the Sudanese data (see table 2), the estimated coefficients of direct trade should be interpreted with caution. Furthermore, we find that Sudanese firms with a common client tend to differ more than other firms with respect to R&D and IT usage. This finding is not consistent with the notion that network proximity tends to result in similar practices regarding innovation.

Next, we consider the role of geographical distance between firms. For Ethiopia, the distance coefficient is negative in all five of the specifications shown in table 3, and this coefficient is statistically significant at least at the 10 percent level in four of these specifications. Hence, geographical proximity tends to be associated with greater differences in innovation practices. The results are similar for Sudan: the distance coefficient is negative and highly statistically significant in the models for R&D (column [8]), IT usage (column [9]), and the first principal component (column [10]). These results suggest that for technology, strategic substitution effects dominate strategic complementarities for firms that are located near each other.

The control variables in these regressions have explanatory power. The estimated coefficients of the same-sector dummy are negative in all of the specifications except [6], and these coefficients are often statistically significant. This result indicates that, as expected, firms in the same sector tend to have similar innovation practices. Differences in firm size, which are measured as the absolute difference in the log of employment, are positively associated with differences in

14. Here, the three levels of usage are combined. The results for the alternative specifications that model email and website use are shown separately in tables S1.E and S1.S, columns [1]–[2], in the online appendix. The results are similar to those shown in table 3.
## Table 3. Correlates of Dyadic Differences: Technology Acquisition

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</thead>
<tbody>
<tr>
<td>Did the firm introduce a new product last year?</td>
<td>[( y_i - y_j )]</td>
<td>0.0492</td>
<td>-0.0471</td>
<td>0.0957</td>
<td>-0.0703</td>
<td>-0.7032</td>
<td>0.0792</td>
<td>0.0147</td>
<td>-0.205</td>
<td>-0.339***</td>
<td>0.451</td>
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<td></td>
<td></td>
<td>(0.126)</td>
<td>(0.117)</td>
<td>(0.108)</td>
<td>(0.188)</td>
<td>(0.240)</td>
<td>(0.350)</td>
<td>(0.326)</td>
<td>(0.140)</td>
<td>(0.572)</td>
<td>(0.237)</td>
</tr>
<tr>
<td>Did the firm invest in plants &amp; equipment last year?</td>
<td>[( y_i - y_j )]</td>
<td>0.0957</td>
<td>-0.0703</td>
<td>-0.7032</td>
<td>0.0792</td>
<td>0.0147</td>
<td>-0.205</td>
<td>-0.339***</td>
<td>0.451</td>
<td>-0.302</td>
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<tr>
<td></td>
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<td>(0.108)</td>
<td>(0.188)</td>
<td>(0.240)</td>
<td>(0.350)</td>
<td>(0.326)</td>
<td>(0.140)</td>
<td>(0.572)</td>
<td>(0.237)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Does the firm conduct any R&amp;D?</td>
<td>[( y_i - y_j )]</td>
<td>-0.0703</td>
<td>-0.7032</td>
<td>0.0792</td>
<td>0.0147</td>
<td>-0.205</td>
<td>-0.339***</td>
<td>0.451</td>
<td>-0.302</td>
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</tr>
<tr>
<td></td>
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<td>(0.188)</td>
<td>(0.240)</td>
<td>(0.350)</td>
<td>(0.326)</td>
<td>(0.140)</td>
<td>(0.572)</td>
<td>(0.237)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IT usage (0 = nothing, 1 = email, 2 = website)</td>
<td>[( y_i - y_j )]</td>
<td>-0.7032</td>
<td>0.0792</td>
<td>0.0147</td>
<td>-0.205</td>
<td>-0.339***</td>
<td>0.451</td>
<td>-0.302</td>
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<td></td>
<td></td>
<td>(0.240)</td>
<td>(0.350)</td>
<td>(0.326)</td>
<td>(0.140)</td>
<td>(0.572)</td>
<td>(0.237)</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>First principal component</td>
<td>[( y_i - y_j )]</td>
<td>0.0792</td>
<td>0.0147</td>
<td>-0.205</td>
<td>-0.339***</td>
<td>0.451</td>
<td>-0.302</td>
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<tr>
<td></td>
<td></td>
<td>(0.350)</td>
<td>(0.326)</td>
<td>(0.140)</td>
<td>(0.572)</td>
<td>(0.237)</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i &amp; j trade with each other</td>
<td></td>
<td>-0.0175</td>
<td>-0.00152</td>
<td>0.0461</td>
<td>-0.0630</td>
<td>-0.0202</td>
<td>-0.0799</td>
<td>-0.154*</td>
<td>-0.183***</td>
<td>-0.272**</td>
<td>-0.310**</td>
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<td></td>
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<td>(0.0400)</td>
<td>(0.0456)</td>
<td>(0.0408)</td>
<td>(0.0660)</td>
<td>(0.0684)</td>
<td>(0.0740)</td>
<td>(0.0791)</td>
<td>(0.0648)</td>
<td>(0.109)</td>
<td>(0.130)</td>
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<tr>
<td>i &amp; j have common supplier</td>
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<td>0.0110</td>
<td>0.0602</td>
<td>-0.0645</td>
<td>0.0247</td>
<td>0.00539</td>
<td>0.123***</td>
<td>0.229***</td>
<td>0.178*</td>
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<td>(0.0336)</td>
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<td>(0.101)</td>
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<tr>
<td>i &amp; j have common client</td>
<td></td>
<td>-0.0175</td>
<td>-0.00152</td>
<td>0.0461</td>
<td>-0.0630</td>
<td>-0.0202</td>
<td>-0.0799</td>
<td>-0.154*</td>
<td>-0.183***</td>
<td>-0.272**</td>
<td>-0.310**</td>
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<td>(0.0400)</td>
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<td>(0.0791)</td>
<td>(0.0648)</td>
<td>(0.109)</td>
<td>(0.130)</td>
</tr>
<tr>
<td>log distance btw i &amp; j</td>
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<td>-0.00129</td>
<td>-0.0104*</td>
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<td>-0.0154*</td>
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<td>(0.00166)</td>
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<td>i &amp; j belong to same sector</td>
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<td>-0.0323*</td>
<td>-0.0561**</td>
<td>-0.0218</td>
<td>-0.0567**</td>
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<td>Abs diff managers’ education</td>
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<td>0.0644**</td>
<td>0.0475**</td>
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<td>-0.000880</td>
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<td>0.00909</td>
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<td>Abs diff log</td>
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<td>0.0304**</td>
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<td>0.121***</td>
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</table>

Notes: The table shows ordinary least squares results. A constant is included in all specifications. The numbers in parentheses are bootstrapped standard errors that are robust with respect to heteroskedasticity and cross-observation correlation in the error terms involving the same firms. Statistical significance at the 10 percent, 5 percent, and 1 percent levels is indicated by *, **, and *** respectively.

Source: Authors’ computations based on data described in the text.

Fafchamps and Söderbom 115
innovation practices in all of the specifications, suggesting that firms of similar size tend to adopt similar practices. There is also some evidence that managers of the same gender or with similar levels of education select similar innovation practices. The coefficients of differences in managers’ experience or firms’ ages are mostly nonsignificant.

**Human Capital and Labor Management**

Table 4 shows the results for our regressions on labor management and investment in human capital. We find no evidence that network proximity is associated with greater similarity in training decisions or labor management in firms. In fact, we obtain a positive and statistically significant coefficient of common clients in specifications [3], [4], and [6], which indicates that firms with a common client tend to have more distinct training policies than firms that do not share a common client.

The estimated coefficients related to the distance between firms are negative in all of the specifications except [5], and these coefficients are statistically significant in four of the specifications (columns [2], [3], [4], and [6]). As with the results for innovation, this result implies that firms that are located close to each other tend to differ more with respect to their human capital decisions compared with firms that are far apart. This finding is consistent with strategic substitution. One possibility that is often emphasized in the literature on agglomeration effects (Henderson 1988; Glaeser et al. 1992) is that firms hire workers who have been trained by other firms. Thus, if there are more nearby firms that provide the necessary training, a given firm needs to train its workers to a lesser extent. Alternatively, strategic substitution may be driven by incentives to avoid local competition. For example, if two firms with similar human capital produce similar output, they will compete with each other if they are based in the same local market. By locating themselves in different places, both firms would face less competition and presumably higher profits. Another possibility is that firms that are located in the same place decide to differentiate their output, which may lead to differences in technology and human capital demand. Mechanisms such as these would result in the pattern that we observe in the data of greater differences between firms that are located close to each other than between firms in distant locations.

Furthermore, we find that, as expected, firms of similar size and firms in the same sector tend to be more similar with respect to their training decisions than firms of different sizes or in different sectors. The coefficients related to the other control variables, that is, differences in firms’ ages and in managers’ education, experience, and gender, are mostly nonsignificant. When they are significant, their coefficients are usually negative, which suggests that greater differences in these firm-level characteristics are associated with closer similarities in outcomes.

**Contractual Practices**

Next, we investigate how the following three measures of contractual practices correlate across firms: whether a firm imports inputs directly, whether it sells on
Table 4. Correlates of Dyadic Differences: Human Capital and Labor Management

<table>
<thead>
<tr>
<th></th>
<th>Ethiopia</th>
<th>Sudan</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ratio of</td>
<td>Any in-house</td>
</tr>
<tr>
<td></td>
<td>nonproduction</td>
<td>training of</td>
</tr>
<tr>
<td></td>
<td>workers to</td>
<td>staff last</td>
</tr>
<tr>
<td></td>
<td>total</td>
<td>year?</td>
</tr>
<tr>
<td>$</td>
<td>y_i - y_j</td>
<td>$</td>
</tr>
<tr>
<td>$i &amp; j$ trade with each other</td>
<td>−0.0218</td>
<td>0.0807</td>
</tr>
<tr>
<td></td>
<td>(0.0334)</td>
<td>(0.107)</td>
</tr>
<tr>
<td>$i &amp; j$ have common supplier</td>
<td>0.0136</td>
<td>0.0439</td>
</tr>
<tr>
<td></td>
<td>(0.0141)</td>
<td>(0.0473)</td>
</tr>
<tr>
<td>$i &amp; j$ have common client</td>
<td>0.0161</td>
<td>0.0396</td>
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<tr>
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<td>(0.0237)</td>
<td>(0.0742)</td>
</tr>
<tr>
<td>log distance btw $i &amp; j$</td>
<td>−0.00193</td>
<td>−0.0168***</td>
</tr>
<tr>
<td></td>
<td>(0.00159)</td>
<td>(0.00299)</td>
</tr>
<tr>
<td>$i &amp; j$ belong to same sector</td>
<td>−0.00244</td>
<td>−0.0173</td>
</tr>
<tr>
<td></td>
<td>(0.00491)</td>
<td>(0.0123)</td>
</tr>
<tr>
<td>Abs diff firm age</td>
<td>−0.000149</td>
<td>−0.000207</td>
</tr>
<tr>
<td></td>
<td>(0.000336)</td>
<td>(0.000720)</td>
</tr>
<tr>
<td>Abs diff managers’ education</td>
<td>−0.00392*</td>
<td>0.0112</td>
</tr>
<tr>
<td></td>
<td>(0.00237)</td>
<td>(0.0184)</td>
</tr>
<tr>
<td>Abs diff managers’ experience</td>
<td>0.000213</td>
<td>−0.00167**</td>
</tr>
<tr>
<td></td>
<td>(0.000477)</td>
<td>(0.000803)</td>
</tr>
</tbody>
</table>

(Continued)
<table>
<thead>
<tr>
<th></th>
<th>Ethiopia</th>
<th></th>
<th>Sudan</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[1]</td>
<td>[2]</td>
<td>[3]</td>
<td>[4]</td>
</tr>
<tr>
<td>Ratio of nonproduction workers to total employment</td>
<td></td>
<td>$</td>
<td>y_i - y_j</td>
<td>$</td>
</tr>
<tr>
<td></td>
<td>[5]</td>
<td>[6]</td>
<td>[7]</td>
<td>[8]</td>
</tr>
<tr>
<td>Ratio of nonproduction workers to total employment</td>
<td></td>
<td>$</td>
<td>y_i - y_j</td>
<td>$</td>
</tr>
<tr>
<td>Any in-house training of staff last year?</td>
<td>0.00767</td>
<td>0.0181</td>
<td>-0.0120</td>
<td>-0.00539</td>
</tr>
<tr>
<td></td>
<td>(0.0111)</td>
<td>(0.0258)</td>
<td>(0.0177)</td>
<td>(0.0403)</td>
</tr>
<tr>
<td>Staff sent to formal training course last year?</td>
<td>0.0298*</td>
<td>0.0446</td>
<td>0.0847</td>
<td>0.204*</td>
</tr>
<tr>
<td></td>
<td>(0.0176)</td>
<td>(0.0375)</td>
<td>(0.0542)</td>
<td>(0.114)</td>
</tr>
<tr>
<td>First principal component</td>
<td>0.00539</td>
<td>0.0298*</td>
<td>0.0446</td>
<td>0.0847</td>
</tr>
<tr>
<td></td>
<td>(0.0111)</td>
<td>(0.0258)</td>
<td>(0.0177)</td>
<td>(0.0403)</td>
</tr>
<tr>
<td>Owners' gender differ</td>
<td>0.0110**</td>
<td>0.0876***</td>
<td>0.0987***</td>
<td>0.230***</td>
</tr>
<tr>
<td></td>
<td>(0.00490)</td>
<td>(0.0155)</td>
<td>(0.0143)</td>
<td>(0.0309)</td>
</tr>
<tr>
<td>Abs diff log employment</td>
<td>0.0182***</td>
<td>0.0567***</td>
<td>0.0780***</td>
<td>0.207***</td>
</tr>
<tr>
<td></td>
<td>(0.00569)</td>
<td>(0.0170)</td>
<td>(0.0205)</td>
<td>(0.0499)</td>
</tr>
</tbody>
</table>

Notes: The table shows ordinary least squares results. A constant is included in all specifications. The numbers in parentheses are bootstrapped standard errors that are robust with respect to heteroskedasticity and cross-observation correlation in the error terms involving the same firms. Statistical significance at the 10 percent, 5 percent, and 1 percent levels is indicated by *, **, and ***, respectively.

Source: Authors’ computations based on data described in the text.
credit, and whether it subcontracts part of its production. The results are shown in table 5.

For Sudan, we find a negative and highly significant coefficient on the dummy variable that indicates whether firms $i$ and $j$ trade directly with each other in the models for direct imports, selling on credit, and the first principal component. Thus, Sudanese firms that trade with each other tend to have more similar contractual practices. In addition, having a common supplier is associated with a greater similarity in direct imports, although this effect is only statistically significant at the 10 percent level. In contrast, for Ethiopia, the correlation between network proximity and the similarity in contractual practices is weak and nonsignificant in all of the specifications except for subcontracting, for which we obtain a positive coefficient related to having a common supplier (column [3]).

The estimated distance coefficients vary considerably across regressions. In two regressions, they are positive and significantly different from zero (direct imports and selling on credit in Sudan; columns [5] and [6]), which suggests that firms that are close to each other have more similar contractual practices than other firms. However, in two other regressions, the coefficients are significantly negative (direct imports in Ethiopia and subcontracting in Sudan; columns [1] and [7]). For both countries, distance is statistically nonsignificant in the regressions that model the difference in the first principal component. Thus, it is difficult to see a pattern here, which may be because the relative importance of strategic substitution and diffusion varies from one contractual practice to another. Regarding the control variables, the pattern is similar to what we observed above; whereas firms of similar size and in the same sector tend to have similar contractual practices, for other controls, the results are mixed.

Reputation Mechanisms

Here, we examine whether there is evidence that network links facilitate the diffusion of information on contractual disputes between suppliers and clients. The theoretical literature has emphasized the role of the diffusion of information on contractual disputes along social networks in the development of modern market institutions (North 1990; Greif 1993). Consequently, we expect to find a strong correlation in answers from firms in the same networks.

Using the five questions on the perceived consequences of disputes that are discussed in section 3, we code $y_i = 2$ for “yes,” $y_i = 1$ for “maybe/do not know” and $y_i = 0$ for “no.” Then, we compute $|y_i - y_j|$ for every pair of firms in the data. The regression results are shown in table 6a and do not conform to theoretical expectations. Except for isolated cases in which a network regressor is significant (columns [6] and [10], but with opposite signs), the social network variables are not significant. One possible explanation is insufficient power: the

15. Columns [3]–[8] in tables S.1E and S1.S in the online appendix show the results for alternative specifications in which the reputation variables are defined as binary variables in the following way: yes = 1 and maybe or no = 0. The results are similar to those in table 5.
**Table 5.** Correlates of Dyadic Differences: Contractual Practices

<table>
<thead>
<tr>
<th></th>
<th>Ethiopia</th>
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<th>Sudan</th>
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<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Any direct imports of inputs?</td>
<td>Do you sell on credit?</td>
<td>Does firm subcontract production?</td>
<td>First principal component</td>
<td>Any direct imports of inputs?</td>
<td>Do you sell on credit?</td>
<td>Does firm subcontract production?</td>
</tr>
<tr>
<td>$\Delta y_i - y_j$</td>
<td>0.0245</td>
<td>-0.0122</td>
<td>0.110</td>
<td>0.114</td>
<td>-0.423**</td>
<td>-0.436**</td>
<td>0.0488</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(0.117)</td>
<td>(0.174)</td>
<td>(0.177)</td>
</tr>
<tr>
<td>$\Delta y_i - y_j$</td>
<td>-0.0186</td>
<td>-0.00130</td>
<td>0.0755**</td>
<td>-0.116</td>
<td>-0.145*</td>
<td>0.0150</td>
<td>0.0479</td>
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<tr>
<td></td>
<td>(0.0501)</td>
<td>(0.0404)</td>
<td>(0.0366)</td>
<td>(0.0751)</td>
<td>(0.0762)</td>
<td>(0.0789)</td>
<td>(0.0812)</td>
</tr>
<tr>
<td>$\Delta y_i - y_j$</td>
<td>0.0838</td>
<td>-0.0139</td>
<td>0.0765</td>
<td>0.184</td>
<td>-0.0457</td>
<td>-0.00759</td>
<td>-0.0310</td>
</tr>
<tr>
<td></td>
<td>(0.0572)</td>
<td>(0.0524)</td>
<td>(0.0702)</td>
<td>(0.124)</td>
<td>(0.0422)</td>
<td>(0.0430)</td>
<td>(0.0651)</td>
</tr>
<tr>
<td>$\Delta y_i - y_j$</td>
<td>-0.0123**</td>
<td>-0.000254</td>
<td>0.00530</td>
<td>-0.00906</td>
<td>0.00814***</td>
<td>0.00915**</td>
<td>-0.00867**</td>
</tr>
<tr>
<td></td>
<td>(0.00572)</td>
<td>(0.00143)</td>
<td>(0.00671)</td>
<td>(0.00796)</td>
<td>(0.00314)</td>
<td>(0.00422)</td>
<td>(0.00417)</td>
</tr>
<tr>
<td>$\Delta y_i - y_j$</td>
<td>-0.0397**</td>
<td>-0.0171</td>
<td>-0.00192</td>
<td>-0.0368</td>
<td>-0.0299*</td>
<td>-0.00602</td>
<td>-0.00572</td>
</tr>
<tr>
<td></td>
<td>(0.0160)</td>
<td>(0.0155)</td>
<td>(0.00908)</td>
<td>(0.02986)</td>
<td>(0.0157)</td>
<td>(0.0137)</td>
<td>(0.0131)</td>
</tr>
<tr>
<td>Abs diff firm age</td>
<td>-0.000424</td>
<td>0.000480</td>
<td>-0.00207***</td>
<td>-0.00417***</td>
<td>0.000105</td>
<td>-8.22e-05</td>
<td>-0.000668</td>
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<tr>
<td></td>
<td>(0.000804)</td>
<td>(0.000556)</td>
<td>(0.000636)</td>
<td>(0.00145)</td>
<td>(0.000240)</td>
<td>(0.000582)</td>
<td>(0.000563)</td>
</tr>
<tr>
<td>Abs diff managers’ education</td>
<td>0.0299</td>
<td>0.000668</td>
<td>-0.0204***</td>
<td>0.0373</td>
<td>0.0215*</td>
<td>0.00583</td>
<td>0.00164</td>
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<td></td>
<td>(0.0199)</td>
<td>(0.00500)</td>
<td>(0.00748)</td>
<td>(0.0279)</td>
<td>(0.0112)</td>
<td>(0.00657)</td>
<td>(0.00477)</td>
</tr>
<tr>
<td>Abs diff managers’ experience</td>
<td>-0.00152*</td>
<td>0.000485</td>
<td>-0.00178</td>
<td>0.00456**</td>
<td>-9.80e-05</td>
<td>-0.000212</td>
<td>-0.000397</td>
</tr>
<tr>
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<td>(0.000779)</td>
<td>(0.000642)</td>
<td>(0.00120)</td>
<td>(0.00210)</td>
<td>(0.000305)</td>
<td>(0.000728)</td>
<td>(0.000633)</td>
</tr>
<tr>
<td>Owners’ gender differ</td>
<td>0.0457</td>
<td>0.00391</td>
<td>0.0235</td>
<td>0.0402</td>
<td>0.00257</td>
<td>-0.0164</td>
<td>0.0109</td>
</tr>
<tr>
<td></td>
<td>(0.0297)</td>
<td>(0.00948)</td>
<td>(0.0306)</td>
<td>(0.0420)</td>
<td>(0.00677)</td>
<td>(0.0126)</td>
<td>(0.0382)</td>
</tr>
<tr>
<td>Abs diff log employment</td>
<td>0.131***</td>
<td>0.00259</td>
<td>0.0150</td>
<td>0.138***</td>
<td>0.0659***</td>
<td>0.00494</td>
<td>-0.00398</td>
</tr>
<tr>
<td></td>
<td>(0.0150)</td>
<td>(0.00473)</td>
<td>(0.0132)</td>
<td>(0.0312)</td>
<td>(0.0145)</td>
<td>(0.00781)</td>
<td>(0.0123)</td>
</tr>
</tbody>
</table>

Notes: The table shows ordinary least squares results. A constant is included in all specifications. The numbers in parentheses are bootstrapped standard errors that are robust with respect to heteroskedasticity and cross-observation correlation in the error terms involving the same firms. Statistical significance at the 10 percent, 5 percent, and 1 percent levels is indicated by *, **, and ***, respectively.

