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Distributional Effects of Competition: A Simulation Approach[1]

Carlos Rodríguez-Castelán[2] Abdelkrim Araar[3] Eduardo A. Malásquez[4]

Sergio Olivieri[5] Tara Vishwanath[6]

Abstract

Understanding the economic and social effects of the recent global trends of rising market concentration and market power has become a policy priority, particularly in developing countries where markets are often more concentrated. In this context, since the poor are typically the most affected by lack of competition, new analytical tools to assess the distributional effects of variations in market concentration in a rapid and cost-efficient manner are required. To fill this knowledge gap, this paper introduces a simple simulation method, the Welfare and Competition tool (WELCOM), to estimate with minimum data requirements the direct distributional effects of market concentration through the price channel. Using this simple yet novel tool, this paper also illustrates the simulated distributional effects of reducing concentration in two markets in Mexico known because of their high level of concentration: mobile telecommunication and corn products. Results show that increasing competition from 4 to 12 firms in the mobile telecommunications industry and reducing the market share of the oligopoly in corn products from 31.2 percent to 7.8 percent, would achieve a combined reduction of 0.8 percentage points in the poverty headcount as well as a decline of 0.32 points in the Gini coefficient.

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[2] Lead Economist, Poverty and Equity GP, World Bank (crodriguezc@worldbank.org) (corresponding author)
[3] Research Fellow, University of Laval, World Bank and PEP (aabd@ecn.ulaval.ca)
[4] Economist, Poverty and Equity GP, World Bank (emalasquez@worldbank.org)
[5] Senior Economist, Poverty and Equity GP, World Bank (solivieri@worldbank.org)
[6] Lead Economist, Poverty and Equity GP, World Bank (tvishwanath@worldbank.org)

1. Introduction

Understanding the effects of market concentration on economic productivity and household welfare, poverty, and inequality has become a policy priority, especially in developing countries, which often have more concentrated markets.[7] In addition, a better understanding of the distributional effects of competition is central to policy making since poor households are typically the most affected by the lack of competition, given that they consume more homogeneous goods, have less opportunities to substitute consumption, and have limited access to markets (Creedy and Dixon 1998; Urzúa 2013). Moreover, policies fostering competition have the potential to provide a cost-effective and sustainable mechanism for poverty reduction, particularly compared with welfare interventions, such as social protection or fiscal policies.[8]

Although most of the evidence in developed countries is typically centered on the effects of competition on economic productivity and prices, the rise of marker power and the capital share of income have received more attention in developing countries and have ignited the impetus of academics to conduct rigorous analysis on the causal relationship of market concentration and household welfare.[9] Atkin et al. (2018) analyze a regulatory reform in Mexico that allowed the entry of foreign retailers (Walmart supermarkets) during the 2000s by combining microdata sources and bar-coded information on prices. They find that an external source of market competition in local retail markets led to significant welfare gains (6.2 percent) for the average household. However, the positive welfare effects benefited richer households the most. The gains of these households were around 50 percent more than the overall welfare gains of the poorest households because the poor transfer less of their retail consumption to foreign stores. Similarly, Busso and Galiani (2019) take advantage of a random supply shock in the local retail sector in the Dominican Republic through the expansion of small grocery stores generated by the rollout of a social protection program and find significant welfare gains driven by a reduction in prices of about 6 percent. In addition, Urzúa (2013) estimates the distributive and regional effects of firms with market power in Mexico and finds evidence that welfare losses due to monopoly power are significant and larger, in relative terms, among lower-income households and households in rural areas.

Such rigorous studies on the welfare effects of competition are intensive in data requirements—for example, price data, including barcode data; locally disaggregated data; data on the rollout of supply expansion, and so on—and resources, and usually depend on identifying natural experiments to measure impacts, though this may not be feasible in most developing countries. Moreover, undertaking reforms that improve competition through either the retail trade or regulatory reform are often fraught with political resistance because of concerns about likely adverse impacts on employment and incomes, especially among small local retailers. In such contexts, illustrative ex ante

[7] Industries in developing countries tend to have high numbers of intermediaries and middlemen because of the lack of strong vertical links.

[8] Evidence from Mexico points to the fact that higher local market concentration in the retail sector raises the extreme poverty headcount. An increase in one standard deviation in the Herfindahl-Hirschman index is linked to an increase of 1.13 to 1.59 percentage points in the Foster–Greer–Thorbecke headcount ratio (FGT0) for the extreme poverty line. Furthermore, in 2010, the program now known as Prospera reduced the poverty line by 2 percentage points, with 57 percent to 79 percent attributed to the effect of market concentration (Rodriguez-Castelan and Rodriguez-Chamussy 2018).

[9] For instance, on the effects of mergers and acquisitions, see Connor (2014); Griffith and Harmgart (2012); Hausman and Leibtag (2007); Notaro (2014).

assessments through simulations to predict the direct distributional effects of changes in market concentration could serve as a useful starting point for inputs into a proposed reform program.

The simulation tool presented in this paper, the Welfare and Competition tool (WELCOM), has minimum data requirements: a representative household survey with detailed expenditure data, along with explicit parameters that define the market structure of the industry of interest. This simulation approach builds a set of flexible theoretical models (monopoly, oligopoly with a homogeneous good, and partial collusive oligopoly) into a user-friendly interphase that can be used to assess the impact of market concentration on household welfare, poverty, and inequality. WELCOM is a Stata-based package conceived as part of a larger effort by the World Bank to improve the understanding of the links among competition, growth, and shared prosperity as well as to promote policies that foster competition, especially in developing countries.[10]

This simulation approach contributes to development policy in three ways. First, it provides a simple tool for practitioners and scholars to implement a first-stage analysis of the distributional effects of changes in market concentration. Second, the simulation approach intends to attract the interest of and use by practitioners to motivate discussions on procompetition policy reforms, as well as to improve the understanding of the likely distributional impact impacts by identifying potential winners and losers of policy changes. Third, the technique contributes to the emerging literature on the effects of competition on household welfare described above, as well as to the literature on simulation methods, which, to the best of our knowledge, does not include other tool to measure the distributional effects of market concentration.

As with any microsimulation tool, WELCOM is not without limitations. First, the tool follows a partial equilibrium approach that relies on the expenditure of households on the products expected to be affected by the policy reform. It thus only captures the first-order effects of competition on welfare. Second, the current version of WELCOM only analyzes the distributional effects of changes in market concentration through the price channel, potentially missing other impacts from alternative channels, such as labor markets or the value of assets, the diversity of alternatives available for purchase, the reallocation of resources, and new consumers who had previously been priced out under imperfect competition. Notably, competition can improve the quality of the products and services provided without noticeable changes in prices. However, because WELCOM relies on household surveys (which typically do not include detailed information on the quality or brand of the goods and services consumed), the tool is not able to capture the potential welfare effects through quality. Third, the tool does not take into consideration firms that may behave outside the conventional norms established in the microeconomic literature, such as public monopolies that provide subsidized services.

This paper also illustrates an application of the tool by simulating the distributional effects of a rise in competition in two markets in Mexico known because of their high levels of concentration: mobile telecommunication and corn products. The application of WELCOM to Mexico relies on nationally representative household income and expenditure data from the 2014 round of the Encuesta Nacional de Ingresos y Gastos de los Hogares (ENIGH, National Household Income and Expenditure Survey). This dataset includes expenditure categories that could be matched with the two markets of interest.

[10] WELCOM was developed by Poverty and Equity Global Practice in the World Bank. More information about this tool, including installation and documentation, can be found at http://dasp.ecn.ulaval.ca/webwel/welcom.html.

The analysis is also based on information from the Mexican Federal Competition Commission and assumes that the mobile telecommunication market behaves as an oligopoly (OLI-NASH) and that corn markets mimic a partial collusive oligopoly (PCO). Then, using WELCOM, data from ENIGH, and assumed parameters of these two markets from recent literature, the analysis shows that expanding competition from 4 to 12 firms in the mobile telecommunications industry and reducing the market share of the dominant oligopoly in corn products from 31.2 percent to 7.8 percent would produce a combined reduction of 0.8 percentage points in the poverty rate and of 0.31 points in the Gini coefficient. The contribution of each market to poverty reduction would be: 0.11 percentage points with mobile telecommunication and 0.66 percentage points with corn products.[11]

The paper is organized as follows. Section 2 briefly describes the theoretical models adapted and included in the simulation approach. It also describes the options available for estimating the effects on household welfare. Section 3 introduces the simulation technique and describes the data requirements. Section 4 presents the rationale of selecting Mexico as a relevant case study, as well as some stylized facts on the degree of concentration of the industries selected, that is, mobile telecommunication and corn products, and some descriptive statistics, including data on household expenditures on categories linked to the selected markets. Section 5 discusses the parameters used in the analysis, the main results, and the limitations of the analysis. Section 6 concludes and lays out potential extensions for the simulation approach.