Source: Authors’ computations based on data described in the text.
<table>
<thead>
<tr>
<th></th>
<th>Ethiopia</th>
<th></th>
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<th></th>
<th></th>
<th>Sudan</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>If you have a customer dispute, will other customers find out?</strong></td>
<td>[1] -0.187 (0.206)</td>
<td>[2] 0.0330 (0.178)</td>
<td>[3] -0.0502 (0.166)</td>
<td>[4] 0.124 (0.207)</td>
<td>[5] 0.0158 (0.161)</td>
<td>[6] -0.704* (0.373)</td>
<td>[7] -0.209 (0.622)</td>
<td>[8] 0.557 (0.515)</td>
<td>[9] 0.280 (0.614)</td>
</tr>
<tr>
<td><strong>If another firm has a customer dispute, will you refuse to deal with customer?</strong></td>
<td>[1] -0.0159 (0.0914)</td>
<td>[2] 0.0321 (0.0896)</td>
<td>[3] -0.0611 (0.0663)</td>
<td>[4] -0.0335 (0.0914)</td>
<td>[5] -0.0490 (0.0745)</td>
<td>[6] -0.154 (0.166)</td>
<td>[7] -0.0828 (0.145)</td>
<td>[8] -0.0368 (0.141)</td>
<td>[9] -0.105 (0.164)</td>
</tr>
<tr>
<td><strong>If you have a supplier dispute, will other firms refuse to deal with that customer?</strong></td>
<td>[1] 0.0480 (0.0795)</td>
<td>[2] 0.0293 (0.129)</td>
<td>[3] -0.0588 (0.0990)</td>
<td>[4] 0.00750 (0.0916)</td>
<td>[5] 0.0853 (0.111)</td>
<td>[6] 0.0580 (0.0557)</td>
<td>[7] 0.0328 (0.0669)</td>
<td>[8] -0.104 (0.116)</td>
<td>[9] -0.105 (0.111)</td>
</tr>
<tr>
<td><strong>If another firm has a supplier dispute, will you refuse to deal with that supplier?</strong></td>
<td>[1] -0.00832 (0.0272)</td>
<td>[2] -0.0163 (0.0258)</td>
<td>[3] 0.00167 (0.0187)</td>
<td>[4] -0.0201 (0.0254)</td>
<td>[5] -0.0113 (0.0186)</td>
<td>[6] -0.00888 (0.0213)</td>
<td>[7] -0.0213 (0.0281)</td>
<td>[8] -0.00301 (0.0194)</td>
<td>[9] 0.0275* (0.0186)</td>
</tr>
<tr>
<td><strong>If you have a customer dispute, will other firms refuse to deal with that customer?</strong></td>
<td>[1] -0.000181 (0.000404)</td>
<td>[2] -0.007955 (0.00180)</td>
<td>[3] -0.00166 (0.000109)</td>
<td>[4] 0.000648 (0.000791)</td>
<td>[5] 5.85e-05 (0.00149)</td>
<td>[6] -0.000854 (0.000725)</td>
<td>[7] 0.000383 (0.000106)</td>
<td>[8] 0.000530 (0.000094)</td>
<td>[9] -0.000695 (0.000812)</td>
</tr>
<tr>
<td><strong>If you have a supplier dispute, will other firms refuse to deal with that supplier?</strong></td>
<td>[1] -0.00403 (0.00757)</td>
<td>[2] -0.00932 (0.0117)</td>
<td>[3] -0.00511 (0.00884)</td>
<td>[4] -0.00802 (0.0112)</td>
<td>[5] -0.00229 (0.00726)</td>
<td>[6] 0.000897 (0.00726)</td>
<td>[7] 0.00325 (0.00754)</td>
<td>[8] 0.00295 (0.00795)</td>
<td>[9] -0.00144 (0.00705)</td>
</tr>
<tr>
<td><strong>Log distance btw i &amp; j</strong></td>
<td>[1] 0.0110** (0.00562)</td>
<td>[2] -0.0198*** (0.00578)</td>
<td>[3] -0.0171*** (0.00487)</td>
<td>[4] 0.0104* (0.00544)</td>
<td>[5] -0.0268*** (0.00530)</td>
<td>[6] -0.00683** (0.00306)</td>
<td>[7] -0.00611** (0.00310)</td>
<td>[8] -0.000383 (0.00323)</td>
<td>[9] -0.00298 (0.00282)</td>
</tr>
<tr>
<td><strong>i &amp; j belong to same client</strong></td>
<td>[1] -0.000832 (0.0272)</td>
<td>[2] -0.0163 (0.0258)</td>
<td>[3] 0.00167 (0.0187)</td>
<td>[4] -0.0201 (0.0254)</td>
<td>[5] -0.0113 (0.0186)</td>
<td>[6] -0.00888 (0.0213)</td>
<td>[7] -0.0213 (0.0281)</td>
<td>[8] -0.00301 (0.0194)</td>
<td>[9] 0.0275* (0.0186)</td>
</tr>
<tr>
<td><strong>Abs diff firm age</strong></td>
<td>[1] -0.0000181 (0.000404)</td>
<td>[2] -0.000755 (0.00180)</td>
<td>[3] -0.00166 (0.000109)</td>
<td>[4] 0.000648 (0.000791)</td>
<td>[5] 5.85e-05 (0.00149)</td>
<td>[6] -0.000854 (0.000725)</td>
<td>[7] 0.000383 (0.000106)</td>
<td>[8] 0.000530 (0.000094)</td>
<td>[9] -0.000695 (0.000812)</td>
</tr>
<tr>
<td><strong>Abs diff managers’ education</strong></td>
<td>[1] -0.00403 (0.00757)</td>
<td>[2] -0.00932 (0.0117)</td>
<td>[3] -0.00511 (0.00884)</td>
<td>[4] -0.00802 (0.0112)</td>
<td>[5] -0.00229 (0.00726)</td>
<td>[6] 0.000897 (0.00726)</td>
<td>[7] 0.00325 (0.00754)</td>
<td>[8] 0.00295 (0.00795)</td>
<td>[9] -0.00144 (0.00705)</td>
</tr>
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</table>

(Continued)
### Table 6a. Continued

<table>
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<tr>
<th></th>
<th>Ethiopia</th>
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<th></th>
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<th>Sudan</th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>If you have a customer dispute, will other customers find out?</td>
<td>(</td>
<td>y_i - y_j</td>
<td>)</td>
<td>(</td>
<td>y_i - y_j</td>
<td>)</td>
<td>(</td>
<td>y_i - y_j</td>
<td>)</td>
<td>(</td>
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<td>Abs diff managers’ experience</td>
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<td>0.00286</td>
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<td>-0.000772</td>
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<td>(0.00264)</td>
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<td>(0.000804)</td>
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<td>(0.000703)</td>
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<td>(0.00144)</td>
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<td>Owners’ gender differ</td>
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<td>0.06000</td>
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<td>0.0541</td>
<td>0.0298</td>
<td>0.00190</td>
<td>-0.0103</td>
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<td>(0.0558)</td>
<td>(0.0550)</td>
<td>(0.0299)</td>
<td>(0.0597)</td>
<td>(0.0332)</td>
<td>(0.0341)</td>
<td>(0.0252)</td>
<td>(0.0387)</td>
<td>(0.0461)</td>
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<tr>
<td>Abs diff log employment</td>
<td>0.00230</td>
<td>-0.00417</td>
<td>0.00893</td>
<td>0.0151</td>
<td>0.0102</td>
<td>0.0219</td>
<td>-0.0130</td>
<td>-0.00426</td>
<td>-0.0267***</td>
<td>-0.0311**</td>
</tr>
<tr>
<td>(0.00661)</td>
<td>(0.0180)</td>
<td>(0.0150)</td>
<td>(0.0132)</td>
<td>(0.0190)</td>
<td>(0.0157)</td>
<td>(0.0113)</td>
<td>(0.0114)</td>
<td>(0.00875)</td>
<td>(0.0133)</td>
<td></td>
</tr>
</tbody>
</table>
five categorical reputation variables may contain insufficient information to identify the social network coefficients. Additionally, no network variable is significant in the principal component regressions shown in table 6b; hence, combining the information contained in all five of them does not lead to better results. Furthermore, the coefficients related to the control variables are nonsignificant in the vast majority of cases.

There are two possible interpretations of these findings: either the information about contractual disputes does not diffuse along the type of social networks that we have been able to measure, or this information diffuses so well that social links do not matter. One way to identify which of these two interpretations is more likely is to examine the coefficient of the distance variable. Even though information may diffuse rapidly along social networks within certain areas, the diffusion of information need not happen everywhere because strategic complementarities in diffusion create the possibility of multiple equilibria. If there are multiple equilibria, we expect to find that firms that are distant from each other perceive the consequences of contractual disputes differently.

### Table 6b. Correlates of Dyadic Differences: Perceived Consequences of Disputes, First Principal Component

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>$y_i - y_j$</td>
<td>$y_i - y_j$</td>
</tr>
<tr>
<td>$i &amp; j$ trade with each other</td>
<td>$-0.0757$</td>
<td>$0.339$</td>
</tr>
<tr>
<td></td>
<td>$(0.146)$</td>
<td>$(0.782)$</td>
</tr>
<tr>
<td>$i &amp; j$ have common supplier</td>
<td>$0.00852$</td>
<td>$0.0100$</td>
</tr>
<tr>
<td></td>
<td>$(0.0841)$</td>
<td>$(0.151)$</td>
</tr>
<tr>
<td>$i &amp; j$ have common client</td>
<td>$0.0573$</td>
<td>$0.0579$</td>
</tr>
<tr>
<td></td>
<td>$(0.118)$</td>
<td>$(0.0874)$</td>
</tr>
<tr>
<td>log distance btw $i &amp; j$</td>
<td>$-0.0152^{**}$</td>
<td>$0.00614$</td>
</tr>
<tr>
<td></td>
<td>$(0.00734)$</td>
<td>$(0.00704)$</td>
</tr>
<tr>
<td>$i &amp; j$ belong to same sector</td>
<td>$-0.0130$</td>
<td>$0.0163$</td>
</tr>
<tr>
<td></td>
<td>$(0.0258)$</td>
<td>$(0.0188)$</td>
</tr>
<tr>
<td>Abs diff firm age</td>
<td>$-0.000904$</td>
<td>$-0.00117$</td>
</tr>
<tr>
<td></td>
<td>$(0.00168)$</td>
<td>$(0.000985)$</td>
</tr>
<tr>
<td>Abs diff managers’ education</td>
<td>$-0.00478$</td>
<td>$0.00139$</td>
</tr>
<tr>
<td></td>
<td>$(0.0133)$</td>
<td>$(0.00863)$</td>
</tr>
<tr>
<td>Abs diff managers’ experience</td>
<td>$0.00290$</td>
<td>$0.000487$</td>
</tr>
<tr>
<td></td>
<td>$(0.00340)$</td>
<td>$(0.00169)$</td>
</tr>
<tr>
<td>Owners’ gender differ</td>
<td>$0.00676$</td>
<td>$0.0369$</td>
</tr>
<tr>
<td></td>
<td>$(0.0613)$</td>
<td>$(0.0481)$</td>
</tr>
<tr>
<td>Abs diff log employment</td>
<td>$0.00317$</td>
<td>$-0.0111$</td>
</tr>
<tr>
<td></td>
<td>$(0.0164)$</td>
<td>$(0.0136)$</td>
</tr>
</tbody>
</table>

Notes: The table shows ordinary least squares results. A constant is included in all specifications. The numbers in parentheses are bootstrapped standard errors that are robust with respect to heteroskedasticity and cross-observation correlation in the error terms involving the same firms. Statistical significance at the 5 percent level is indicated by**.

Source: Authors’ computations based on data described in the text.
However, we do not find distinct perceptions of contractual disputes in distant areas. For Ethiopia, although the distance coefficient is negative and highly significant in three of the specifications shown in table 6a, it is positive and significant in the remaining two specifications. Dyadic differences in the principal component that is based on the five individual variables are negatively and significantly related to distance. For Sudan, the distance coefficient is negative and significant in two out of five individual regressions, and in the remaining cases, it is not statistically significant. These findings are difficult to reconcile with the idea of widespread diffusion of contractual information among firms in the same location. If multiple equilibria are present, they seem to coexist within locations; thus, whereas some firms recognize that there are reputational consequences to contractual disputes, others in the same location do not.

**Firm Performance and Growth**

Thus far, we have focused on those business practices that may diffuse within networks. We have also investigated whether the above results are mirrored in labor productivity and growth rates, which are our measures of firm performance. The results for the specifications in which the dependent variable is defined as the absolute difference across firms in these performance indicators are shown in section 4 in the online appendix. For Ethiopia, we find little evidence that firms that are closer in the social-network sense have more similar performance. For Sudan, we find evidence that firms that share the same supplier have more similar performance than other firms. However, other results related to network links and geographical distance are weak. The overall conclusion from our analysis is that network links and geographical proximity are not strongly associated with any convergence in the performance of firms.

**Heterogeneous Diffusion and Networks**

Now, we return to the points raised in section I that are related to the diffusion patterns across heterogeneous firms. We ask whether the reason we find only limited evidence of diffusion is that the firms are too heterogeneous. To investigate whether the evidence for diffusion is stronger among pairs of firms in the same sector, we interact our network and distance variables with a dummy that tracks whether firms $i$ and $j$ belong to the same industrial subsector, and we add these new interaction terms to the baseline specification. To minimize the number of explanatory variables, the same industry dummy is interacted with a single network variable $anylink_{ij}$, which is a dummy variable that is equal to one if there is any link between firms $i$ and $j$. Such a link would amount to direct trade, a common client or a common supplier.

The results for all of the outcome variables are shown in tables S2.E and S2.S in the online appendix. For Ethiopia, the sector-network interaction term is statistically nonsignificant in every specification, and the sector-distance interaction term is significant in only one specification (formal training; see table S2.E, column [8]; the term has a positive sign). For Sudan, the sector-network
interaction term is statistically nonsignificant in every specification, and the
sector-distance interaction term is significant in just one specification (direct
imports; see table S2.S, column [10]; the term has a positive sign). These results
suggest that sector heterogeneity is not the reason for limited diffusion. They also
imply that strategic substitution is equally strong within each sector and across
different sectors.

We repeat this type of analysis, which focuses on firm-size heterogeneity instead
of sector heterogeneity. To that end, we interact anylinkij and the distance variable
\((d_{ij})\) with a dummy that tracks whether firms \(i\) and \(j\) are of similar size, and we add
these new interaction terms to the baseline model.\(^{16}\) The results are shown in
tables S3.E and S3.S in the online appendix. For Ethiopia, the size-network inter-
action term is statistically nonsignificant in all regressions. However, the size-
distance term is negative in the vast majority of cases and is often statistically
significant. This result suggests that strategic substitution is stronger across firms of
similar size than across firms of differing size, which may be because geographi-
cally close firms strategically choose to differentiate themselves from each other to
reduce competition. For Sudan, the network-size interaction term is statistically
nonsignificant in all specifications, and the size-distance interaction term is signifi-
cant in just three specifications (table S3.S, columns [6], 11 and 20). On balance,
we find little evidence that size heterogeneity is a likely reason for slow diffusion,
and we note that the results for Ethiopia lend further support to the idea that
strategic substitution may be important.

**Market Differentiation within Towns**

Finally, we investigate how the estimated coefficients of the geographical distance
change if we add a dummy variable sametownij to the baseline specification. This
dummy variable is equal to one if firms \(i\) and \(j\) are located in the same town and
zero otherwise. We want to establish whether market differentiation within
towns causes the result that a shorter geographical distance between firms is asso-
ciated with greater differences in business practices. It seems plausible to suppose
that strategic substitution is strongest within towns. If markets are localized such
that firms in different towns pose no competitive threat to each other irrespective
of the distance between these towns, events in town \(k\) will not affect the strategic
decisions of firms in town \(l \neq k\). In this case, the relevant geographical circum-
stance is whether firms are in the same town; thus, conditional on sametownij, distance does not matter. Thus, by adding sametownij to the set of explanatory
variables, we generalize the baseline’s functional form with respect to the effect
of distance.

The results that are based on this specification for all outcome variables are
shown in tables S4.E and S4.S in the online appendix. For Sudan, the coefficients
on sametownij are always negative whenever they are significant, which suggests

\(^{16}\) Firms are defined as having a similar size if the absolute log of the difference in employment is less
than 0.2.
that strategic substitution effects do not primarily operate within towns. For Ethiopia, the picture is more mixed: although we obtain positive and significant coefficients in five of the regressions shown in table S4.E columns [1]–[24], we obtain negative and significant coefficients in three regressions. Overall, the support for the idea that strategic substitution effects operate primarily within towns is quite limited.

V. Conclusions

In this paper, we have documented empirical patterns of correlation in the adoption of innovation and contractual practices among manufacturing firms in Ethiopia and Sudan. Our empirical analysis is based on network data that indicate whether any two firms in our sample do business with each other, buy inputs from a common supplier, or sell output to a common client. We also exploit data on firms’ locations to investigate whether firms that are near each other tend to be more similar or dissimilar than firms that are geographically far apart.

Our results can be summarized as follows: (i) for Sudan, but not for Ethiopia, there is some evidence that network proximity is associated with similar innovation strategies; (ii) for both countries, there is relatively strong evidence that firms that are located close to each other differ more with respect to innovation than firms that are far apart; (iii) there is no evidence that network proximity is associated with greater similarity in training decisions or labor management across firms; (iv) there is some evidence that firms that are located close to each other differ more with respect to training decisions than firms that are geographically far apart; (iv) for Sudan, but not for Ethiopia, there is some evidence that network proximity is associated with similar contractual practices; (vi) differences in contractual practices across firms are only weakly related to geographical proximity; (vii) there is no evidence that network proximity is associated with greater similarity in the perceived consequences of disputes; (viii) there is some evidence that geographical proximity is associated with greater differences in the perceived consequences of disputes; and (ix) except for supplier-based links in Sudan, differences in firm performance are only weakly related to geographical and network proximity. Overall, the strongest results are for innovation.

Thus, our results provide limited support for the commonly held idea that firms that are more proximate in a network sense are more likely to adopt similar contractual and technological innovation practices. Furthermore, we find some evidence that for certain practices, adoption decisions are local strategic substitutes. Hence, if one firm adopts, other nearby firms are less likely to do so. What should we make of these results? First, we again note that a correlation in practices does not imply diffusion because there may be unobserved contextual effects. Second, the evidence presented here does not imply that the diffusion of innovation between firms can never be important or even critical for growth. However, diffusion between firms should not be taken for granted. Many of the firms in
our sample follow antiquated business practices even when some neighboring firms do not, which is consistent with the observation that firms in developing countries are often more heterogeneous than firms in developed countries (see, for example, Bloom et al. [2012] for evidence that the quality of management practices is more heterogeneous for the firms in Brazil, China, and India than in the U.S.). Third, it is possible that we searched for diffusion in the wrong place (that is, among existing firms) because it is possible that, in general, the diffusion of innovations takes place not because existing firms learn to imitate each other but rather because new firms emerge that adopt innovative practices. This interpretation is consistent with the findings reported in the exporting literature: although there is limited evidence that incumbent firms learn from exporting, there is ample evidence that firms that begin exporting are more productive than average, even when they are new entrants (Clerides, Lach and Tybout 1998; Fafchamps, El Hamine and Zeufack 2008). Fourth, we acknowledge that our data have certain limitations. One potentially important limitation is that the survey asked for a maximum of three clients and suppliers, which implies that we do not have complete coverage of all of the network links. In addition, it is likely that our network-link variables are measured with error, which may cause the network effects to be underestimated in our analysis. Despite these caveats, we note that in several ways, the evidence for diffusion and complementarities is much weaker than one might expect given the emphasis in much of the current policy discussion on diffusion and agglomeration economies as sources of improved firm performance.