2. Conceptual framework

This section presents an overview of some of the early theoretical approaches to studying the distributional effects of market concentration. Then, it discusses three main theoretical models used in WELCOM to simulate alternative market conditions: (a) the monopolistic structure, (b) the oligopolistic structure (Nash equilibrium), and (c) the PCO structure. These models are the theoretical foundations of the simulation method presented and implemented in the following sections.

2.1. Theoretical model

Stigler (1964) and Dixit and Stern (1982) are among the authors of the first theoretical papers studying the distributional effects of market concentration. The seminal paper by Stigler (1964) proposes a model that focuses on the factors that influence oligopolistic behavior in determining prices above the market threshold. To test empirically his theories on the positive relationship between market concentration and prices, Stigler (1964) started the trend of using the Herfindahl-Hirschman index in econometric analysis. He found that small buyers are more likely to pay higher prices under market concentration than bigger buyers and that buyer diversity ultimately fosters competition. Dixit and Stern (1982) developed an oligopolistic market framework that supported the empirical assessment of welfare under imperfect market conditions. They explored welfare losses in a specific industry with a homogenous good and a small number of firms and noted several distributional issues associated with this framework. For example, if a dollar gain to consumers is perceived as more valuable than a dollar

[11] The impacts on welfare are not linear. The aggregate effect is thus not necessarily equal to the sum of the individual impacts.

of profit, this could be addressed by giving a weight of less than one to the surplus among producers in the summation of overall welfare gains.

Farrell and Shapiro (1990) examined the effects of horizontal mergers on rival firms and consumers and provided a framework for the conditions under which welfare could be improved. Usually, the negative effects of the market power effect dominate, but there may be some conditions under which the efficiency effect dominates, that is, a fall in prices. These results were due to a low industry elasticity of demand because the market share of merged firms increased after the merger, and output shifted to the more efficient firm postmerger. On determining the net effect of prices, welfare implications can be drawn based on the conventional wisdom, that is, a higher price implies less welfare.

Recent papers by Blanchard and Giavazzi (2001), Rodriguez-Castelan (2015), and Spector (2002) have studied the links between the welfare distribution and concentration, but also discussed alternative mechanisms beyond prices, such as wages, employment, and profit shares. Blanchard and Giavazzi (2001) offer useful insights in the design and sequencing of deregulation policy tools, specifically, how product market deregulation raises real wages by lowering the price of goods. In addition, product market deregulation may also decrease unemployment if the barriers to entry are reduced. Moreover, by decreasing total rents, product market deregulation cuts into worker rent appropriation, easing labor market deregulation. However, even if overall unemployment falls, the displacement of workers in incumbent firms may occur, leading to unemployment among currently employed workers as firms shrink. Deregulation must be widespread to avoid rent imbalances between workers in deregulated and workers in regulated sectors. Spector (2002) studies the distributional effects of changes in the magnitude of product market competition. The model predicts that a rise in product market competition raises aggregate employment and the labor share in output in both the short and long run. Specifically, Spector examines how product and labor market regulation were political complements.

Rodriguez-Castelan (2015) examines the direct relationship between market concentration and poverty, more precisely, the policy options needed to achieve poverty reduction under a second-best scenario (of increasing market concentration). The model relies on equivalent income functions and poverty measures and involves studying these links within partial and general equilibrium frameworks. In the general equilibrium approach, the firm ownership and human capital mismatch are possible sources of inequality. If rich individuals are firm owners, high market concentration will increase poverty through the price effect, enabling rich firm owners to receive oligopolistic rents through the income effect. Poverty will increase overall in the model because the price effects outweigh the income effect. In this approach, where consumers have heterogenous skills, there is a threshold of market concentration under which poverty decreases, while concentration increases, but only if the profit shares of the unskilled workers are large enough and there is a significant productivity gap between low- and high-skilled workers. This paper finds that, while it is theoretically possible for high product market concentration to lower poverty, an increase in poverty is more likely.

On the basis of this review of the economic literature, three models have been selected for the simulation: (a) monopoly, (b) oligopoly, and (c) partial collusive monopoly. Each model relies on different assumptions about the underlying structure of the relevant market and the behaviors of the firms. A brief description of these models is presented below. This is useful in determining the parameters that are relevant in the simulation model.