References


The Impact of Financial Literacy Training for Migrants

John Gibson, David McKenzie, and Bilal Zia

Remittances are a major source of external financing for many developing countries, but the cost of sending them remains high in many migration corridors. Despite efforts to lower these costs by offering new products and developing cost-comparison information sources, many new and promising inexpensive remittance methods have relatively low adoption rates. The lack of financial literacy among migrants has been identified as one potentially important barrier to competition and new product adoption. This paper presents the results of a randomized experiment designed to measure the impact of providing financial literacy training to migrants. Training appears to increase financial knowledge and information-seeking behavior and reduces the risk of switching to costlier remittance products, but it does not result in significant changes in the frequency of remitting or in the remitted amount. JEL codes: F24, O12, C93

International migration from a poor country to a rich one is the single act that is perhaps most likely to contribute to dramatically increasing the income of an individual (e.g., Clemens et al. 2009; McKenzie et al. 2010) as well as the income of the family members who remain behind (e.g., Yang 2008; Gibson et al. forthcoming; Yang and Martinez 2005). The most direct channel through which international migrants can reduce poverty for the members of their households who remain in developing countries is through remittances. However, the high costs of sending remittances limit both the amounts that can be received by the remaining household members from a given remittance

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transfer and the incentives of migrants to send remittances if such transfers are effectively taxed by these high transaction costs (Aycinena et al. 2011; Gibson et al. 2006). Reducing the cost of sending remittances has thus become one of the most frequently discussed policy intervention areas in recent years (see the United Nations Global Forums on Migration and World Bank 2006) because doing so is viewed as politically uncontroversial compared to efforts to increase opportunities for migration.

Two important policies aimed at lowering the costs of remittances are the regulatory reforms to allow the introduction of new financial products and efforts to increase the disclosure of the transaction costs of each remittance product, which were pioneered by Mexico (www.remesamex.gob.mx and the United Kingdom (www.sendmoneyhome.org²). However, despite the entry of new products and increased cost disclosure, there is still a wide variation in the costs of different remittance methods in many markets. Furthermore, several promising inexpensive remittance methods have had relatively low adoption rates.³ The lack of financial literacy among migrants has been identified as a potentially important barrier to competition and new product adoption (e.g., Jaramillo 2008; Suki 2007). Although systematic evidence on the financial literacy of migrants is scarce, the available data suggest that migrants often lack knowledge about the components of remittance transaction costs, available remittance methods, or comparing methods (Gibson et al. 2006; 2007). Hence, financial literacy training is a potentially promising way to change remitting behavior.

There is also growing interest from policy makers in providing financial literacy training related to remittances. Much of the focus on financial literacy training for migrants and their families has traditionally been placed on either integrating immigrants into the financial systems of their destination countries by building knowledge of banking services and basic household budgeting and savings techniques (LIRS, undated) or encouraging remittance receivers to make better use of the money they receive, which is the focus of the Microfinance Opportunities/Freedom from Hunger Global Financial Education Program.⁴ However, a number of initiatives, including activities in migrant-sending countries such as the Philippines and Indonesia and pilot programs for seasonal migrants from the Pacific Islands working in New Zealand and Australia, have begun to focus on teaching migrants themselves about the costs and details of different remittance methods. However, to date, no rigorous evidence has been collected on the effectiveness of such programs.

2. This website has since expanded and changed its name to www.fxcompared.com. The World Bank has also launched a remittance prices database (http://remittanceprices.worldbank.org) that covers remittance costs in 163 corridors.
3. Beck and Martinez-Pería (2011) examine the correlates of the cost of remitting across different bilateral corridors and find that financial access and more competition are correlated with lower costs.
This paper presents the results of a randomized experiment designed to measure the impact of providing financial literacy training to migrants in New Zealand and Australia, which recently launched a remittance cost comparison website (www.sendmoneypacific.org) for sending money to the Pacific Islands and, in the case of New Zealand, where regulatory reform had led to the introduction of new remittance methods. The training taught migrants the different elements involved in the cost of sending remittances and how to compare costs across methods, explained how different methods of remitting work, including alerting participants to the presence of new methods, and provided information on comparing the costs of different methods of short-term credit financing for immigrants. The experiment was conducted with three groups that had differing levels of existing education and financial knowledge and differing intensities of remitting. The first group consisted of Pacific Island migrants in New Zealand, who remitted relatively frequently and had a relatively low baseline level of education and financial literacy. The second group included East Asian migrants in New Zealand, who remitted relatively infrequently but had relatively high levels of education and financial literacy. The final group was composed of Sri Lankan migrants in Melbourne, Australia, who remitted relatively frequently and had relatively high education and financial literacy levels.

We found that the training led to increases in financial knowledge among the Pacific Island and East Asian migrants but not the Sri Lankans, which is consistent with the notion that this type of training is most important for those with low knowledge or low experience. This increased knowledge was coupled with changes in behavior, with Pacific Island and East Asian migrants being more likely to use information to compare the costs of different remitting methods and the Pacific Island sample being less likely to switch remitting channels to methods that were not obviously better. However, we found no significant change in the frequency of remitting and no significant impact on the remitted amount. Although our sample size and the variation in remittance data mean that we cannot rule out relatively large percentage changes in the remitted amount, the range of potential impacts on the level of remittances is small relative to migrant incomes. Unfortunately, the comparison of the Pacific Island group with the other two groups is hampered by the fact that few members of the East Asian sample regularly sent remittances, whereas attrition was high and unbalanced by treatment status for the Sri Lankan sample. Thus, the results are most reliable for the sample for which the content was initially developed, the Pacific Island migrants.

In addition to the implications for remitters, our work contributes to the broader literature on the effectiveness of financial literacy programs. The most relevant early contribution in this field is by Bernheim et al. (2003), who find that financial education mandates in the United States have a significant positive effect on the future savings of students who participate in the program. However, these conclusions are subsequently challenged by Cole and Shastry
(2009), who replicate and extend Bernheim et al. (2003) using a much larger sample from census data and do not find any significant effects. In the experimental literature, the most convincing evidence of the role of financial education comes from Duflo and Saez (2003), who conduct an experiment on retirement savings at a U.S. university and find small but significant positive effects. The only comparable evaluation in the developing world is by Cole et al. (2010), who find no significant effects of financial literacy training on the overall population. However, slight increases are observed in the probability of opening savings accounts among those with low initial levels of financial and formal education.

Although the measured effects of financial education in the extant literature appear to be low, a key constraint is that it is often difficult to expect large changes to result from generic curricula. In this vein, Bertrand and Morse (2011) conduct a specific experiment with individuals who borrow from payday lenders in the United States. Their experimental timing is such that their intervention occurs precisely when individuals are making the decision to borrow, which is arguably a “teachable moment” when financial education could be most effective. Although their treatment is quite simple and emphasizes the dollar cost of repeated borrowing using visual cues, the authors find a significant reduction in the probability of individuals renewing payday loans. Our intervention complements this type of approach by introducing information on less expensive remittance methods to individuals seeking to send money back home and providing them with actionable rather than generic content, although an important difference is that our information is not delivered at the moment of the transaction.

The remainder of the paper is structured as follows. Section 2 provides information on the surveys and financial literacy training that were conducted in the randomized experiment and the context of the studied remittance corridors. In section 3, the results of the experiment are described, focusing on financial knowledge, information seeking, remittance frequency, remittance amounts, remittance methods, credit use, and qualitative evaluations by study participants. Section 4 discusses the results, and section 5 contains the conclusions.

**Context, Sample, and Financial Literacy Intervention**

The cost of remitting money has fallen dramatically in a number of migration corridors over the past 15 years as a result of increased competition, new product offerings, and the advent of price-comparison websites. For example, Profeco, Mexico’s consumer protection agency, began reporting the cost of sending money from several U.S. cities to Mexico on a weekly basis in 1998, and Hernández-Coss (2005) reports that the cost of sending US$300 fell from approximately US$32 in 1999 to US$12 in 2003. By September 2011, US$300
could be sent for $3.60 through Bank of America’s account-to-account or cash-to-cash products.5

Nevertheless, the costs of sending money remain high in other migration corridors, with transfer costs between several African countries of 15–20 percent on a US$200 transaction in 2011.6 This was the context of our study, which examined remittance costs in the Pacific in the mid-2000s. We found that the cost of sending money from New Zealand or Australia to several Pacific Islands was in the range of 15–20 percent on a typical NZ$2007 transaction (Gibson et al, 2006, 2007; McKenzie 2007). This research revealed that although average costs were high, lower cost possibilities were available that were not being used and that few migrants were aware of, such as the use of debit cards to make ATM withdrawals. Moreover, although a typical remittance transaction incurs both a fixed fee and an exchange rate commission, the latter component was often opaque, leading migrants to compare remittance methods purely on the basis of the fixed fee component.

Spurred by these research findings, the governments of New Zealand and Australia and their aid agencies along with the World Bank attempted to lower the costs of remitting in the region. In New Zealand, this attempt resulted in changes in know-your-customer regulations, which had previously required banks to see every customer to whom they issued an ATM card. This change allowed banks to give migrants one ATM card for themselves and one for their families back home without having to verify the identity of the second cardholder in person. Westpac Bank was the first to release a new product under these revised regulations. The Westpac Express prepaid debit card was targeted at migrants and received positive reviews (Stock 2009). Furthermore, these organizations launched a new website for both Australia and New Zealand (www.sendmoneypacific.org) based on the U.K.’s successful sendmoneyhome website. This website provides detailed information on the cost of sending remittances from Australia and New Zealand to the Pacific Islands through various channels and is updated regularly.

Despite the introduction of new products and a new information source, the adoption of the Westpac Express product and the volume of transfers using it have not been as high as expected (Pacific Islands Forum Secretariat 2011). One plausible reason for this situation may be lack of financial literacy. Only 12 percent of the Pacific Island migrants in our sample had heard of this card at baseline, and less than half had ever used any source of information to compare the costs of sending money through different methods. Given the increasing policy interest in providing financial education to migrants, we decided to conduct a randomized experiment to measure the impact of

7. At the time of the intervention, NZ$1 was approximately US$0.75–0.80, and the New Zealand minimum wage was NZ$13 per hour.
financial education programs on the financial knowledge and remitting behavior of migrants.

The Sample

The Westpac Express card and sendmoneypacific were both designed for Pacific Island migrants in New Zealand. However, to examine whether training, which focuses on understanding how to remit and how to compare prices, is effective for immigrants in general, we decided to also consider other migrant groups. Because migrants are minority populations, especially migrants from specific countries, obtaining a representative sample can be prohibitively expensive (McKenzie and Mistiaen 2009). Therefore, we decided to recruit study participants through intercept points where migrant populations are known to congregate, mimicking the approach that would typically be used by policy makers and financial institutions attempting to reach migrant populations. This method has the advantage of making our results relevant for the population that is most likely to be the subject of financial literacy efforts, although it does not allow for measurement of the impact on migrants not found in these locations, who are typically less connected to their home countries (and less likely to remit).

Our first group consists of Pacific Islanders living in urban areas in the upper North Island of New Zealand. Approximately one-third of the recruited participants were attendees at a Pacific cultural festival in Hamilton, which drew participants from up to 60 miles away (including South Auckland, which has the largest concentration of Pacific immigrants). The remainder of the participants was recruited from the main Pacific outdoor market (which operates every Saturday morning) in South Auckland and from churches in Auckland and Hamilton. The church-based recruitment tended to bring in older participants, whereas the cultural festival participants were typically in their twenties. The Pacific Islanders were predominantly (three-quarters) from Tonga, with the remainder born in Samoa, the Solomon Islands, Fiji, Australia, and New Zealand. In the Pacific Island community, even second-generation migrants send remittances due to on-going linkages with their extended families in the islands (Lee 2003). Therefore, we did not exclude any New Zealand- or Australian-born participants.

The second chosen group included East Asians, the other main immigrant group in New Zealand. Chinese and Korean participants from Auckland (four-fifths of the total of the East Asian group) were recruited from five different churches located in Northern, Western, and Central Auckland and from a Tai Chi group and a Chinese health organization, both located in Northern Auckland. The remaining Chinese participants were from Hamilton (60 miles south of Auckland), where they were recruited from several churches and from the pre-existing research networks of the Chinese team leader (who was based in Hamilton). No single church or locality contributed more than one-seventh of the sample. This sample was restricted to first-generation migrants.
The final group in our study consisted of first-generation Sri Lankan migrants in Melbourne, Australia, who were recruited through snowball sampling. Initially, 20 people were selected from various Sri Lankan organizations (both formal and informal) in Melbourne. These organizations were selected to represent different demographic and economic groups in terms of length of time residing in Australia, type of migration (skilled, family reunification, and student), education level, ethnicity (predominantly Sinhalese), and location in the greater Melbourne urban area. Each individual from these organizations was asked to provide the names and contact details of five individuals who could be interviewed. Of the 100 potential participants identified in this way, 80 agreed to participate in the baseline survey. When the interviews with these 80 people were conducted, they were asked to provide further referrals, leading to another 129 people who were interviewed. Some of the participants who were obtained through the second round of referrals were uncomfortable with the questions on financial information and remittances and refused to provide any contact addresses, which excluded them from being invited to the training or participating in the four follow-up surveys.

A common concern about randomized experiments involves the generalizability of their results, particularly when studies are conducted on a single population. Consequently, we chose three migrant groups, which include a range of educational levels and differing intensities of remitting frequencies, to gauge the impact of financial literacy training across different migrant groups.

To ensure that the surveys and financial literacy training were conducted in the most effective and culturally appropriate way, we recruited individuals from these migrant populations to lead the field work for each of the component studies. Because each of these team leaders had a PhD, two of which were in economics and one of which was in psychology (specializing in field studies of migrants), the level of training and skill of the financial literacy intervention providers is likely to be atypically high. Each of the team leaders recruited assistants who were local individuals drawn from the population groups that were being studied. The questionnaires, PowerPoint presentations and written materials were available in English, Mandarin, and Korean for the participants in the East Asian group and in English for the Pacific and Sri Lankan groups (English is the language of education throughout the Pacific, and the Sri Lankan group was highly educated although English was not their first language).

Baseline Survey, Randomization, and Financial Literacy Levels

Respondents were recruited from December 2010 to January 2011 (Pacific Island sample), December 2010 to February 2011 (East Asian sample), and

8. We planned to include a sample of Pacific Island migrants living in Sydney, Australia, but the field leader in charge of this process experienced health problems during the recruitment and training processes, leading to the exclusion of this sample from the study.
January 2011 to March 2011 (Sri Lankan sample). The resulting sample sizes were 349 Pacific Islanders, 352 East Asians, and 209 Sri Lankans. A baseline questionnaire collected information on the respondents’ background characteristics, their use and awareness of different remittance methods, and their financial literacy, with specific emphasis on knowledge relevant to remittances and the use of financial instruments.

Within each of the three samples we formed eight strata based on three baseline characteristics: (i) reported frequency of remitting (remitting at least every three months); (ii) knowledge of the savings in transactions costs from bundling two remittances of NZ$100 into a single remittance of NZ$200; and (iii) knowledge of which credit card repayment patterns would lead to the highest charges. Individuals were then randomized by computer into a treatment group, whose members were invited to financial literacy training, and a control group, whose members were not invited to the training.

Table 1 displays the baseline characteristics of each of the three samples by treatment status. An F-test cannot reject joint orthogonality for each sample, confirming that we did not obtain an unlucky draw and that the randomization succeeded in achieving balance on baseline characteristics.

We observe that the three migrant groups differ from one another in a number of important ways. The Pacific Island migrants are younger and less educated than members of the other groups, with almost half under 35 years of age and only 9 percent having a university degree. Of the Pacific Island migrants, 39 percent are male, and just under half have a parent or child in a Pacific Island home country. They are relatively frequent remitters, with 59 percent remitting a mean amount of NZ$299 (US$244) and a median of NZ$200 at least once every three months. The East Asian migrants are older, with only one-third under 35 years of age, and are more settled, with only one-quarter having immigrated in the past five years. Of the East Asian migrants, 43 percent are male, and 57 percent have university degrees. They are infrequent remitters, with only 6.5 percent remitting within the past three months despite the fact that 66 percent have a parent or child in the home country. The few remittances that occur are for relatively large amounts, with a mean (median) of NZ$4,235 (NZ$1,000). The Sri Lankan migrants differ in that they are mostly male (73 percent) and have the highest education and employment rates, with 59 percent having a university education. They are also relatively frequent remitters, with 55 percent remitting a mean (median) amount of NZ$1,525 (NZ$675) at least every three months and 75 percent having a parent or child in Sri Lanka. It is likely that these differences across groups reflect different immigration patterns: Pacific Islanders tend to immigrate to New Zealand as a result of family reunification and special concessionary migration quotas (McKenzie et al. 2010), whereas Asian migrants to New Zealand typically entered through points systems that reward skills and wealth. The Sri Lankan migrants are typically individuals who either entered Australia
# Table 1. Characteristics of Sample by Treatment Status

<table>
<thead>
<tr>
<th>Variables stratified on</th>
<th>Pacific Islanders in New Zealand</th>
<th>East Asians in New Zealand</th>
<th>Sri Lankans in Australia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remit at least every three months</td>
<td>Treatment: 0.59 Control: 0.59</td>
<td>Treatment: 0.08 Control: 0.05</td>
<td>Treatment: 0.54 Control: 0.56</td>
</tr>
<tr>
<td>Knows it is cheaper to bundle remittances into large transaction</td>
<td>Treatment: 0.49 Control: 0.49</td>
<td>Treatment: 0.64 Control: 0.65</td>
<td>Treatment: 0.78 Control: 0.78</td>
</tr>
<tr>
<td>Knows only paying minimum on credit card costs the most</td>
<td>Treatment: 0.41 Control: 0.41</td>
<td>Treatment: 0.55 Control: 0.54</td>
<td>Treatment: 0.44 Control: 0.44</td>
</tr>
</tbody>
</table>

**Personal Characteristics**

<table>
<thead>
<tr>
<th></th>
<th>Pacific Islanders in New Zealand</th>
<th>East Asians in New Zealand</th>
<th>Sri Lankans in Australia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>Treatment: 0.36 Control: 0.42</td>
<td>Treatment: 0.45 Control: 0.41</td>
<td>Treatment: 0.76 Control: 0.69</td>
</tr>
<tr>
<td>Age is under 35</td>
<td>Treatment: 0.47 Control: 0.49</td>
<td>Treatment: 0.33 Control: 0.33</td>
<td>Treatment: 0.28 Control: 0.30</td>
</tr>
<tr>
<td>First generation migrant</td>
<td>Treatment: 0.81 Control: 0.81</td>
<td>Treatment: 0.99 Control: 0.98</td>
<td>Treatment: 1.00 Control: 0.99</td>
</tr>
<tr>
<td>Migrated within last five years</td>
<td>Treatment: 0.34 Control: 0.35</td>
<td>Treatment: 0.25 Control: 0.27</td>
<td>Treatment: 0.47 Control: 0.41</td>
</tr>
<tr>
<td>Has a parent or child in the origin country</td>
<td>Treatment: 0.47 Control: 0.42</td>
<td>Treatment: 0.69 Control: 0.64</td>
<td>Treatment: 0.75 Control: 0.76</td>
</tr>
<tr>
<td>Married</td>
<td>Treatment: 0.69 Control: 0.65</td>
<td>Treatment: 0.69 Control: 0.70</td>
<td>Treatment: 0.84 Control: 0.93</td>
</tr>
<tr>
<td>Education of Fifth Form (10th grade) or less</td>
<td>Treatment: 0.46 Control: 0.39</td>
<td>Treatment: 0.09 Control: 0.11</td>
<td>Treatment: 0.01 Control: 0.02</td>
</tr>
<tr>
<td>University degree</td>
<td>Treatment: 0.10 Control: 0.08</td>
<td>Treatment: 0.59 Control: 0.54</td>
<td>Treatment: 0.64 Control: 0.54</td>
</tr>
<tr>
<td>Employed</td>
<td>Treatment: 0.63 Control: 0.59</td>
<td>Treatment: 0.42 Control: 0.47</td>
<td>Treatment: 0.81 Control: 0.80</td>
</tr>
<tr>
<td>Uses email at least weekly</td>
<td>Treatment: 0.31 Control: 0.33</td>
<td>Treatment: 0.59 Control: 0.56</td>
<td>Treatment: 0.73 Control: 0.79</td>
</tr>
</tbody>
</table>

**Financial Characteristics**

<table>
<thead>
<tr>
<th></th>
<th>Pacific Islanders in New Zealand</th>
<th>East Asians in New Zealand</th>
<th>Sri Lankans in Australia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ever compared costs of sending remittances</td>
<td>Treatment: 0.48 Control: 0.47</td>
<td>Treatment: 0.40 Control: 0.41</td>
<td>Treatment: 0.62 Control: 0.59</td>
</tr>
<tr>
<td>Has a cheque account</td>
<td>Treatment: 0.35 Control: 0.33</td>
<td>Treatment: 0.56 Control: 0.58</td>
<td>Treatment: 0.79 Control: 0.75</td>
</tr>
<tr>
<td>Has an ATM card</td>
<td>Treatment: 0.80 Control: 0.76</td>
<td>Treatment: 0.80 Control: 0.76</td>
<td>Treatment: 0.88 Control: 0.85</td>
</tr>
<tr>
<td>Has a credit card</td>
<td>Treatment: 0.15 Control: 0.16</td>
<td>Treatment: 0.64 Control: 0.60</td>
<td>Treatment: 0.76 Control: 0.72</td>
</tr>
<tr>
<td>Last amount remitted conditional on remitting (NZD)</td>
<td>Treatment: 288 Control: 310</td>
<td>Treatment: 4235 Control: 4234</td>
<td>Treatment: 1200 Control: 1884</td>
</tr>
<tr>
<td>Gets APR on two week loan correct</td>
<td>Treatment: 0.02 Control: 0.03</td>
<td>Treatment: 0.44 Control: 0.47</td>
<td>Treatment: 0.42 Control: 0.41</td>
</tr>
<tr>
<td>Knows components of a remittance fee</td>
<td>Treatment: 0.03 Control: 0.02</td>
<td>Treatment: 0.13 Control: 0.11</td>
<td>Treatment: 0.20 Control: 0.15</td>
</tr>
<tr>
<td>Number of methods for sending remittances known</td>
<td>Treatment: 3.00 Control: 2.83</td>
<td>Treatment: 2.63 Control: 2.69</td>
<td>Treatment: 3.68 Control: 3.64</td>
</tr>
</tbody>
</table>

**Sample Size**

<table>
<thead>
<tr>
<th>Pacific Islanders in New Zealand</th>
<th>East Asians in New Zealand</th>
<th>Sri Lankans in Australia</th>
</tr>
</thead>
</table>

**p value for test of joint orthogonality**

<table>
<thead>
<tr>
<th>Pacific Islanders in New Zealand</th>
<th>East Asians in New Zealand</th>
<th>Sri Lankans in Australia</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.913</td>
<td>0.978</td>
<td>0.356</td>
</tr>
</tbody>
</table>
as students and chose to stay or migrated by qualifying under Australia’s points-based migration system as a result of civil conflict in Sri Lanka.