2.2. Monopolistic structure

The extreme scenario of market concentration and high market share involves a single producer, that is, a monopoly, or a group of firms acting as a monopoly. The prices and quantities associated with such a market will include the subscript MONO, while competitive prices and quantities include the subscript COMP. If the monopolist faces a market demand that is a continuous decreasing function of price, then a small increase in price above the competitive level may lead only to a small decrease in quantities (Mas-Colell et al. 1995). Thus, raising prices above the competitive level is an optimal profit maximization strategy for the monopolist.

The monopolist decision problem consists in choosing the level of output to sale, $\mathrm{q_{MONO}} \geq 0$, given the inverse demand function $\mathrm{p(q)}$—the price that must be charged to sell q units of output—and a known cost function $\mathrm{c(q)}$:[12]

$$\max_{\mathrm{q}\geq 0} \mathrm{p(q)} \cdot \mathrm{q} - \mathrm{c(q)} \tag{1}$$

The change in the price in a percentage resulting from the shift from a competitive equilibrium to a monopolistic structure is equivalent to the following:

$$\mathrm{dp} = \frac{\mathrm{p_{MONO}} - \mathrm{p_{COMP}}}{\mathrm{p_{COMP}}} \tag{2}$$

$$\mathrm{dp_{MONO}} = \frac{\mathrm{p_{MONO}}}{\mathrm{p_{COMP}}} - 1 = \mathrm{p_{MONO}} \cdot \frac{1}{\mathrm{p_{COMP}}} - 1 = \left(\frac{\eta}{1+\eta}\mathrm{MC}\right) \cdot \frac{1}{\mathrm{MC}} - 1$$

$$\mathrm{dp_{MONO}} = \frac{\eta}{1+\eta} - 1 = -\frac{1}{1+\eta} \tag{3}$$

Based on equation (3), the elasticity faced by the monopolist in maximizing the profit must be greater than 1 in absolute value, that is, the empirical estimated elasticity should be lower than -1. For a detailed derivation of equation (3), refer to Annex 1.

2.3. Oligopolistic Cournot-Nash equilibrium structure

In an oligopolistic market, competition among firms is inherently affected by a setting of strategic interactions (Mas-Colell et al. 1995). Two traditional approaches to model competition in oligopolies are the Cournot (1838) and Bertrand (1883) models. In the Cournot model, the firms choose simultaneously the amount of output they want to supply and sell at the market clearing price. In the Bertrand model, the firms also choose simultaneously, with price as the strategic variable. Firms decide over the prices they want to charge and then produce the output necessary to meet the demand after the price choices become known (Fudenberg and Tirole 1991). This model implies a one-stage game

[12] Following Mas-Colell et al. (1995), the monopolist faces a demand function given by $x(p)$ that is continuous and strictly decreasing at all p such that $x(p) > 0$. Then, the inverse demand function is given by $p(\cdot) = x^{-1}(\cdot)$.

in which firms choose their quantities or capacities simultaneously.[13] Given these quantity choices, the price will adjust to the level that clears the market, $p(Q)$, where $Q = q_1 + \cdots + q_n$, and $p(\cdot)$ is the inverse demand function. It is possible to assume a generalized profit function, $\Pi^i(q_1, \ldots, q_i, \ldots, q_n)$, such that the optimization problem faced by the firm can be written as follows:[14]

$$\max_{q_i \geq 0} \Pi^i(Q) = q_i \cdot p(Q) - C_i(q_i) \tag{4}$$

It can also be expressed as follow:

$$\max_{q_i \geq 0} \Pi^i(q_1, \ldots, q_i, \ldots, q_n) = q_i \cdot p(q_1, \ldots, q_i, \ldots, q_n) - C_i(q_i) \tag{5}$$

Both expressions are equivalent, but equation (5) explicitly shows that the price is a function of the aggregate output of all firms in the market, while the cost is only a function of each firm's own production level. Each firm maximizes profits given the quantity supplied by all the other firms in the market. Under the key assumption that, in competitive markets, prices are equal to the marginal cost and denoting the Nash equilibrium outcomes of the oligopoly model by the subscript $OLI - NASH$ shows the following:[15]

$$dp = \frac{p_{OLI-NASH} - p_{COMP}}{p_{COMP}} \tag{6}$$

$$dp_{OLI-NASH} = \frac{\frac{\eta N}{1 + \eta N} \cdot MC - MC}{MC} \tag{7}$$

$$dp_{OLI-NASH} = -\frac{1}{1 + \eta \cdot N} \tag{8}$$

2.4. Partial collusive oligopolistic structure

A third structure for modeling concentrated markets, the PCO structure, assumes that a few firms with significant market share coexist with multiple smaller firms with small market shares and no market power, that is, the small firms can contribute in the provision of the good, but are not able individually to influence prices. This structure is not too different from the idea of a dominant firm and competitive fringe discussed by Perloff (2013). In this latter model, a monopoly with a competitive fringe could occur if a former monopoly maintains a cost advantage over later entrants (for example, after the end of import restrictions, foreign firms enter the market, but they might face higher costs than the former monopoly), which can only supply a small part of the market acting as price takers. Thus, these price-taking firms are the competitive fringe. In this model, the former monopoly acts as

[13] An example of competition following a Cournot model are "farmers deciding how much of a perishable crop to pick each morning and send to a market. Once they have done so, the price at the market ends up being the level at which the crops that have been sent are sold" (Mas-Colell et al. 1995, 389).

[14] Strictly speaking, in the Cournot model, firms compete by simultaneously choosing quantities and then an auctioneer chooses the market clearing price, that is, equates supply and demand (Tirole 1988).

[15] A detailed derivation is available in Annex 2.

a price-setting firm that competes with price-taking firms and maximizes profits based on a residual demand curve, that is, the demand that is not met by the competitive fringe at any given price.[16]

The PCO model proposed here requires four basic assumptions. First, a small number of large firms have a significant share of the market, while the rest of the market is supplied by many smaller firms that lack market power. Second, in the short or medium term, the smaller firms cannot easily update their produced or supplied quantities; hence, their outputs are assumed to be fixed or highly rigid to adjustments. There are several reasons for such rigidity. For instance, the limited supply of some specific production inputs (specialized labor, specific intermediate inputs, and so on) or a prohibitive cost of entry for new firms. Thus, it is assumed that the supply of the small firms is constant. Third, the firms with market power (the oligopoly) coordinate or collude to maximize profits given a predefined market share—if they act as in a competitive market—of ϕ_O. In addition, the model assumes that firms know the price elasticity of demand (η). Fourth, the group composed of the smaller firms with no market power behave as followers. Firms of this group will benefit from the increase in price implied by the reduction in the supplied quantity of the oligopoly group.

To understand the relationship between market power and prices in this scenario, suppose that the cartel (the oligolpoly group) acts as a leader and decides to reduce its share of quantity supplied by $d\phi_O$. This cartel cannot influence the quantity produced by the small firms (Q_S) that behave as price takers when $p \geq MC$. Given a price elasiticty equal to η, what would be the level of $d\phi_O$ that maximises the profit of the oligopoly group? For simplicity, suppose that the marginal cost is constant and equal to the price of the full competitive market. Then, the profit of the oligopoly group would be as follows:

$$\pi_O = p(Q = Q_O + Q_S) \cdot Q_O - C(Q_O) \tag{9}$$

Under the previous conditions and assuming that π_O is a concave and twice differentiable continuous function, the first-order condition would be given by the following:

$$p_{PCO} = \left(\frac{1}{1 + {\phi_O}/{\eta}} \right) \cdot MC \tag{10}$$

This formula reproduces some familiar results. For instance, from equation (10), it follows that, if $\phi_O \to 0$, then $p = MC$, the classical result in competitive markets. Also, this formula could be useful for inferring information on the proportion of the increase in the price implied by the market concentration. Passing from the competitive market outcome, $(p_{CM} = MC)$, to the partial collusive oligopoly, $\left(p_{PCO} = \frac{MC}{1-\phi_O \eta}\right)$, implies a proportional price increase as follows:

$$dp = \frac{p_{PCO} - p_{CM}}{p_{CM}} = -\frac{{\phi_O}/{\eta}}{1 + {\phi_O}/{\eta}} = -\frac{\phi_O}{\eta + \phi_O} \tag{11}$$