The baseline survey asked three questions to measure remittance-specific financial literacy as well as two questions on broader financial literacy related to credit (see appendix 1). The remittance-specific questions are direct knowledge-based questions that do not require mathematical knowledge and directly measure the information taught by the financial literacy course. The general financial literacy questions are similar to those that have been used in a number of countries around the world (e.g., Lusardi and Tufano 2009); they are what Carpena et al. (2011) call computational or numeracy-based measures.

Baseline financial literacy was lowest among the Pacific Island migrants. Only 49 percent knew that it was cheaper to bundle remittances as a single transaction than to send them separately (and pay the fixed fee twice), only 5.7 percent knew that the prepaid ATM card was the cheapest method of remitting (among the given options), and only 3 percent knew that the remittance fee consists of an exchange rate commission and a fixed fee. Knowledge of the available methods of remitting was also relatively low. When the migrants were asked whether they had heard of each of 10 different methods of sending money (e.g., Western Union, Melie Mei Langi, Travellers Check), the mean respondent had heard of only three such methods. Financial literacy related to credit was also relatively low; 41 percent knew that someone who makes only the minimum payment would have the highest credit card fees, and only 3 percent were able to correctly calculate the nominal APR on a two-week payday loan (which simply involves multiplying by 26 rather than any use of exponentiation).

Baseline financial literacy rates were higher among the Sri Lankans and East Asians, reflecting their much higher education levels and greater use of credit cards and checking accounts. In these groups, 65 percent of the East Asians and 78 percent of the Sri Lankans knew that it was cheaper to bundle remittance transactions, and more than 40 percent of both groups were able to correctly calculate the APR on a two-week payday loan. However, knowledge of the components of a remittance fee remained low, with only 12 percent of the East Asians and 18 percent of the Sri Lankans knowing the correct answer to this question. As with the Pacific Islanders, these migrant groups claimed to have heard of only three to four possible ways of sending remittances out of a list of 10–12 methods.

**Potential Savings from Greater Financial Literacy and Potential to Switch Methods**

Participants had a range of different remittance methods available to them in all samples. The remittance methods available to the participants had transaction costs that ranged from almost zero to almost 20 percent for a typical transaction at the start of the intervention. The greatest potential gains appear to be for the Pacific Island migrants in New Zealand as a result of substantial
heterogeneity in costs and lower typical remittance amounts. Figure 1 in the Online Appendix illustrates the variation in the cost of sending NZ$200 (the median transaction) from New Zealand to Tonga (the main destination) over our sample period. Transaction costs approached 20 percent for a money transfer operator called Mana, 15 percent using a bank transfer, 12–14 percent using either Western Union or MoneyGram, 8–11 percent using the major indigenous money transfer operator (Melie Mei Langi), and 7–8 percent using the Westpac Express prepaid remittance card. One internet-based, peer-to-peer currency exchange provider (KlickEx) had transaction costs of less than 1 percent for its least expensive service and 2.75 percent for its fast service, although no participants had ever used this method. For the most commonly used methods, Western Union and Melie Mei Langi, bundling two transactions into one would save a fixed fee of NZ$8–14, whereas switching from one of these methods to the Westpac Express Card would save NZ$6–12 per NZ$200 transaction.

There was less variation in costs for the East Asians in New Zealand and, because of the low level of remittances, fewer potential gains. For money transfers to China, the transaction costs of sending NZ$200 varied between 14 percent for Western Union and the most expensive indigenous money transfer operator (Global FX) and 10 percent using the least expensive money transfer operator (Convergence Group). Some of the Chinese money transfer operators would only transfer a minimum of NZ$1,000, for which the transaction costs were as low as 3 percent. Because the cost of remitting decreases as a percentage of the remitted amount as a result of the fixed fee component and the median amount remitted among East Asian migrants was NZ$1,000 at baseline, the percentage cost of remitting was 3–6 percent.

For the Sri Lankan participants in Australia, spending A$200 on a remittance would incur transaction costs of 16 percent using a bank transfer, 9 percent using Western Union, 5 percent using MoneyGram, and 3 percent using any of the inexpensive indigenous money transfer operators (FastCash, Remittance Plus, or Serandib). For their median remittance amount of A$500 (NZ$675), the transaction costs were 11 percent using a bank transfer, 5–6 percent using Moneygram or Western Union, 4 percent using Kapruka, and 3 percent using FastCash, Remittance Plus, or Serandib. Cash Express, which began operating after the intervention started, charged just 2 percent for a remittance of A$500. Because the most common methods at baseline were Kapruka and FastCash, this sample had relatively limited potential gains from switching providers.

Although migrants have a variety of remittance providers from which they can choose, there are differences in the convenience of these methods for them and for their receiving family members. For example, Western Union has an exclusive agreement with the New Zealand Post Office (and is found in small grocery stores and other locations) and has a wide range of locations throughout the Pacific. In contrast, the use of bank transfers and ATM cards involves
limited banking hours and few ATM locations, with considerably less spatial coverage in the Pacific (see Gibson et al. 2007). Price competition among providers in New Zealand or Australia may therefore not be sufficient to entice consumers to switch providers if remittance receivers find it much easier to use one method over another. However, when viewing switching as an outcome, we observed that 16 percent of the control group switched remittance methods within a six-month period, demonstrating that switching is certainly possible for at least some migrants.

The Financial Literacy Intervention

The financial literacy training content was originally developed by the authors in collaboration with the Ministry of Pacific Island Affairs and was piloted on a Pacific Island population in 2009. The material begins with a discussion of the reasons people remit and the factors involved in the remittance method decision, such as cost, speed, convenience for both the sender and the receiver, familiarity, trust, and the financial provider’s ability to offer other services. The focus is on helping participants to understand the components of remittance costs, providing strategies for reducing these costs, and highlighting sources of information for comparing costs and learning about new remittance products. This process includes explaining the fixed fee and exchange rate commission components of transaction costs and illustrating the extent to which they vary across different providers, showing how the transaction costs decrease with the amount sent so that bundling several smaller transactions into one large transaction saves money, and providing information about the sendmoneypacific website for comparing costs and the new Westpac direct debit card product.9

The remittance material was adapted for the East Asian and Sri Lankan populations. Because sendmoneypacific does not cover remittance transactions for these remittance corridors, both groups were given instructions and shown how to access rates and the expected amount received on the Western Union website as well as on ANZ Bank online and fxcompared.com for the Sri Lankans and MoneyBookers for the East Asians.

The randomly chosen survey respondents were then invited to the financial literacy training sessions, which were held at multiple times and venues to ensure maximum participation from those who were invited. The sessions were typically held at churches, community centers, and sports clubs and usually trained groups of about 30 people at a time for approximately two hours. In addition to a presentation of approximately 25 PowerPoint slides, written material was provided, examples were considered, and there was continuous discussion with the community. As previously noted, to minimize any

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9. Because the baseline survey data for the Pacific Island group indicated that very few respondents had credit cards and that the media presented stories of hardship caused by the use of more expensive sources of financing, the Pacific Island group’s presentation also included a small amount of content on how to compare the costs of different sources of credit. We do not expect this to directly affect remittance behavior over the considered time horizon.
cross-cultural communication barriers, the presenters were all members of the immigrant groups. It was emphasized that the aim of the training was not to advocate for any one particular remittance provider but instead to help the participants become more informed consumers who could shop for better remittance deals (see online appendix figure 2 as an example).

The attendance rate for the training session was 148 out of 177 for the Pacific Island treatment group (84 percent). Three members of the control group who were accompanying friends in the treatment group also attended (1.7 percent). For the East Asian migrants, attendance was 112 out of 179 (63 percent) in the treatment group, with 26 out of 173 (15 percent) members of the control group, who were friends of and attended the same churches as the treatment group participants, also attending. Among the Sri Lankans, the attendance rate was 60 out of 107 (56 percent) for the treatment group, and no participants attended from the control group. Meier and Sprenger (forthcoming) find that in a U.S. context, individuals who discount the future (and thus who may be in more need of financial planning) are less likely to attend financial literacy training. We do not measure time preferences in our study, but we find no significant relationship between education or baseline financial literacy measures and the likelihood of attending training among our samples.

**Follow-up Surveys**

For the three months following the financial literacy training, all respondents of the baseline survey were given brief monthly follow-up surveys on their remittance activity during the past month along with questions on major financial actions taken during the previous month, such as applying for a credit card. In addition, the one-month survey asked several financial literacy questions to measure whether financial knowledge had increased as a result of the literacy training. Six months after training, all participants from both the treatment and control groups were invited to participate in community forums. A final round of follow-up surveys was conducted at the beginning of this forum, after which both the treatment and control groups were given information on the main messages of the training course as well as on new products and developments in the market that had occurred since the original intervention.

The timing of these follow-up surveys means that our analysis only measures the short-term effects of financial literacy training. Unfortunately, the timing dictated by the funding cycle supporting this study meant that our interventions and follow-up surveys did not encompass the Christmas period, which is a prime remitting period (although remitting behavior during this period may be very different from the norm). However, our study incorporates periods during which people remit for many of the standard reasons: regular household maintenance, school fees, annual church fundraising in Tonga, and sudden household emergencies such as health visits. The advantage of a randomized

10. All survey questions are available online at http://go.worldbank.org/C0LFUHFU70.
experiment is that any such seasonality will be netted out when comparing the treatment and control groups.

Table 2 shows the attrition rates by survey round and ethnic group sample. Attrition rates were lowest for the Pacific Island sample, averaging 5 percent at one month, 9–10 percent at two and three months, and 14 percent at six months. We cannot reject a balance between the treatment and control groups in any survey round. The East Asian sample had attrition rates of 9 percent at one month, 17 percent at two months, 23 percent at three months, and 75 percent at six months, again balanced by treatment status. The Sri Lankan group had the highest attrition, with 45 percent attrition in the treatment group by one month compared to 29 percent of the control group and 76 percent attrition in the six-month follow-up. The high attrition was attributed by the survey leader to the refusal of some participants to provide contact details at the time of the baseline survey and to discomfort about discussing financial matters by some members of the sample, which may have been exacerbated by the invitation to the training. Attrition was much higher among the noncompliers (69 percent) than among those who actually received training (27 percent).

Table 1 in the appendix examines the determinants of attrition in the Sri Lankan sample and whether these determinants differ according to treatment status. Column 1 shows that attrition is higher for older individuals and for those with lower education levels; conditional on these variables, there is no significant effect of baseline financial literacy. Columns 2 and 3 show that there is no significant interaction between any of these determinants and treatment status. However, this finding may reflect low power in a relatively small sample with large point estimates for the interactions with age and education. For the Sri Lankan sample, we control for age, education level, gender, and the number of remittance methods an individual knew about at baseline in addition to our stratifying variables to mitigate any influence of selective attrition.
Despite the use of door prizes and gifts to their community groups as incentives, the six-month attrition level was high in the East Asian and Sri Lankan groups because these surveys were conducted at community events, which had very low attendance for these groups. Therefore, we do not use the six-month survey data for these two samples. Given these attrition rates, we view the general results as most reliable for the Pacific Island group and the short-term outcomes as also reliable for the East Asians.

**Results**

To estimate the impact of financial literacy training on the various outcomes of interest, we first estimate the following equation:

\[
Outcome_{i,t} = a + b \times TreatAssign_{i+c} \times Outcome_{i,0} + \sum_{s=1}^{5} \delta_s d_{i,s} + \varepsilon_{i,t},
\]

where \(TreatAssign_i\) is a dummy variable indicating assignment to treatment, the lagged outcome variable is controlled for where possible (McKenzie 2012), and dummy variable \(d_{i,s}\) represents randomization strata (Bruhn and McKenzie 2009) to maximize power. Robust (White-corrected) standard errors are reported in parentheses under the coefficients in the tables. Coefficient \(b\) gives the intention-to-treat effect, which is the effect of being offered financial literacy training regardless of whether individuals attend. This policy parameter is relevant for assessing the impact of offering financial literacy training to the average person in our sample.

We also estimate the impact of actually receiving training by replacing \(TreatAssign_i\) with \(TreatReceive_i\) in (1), where \(TreatReceive_i\) is an indicator of whether individual \(i\) actually received treatment, and estimating the resulting equation by two-stage least squares, with treatment assignment used as the instrument in the first stage. This method provides a local average treatment effect for the impact of the financial literacy training for the types of people who attend when assigned to training and who would not have attended if assigned to the control group.

Several of our key outcomes are measured multiple times as a result of the repeated follow-up surveys. The use of repeated measurements at relatively short time intervals can be used to increase statistical power (McKenzie 2012). We combine multiple measures to examine either averages or totals from our

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11. The average value of gifts given to individuals (or the groups they represented) for participating and as incentives, such as door prizes, was US$40 per participant. This incentive design, along with all other aspects of the study, received prior ethical approval from the human ethics committee of the Waikato Management School.

12. For the Sri Lankan sample, we included controls for age, education, gender, and number of remittance methods known at baseline to mitigate the concerns related to the high attrition rate. In the text, we discuss the one case in which this method led to results that differed significantly from controlling for randomization strata.
survey rounds as an outcome, which provides an estimate of the average effect over the period of our follow-up surveys. Finally, we can boost power by pooling the three separate samples and examining the results for this pooled sample.

One caveat is that our results come exclusively from surveys and not from administrative data. A possible concern, as with many experiments that rely on self-reports, is that treated individuals may provide the responses that they think the surveyors want and that were emphasized by the training, even if these responses do not reflect their actual behavior. We address this possibility in several ways. First, we measure knowledge (which is less easily misreported) as well as behaviors, hoping to see consistency among them. Second, we consider the linkage to outcomes; the fact that we do not find any effect on people saying that they are performing some of the main actions encouraged by the course suggests that our results are not merely the result of reporting effects.

A second caveat is that our estimate of the treatment effect comes from comparing the treatment and control groups. To the extent that there are information spillovers between these groups, this comparison will understate the treatment effect, and our estimates should therefore be considered a lower bound on the impact of this type of training. Nevertheless, the fact that we observe relatively large differences in financial knowledge and in information-seeking behavior between the treatment and control groups suggests that these spillovers are, at most, second order to the main treatment effects.

**Impact on Financial Knowledge**

Table 3 examines whether financial literacy training succeeds in increasing migrants’ knowledge about the costs of remitting and using credit. We observe large short-term impacts on financial knowledge for the Pacific Island sample. The local average treatment effect (LATE) shows that those who received training were 19 percent more likely to know that it costs less to bundle remittances into a larger transaction and were 62 percent more likely to know that the ATM/prepaid debit card is the least expensive method of remitting among the given options. Both of these results are significant at the 1 percent level. There was a slight downward trend in the knowledge that it is less costly to bundle remittances by the six-month follow-up survey, but even at six months, the migrants who were assigned to training were more likely to understand the exchange rate commission. Consistent with other studies on financial literacy (Carpena et al. 2011), we find no impact on computational measures of financial literacy, such as the ability to correctly calculate the APR on a payday loan or to understand compound interest (which was not taught in the course).

We also find some increases in financial knowledge about remittances for the other two groups. East Asian migrants who received training were 25 percent more likely to know that it costs less to bundle remittances into a larger transaction and were 19 percent more likely to know the least expensive method for remitting. The Sri Lankan migrants who received training saw a 28
Table 3. Impact on Financial Knowledge

<table>
<thead>
<tr>
<th>Time after intervention:</th>
<th>Knows it is cheaper to bundle remittances</th>
<th>Knows cheapest method</th>
<th>Knows about exc. rate commission</th>
<th>Calculates APR correctly</th>
<th>Understands compound Interest</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 month</td>
<td>6 months</td>
<td>1 month</td>
<td>6 months</td>
<td>6 months</td>
</tr>
<tr>
<td><strong>Panel A: Pacific Island Migrants in New Zealand</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>ITT results</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assigned to treatment</td>
<td>0.160***</td>
<td>0.0682</td>
<td>0.532***</td>
<td>0.214***</td>
<td>0.0114</td>
</tr>
<tr>
<td></td>
<td>(0.0487)</td>
<td>(0.0484)</td>
<td>(0.0440)</td>
<td>(0.0546)</td>
<td>(0.0277)</td>
</tr>
<tr>
<td><strong>LATE results</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Received training</td>
<td>0.185***</td>
<td>0.0799</td>
<td>0.616***</td>
<td>0.252***</td>
<td>0.0128</td>
</tr>
<tr>
<td></td>
<td>(0.0550)</td>
<td>(0.0548)</td>
<td>(0.0479)</td>
<td>(0.0629)</td>
<td>(0.0315)</td>
</tr>
<tr>
<td>Observations</td>
<td>328</td>
<td>302</td>
<td>323</td>
<td>296</td>
<td>299</td>
</tr>
<tr>
<td>Control group mean</td>
<td>0.53</td>
<td>0.54</td>
<td>0.13</td>
<td>0.25</td>
<td>0.06</td>
</tr>
<tr>
<td><strong>Panel B: Asian Migrants in New Zealand</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>ITT results</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assigned to treatment</td>
<td>0.125***</td>
<td>0.0988**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0477)</td>
<td>(0.0401)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>LATE results</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Received training</td>
<td>0.248***</td>
<td>0.191**</td>
<td></td>
<td></td>
<td></td>
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<tr>
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<td>(0.0946)</td>
<td>(0.0751)</td>
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<td>Observations</td>
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<td>0.68</td>
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</table>
Panel C: Sri Lankan Migrants in Australia

**ITT results**

<table>
<thead>
<tr>
<th></th>
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<th>Observations</th>
<th>Control group mean</th>
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<td>0.0131</td>
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<td></td>
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<td>(0.0627)</td>
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<td></td>
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</tr>
<tr>
<td></td>
<td>0.217***</td>
<td>0.280***</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0652)</td>
<td>(0.0754)</td>
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</table>

Panel D: All Groups Pooled

**ITT results**

<table>
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<tr>
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<th>Control group mean</th>
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<tr>
<td></td>
<td>0.118***</td>
<td>0.169***</td>
<td>780</td>
<td>0.65</td>
</tr>
<tr>
<td></td>
<td>(0.0299)</td>
<td>(0.0418)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>LATE results</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.296***</td>
<td>0.420***</td>
<td>762</td>
<td>0.22</td>
</tr>
<tr>
<td></td>
<td>(0.0287)</td>
<td>(0.0387)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note:** Robust standard errors in parentheses; *, **, and *** indicate significance at the 10, 5, and 1% levels, respectively.

All regressions include controls for strata dummies and for baseline outcome where available.

Six month follow up results only shown for the Pacific Island sample due to extreme attrition in other samples.

Sri Lankan results also control for baseline age, education, gender, and number of remittance methods known.
percent increase in knowledge of the least expensive method but no increase (from a high baseline) in knowledge about remittance bundling. Finally, we find a large and statistically significant increase in knowledge in the pooled sample, reflecting the increases found in the individual groups.

**Impact on Information Seeking and Budgeting**

Our monthly follow-up surveys asked whether respondents had used any source of information to compare remittance costs across methods or products and, if so, which information source they had used. Because our intervention focused on the use of several internet comparison sites, we were particularly interested in learning whether participants used the internet more often to compare remitting costs as a result of the intervention. Our one- and six-month surveys also asked whether individuals always kept track of how much they spent each month (although this question was not asked of the Sri Lankan sample). The financial literacy course made no mention of doing this; thus, we would not expect to see any effect. This item serves as a check on reporting bias to ensure that individuals who attended training did not simply report that they perform every perceived desirable financial behavior.

Table 4 examines whether the increase in knowledge about the costs of remitting leads to changes in information-seeking behavior. We find that, in the short-term, assignment to training caused the Pacific Island and East Asian migrants to be more likely to use information to compare remitting costs and to use the internet to compare costs, with no impact on keeping track of monthly expenses. One month after training, the migrants who received training were 20–24 percent more likely to have compared costs and 8–22 percent more likely to have used the internet to do so. However, the strongest impacts were found in the first month after the training, with no impact on the use of the internet three or six months later. The average effect over the various follow-up surveys was positive and significant.

The impacts on overall use of information to compare costs were positive but not statistically significant for the Sri Lankan sample, which may reflect imprecision due to the smaller sample size. Alternately, the effects may be weaker for this group because the majority already used one of the least expensive methods prior to the intervention.

One rationale for a drop-off in the use of information to compare costs over time is that the relative ranking of remittance providers, in terms of transaction costs, does not change significantly from month to month. Figure 1 in the online appendix shows that for the Pacific Island group, bank transfers and Mana are always the most expensive, Klick-Ex is always the least expensive, and the only company to significantly change costs over the sample period is Melie Mei Langi, which lowered its fixed fee component from NZ$8 to NZ$5 for several months before raising it again. Thus, once migrants had compared costs in the first month after training, they would not need to recheck frequently to know which methods were less costly. As previously noted, the gains
Table 4. Impact on Financial Behavior

<table>
<thead>
<tr>
<th></th>
<th>Used information to compare remitting costs</th>
<th>Used internet to compare remitting costs</th>
<th>Keeps track of monthly spending</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>1 month</td>
<td>2 months</td>
<td>3 months</td>
</tr>
<tr>
<td><strong>Panel A: Pacific Island Migrants in New Zealand</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td><strong>ITT results</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assigned to treatment</td>
<td>0.206***</td>
<td>0.0289</td>
<td>0.0975*</td>
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<tr>
<td></td>
<td>(0.0428)</td>
<td>(0.0490)</td>
<td>(0.0513)</td>
</tr>
<tr>
<td><strong>LATE results</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Received training</td>
<td>0.240***</td>
<td>0.0290</td>
<td>0.116**</td>
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<td>(0.0496)</td>
<td>(0.0565)</td>
<td>(0.0528)</td>
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<td>Observations</td>
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<td>318</td>
<td>316</td>
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<tr>
<td>Control group mean</td>
<td>0.60</td>
<td>0.68</td>
<td>0.80</td>
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</table>

| **Panel B: Asian Migrants in New Zealand** |
| **ITT results** |          |          |          |          |         |          |          |          |          |         |          |          |
| Assigned to treatment | 0.0977** | 0.0372  | 0.0827* | 0.104*** | 0.0396  | 0.0515  | 0.0269  | 0.0582** | −0.0915 |
|                  | (0.0480) | (0.0474) | (0.0467) | (0.0350) | (0.0442) | (0.0325) | (0.0330) | (0.0255) | (0.0564) |
| **LATE results** |          |          |          |          |         |          |          |          |          |         |          |          |
| Received training | 0.195**  | 0.0711  | 0.147*  | 0.209*** | 0.0786  | 0.0980  | 0.0476  | 0.116**  | −0.1670 |
|                  | (0.0982) | (0.0888) | (0.0821) | (0.0721) | (0.0875) | (0.0608) | (0.0580) | (0.0520) | (0.1035) |
| Observations     | 318      | 291      | 272      | 320      | 321      | 293     | 274     | 323      | 282      |
| Control group mean | 0.23   | 0.20     | 0.14     | 0.18     | 0.18     | 0.06    | 0.06    | 0.10     | 0.63     |

(Continued)
Table 4. Continued

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<tr>
<th>Panel C: Sri Lankan Migrants in Australia</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>1 month</td>
<td>2 months</td>
<td>3 months</td>
<td>6 months</td>
<td>Average</td>
<td>1 month</td>
<td>2 months</td>
<td>3 months</td>
<td>6 months</td>
<td>Average</td>
<td>1 month</td>
<td>6 months</td>
</tr>
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<td>0.0377</td>
<td>0.0239</td>
<td>0.0469</td>
<td>0.000182</td>
<td>0.000236</td>
<td>0.0198</td>
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<td></td>
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<td></td>
<td>0.0829</td>
<td>0.0772</td>
<td>0.0699</td>
<td>(0.0651)</td>
<td>(0.0547)</td>
<td>(0.0415)</td>
<td>(0.0362)</td>
<td>(0.0382)</td>
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<tr>
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<td>0.04</td>
<td>0.08</td>
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<table>
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<th>Panel D: All Groups Pooled</th>
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<tbody>
<tr>
<td></td>
<td>1 month</td>
<td>2 months</td>
<td>3 months</td>
<td>6 months</td>
<td>Average</td>
<td>1 month</td>
<td>2 months</td>
<td>3 months</td>
<td>6 months</td>
<td>Average</td>
<td>1 month</td>
<td>6 months</td>
</tr>
<tr>
<td>Used information to compare remitting costs</td>
<td>0.132***</td>
<td>0.0320</td>
<td>0.00678</td>
<td>0.0767***</td>
<td>0.0910***</td>
<td>0.0774***</td>
<td>0.00423</td>
<td>0.0515**</td>
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<td>0.0305</td>
<td>0.0312</td>
<td>0.0297</td>
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<td>(0.0282)</td>
<td>(0.0270)</td>
<td>(0.0280)</td>
<td>(0.0205)</td>
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<td>0.108***</td>
<td>0.00419</td>
<td>0.0732**</td>
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<td>(0.0403)</td>
<td>(0.0376)</td>
<td>(0.0378)</td>
<td>(0.0292)</td>
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<td>782</td>
<td>782</td>
<td>744</td>
<td>720</td>
<td>787</td>
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<tr>
<td>Control group mean</td>
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<td>0.40</td>
<td>0.42</td>
<td>0.38</td>
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<td>0.17</td>
<td>0.20</td>
<td>0.18</td>
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</table>

Note: Robust standard errors in parentheses; *, **, and *** indicate significance at the 10, 5, and 1% levels, respectively.
All regressions include controls for strata dummies and for baseline outcome where available.
Note averages are over one to three months for Asians and Sri Lankans and six month impacts not shown due to extreme attrition in this round.
Sri Lankan results also control for baseline age, education, gender, and number of remittance methods known.
Sri Lankan surveys did not collect data on keeping track of monthly spending.
from frequent checking were also unlikely to be large for the other two groups given that the East Asians remitted infrequently and most of the Sri Lankans were already using the two least expensive methods.

**Impact on Remitting Frequency and Amount**

Next, we examine whether the financial literacy training had an impact on the likelihood of sending remittances or on the total remitted amount. Ex ante, the expected direction of the effect of financial literacy training is unclear. The content on bundling transactions into less frequent, larger transactions would be expected to reduce the frequency of remitting but to have no impact on the total amount, whereas the content stressing less costly methods of remitting may lead individuals to be more willing to make smaller transactions and therefore to increase the frequency and number of remittances. Gibson et al. (2006) use hypothetical questions with a sample of Tongan migrants in New Zealand who express a negative cost elasticity and claim that they would send more remittances if costs were to decrease. Supporting experimental evidence comes from Aycinena et al. (2011), who gave randomized discounts to Salvadorean migrants in the United States and found that price discounts led to significant increases in remitted amounts, which they attributed to an increase in the frequency of remitting rather than the amount sent per transaction.

Table 5 shows that the financial literacy training does not appear to have significant impacts on either the likelihood of remitting or the total remitted amounts for any of the groups. The impact on the average remittance frequency is very close to zero for all three samples and has a 95 percent confidence interval for the intention-to-treat effect of $-0.043$ to $+0.025$ in the pooled sample. We consider this a relatively precise zero effect, allowing us to rule out large positive or negative effects of training on remitting frequency. Panel D shows that the pooled effect is significantly negative for the three-month follow-up, but not when averaged over all follow-up rounds.

When we consider remittance amounts, we do not observe a significant impact on the total remitted amount in any of the samples. Remittance amounts exhibit more variation, so we have less precision in estimating this effect. Our precision is greatest for the Pacific Island sample, for which we have a point estimate of an increase of NZ$4, with a 95 percent confidence interval of $-NZ$63 to $+NZ$71 for total remittances over six months. This confidence interval encompasses a range of large percentage increases or decreases relative to the control group mean of NZ$115 but is small in absolute terms, especially when compared to the median annual income of NZ$20,000–30,000 for the Pacific Islanders in our sample.

There is a positive and significant effect on the remitted amount in the two-month follow-up survey for the Sri Lankan sample. However, this is the only estimate that is sensitive to whether we control for age, education, gender, and baseline literacy, with the point estimate dropping from A$134 to $-A$43 when these controls are not included. This result is in contrast to the other
### Table 5. Impacts on Remittance Outcomes

<table>
<thead>
<tr>
<th>Panel A: Pacific Island Migrants in New Zealand</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>Made a remittance in past Month</th>
<th>Total amount remitted (unconditional)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ITT results</strong></td>
<td>Assigned to treatment</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.0110</td>
<td>-0.0585</td>
<td>-0.0550</td>
<td>0.0435</td>
<td>-0.0210</td>
<td>12.33</td>
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<td></td>
<td>(0.0383)</td>
<td>(0.0377)</td>
<td>(0.0350)</td>
<td>(0.0443)</td>
<td>(0.0288)</td>
<td>(9.534)</td>
</tr>
<tr>
<td><strong>LATE results</strong></td>
<td>Received training</td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-0.0128</td>
<td>-0.0702</td>
<td>-0.0662</td>
<td>0.0472</td>
<td>-0.0264</td>
<td>14.37</td>
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<tr>
<td></td>
<td>(0.0439)</td>
<td>(0.0432)</td>
<td>(0.0404)</td>
<td>(0.0502)</td>
<td>(0.0331)</td>
<td>(10.93)</td>
</tr>
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<td>316</td>
<td>317</td>
<td>299</td>
<td>332</td>
<td>321</td>
</tr>
<tr>
<td>Control group mean</td>
<td>0.16</td>
<td>0.17</td>
<td>0.14</td>
<td>0.18</td>
<td>0.16</td>
<td>20</td>
</tr>
</tbody>
</table>

### Panel B: Asian Migrants in New Zealand

| **ITT results** | Assigned to treatment | | | | | |
| | 0.00224 | 0.0104 | -0.0143 | 0.00127 | 0.0182 | -172.7 | 292.2 | -172.1 | 81.21 |
| | (0.0309) | (0.0230) | (0.0185) | (0.0182) | (0.0331) | (160.9) | (224.6) | (143.5) | (314.4) |
| **LATE results** | Received training | | | | | |
| | 0.00443 | 0.0197 | -0.0253 | 0.00254 | 0.0337 | -345.7 | 556.9 | -305.1 | 142.9 |
| | (0.0603) | (0.0431) | (0.0319) | (0.0337) | (0.100) | (320.1) | (427.6) | (249.7) | (544.5) |
| Observations | 321 | 293 | 274 | 323 | 316 | 316 | 290 | 271 | 269 |
| Control group mean | 0.088 | 0.041 | 0.029 | 0.054 | 0.054 | 352 | 62 | 193 | 523 |

### Panel C: Sri Lankan Migrants in Australia

| **ITT results** | Assigned to treatment | | | | | |
| | -0.0449 | 0.0952 | -0.0791 | -0.00470 | 0.0621 | 644.9 | 134.4** | -72.21 | -616.9 |
| | (0.0812) | (0.0795) | (0.0805) | (0.0621) | (0.100) | (490.1) | (66.46) | (62.96) | (525.7) |
| **LATE results** | Received training | | | | | |
| | -0.0580 | 0.123 | -0.114 | -0.0166 | 0.0759 | -738.5 | 154.1** | -87.91 | -704.9 |
| | (0.0999) | (0.0958) | (0.100) | (0.0759) | (0.100) | (521.4) | (69.56) | (67.32) | (557.4) |
| Observations | 127 | 126 | 126 | 128 | 98 | 97 | 97 | 97 | 97 |
| Control group mean | 0.361 | 0.282 | 0.319 | 0.326 | 0.326 | 630 | 361 | 144 | 868 |
Panel D: All Groups Pooled

<table>
<thead>
<tr>
<th></th>
<th>Assigned to treatment</th>
<th></th>
<th></th>
<th></th>
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</tr>
<tr>
<td></td>
<td>-0.00950</td>
<td>-0.00486</td>
<td>-0.0433**</td>
<td>-0.00911</td>
<td>-148.1</td>
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<td>-46.08</td>
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<td>(0.0231)</td>
<td>(0.0218)</td>
<td>(0.0174)</td>
<td>(90.11)</td>
<td>(98.83)</td>
<td>(58.83)</td>
<td>(150.0)</td>
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</tr>
<tr>
<td><em>LATE results</em></td>
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<tr>
<td></td>
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<td>739</td>
<td>720</td>
<td>787</td>
<td>736</td>
<td>698</td>
<td>676</td>
<td>642</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control group mean</td>
<td>0.165</td>
<td>0.142</td>
<td>0.132</td>
<td>0.146</td>
<td>265</td>
<td>102</td>
<td>108</td>
<td>424</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note:* Robust standard errors in parentheses; *, **, and *** indicate significance at the 10, 5, and 1% levels, respectively. All regressions include controls for strata dummies, and remittance amount regressions also include baseline amount remitted. Six month follow-up results only shown for the Pacific Island sample due to extreme attrition in other samples. Sri Lankan results also control for baseline age, education, gender, and number of remittance methods known.
Sri Lankan estimates, which are not as sensitive to the inclusion of these controls. Moreover, the estimated impact on the total remitted amount over the three monthly follow-up surveys is negative and insignificant. Similarly, there is no significant impact on the East Asian or pooled samples.

Migrants may be reluctant to bundle transactions and to change remitting frequency if they have a regular pattern of sending a set monthly amount because they have budgeted a fixed amount of each monthly pay check or they send a fixed amount to meet the monthly needs of the family at home, who find it difficult to budget larger amounts over longer periods as a result of savings constraints, the risk of theft, or self-control problems. This type of remitting behavior appears to be typical of the Pacific Island sample, with 84 percent of those who made multiple transactions sending the same amount each time. However, 40 percent of those who remitted did so only once in the three-month survey period. This behavior is less typical of the other two groups, with the East Asians sending large transactions infrequently and only 41 percent of the Sri Lankans who made multiple transactions sending the same amount each time.

One possible reason for the lack of impact on remitting levels could be that migrants saved more so that they could bundle remittances in the future. Given the reluctance of these groups to provide data on savings, we were not able to collect savings levels in the surveys. Therefore, we cannot completely exclude this possibility. However, the fact that we see no change in the Pacific Island sample’s remittances over even a six-month period suggests that migrants are not shifting from remitting monthly to remitting larger amounts every two or three months.

**Impact on Remitting Channel**

Even if immigrants do not change their remittance frequency or the remitted amount, they may benefit from the training if it causes them to change the methods they use to remit. In table 6, we examine whether the migrants in our samples stated that they used a different method of remitting in any of the follow-up surveys than the method they had used in the 12 months prior to the baseline survey. We find that in the Pacific Island sample, 16 percent of the control group use a different method at least once during the four follow-up surveys. Financial literacy training led to a significant reduction in this behavior, halving the rate of switching to new products. Although the training introduced these migrants to a new product, the Westpac prepaid express card, we find no increase in the usage of this product among those who were trained. Instead, the main effect appears to be that fewer individuals switched from using Western Union or Melie Mei Langi to Mana. Mana is a church-based money transfer method with a low fixed fee (NZ$5–8) but an unfavorable exchange rate, making it the most expensive of the money transfer operators for the median remittance amount (online appendix figure 1). Moreover, Mana is
<table>
<thead>
<tr>
<th>Panel A: Pacific Island Migrants in New Zealand</th>
<th>1 month</th>
<th>2 months</th>
<th>3 months</th>
<th>6 months</th>
<th>Ever switch</th>
<th>Ever use Mana</th>
<th>Ever use Westpac card</th>
<th>Mean percentage cost paid if remit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assigned to treatment</td>
<td>-0.0380</td>
<td>-0.0645**</td>
<td>-0.0675**</td>
<td>-0.0118</td>
<td>-0.0865**</td>
<td>-0.0369**</td>
<td>0.00598</td>
<td>-0.2848</td>
</tr>
<tr>
<td>(0.0264)</td>
<td>(0.0280)</td>
<td>(0.0271)</td>
<td>(0.0200)</td>
<td>(0.0340)</td>
<td>(0.0184)</td>
<td>(0.0161)</td>
<td>(0.6620)</td>
<td></td>
</tr>
<tr>
<td>Received training</td>
<td>-0.0442</td>
<td>-0.0769**</td>
<td>-0.0804**</td>
<td>-0.0149</td>
<td>-0.103***</td>
<td>-0.0426**</td>
<td>0.00681</td>
<td>-0.3475</td>
</tr>
<tr>
<td>(0.0304)</td>
<td>(0.0325)</td>
<td>(0.0315)</td>
<td>(0.0227)</td>
<td>(0.0395)</td>
<td>(0.0214)</td>
<td>(0.0185)</td>
<td>(0.7631)</td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>329</td>
<td>318</td>
<td>316</td>
<td>299</td>
<td>332</td>
<td>332</td>
<td>332</td>
<td>84</td>
</tr>
<tr>
<td>Control group mean</td>
<td>0.08</td>
<td>0.10</td>
<td>0.10</td>
<td>0.04</td>
<td>0.16</td>
<td>0.079</td>
<td>0.018</td>
<td>13.02</td>
</tr>
</tbody>
</table>

| Panel B: Asian Migrants in New Zealand      |         |          |          |          |             |               |                     |                                  |
| ITT results                                 |         |          |          |          |             |               |                     |                                  |
| Assigned to treatment                       | -0.0123 | -0.00563 | 0.000445 | -0.0240  |             |               |                     |                                  |
| (0.0154)                                    | (0.0110)| (0.0114) | (0.0195) |           |             |               |                     |                                  |
| LATE results                                |         |          |          |          |             |               |                     |                                  |
| Received training                           | -0.0243 | -0.0107  | 0.000786 | -0.0480  |             |               |                     |                                  |
| (0.0302)                                    | (0.0206)| (0.0198) | (0.0389) |           |             |               |                     |                                  |
| Observations                                | 321     | 293      | 274      | 323      |             |               |                     |                                  |
| Control group mean                          | 0.03    | 0.01     | 0.01     | 0.04     |             |               |                     |                                  |

| Panel C: Sri Lankan Migrants in Australia   |         |          |          |          |             |               |                     |                                  |
| ITT results                                 |         |          |          |          |             |               |                     |                                  |
| Assigned to treatment                       | -0.0129 | 0.0756   | 0.00214  | 0.0970   | -1.1256     | (0.8155)      |                     |                                  |
| (0.0498)                                    | (0.0586)| (0.0511) | (0.0710) |           |             |               |                     |                                  |
| LATE results                                |         |          |          |          |             |               |                     |                                  |
| Received training                           | -0.0167 | 0.0979   | -0.0133  | 0.113    | -1.1521     | (0.7088)      |                     |                                  |
| (0.0612)                                    | (0.0706)| (0.0610) | (0.0848) |           |             |               |                     |                                  |

(Continued)
<table>
<thead>
<tr>
<th></th>
<th>1 month</th>
<th>2 months</th>
<th>3 months</th>
<th>6 months</th>
<th>Ever switch</th>
<th>Ever use Mana</th>
<th>Ever use Westpac card</th>
<th>Mean percentage cost paid if remit</th>
</tr>
</thead>
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<tr>
<td>Observations</td>
<td>131</td>
<td>130</td>
<td>129</td>
<td>132</td>
<td>41</td>
<td>0.10</td>
<td>0.07</td>
<td>0.09</td>
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<td>Control group mean</td>
<td>0.10</td>
<td>0.07</td>
<td>0.09</td>
<td>0.15</td>
<td></td>
<td>8.69</td>
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<td></td>
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<tr>
<td><strong>Panel D: All groups pooled</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>ITT results</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assigned to treatment</td>
<td>$-0.0200$</td>
<td>$-0.0157$</td>
<td>$-0.0310^{**}$</td>
<td>$-0.0304$</td>
<td>$-0.541$</td>
<td>$0.0151$</td>
<td>$0.0164$</td>
<td>$0.0155$</td>
</tr>
<tr>
<td>Control group mean</td>
<td>0.06</td>
<td>0.06</td>
<td>0.06</td>
<td>0.11</td>
<td></td>
<td>126</td>
<td></td>
<td></td>
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<tr>
<td><strong>LATE results</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Received training</td>
<td>$-0.0287$</td>
<td>$-0.0228$</td>
<td>$-0.0465^{**}$</td>
<td>$-0.0473$</td>
<td>$-0.634$</td>
<td>$0.0215$</td>
<td>$0.0229$</td>
<td>$0.0209$</td>
</tr>
<tr>
<td>Observations</td>
<td>781</td>
<td>741</td>
<td>719</td>
<td>787</td>
<td>126</td>
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<tr>
<td>Control group mean</td>
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<td>0.06</td>
<td>0.06</td>
<td>0.11</td>
<td></td>
<td>11.71</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note:** Robust standard errors in parentheses; *, **, and *** indicate significance at the 10, 5, and 1% levels, respectively. All regressions include controls for strata dummies. Six month follow-up results only shown for the Pacific Island sample due to extreme attrition in other samples. Sri Lankan results also control for baseline age, education, gender, and number of remittance methods known.
not included on the sendmoneypacific website, making its cost structure even less transparent.