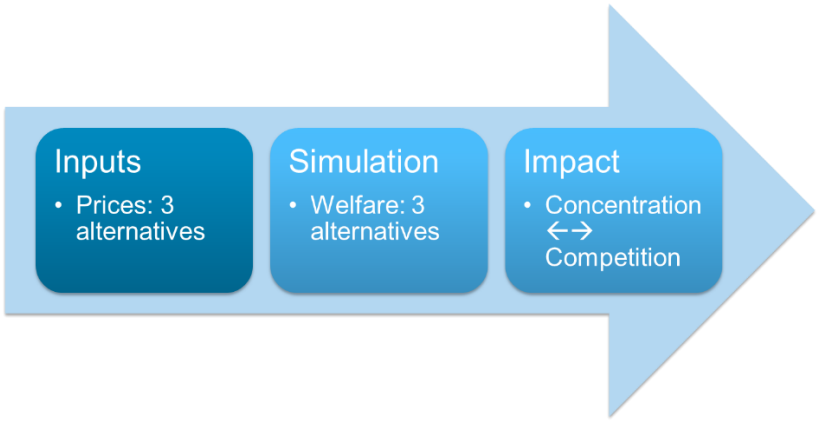
[16] See Perloff (2013).

3. Simulation approach: data requirements and case study

The ex ante evaluation of different market reform scenarios in this study relies on WELCOM.[17] This simulation tool is designed to estimate the distributional impacts of market concentration reforms with minimum information requirements. Representative household expenditure or consumption data surveys are the main data source for WELCOM. Three key variables must be drawn from the microdata survey: the per capita welfare measure to estimate poverty, often measured by the total consumption or income of a household, divided by the number of household members; the per capita consumption or expenditure in the product or sector of interest (that is, a specific staple); and the national poverty line measured by either household consumption or income (depending on each country's poverty methodology). In addition to the microdata, a minimum set of parameters defining the market structure are required. WELCOM's interface enables the user to input the parameters directly into the model.

Figure 1 depicts how the WELCOM tool works. First, to estimate the effects of competition policy reforms, users need to identify the market structure they wish to model. The tool accommodates three alternative market structures. First, it can estimate the effects of competition policy reforms in a monopolistic market. Second, it can estimate the effects of enhancing competition in oligopolistic markets where few similar firms with market power compete. Third, the tool is also able to be used to analyze a third market structure, a partial collusive oligopoly where few firms controlling significant shares of the market act as leaders, while several smaller firms with no market share act as followers.

Figure 1. The WELCOM approach to the analysis of concentration in welfare



Under the monopolistic market structure, the sole parameter required on market structure is the price elasticity of demand. In case the industry to be examined is dominated by an oligopoly, the tool needs two parameters: the number of firms in the market that make up the oligopoly and the demand price elasticity of the sector. Finally, if the industry is a PCO, the tool requires the market share of the firms colluding and the demand price elasticity. In all three models, the demand price elasticity is a mandatory parameter. Elasticities of demand and the market share of firms can be obtained from the literature, such as academic papers, or estimated using WELCOM's forthcoming price elasticity modules. In the illustrative examples below, one assumes that the mobile telecommunication market

[17] Abdelkrim et al. (2018). http://dasp.ecn.ulaval.ca/webwel/welcom.html.

is an oligopoly market (OLI-NASH) and that the corn market behaves like a PCO. An additional feature of WELCOM is that it enables users to study multiple sectors simultaneously under different market structures.

WELCOM also allows the user to choose the type of welfare function applied to assess the impacts of the competition reforms. There are three alternative money metric measures available to assess changes in welfare: (a) Laspeyres, (b) equivalent variation, or (c) compensated variation. The latter two options also require the selection of the functional forms to define the utility function of a household. The options available for the simulation method are (a) Cobb-Douglas and (b) constant elasticity of substitution. (CES)[18] The user then needs to define the original and final conditions or the characteristics of the market under analysis. The default scenario assumes that the policy reform enhances competition in the market (that is, the movement from concentration to competition); however, the tool also allows an analysis of the opposite scenario (from a competitive market to a market with higher concentration). WELCOM also enables the user to carry out the simulations in gradual steps, thereby providing users with the option to see the gradual liberalization or concentration of sectors of interest, while also focusing on providing the extreme case of perfect (imperfect) competition to determine upper-bound estimates of such an outcome.

In sum, the empirical analysis produced by the WELCOM tool will be based on microeconomic models in which the household is the unit of reference. The data requirements of the module include a representative sample of the population, information on total household expenditures, and household expenditures on the product of interest where the market concentration is observed, or the competition policy reform is expected.