In the final column of table 6, we consider only the subsample of individuals who remitted and calculate the percentage cost they would pay on these remittances, standardizing the cost at NZ$200 to allow comparability across individuals. We find that training results in a 0.34 percent reduction in costs, but this reduction is not significant. This finding is in line with the 4 percent reduction in using Mana multiplied by the 7 to 8 percent average savings from using Melie Mei Langi or Western Union instead. This point estimate indicates that migrants would have to send NZ$8,823 in remittances to recoup the NZ$30 cost of providing the training, which is likely more than one order of magnitude higher than annual remittances for this group.13

We find no significant impact on switching methods among the other two groups. For the East Asians, this situation partly reflects the overall low frequency of remittances; there is a small number of transactions for which switching can be considered. For the Sri Lankans, most immigrants were using a relatively cheap method at baseline, so they had relatively little to be gained by switching (as well as the caveat of high attrition).

The Main Benefits According to Participants

In the one-month follow-up survey, individuals who attended training were asked whether it had been useful, whether they would recommend it to friends and family, what the most useful topic was, and whether it had caused them to change their behavior. Among the Pacific Island group, all participants stated that the training was very useful and that they would recommend it to others. The most useful topic was related to the different costs and methods of sending money. Sixty percent of the respondents stated that the training had caused them to change their behavior, including using the website to compare costs and asking around for better rates. Eighty percent of the East Asians who attended the training stated that it was useful, and 75 percent would recommend it to others, with the most useful knowledge related to remittance fees. Only 21 percent stated that they had changed their behavior, mostly in terms of examining the costs of sending money. Among the Sri Lankan sample, 91 percent of those who answered the follow-up survey stated that the training had been useful, but only two people who had attended the training stated that they had changed their behavior as a result. These direct reports are consistent with the empirical results, suggesting an increase in knowledge that resulted in some changes in information-seeking behavior for the Pacific Island group but no major changes in remitting behavior.

13. Total unconditional remittances (including zeros for those who do not remit) are NZ$151 for the control group over a five-month period that does not include Christmas.
The training succeeded in increasing financial knowledge about the components of remittance costs and encouraging people to search for information about the costs of sending money. The training was fairly inexpensive to deliver; courses were typically taught in churches or other community spaces, and once the content was developed, the main costs were the time of the trainer and snacks and refreshments for training attendees, which cost approximately NZ$20–30 per attendee. However, the measured benefits in terms of realized cost savings were very low, such that a cost-benefit calculation that only includes the realized savings in remittance fees as benefits would not view this program as valuable for the money. Because our analysis only focuses on the short term, we cannot measure benefits that take longer to manifest, and there may be potential spillover benefits in other dimensions of financial behavior from encouraging migrants to think critically about the financial matters covered in the training.

Nonetheless, despite the emphasis placed on the Westpac prepaid debit card as having the lowest remitting cost and on credit cards as a low cost of way obtaining credit for the Pacific Island sample, we do not see an impact of training on these outcomes. The final survey asked participants why they were not using the least expensive method of remitting; 41 percent replied that another method was more convenient for them, and 55 percent stated that another method was more convenient for the receiver. The latter finding is consistent with Gibson et al. (2007), who show that the geographic spread of ATM facilities in Tonga covers a lower share of the population than that of Western Union offices. Further evidence of the lack of low-cost technology adoption in the Pacific Islands comes from other methods. The internet-based, peer-to-peer currency exchange operator KlickEx had the lowest costs overall but was unused by participants in our study. In October 2011, KlickEx joined forces with a major mobile phone provider, Digicel, to offer remittance transfers into mobile wallets in Tonga, Samoa, or Fiji, which could be withdrawn as cash at very low transaction costs. To date, this new method seems to have very low adoption rates.

One reason that convenience may have the highest priority is that the amounts saved through better financial literacy may be too trivial to warrant action. This is especially the case for the East Asians (who tend to remit large amounts relatively infrequently) and the Sri Lankans (who were already using inexpensive methods). Even for the Pacific Island sample, however, the savings from switching to one of the more inexpensive methods may amount to NZ$6–12 per NZ$200 transaction, which would justify the costs of learning about and trying new methods only for those who remit very frequently. Many Pacific Island migrants earn little more than the minimum wage in New Zealand, which is NZ$13 per hour. Therefore, taking an hour to learn about a new remittance method and additional time to use it could quickly make the
opportunity cost of this time equal to the amount of money saved. Given that the baseline survey revealed an average remitting frequency of five times per year for the Pacific Island sample, the annual savings from switching to the least expensive methods is just NZ$30–60. The scope for changes in ultimate outcomes may therefore be greater for financial literacy initiatives that focus on savings and budgeting behavior or those that allow people at risk of obtaining high-cost credit to avoid excessively expensive loans (e.g., Bertrand and Morse 2011).

Conclusions

Our results show that simple financial education training for migrants can change their knowledge about remitting costs and lead them to investigate price alternatives. Nevertheless, we find no major changes in ultimate outcomes. Instead, we observe a modest effect whereby migrants avoid switching to more expensive or less transparent remittance channels but do not change their remittance amounts or frequencies. The impact on the frequency of remitting is a relatively precise zero, whereas a confidence interval for the impact on the remitted amount incorporates both large positive and large negative percentage changes, although the absolute magnitudes of the effects remain small relative to the incomes of the migrants.

There are several caveats to this work that should be emphasized when interpreting these conclusions. Our analysis is relatively short term in nature and does not include the Christmas period, which is one of the most important remittance periods, reducing our power to detect effects. The study includes a range of different types of migrants, which is important for determining the general applicability of the training. However, this sample selection came at the cost of including migrants with infrequent remitting behavior. Finally, attrition was an issue, particularly for the Sri Lankan sample. Despite these limitations, the results provide the first experimental evidence on the impact of financial literacy training for migrants, generating insights for policy and providing a basis for future studies.

Our results suggest that, although informing remitters about remittance costs is a relatively inexpensive and uncontroversial intervention, it will not necessarily lower average remittance costs by causing remitters to switch to less expensive methods. Instead, governments that wish to reduce average money transfer costs may need to address other barriers, such as excessive regulation and exclusive arrangements made by state-owned entities that deter new entry into remittance corridors and barriers to access to financial services in receiving countries. It is also possible that the process of providing transparent information on remitting costs through different methods will lower costs through competition without forcing migrants to switch providers. For example, transfer fees from New Zealand to the Pacific Islands have fallen since the launch of sendmoneypacific, although the extent of this decrease may be attributable to...
the website rather than other market events, and there is still a large amount of variation in costs across providers and relatively little adoption of the most inexpensive methods.

In terms of financial education itself, another implication of this study is that the case for providing financial literacy training to migrants may rest on criteria other than the financial savings generated through less expensive remittance methods, such as improvements in migrants’ ability to be informed customers and potential savings from financial management activities such as a choice of debt levels and instruments. Moreover, because the majority of the respondents list the convenience of the recipient as the reason for not using the most inexpensive method, training that is targeted at remittance recipients may also be productive. Further experimentation with additional training content on budgeting, saving, and debt management and expansion of the definition of remittance decision makers to include recipients are fruitful areas for policy refinement. The early results of a financial literacy experiment in Indonesia, which offered training on budgeting and savings to both migrants and their family members, appear to be promising in this regard, showing that training both migrants and their remittance receivers prior to the migrants’ departures resulted in increased savings by home families (Doi et al. 2012).

REFERENCES


Policy Barriers to International Trade in Services: Evidence from a New Database

Ingo Borchert, Batshur Gootiiz, and Aaditya Mattoo

Surprisingly little is known about policies that affect international trade in services. Previous analyses have focused on policy commitments made by countries in international agreements, but in many cases, these commitments do not reflect actual policy. This paper describes a new initiative to collect comparable information on trade policies for services from 103 countries across a range of service sectors and relevant modes of service delivery. The resulting database reveals interesting policy patterns. Although public monopolies are now rare and few services markets are completely closed, we observe numerous “second-generation” restrictions on entry, ownership, and operations. Even in instances in which there is little explicit discrimination against foreign providers, market access is often unpredictable because the allocation of new licenses remains opaque and highly discretionary in many countries. Across regions, some of the fastest-growing countries in Asia and the oil-rich Gulf states have restrictive policies in services, whereas some of the poorest countries are remarkably open. Across sectors, professional and transportation services are among the most protected industries in both industrial and developing countries, whereas retail, telecommunications, and even finance tend to be more open. JEL codes: F13, F14, L80

Compared to the vast empirical literature on policies affecting trade in goods, empirical analysis of trade policy for services remains in its infancy. A major constraint has been inadequate data on policies affecting services trade, particularly

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in developing countries. Previous research has tended to rely on secondary sources and policy commitments under international agreements (Hoekman 1995). However, it is widely recognized that these measures bear little resemblance to the reality of policy today, even if they approximate policy in the past. More recent work tends to be confined to specific countries and sectors (Findlay and Warren 2000; Centre for International Economics 2010; OECD 2011; Reisman and Vu 2012) or to restrictions on foreign direct investment alone (Golub and Koyama 2006; Golub 2009; World Bank 2010).

Our limited knowledge of the patterns of services policy contrasts with the growing awareness of the importance of services in economic activity. Today, some 80 percent of gross domestic product in the United States and the European Union (EU) originates in services, and the proportion is well over 50 percent in most industrial and developing countries. As countries confront the challenges of boosting productivity, services policy reform has been identified as a priority from Europe to Southeast Asia. However, there is surprisingly little empirical evidence on how to best design such reforms. The United States and EU account for over 60 percent of world services exports, and the service exports of India, China, and Brazil have grown by well over 15 percent every year for the last decade. As these countries seek to sustain export growth and other countries seek to replicate it, international negotiators have struggled to negotiate away policy barriers with only limited knowledge of what these barriers actually are.

This paper describes a new Services Trade Restrictions Database (STRD) that collects and makes publicly available information on services trade policy. This information is assembled in a comparable manner for 103 countries, 18 service sectors from five broad industries—financial services (banking and insurance), telecommunications, retail distribution, transportation, and professional services (accounting and legal)—and three modes of delivery (cross-border, commercial presence, presence of natural persons). We describe the variation in individual policy measures across sectors and countries. We also propose a relatively simple way of measuring the restrictiveness of services trade policy, and we use this measure to establish stylized facts about the distribution of policy barriers across regions and sectors.

I. Services Policy Data

The entire database, including all qualitative and quantitative information, annotated descriptions of policies, and detailed documentation is publicly available at http://data.worldbank.org/data-catalog/services-trade-restrictions.¹

In this section, we describe the scope of the database and the relationship between this database and other databases covering services policies and procedures. A more detailed description of the database, including details on the data collection process, the full list of policy measures covered, a list of governments

1. Any inquiries or feedback regarding the database can be addressed to servicestrade@worldbank.org.
that confirmed policy information, detailed documentation of scoring rules, and the questionnaire used in the data collection, is provided in a companion paper, “Guide to the Services Trade Restrictions Database” (Borchert, Gootiiz, and Mattoo, 2012a, referred to hereafter as the “Database Guide”) and in supplementary material available at http://data.worldbank.org/data-catalog/services-trade-restrictions.

Data Description

The STRD contains information on policies that affect international trade in services, which is defined, as is now customary, to include the supply of a service through cross-border delivery, by establishing a commercial presence or by the presence of a natural person. The perspective is that of a foreign supplier who wishes to provide services to a particular country. We focus mainly on policy measures that discriminate against foreign services or foreign service providers.

The database includes information from a total of 103 countries, (79 developing countries and 24 Organisation for Economic Co-operation and Development (OECD) countries), which broadly represents all regions and income groups in the world. First-hand information for developing countries was collected by administering a questionnaire in phases over the 2008–2010 period, whereas information for OECD countries was obtained from publicly available sources. To ensure data accuracy, the policy information was subjected to review by government officials, which led to confirmation or updates of the data for most OECD countries and a number of developing countries. To the best of our knowledge, no other data source provides similar information on barriers to services trade in a comparable manner for a global cross-section of countries.

2. We do not cover “consumption abroad,” a mode of delivery that is particularly important in services such as tourism, education, and healthcare. These sectors are not covered by the database.

3. The regional affiliation of countries in this paper (and the database) follows the official World Bank country classification, which groups all non-high-income countries into world regions. For ease of exposition, there are two exceptions to this rule. Trinidad and Tobago is presented as part of the Latin America and Caribbean region, and Bahrain, Kuwait, Oman, Qatar, and Saudi Arabia are referred to as Gulf Cooperation Council (GCC) countries. All six are high-income countries in official World Bank terms.

4. The questionnaires were completed by local law firms familiar with the policy regime in the respective countries and sectors. Although most of the surveys were conducted in phases over the 2008–2010 period, an effort was made to update the information for some of the countries that were surveyed at earlier stages. The information on policies was evaluated and its restrictiveness was assessed by a team of World Bank economists. The consistency of information was cross-checked in consultation with industry experts, private sector officials, and lawyers.

5. These sources include the World Trade Organization (WTO) Trade Policy Reviews, countries’ most recent offers submitted in the WTO’s Doha negotiations, the Axcro insurance database, OECD reports on “Exceptions to National Treatment for Foreign-Controlled Enterprises,” and the International Monetary Fund’s annual reports on exchange arrangements and exchange restrictions.
The database covers five major services sectors that are further disaggregated into 19 subsectors (table 1). The choice of sectors was based primarily on our assessment of their economic importance from a development perspective, on the existence of meaningful restrictions on services trade, and on the feasibility of collecting relevant policy data. Within each subsector, the database covers the following three most relevant modes of supplying the respective service: establishing a commercial presence or foreign direct investment (mode 3 in WTO parlance) in every subsector; cross-border trade in services (mode 1) in financial, transportation, and some professional services; and the presence of service-supplying individuals (mode 4) in professional services. The combinations of subsectors and modes for which information is available are summarized in table 1.

At this stage, we have not covered two important areas of export interest for developing countries. First, cross-border trade in business-processing services (associated with the “outsourcing” phenomenon) is not covered because it is

<table>
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<tr>
<th>Sectors/Subsectors</th>
<th>Mode 1</th>
<th>Mode 3</th>
<th>Mode 4</th>
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<tr>
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<tr>
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<tr>
<td>Retail distribution</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Transport</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Air passenger domestic</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Air passenger international</td>
<td></td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Maritime shipping national</td>
<td></td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Maritime auxiliary services</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Road trucking</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Railway freight</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Professional Services</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accounting</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Auditing</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Legal advice foreign law</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Legal advice domestic law</td>
<td></td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Court representation</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
</tbody>
</table>

Source: STRD, as discussed in the text.

The database covers five major services sectors that are further disaggregated into 19 subsectors (table 1). The choice of sectors was based primarily on our assessment of their economic importance from a development perspective, on the existence of meaningful restrictions on services trade, and on the feasibility of collecting relevant policy data. Within each subsector, the database covers the following three most relevant modes of supplying the respective service: establishing a commercial presence or foreign direct investment (mode 3 in WTO parlance) in every subsector; cross-border trade in services (mode 1) in financial, transportation, and some professional services; and the presence of service-supplying individuals (mode 4) in professional services. The combinations of subsectors and modes for which information is available are summarized in table 1.

At this stage, we have not covered two important areas of export interest for developing countries. First, cross-border trade in business-processing services (associated with the “outsourcing” phenomenon) is not covered because it is

6. Regarding policies governing cross-border (mode 1) trade in international air passenger transportation services, we draw on the WTO’s Quantitative Air Services Agreements Review database (WTO 2006), which represents the most comprehensive source currently available on bilateral air services agreements, covering over 2,000 agreements.
largely free from explicit restrictions or the fragmentation of services—facilitated by advances in information technology—has made it possible to trade unregulated parts of such services.\(^7\) Second, the database does not cover policies affecting the international movement of less skilled individuals to deliver, for example, construction services because (immigration) policies affecting such movement are notoriously opaque. We hope to address these gaps in future data collection exercises. We recognize that some of our conclusions, such as the overall restrictiveness of services policy at the country level and the relative restrictiveness of services sectors, are necessarily influenced by the choice of sectors. We also recognize that the growing scope for digital delivery, such as in certain intermediate professional services, allows services providers to circumvent traditional barriers to trade; therefore, trade in these areas may de facto be more liberal than our data suggest.

The primary focus of the questionnaire is to gather information on policies and regulations that restrict trade in services. Measures that explicitly discriminate against foreign services or service providers impede trade almost by definition. Thus, all of these measures belong in the database. However, these are not the only measures that obstruct trade. Certain measures that on the face of it do not discriminate against foreign services providers may nevertheless restrict trade. First, quantitative restrictions, such as those that limit the total number of providers, may harm trade by preventing foreign entry, although they also limit domestic entry. Second, regulations such as qualification and licensing requirements ostensibly address the asymmetric information problem in certain services sectors but may impose a disproportionate burden on foreign providers, such as professionals who have previously met these requirements in their home countries. Third, in some sectors, the absence of regulations, such as those that ensure that all (domestic and foreign) entrants have access to essential facilities such as ports and telecommunications networks, can be understood as a “sin of omission” because entry may not be feasible without such access. Addressing each possible sin of commission or omission in all sectors is virtually impossible, but we attempt to include at least those that are likely to have a significant trade impact.

Our judgment about what measures should be covered resulted in a core set of questions that were administered for each subsector-mode combination. This “harmonized” set of measures was supplemented with sector-specific variables, such as limits on the size of loans in retail banking. If restrictions arise from “horizontal” legislation covering all sectors, such as labor laws stipulating a minimum percentage of domestic employees (nationals), this information is included in every subsector. Measures that pertain to mode 3, for which information is available for every subsector, span the following broad categories:

\(^7\) As a result, the market for “intermediate” services is increasingly contestable although entry into the “final” stage, on which this database mainly focuses, remains affected by regulatory requirements. For instance, in legal services, research and documentation can be outsourced, whereas representation in courts must be performed by a local firm. In accounting, bookkeeping can be outsourced, whereas conformity with local requirements and ultimate responsibility rests with local professionals/firms.
(i) Requirements on the legal form of entry and restrictions on foreign equity;  
(ii) Limits on licenses and discrimination in the allocation of licenses;  
(iii) Restrictions on ongoing operations; and  
(iv) Relevant aspects of the regulatory environment.

Measures governing mode 1 are slightly different because they typically stipulate conditions under which cross-border trade may occur rather than conditions imposed on the service provider. Mode 4 measures—covered only in professional services—focus on qualification, (re)certification requirements, and entry and immigration rules, all of which strongly affect the movement of service-supplying individuals. Predictably, the greatest challenge is posed by regulatory measures whose presence (or absence) affects foreign entry, even when they are not explicitly directed against foreign providers. Although we attempt to capture the most important of these regulations in professional services (where they have a significant impact on trade), future work might focus on efforts to improve the coverage of these measures in areas such as financial services.

One difficulty in collecting data is that some countries are part of regional or other preferential arrangements and have one set of policies for their preferred partners and another set for the rest of the world. For the most part, our database describes a country’s most-favored nation policies, which, in trade parlance, indicates nonpreferential policies. However, in the case of some countries in which the preferential regime dominates trade (such as the countries of the EU), the database does include a description of the preferential policies. In general, any assessment of restrictiveness (cf. section II) is based upon a country’s most-favored nation policies. However, such an approach does not adequately reflect the openness of EU member countries because they are distinctly more open toward one another and trade a significant amount of services among themselves. The issue has been resolved by creating an entity called “EU20” with policy descriptions and scores corresponding to EU member countries’ average policies toward non-EU providers. In contrast, individual EU countries’ measures of openness reflect a trade-weighted average of intra- and extra-EU policy regimes. The database does contain information about preferential trade policies in other cases as well, such as for GCC members, although at present “EU20” is the only aggregate entity that has been added to the database. In future work, we hope to extend this approach to other regional groupings.

Another challenge is to ensure that the database is up to date and covers other service sectors. In our experience, services policies are slow to change. However, we have recently reviewed policies in major countries that were surveyed in the first phase in 2008, and subsequent reforms are reflected in the database. As

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8. Policy changes were generally not significant, and the direction differs across countries. For instance, there was no major policy modification in Mexico. China enacted further liberalization and halved the limit on registered capital for foreign-invested basic telecommunications companies (from two to one billion Renminbi for national operation, effective September 2008), and it abolished the requirement that Chinese insurance companies prioritize the right of first bid to domestically admitted reinsurers based in China, effective October 2009. Brazil has tightened the conditions under which professional services can be supplied by foreign providers.
indicated above, we invite feedback on the accuracy of the data, and suggested changes will be incorporated into the database after verification. Ideally, these updates would be systematic and would eventually lead to a panel of policy data across more sectors and countries over time, which would also support rigorous policy analysis. To this end, we have proposed a collaborative arrangement with other international organizations that are either already collecting or proposing to collect services policy data.

**Relationship to Other Databases**

It is useful to clarify how this database fits into the existing data landscape. Although no other database collects services trade policies for a similarly wide range of countries and sectors, there are related datasets, such as the World Bank’s Investing Across Borders data, the World Bank’s Doing Business data, and the OECD’s Product Market Regulation database. These databases are largely complementary to our database. Together, they provide an increasingly comprehensive perspective on regimes for trade in services. Existing datasets differ in two important dimensions: whether the focus is on foreign providers only or on all firms and whether the focus is on policies and regulations or administrative/implementation requirements and, in some cases, outcomes. At the risk of oversimplification, the STRD and other related data sources are compared along these two dimensions (table 2).

Notwithstanding differences across these datasets in terms of goals, units of measurement, and sampling period, we find our services trade policy information to be reasonably consistent with other databases. For instance, there is a tight and negative correlation between the country-level Services Trade Restrictions Index (STRI) score regarding the establishment of commercial presence and the Investing Across Border’s “Ease of Establishment” index, which suggests that across countries a more liberal services trade policy stance is associated with a greater ease of establishment. Likewise, there is a high positive correlation between a country’s overall STRI score and the OECD’s Product Market Regulation index (both increasing in restrictiveness; see figs. S1.1 and S1.2 in the supplemental appendix, available at http://wber.oxfordjournals.org).

9. There are other sector-specific databases, such as the World Bank’s FinStats, a worldwide financial database that covers 40 key financial indicators; the World Bank’s Logistics Performance Index, an interactive benchmarking tool to help countries assess their performance on trade logistics; and the International Telecommunication Union’s World Telecommunication/ICT Indicators Database. The primary focus of these databases is on outcomes in these respective sectors rather than on policies affecting foreign services or service providers. In combination with the STRD, these databases could, for instance, be used for sector impact analyses.

10. Francois, Pindyuk, and Worz (2009) have compiled a unified dataset of services trade flows encompassing cross-border and foreign direct investment data from various sources (Trade in Services Database, version 4). Trade-flow data are highly complementary to trade policy information.

11. Table 2 cannot do justice to the richness of information contained in each database listed; it is merely intended to clarify the difference in focus.
II. Measuring Services Trade Policy

It is notoriously difficult to measure policies that affect services trade because of their variety and complexity (see, for example, the overview by Deardorff and Stern [2008]). We develop a measure of the restrictiveness of a country’s policy regime, the STRI, which has the weakness of being subjective but the virtue of being simple, transparent, and robust. This measure is most convenient to depict overall patterns in policy across countries and sectors. It builds on a relatively long tradition of restrictiveness indices that range from simple counts of policy barriers (Hoekman 1996) to more complex weighted averages, in which weights reflect prior (usually subjective) assessments of the relative restrictiveness of specific policy barriers. Work currently being undertaken at the OECD12 uses an elaborate version of this method, which is described in OECD (2009a).

We construct a single measure of overall openness for any subsector-mode combination—for example, one for the cross-border supply of bank loans and another for accepting bank deposits by establishing commercial presence abroad. This measure avoids the pitfalls of approaches that assign fixed weights to all types of restrictions (entry, operational, regulatory) and that treat the restrictions as additive. For instance, if foreign suppliers are not allowed to enter in the first place, then that restriction is binding, and other restrictions on operations and regulatory environment simply do not matter. Similarly, a foreign equity limit of 49 percent typically precludes foreign corporate control; adding to this limit a further (frequently encountered) requirement that the majority of board of directors be nationals would amount to double counting.

We assess policy regimes in their entirety and assign them to one of the following five principal categories: completely open (that is, no restrictions at all); completely closed (that is, no entry allowed at all); virtually open but with minor restrictions; virtually closed but with limited opportunities to enter and operate; and a residual “intermediate” category of regimes that allow entry and

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12. Further information about the OECD’s work in this area, which focuses on Member economies, can be found at http://www.oecd.org/trade/stri and is described in OECD (2011). The ability of the OECD’s index to capture trade costs in services is explored in OECD (2009b).
operations but impose restrictions that are neither trivial nor stringent. To further illustrate the portfolio of policies that might underpin these principal categories, we provide an example for each case taken from the “Key restrictions” section of the database (table 3).

Because the principal criterion for covering certain policy measures in the database is their potential to significantly affect services trade (as described in the data description section), most measures included in the database are taken into account in determining the STRI. However, there are some exceptions. First, there is a de minimis threshold in the sense that although some variables clearly add to the rich texture of the database, their restrictive impact is either not clear or small relative to the impact of other variables. For instance, we do not penalize the failure to give advance notice prior to introducing regulatory changes. Similarly, when there are previous restrictions on greenfield investment and acquisitions, we do not penalize additional restrictions on forming joint ventures. A variable may be more important in one sector, but its impact may fall below the de minimis threshold in others. For instance, restrictions on entry as a branch matter in financial services but do not matter to the same extent in other sectors in which local incorporation is the preferred mode of establishing commercial presence. Similarly, restrictions on acquiring state-owned firms matter in transportation and telecommunications sectors, in which there are likely to be state-owned incumbents, but not in professional and retail services. Finally, a few variables for which the response rate was low or inconsistent (for example, license length or license allocation mode) were not considered for scoring because cross-country differences would reflect response rates or interpretation differences rather than differences in restrictiveness.

It is convenient to assign a value to each of these five categories of regimes on an openness scale from zero to one with intervals of 0.25.13 We call the resulting score the STRI. As the examples show (table 3), most policy regimes have more than one provision in place per subsector and mode of supply, in which case the assigned score (shown in the second column) reflects the overall restrictiveness of all measures evaluated simultaneously.14 Because the STRI focuses mainly on the

13. At this level, basic STRI scores are no more than “labels” attached to the five ordered categories of restrictiveness. However, when these scores are further processed, either by aggregation or by use in a quantitative model, the specific values assume a cardinal meaning that implies the five categories are “equidistant” in terms of restrictiveness. The working paper version of this article (Borchert, Gootiiz, and Mattoo 2012b) discusses an alternative approach of ranking policy bundles purely ordinally.

14. Section 4 of The Database Guide (Borchert, Gootiiz, and Mattoo 2012a) offers three further examples from Burundi, Thailand, and India that illustrate how a portfolio of several measures is assigned to one of the five basic scores. In principle, policy measures can be divided into two tiers. The first-tier measures include those that affect market-entry decisions most significantly, such as limits on foreign ownership and the number of licenses. The second-tier measures are those that affect operations of service providers, such as restrictions on the repatriation of earnings. The second-tier measures do not contribute to overall restrictiveness when first-tier measures are prohibitive. By contrast, if the first-tier measures are not prohibitive, then second-tier measures are also considered in determining the overall restrictiveness score.
### Table 3. STRI: Quantifying Trade Policy Measures

<table>
<thead>
<tr>
<th>Overall policy description</th>
<th>Five-point scale</th>
<th>Policy example: Brazil (relevant subsector-mode indicated)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open without restrictions</td>
<td>0</td>
<td>“Entry is allowed through a subsidiary and branches. Authorization is required.” (Automobile insurance – mode 3)</td>
</tr>
<tr>
<td>Virtually open</td>
<td>0.25</td>
<td>“Cross-border deposit taking is allowed subject to approval and registration.” (Bank deposit acceptance – mode 1)</td>
</tr>
<tr>
<td>Existence of major/nontrivial restrictions</td>
<td>0.50</td>
<td>“Residency is required. There is an education requirement; foreign degrees may be accepted. There is a quota for intra-corporate transferees and independent professionals: at least two thirds of employees of a firm must be Brazilians. The duration of stay initially allowed is 90 days to two years, depending on visa type. Extensions are possible, depending on the type of visa, but usually only once. Foreign-licensed professionals are subject to labor market test and economic needs test. There is a minimum wage/wage parity requirement.” (Auditing – mode 4)</td>
</tr>
<tr>
<td>Virtually closed</td>
<td>0.75</td>
<td>“The limit on foreign ownership is 20 percent of voting capital, and there is no limit on foreign ownership of non-voting capital. Firms with 3 or more employees are required to employ Brazilian nationals to fill at least two-thirds of their positions.” (International air passenger transportation – mode 3)</td>
</tr>
<tr>
<td>Completely closed</td>
<td>1</td>
<td>“Cross-border provision of services not allowed. Must be established as a local office and headquarter and must be properly registered with local professional association.” (Accounting – mode 1)</td>
</tr>
</tbody>
</table>

**Notes:** For the purposes of consistent illustration, all policy examples are drawn from one country (Brazil). As is apparent from the examples shown, most subsector-mode combinations are characterized by multiple provisions, in which case the regime assignment reflects the overall restrictiveness of all applicable measures.

**Source:** STRD; categories and scores as discussed in the text.
set of measures that discriminate against foreign services and foreign providers, the greatest level of openness is associated with a value of zero. However, because the STRI does not adequately cover complementary areas of nondiscriminatory prudential and procompetitive regulation and because it is likely that the results of liberalization depend on the state of these types of complementary regulation, we cannot say that a zero level of STRI is necessarily immediately desirable from a broader welfare or development perspective.

Once a score has been attached to each regime, STRI values can be aggregated across sectors and modes of supply. Let $s_{jm}$ denote the basic scores on a five-point scale per subsector $j$ and mode of supply $m$, as described in table 3. To arrive at an aggregate STRI of country $c$, $STRI_c$, we begin by taking weighted averages across modes of supply $m \in M$, whereby the set of modal weights $w_{jm}$ is specific to sector $j$. The sectors differ in the relative importance of alternative modes for delivering a specific service. For instance, in a “consumer service” such as life insurance, a higher modal weight is attached to commercial presence than in the reinsurance sector, in which cross-border provision among firms is the dominant mode of supply. Formally, the sectoral scores are given by

$$STRI_{cj} = \sum_m w_{jm} s_{jm}. $$

Sectoral scores are then aggregated across all sectors $j \in J$ using weights $w_j$ that reflect the relative importance of constituent services sectors in domestic value added. Sector weights $w_j$ are based on services sectors’ standardized share in total services output for an “average” industrialized country. Overall country-level scores are obtained as follows:

$$STRI_c = \sum_j w_j STRI_{cj}. $$

Further details and the complete weighting schemes used to aggregate modes, subsectors, and sectors can be found in the appendix (table A.1). All scores at any level of aggregation are available from the “STRI” section of the database. In particular, the full set of baseline values $s_{jm}$ is accessible so that users are free to devise alternative aggregation schemes.

We recognize the subjectivity of this approach, but there is no obviously superior method of quantification given the data constraints and the wide range of sectors covered. A demonstration that the STRI assessments are broadly corroborated by alternative methods of quantification can be found in the working paper version of this paper (Borchert, Gootiiz, and Mattoo 2012b). The subjectivity of

15. A sense of how sectors are over-/underweighted in low-income countries can be gleaned from the fact that the share of financial and business/professional services tends to rise with income whereas the share of retail distribution and, to some extent, telecommunications services tends to decline with income. However, for the STRI to be comparable across countries, we need to use one uniform set of weights for all countries (see annex 1 for further details).
the STRI is somewhat mitigated by the extensive consultations that we have conducted with the private sector and regulators in assigning weights to specific categories. We also checked the robustness of the assignments by moving borderline policy regimes across categories. We believe that the adopted approach is more suitable at this stage than any fixed algorithm to turn the rich aspects of policy information, which are difficult to quantify, into a broadly plausible (if somewhat imprecise) restrictiveness score. In Paul Krugman’s words, this approach has the virtue of being “roughly right rather than precisely wrong.”

III. PATTERNS OF SERVICES TRADE POLICY

The pattern of services trade policies may be examined from different perspectives and at different levels of aggregation. Which countries are open to foreign services provision, and which restrict the services supply from foreign suppliers? In which sectors are there more stringent limits on foreign participation? What types of instruments are used to limit the entry and operations of foreign suppliers? What does the pattern of openness look like across the different modes of supply? This section illustrates the variation of applied trade policy regimes across countries and sectors, but it is by no means exhaustive; the database contains much more detailed information than can be presented here. We begin by describing basic patterns of openness across services sectors. We then describe how individual policy measures combine to shape access for foreign providers across countries and sectors, drawing upon the numerical STRI scores.

The following stylized facts about the global incidence of policy barriers are notable:

(i) Although public monopolies are now rare and few services markets are completely closed, we observe numerous “second-generation” restrictions on entry, ownership, and operations.

(ii) Even in instances in which there is little explicit discrimination against foreign providers, market access is often not predictable. From retail to banking and insurance, the allocation of new licenses remains opaque and highly discretionary in many countries. Hence, a high degree of de jure openness may not always imply de facto openness.

(iii) Regulatory discretion is accentuated by a lack of accountability in a number of countries in which regulators are not required to provide reasons for rejecting a license application or foreign providers do not have the right to appeal regulatory decisions.

(iv) The movement of natural persons in professional services sectors (mode 4) appears to be heavily restricted in both developed and developing countries. There typically exist multiple layers of policy measures, ranging from explicit quotas and economic needs tests to domestic qualification, residency, and immigration-related requirements.
The restrictiveness of applied policies varies among rich and poor countries, but much more so within the latter. While most OECD countries are quite open, some of the most restrictive policies today are visible in the rapidly growing economies of Asia and in the oil-rich countries of the Middle East.

Although certain world regions are, on average, more restrictive than others, the relative openness across sectors tends to be similar across regions. In particular, professional services and (to a certain extent) transportation remain bastions of protectionism in high-income countries and developing countries alike, whereas retail, telecommunications, and even finance tend to be relatively open.

Patterns of Openness and Market Entry

All sectors in all countries fall into one of the following three categories: (i) completely closed to foreign service providers, (ii) open with restrictions, or (iii) unconditionally open. The distribution of sector openness thus defined is shown in figure 1, separately for each mode of supply covered by the database. Foreign providers are most likely to be excluded from establishing a commercial presence abroad (mode 3) in railways and in professional services sectors (fig. 1a). It is also apparent that restrictions on investment are pervasive because only about 40 percent of countries can be considered “open” in any of the sectors.

Openness to cross-border trade (mode 1) varies substantially across sectors (fig. 1b). Even within financial services, cross-border supply is much more restricted in insurance sectors than in banking sectors. Overall, it appears that there is less “middle ground” in cross-border supply compared to investment because sectors are either closed or fully open, and there are fewer instances of conditional openness.

Lastly, trade in the five professional services subsectors relies heavily on openness to the movement of natural persons as service suppliers (fig. 1c). Engaging in representation before a domestic court or in advising on domestic law carries a nationality requirement in approximately a quarter of all countries, which renders these two sectors the most restricted. There are virtually no instances of unconditional openness in professional services. In almost every case, foreign professionals must fulfill educational or local work experience requirements, and the actual award of a license is, in some instances, conditional on passing economic needs tests.

16. For example, foreign-licensed professionals are eligible to advise on domestic law in Australia subject to having a practice certificate (full license), which entails fulfilling (i) an education requirement, and a foreign degree may be accepted subject to evaluation by the Law Admissions Consultative Committee of Australia); (ii) a training requirement in which applicants must complete a practical training course (foreign work experience may be taken into account by the Law Admissions Consultative Committee of Australia); (iii) passing a mandatory local examination; (iv) a labor market test; and (v) a minimum wage/wage parity requirement.
Source: Authors’ analysis is based on information from the STRD.
A key market entry restriction for foreign investors is a limit on their ownership share in domestic firms. When broken down by world region, the ownership data show that countries from the Gulf, the Middle East, and some dynamic economies from East and South Asia assume the toughest stance on permitting foreign ownership (fig. 2a). Foreign ownership is far less restricted in most countries across Europe, Central Asia, and Latin America. In most regions, the public sector is shielded to a greater extent from foreign acquisitions than the private sector. In terms of sectors, ownership limits tend to be more stringent in

**Figure 2. Limits on Foreign Equity Participation, by Region and Sector**

**Notes:** Landlocked countries excluded in the maritime shipping sector. Countries without rail tracks excluded in the railway sector. For five professional services sectors, dark bars (*) denote ownership limits applying to foreign nationals, whereas grey bars (**) denote ownership limits applying to nonlocally licensed professionals.

**Source:** Authors’ analysis is based on information from the STRD.
Patterns of Individual Policy Measures

Conditional on a sector being open to foreign entry, we now discuss patterns of individual policy measures in the remaining areas covered by the database: licensing procedures, restrictions on ongoing operations, and relevant aspects of the regulatory environment (table 4). In telecommunications, license limits are

17. The sectors are grouped into professional services sectors (left) and nonprofessional service sectors. Within each group, they are sorted by equity limits. The reason for this separation lies in the fact that equity participation is defined slightly differently in professional services, as explained in the legend to figure 2. Information on maximum ownership permitted for Greenfield entities is not available in professional services. Sectors that are closed to foreign investment (see fig. 1) are factored in with a maximum ownership limit of zero.

18. The numbers shown represent simple frequency measures across the sample of 103 countries. The incidence patterns are qualitatively unchanged when expressing the count measure as percentages of nonmissing values. Rank correlations of both representations are high and are available upon request.

### Table 4. Incidence of Specific Policy Measures: Licensing and Regulatory Regimes (Absolute Count Measures)

<table>
<thead>
<tr>
<th>Sectors</th>
<th>(1) License limit</th>
<th>(2) License criteria discrim.</th>
<th>(3) License criteria not public</th>
<th>(4) License award discretion</th>
<th>(5) No reasons rejection</th>
<th>(6) No indep. regulator</th>
<th>(7) Prior notice</th>
<th>(8) No appeal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bank deposits</td>
<td>9</td>
<td>13</td>
<td>0</td>
<td>41</td>
<td>23</td>
<td>4</td>
<td>35</td>
<td>13</td>
</tr>
<tr>
<td>Bank lending</td>
<td>9</td>
<td>13</td>
<td>0</td>
<td>41</td>
<td>23</td>
<td>4</td>
<td>35</td>
<td>11</td>
</tr>
<tr>
<td>Insurance nonlife</td>
<td>9</td>
<td>18</td>
<td>4</td>
<td>29</td>
<td>22</td>
<td>29</td>
<td>42</td>
<td>11</td>
</tr>
<tr>
<td>Insurance life</td>
<td>7</td>
<td>17</td>
<td>4</td>
<td>29</td>
<td>22</td>
<td>29</td>
<td>42</td>
<td>11</td>
</tr>
<tr>
<td>Reinsurance</td>
<td>6</td>
<td>18</td>
<td>3</td>
<td>29</td>
<td>20</td>
<td>23</td>
<td>42</td>
<td>11</td>
</tr>
<tr>
<td>Telecom fixed line</td>
<td>12</td>
<td>3</td>
<td>5</td>
<td>35</td>
<td>19</td>
<td>24</td>
<td>33</td>
<td>5</td>
</tr>
<tr>
<td>Telecom mobile</td>
<td>15</td>
<td>5</td>
<td>6</td>
<td>43</td>
<td>21</td>
<td>28</td>
<td>40</td>
<td>6</td>
</tr>
<tr>
<td>Retail</td>
<td>6</td>
<td>17</td>
<td>2</td>
<td>13</td>
<td>17</td>
<td>35</td>
<td>48</td>
<td>16</td>
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<tr>
<td>Air transportation</td>
<td>1</td>
<td>10</td>
<td>4</td>
<td>22</td>
<td>19</td>
<td>45</td>
<td>51</td>
<td>12</td>
</tr>
<tr>
<td>Maritime shipping</td>
<td>2</td>
<td>5</td>
<td>3</td>
<td>12</td>
<td>17</td>
<td>40</td>
<td>40</td>
<td>15</td>
</tr>
<tr>
<td>Maritime auxil. Serv.</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>7</td>
<td>10</td>
<td>18</td>
<td>21</td>
<td>9</td>
</tr>
<tr>
<td>Railway</td>
<td>3</td>
<td>3</td>
<td>7</td>
<td>14</td>
<td>8</td>
<td>32</td>
<td>27</td>
<td>9</td>
</tr>
<tr>
<td>Road trucking</td>
<td>1</td>
<td>6</td>
<td>6</td>
<td>17</td>
<td>18</td>
<td>52</td>
<td>52</td>
<td>12</td>
</tr>
</tbody>
</table>

Notes: Table entries represent a count measure of countries (out of 103 in total) that apply a given policy measure. The number of nonmissing observations varies across sectors and policy measures. The precise survey questions corresponding to each column are as follows: column (1): “Is the number of licenses limited?”; column (2): “Do the licensing criteria differ between foreign and domestic firms?”; column (3): “Are the criteria that a firm must fulfill to obtain a license publicly available?”; column (4): “Does the fulfillment of publicly available criteria ensure that a license is granted?”; column (5): “Is the issuing authority obliged by law to inform applicants of the reasons for rejection of a license?”; column (6): “Is the regulatory authority established by statute as a body independent from the sector ministry?”; column (7): “Are there procedures that give foreign investors prior notice of, and allow them to comment on, proposed regulatory changes?”; column (8): “Are there procedures in place that allow foreign investors to appeal regulatory decisions?”

Source: Authors’ analysis based on information from the STRD.
more important than in other sectors (column 1), and licensing criteria for domestic and foreign firms rarely differ (column 2). In contrast, in sectors such as financial services, retail, and transportation, different licensing criteria often apply to foreign applicants, but hard license limits are less of an issue. An example of differing licensing criteria may be found in China, which requires a foreign bank to have had a representative office within its territory for at least two years and to have total assets of no less than USD 10 billion to be eligible for a banking license. Although licensing criteria are publicly available in most cases, in many countries, their fulfillment does not ensure that a license will be automatically granted. The fact that authorities retain significant discretion is also evident from the fact that in many countries, they are frequently not obligated to give applicants any reasons for the denial of licenses.

Certain aspects of the regulatory environment are highlighted in columns 5–8. The near-universal existence of an independent regulatory authority in the banking sector (column 6) reflects the fact that Central Banks, rather than the Ministry of Finance, typically exercise regulatory oversight over the banking sector. However, the insurance sector and, more surprisingly, the telecommunications sector have an independent regulator in far fewer countries. It seems that countries are more willing to grant foreign investors the opportunity to appeal regulatory decisions (column 8) than to give them prior notice and opportunity to comment on regulatory changes (column 7).

In addition to the measures discussed so far, the database also covers restrictions on ongoing operations. Relatively few countries (approximately ten) seem to impose restrictions on the repatriation of capital, and nationality requirements on employees tend to be primarily a Latin American phenomenon. Other operational restrictions are sector specific and range from cession requirements in insurance (maintained by more than 20 countries) to voice-over-Internet Protocol routing restrictions in telecommunications (maintained by 19 countries). More and better information is needed on operational restrictions, particularly in sectors such as retail, because the quality of responses on measures such as zoning laws tend to be uneven.

Beyond the detailed cross-sectoral patterns, it may be of interest to assess how much of the observed variation in policy measures may be attributed to country effects, region effects, and sectoral effects. To this end, we conduct an analysis of variance decomposition for key variables, pooled across countries and sectors (table 5). The results demonstrate that variation across countries explains a sizable share of the variation in discriminatory licensing criteria, in

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19. The database does not count as “different licensing criteria” relatively light additional documentation requirements for foreign firms, such as ownership and vessel registration certificates for foreign maritime shipping companies.

20. The World Bank’s “Bank Regulation and Supervision Database” shows that the Central Bank is the supervisory authority for banks in 51 out of 80 countries that can be matched (as of 2008). The regulator’s widespread independence in the financial sector is in contrast to transportation services, in which regulatory powers are typically assumed by the relevant sector ministry.
<table>
<thead>
<tr>
<th></th>
<th>Foreign equity limit</th>
<th>License limit</th>
<th>License criteria discrim.</th>
<th>License criteria not public</th>
<th>No reasons rejection</th>
<th>No appeal</th>
<th>Restr. nation’ty. employ</th>
<th>Restr. repatr. earnings</th>
<th>No indep. regulator</th>
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<td>27.9</td>
<td>43.7</td>
<td>39.7</td>
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<td>52.2</td>
<td>86.7</td>
<td>90.1</td>
<td>26.1</td>
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<td>Sector</td>
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<td>1.8</td>
<td>2.5</td>
<td>2.0</td>
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<td>1.3</td>
<td>0.3</td>
<td>0.0</td>
<td>18.5</td>
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<tr>
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<td>70.4</td>
<td>53.6</td>
<td>57.7</td>
<td>36.4</td>
<td>46.1</td>
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<tr>
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<td>3.1</td>
<td>10.6</td>
<td>13.8</td>
<td>28.1</td>
<td>14.1</td>
<td>18.2</td>
<td>22.2</td>
<td>3.8</td>
</tr>
<tr>
<td>Sector</td>
<td>15.9</td>
<td>1.6</td>
<td>2.4</td>
<td>3.4</td>
<td>0.1</td>
<td>1.7</td>
<td>0.5</td>
<td>0.1</td>
<td>19.8</td>
</tr>
<tr>
<td>Residuals</td>
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<td>95.1</td>
<td>86.7</td>
<td>83.5</td>
<td>71.6</td>
<td>84.1</td>
<td>81.1</td>
<td>77.6</td>
<td>72.6</td>
</tr>
<tr>
<td>Income</td>
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<td>2.3</td>
<td>5.6</td>
<td>4.7</td>
<td>13.5</td>
<td>9.7</td>
<td>5.8</td>
<td>5.3</td>
<td>2.4</td>
</tr>
<tr>
<td>Sector</td>
<td>15.9</td>
<td>1.6</td>
<td>2.3</td>
<td>2.8</td>
<td>0.2</td>
<td>1.8</td>
<td>0.7</td>
<td>0.1</td>
<td>20.0</td>
</tr>
<tr>
<td>Residuals</td>
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<td>95.9</td>
<td>91.8</td>
<td>92.7</td>
<td>86.2</td>
<td>88.6</td>
<td>93.5</td>
<td>94.5</td>
<td>73.9</td>
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<tr>
<td>Obs.</td>
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<td>1,033</td>
<td>972</td>
<td>1,077</td>
<td>1,068</td>
<td>1,124</td>
<td>847</td>
<td>1,170</td>
<td>996</td>
</tr>
</tbody>
</table>

Notes: Figures shown are in percentages because an analysis of variance decomposes the observed variance of the variables aligned in columns into components attributable to different sources of variation—in this instance, countries, regions, and income groups, respectively, along with sector-fixed effects in each case. The “Residual” rows contain the share of unexplained variation. All variables except foreign equity restrictions are binary, so the underlying regression is a linear-probability model. Results cover the 13 nonprofessional services sectors and are conditional on sectors being open (cf. section III).

Source: Authors’ analysis based on information from the STRD.
accountability (reflected in being obliged to give reasons for license rejection), and in operational restrictions regarding the nationality of employees and repatriation of earnings. The explanatory power of country effects is driven partly by policy regimes that differ along the income-per-capita dimension (see fig. 4 below). Differences in foreign equity limits and in independent regulatory bodies may to some extent be traced back to variations across sectors. The latter reflects the fact that the rationale for independent oversight is much more widely recognized in sectors such as finance and telecommunications than in transportation. Although variation across regions seemingly does not explain much of the variation in equity restrictions and license limits (columns 1–2), it is reasonable to think of entry barriers as systematically higher in certain regions than in others, particularly in the Gulf and in South Asia. However, each group is relatively small (five members) compared to other regions.

Country-level Indicators of Services Openness

Across the entire sample of 103 countries, most countries exhibit a fairly open profile of services policies, resulting in a distribution of country-level indices that is skewed toward lower STRI values, which can range from 0 to 100 (fig. 3). The median STRI value is approximately 24; more than half of all countries would, on average, be classified as “virtually open.” Furthermore, the STRI score of

![Figure 3: Distribution of Country-level Restrictiveness Scores (STRI)](image-url)
90 percent of all countries lies strictly below 50—on average, this is below the score signifying the presence of “major restrictions.”

Plotting each country’s overall index of services trade restrictions aggregated across all sectors and modes against its per capita income confirms the earlier finding that most countries are fairly open (fig. 4). The linear fit of the relationship between the country STRI and per capita income is downward sloping, reflecting the fact that only a limited number of countries have adopted an across-the-board restrictive stance on services by either closing sectors altogether or by imposing other stringent measures on foreign entry.

However, the data also reveal a great deal of variation across world regions in the overall restrictiveness of services trade policies. On the one hand, most OECD countries are clustered together at the bottom-right corner, which is a testimony to their general overall openness (notwithstanding some rather restricted subsectors). On the other hand, the GCC countries, although equally rich, exhibit some of the most restrictive policies observed in the sample, placing Qatar, Kuwait, Bahrain, Oman, and Saudi Arabia in the top-right corner of figure 4.

**Figure 4.** Country-level Restrictiveness Scores (STRI) and Per Capita Income

Notes: Gross domestic product per capita 2007 is in purchasing power parity terms and constant 2005 international U.S. dollars. Banking (two subsectors; modes 1 and 3), insurance (three subsectors; modes 1 and 3), telecommunications (two subsectors; mode 3), retailing (mode 3), transportation (maritime and air: modes 1 and 3; maritime auxiliary services, rail, and road: mode 3), and professional services (four subsectors; modes 1, 3, and 4).

Source: Authors’ analysis is based on information from the STRD.
Among developing countries, the restrictiveness of applied policies varies widely. Notably, some of the most restrictive policies are visible in the rapidly growing economies of Asia, including China, India, Indonesia, Malaysia, Philippines, and Thailand, and in the Middle East, including Egypt, Iran, Saudi Arabia, and Tunisia. Some of Africa’s poorest nations also have rather restrictive services policies. In particular, Ethiopia, Zimbabwe, and the Democratic Republic of Congo are among the most restrictive countries in the sample (top-left corner). Another group of developing countries, including Rwanda, Madagascar, Senegal, and Mongolia, is remarkably open (bottom-left corner). It is also true, however, that for some of these developing countries, the absence of any sectoral regulation leads to a low STRI score, in which case the resulting openness is qualitatively different from the predictable market access in countries that formally institute open policies.

Sectoral Policy Patterns across Country Groups

We can further decompose the average level of restrictiveness by major service sector and by per capita income group (fig. 5). On average, the most restrictive policies are applied by members of the high-income GCC. This group features a regional average STRI score of 50. With the exception of GCC countries, average restrictiveness falls monotonically with increasing per capita income. Disaggregating restrictiveness levels by sector and region shows that the countries in South and East Asia, not all of which are low income, also tend to apply restrictive policy regimes (fig. S2.1 in the supplemental appendix, available at http://wber.oxfordjournals.org).

The data also demonstrate that not all sectors obey the monotone relationship between openness and income (fig. 5). In particular, the level of restrictiveness in professional services is nearly identical across all income groups and is by far the most restricted sector in OECD economies. One reason is that the international movement of professionals (mode 4) is critical for these services sectors. This movement faces two daunting barriers, immigration-related restrictions (which make even entry difficult for foreigners intending to sell services) and licensing and qualification-related restrictions (which make it difficult for foreign-trained professionals to practice their professions). However, the problem is not mode 4 alone; in legal and accounting services, cross-border delivery and commercial presence also tend to be restricted. Even those OECD countries (and Europe and Central Asia; see fig. S2.1) that are widely known for their open policies regarding the establishment of commercial presence continue to maintain substantial barriers over a range of professional services subsectors.

In addition to professional services, transportation services remain one of the few bastions of protectionism in high-income countries and are subject to relatively high barriers in developing countries. In maritime transport, entry into cabotage and auxiliary services such as cargo handling is restricted in many countries, although international shipping is currently considered to be open. In air transportation, most countries across all income groups require international
services to be provided within the highly confining framework of bilateral air services agreements and restrict investment in the supply of international and domestic air passenger services. Trade in financial, telecommunications, and retail services appears to be relatively free of discriminatory restrictions in OECD countries. In general, the average restrictiveness in these sectors falls markedly as per capita income rises.

Although markets for most services are now competitive and allow foreign participation, it is evident that in most countries, they remain some distance from being completely open. In telecommunications, public monopolies are a relic of history in most countries, and some measure of competition has been introduced in both mobile and fixed-line services. At the same time, new entry by foreign providers is not permitted in a number of countries. Even where it is, governments continue to limit the number of providers or (particularly in Asia) the extent of foreign ownership. Likewise, in banking and insurance, domination by state-owned entities has given way to increased openness to the presence of foreign and private financial institutions. In both banking and insurance, however, the allocation of new licenses often remains opaque and highly

**Notes:** The STRI at the income-group level is calculated as a simple average of individual countries’ STRIs. The STRI in the cross-border air passenger transport subsector comes from the Quantitative Air Services Agreements Review database (see WTO 2006). The “High income: OECD” group includes Trinidad and Tobago, which is a high-income country but not a member of the OECD in order to avoid creating a group composed of only one member.

**Source:** Authors’ analysis is based on information from the STRD. In all, 103 countries are included.
discretionary. Retail distribution consistently ranks among the most open services sectors in any region, but even in this case, a range of domestic regulations, such as zoning laws, can occasionally impede entry in both developing and industrial countries.  

Actual Policy and WTO Commitments and Offers

The information about actual applied policies in the database also generates a fresh perspective on ongoing services negotiations at the WTO. These multilateral negotiations began in the Uruguay Round, which concluded in 1995 and were meant to reduce policy uncertainty by inducing countries to begin to lock in unilateral liberalization. The more recent services negotiations, as part of the Doha Agenda that has been underway since 2001, were intended to push for greater liberalization, and WTO members have submitted offers to open markets. Borchert, Gootiiz, and Mattoo (2011) compare the Uruguay Round commitments (which are legally binding) and the Doha offers (which have no legal status as yet) with actual policy.

A central finding from this exercise is that in all regions of the world, actual policy is substantially more liberal than the Uruguay Round commitments. Doha offers improve somewhat upon Uruguay Round commitments but the distance from actual policy remains large—the STRI measure of Doha offers is, on average, still twice as restrictive as the actual policies. As a result, the Doha process does not appear to offer much liberalization; instead, it offers some reassurance that access will not worsen. The substantial gap between actual and bound policies, analogous to the “binding overhang” for tariffs, suggests that using General Agreement on Trade in Services commitments as a proxy for openness in services may be misleading.

IV. Conclusion

Our primary contribution is collecting and making available information on key dimensions of services trade policy for a wide range of countries, sectors, and modes of supply. We discuss sectoral patterns of openness and the incidence of specific policy measures governing market entry, operational restrictions, and aspects of the regulatory environment. We then construct a STRI that simply and transparently captures the restrictive effect of the entire set of policies applied by a country in a given service sector and mode of supply. This measure helps us to depict the broad policy patterns across countries and sectors.

What have we learned? Although few services markets are completely closed, we observe numerous “second-generation” restrictions on entry, ownership, and

21. Interested readers can find a more extensive description of policy patterns by sector in the working paper version of this article.

22. Of the 103 countries surveyed in the database, 10 countries were excluded from this analysis because they were not yet WTO members. Of the remaining 93 countries, 62 submitted offers during the Doha negotiations.
operations. Even in instances in which there is little explicit discrimination against foreign providers, market access is often not predictable because of regulatory discretion and a lack of accountability. From retail to banking and insurance, the allocation of new licenses remains opaque and highly discretionary in many countries, suggesting that a high degree of de jure openness may not always imply de facto openness.

Across regions, some of the fastest-growing countries in Asia and the oil-rich Gulf states have some of the most restrictive policies in services, whereas some of the poorest countries, such as Cambodia, Ghana, Senegal, and Mongolia, are remarkably open. Although most OECD countries are generally open overall, they tend to exhibit greater restrictiveness in transportation services and toward the movement of natural persons as services suppliers. In fact, across sectors, professional and transportation services are among the most protected in both industrial and developing countries, whereas retail, telecommunications, and even finance tend to be more open. Of course, these conclusions are based on the specific sectors that are included in our study.

Four gaps in the data limit the scope of this analysis and should be the focus of future data collection and research. First, we do not have adequate data on the existing market structure (for example, the number of firms and their market share and ownership) across sectors and countries. Thus, our policy measures capture restrictions on entry into markets but do not capture the prevailing extent of competition between domestic and foreign firms. Second, the paucity of internationally comparable data on outcome variables, such as prices, quality, or diversity of services, makes it difficult to infer the restrictiveness of policies by econometrically analyzing their impact on outcome variables of interest. Third, we are able to capture only limited information on the state of prudential and procompetitive regulation, which makes it difficult to assess the extent to which these ostensibly nondiscriminatory measures offer de facto protection to domestic service providers. More important, this gap makes it difficult to assess the extent to which the gains from market opening depend on the state of complementary regulation. We emphasize that a mechanical elimination of trade barriers without reform of complementary regulation is not necessarily desirable in all sectors. Finally, we capture only limited information on the implementation of policies. For instance, we make an effort to identify certain aspects of the processes involved in licensing services providers, such as transparency and accountability, but the process remains opaque, and it is difficult to determine whether the processes themselves offer protection to domestic providers.

The difficulty of the task that we have set for ourselves is well known and has inhibited efforts of a similar scope in the past despite the strong demand for better information from policy makers, negotiators, businesses, and researchers. Our main reason for presenting a product that is inevitably imperfect is to begin to enhance policy transparency and to encourage further research in this important area. Even in its present form, we believe that the database will play an important role in advancing policy reform by facilitating the analysis of services
policies, informing international negotiations by providing data on actual policies, and provoking dialogue and refinements by making information on policies publicly available. Thus, we believe that this database provides not a definitive picture of trade policy but a first approximation that will evolve, through feedback from various interested parties, into a collectively created public good.

**Appendix**

**Weighting Schemes for the STRI.** The complete set of weights used to derive aggregate, country-level STRI scores, $STRI_c$, from basic scores per subsector and mode, $s_{jmc}$, is documented in table A.1. Modal weights sum to unity within any given subsector (for example, entries (22), (25), and (30) for “Accounting”). The relative importance of alternative modes of delivery for trading a specific service internationally was assessed by a team of World Bank economists in consultation with industry experts and private sector officials. Subsectors are aggregated to the sectoral level, such as “Telecommunications,” using simple averages. Sector scores are aggregated to the country level using standardized weights based on the constituent services sectors’ share in total services output for an “average” industrialized country. The service sector output shares are taken from Hoekman

<table>
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<tr>
<th>Aggregate sectors</th>
<th>Subsectors, by mode of supply</th>
<th>Modal weights $w^{(j)}_m$</th>
<th>Sector weights $w_j$</th>
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</thead>
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<td>Banking</td>
<td>Mode 1:</td>
<td></td>
<td>0.149</td>
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<tr>
<td></td>
<td>(1) Deposit acceptance</td>
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</tr>
<tr>
<td></td>
<td>(2) Bank lending</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Mode 3:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(3) Deposit acceptance</td>
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<td></td>
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<tr>
<td></td>
<td>(4) Bank lending</td>
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<tr>
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<td>(6) Automobile</td>
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<td></td>
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<tr>
<td></td>
<td>(7) Reinsurance</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Mode 3:</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>(8) Life</td>
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<td></td>
<td>(9) Automobile</td>
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<td>(13) Retail distribution</td>
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