4. The Mexico case study

Mexico is well known for its history of monopolies, including TELMEX on fixed lines (privatized in 1990) and PEMEX in fuel (a state-owned enterprise opened to competition only after 2013), as well as an oligopoly in corn products, an important staple for households in the country.[19] These monopolies and oligopolies emerged because of government intervention and weak regulations and did not deliver the intended results they were originally established to meet (Del Villar 2009). Plagued by low productivity and limited innovation, resulting in high prices for consumers, these monopolies have become an integral part of Mexico's paradoxical growth performance, especially because recent estimates have concluded that there exists an average 98.2 percent markup in goods across households (Aradillas 2018). This paper shows some stylized facts on the degree of concentration in the two industries selected (mobile telecommunication and corn products) to illustrate the simulation approach, as well as some descriptive statistics, including household expenditures on categories linked to these two industries.

The key data source necessary to use WELCOM is a representative household expenditure survey. In the case of the two sectors studied, the per capita household share of expenditures on mobile

[18] See Abdelkrimm et al. (2018).

[19] For TELMEX, see See Acemoglu and Robinson (2013). The category of corn products includes grain corn, maize flour, mass of corn, corn tortilla, toast, and other maize products.

telecommunication and corn products are calculated using the ENIGH from 2014. Furthermore, the per capita income (welfare variable) measured using the monthly income is also calculated from the ENIGH for each household. WELCOM requires the poverty line as a variable in the dataset to provide insights on impacts on poverty levels. The poverty line used in this case is based on the same survey, following the calculations of the Consejo Nacional de Evaluación de la Política de Desarrollo Social (National Council for the Evaluation of Social Development Policy).[20] For the market structure parameters, the market share of the largest firms in each sector is calculated based on the 2014 economic census produced by the Instituto Nacional de Estadística y Geografía (INEGI, National Institute of Statistics and Geography). The demand price elasticities are derived from existing research papers and from the forthcoming Stata module for WELCOM that will enable users to estimate price and income elasticities.[21]

4.1. The mobile telecommunication industry

The telecommunication sector became a key element of Mexico's economy during the process of liberalization in 2013. According to the OECD (2017), since the reform started, there has been a 75 percent price reduction in mobile broadband packages alone, adding 50 million subscriptions, more than the entire population of all (seven) Central American countries. Furthermore, Mexico now has the eighth lowest fixed broadband price basket in the OECD for low end users. However, despite the advances in the reform, Mexico still has the highest fixed broadband price basket in the OECD for high end users, demonstrating that higher quality and speed of service remain out of the reach among lower-income groups.[22]

Since 2012, mobile cellular basket prices have decreased by 61 percent, well below any of the aforementioned income groups as its subscriptions per 100 population increased by 6 percent (figure 2). However, the market remains highly concentrated. Mexico has the second most highly concentrated market in the world measured through the Herfindahl-Hirschman index (HHI), after the Philippines (Ayala et al. 2017), resulting in the highest HHI among OECD countries (Figure 3). Moreover, per the *OECD Review of Telecommunication Policy and Regulation in Mexico* (2012), the average loss in consumer surplus due to overpricing and unrealized subscriptions in this sector was 1.8 percent of Mexico's GDP (2005–09), highlighting the important implications of market concentration for consumer welfare.

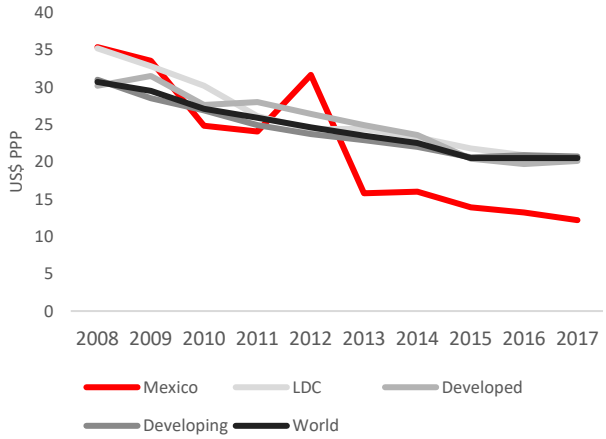
[20] For the purpose of this paper, the definition of poverty is based on household per capita income (instead of adult equivalent). It is thus not exactly the same as the official poverty headcount published by the government of Mexico. The indicator used is the percentage of the population with an income that is lower than the well-being line (linea de bienestar) as defined by the National Council for the Evaluation of Social Development Policy.

[21] See http://dasp.ecn.ulaval.ca/webwel/welcom.html for more information.

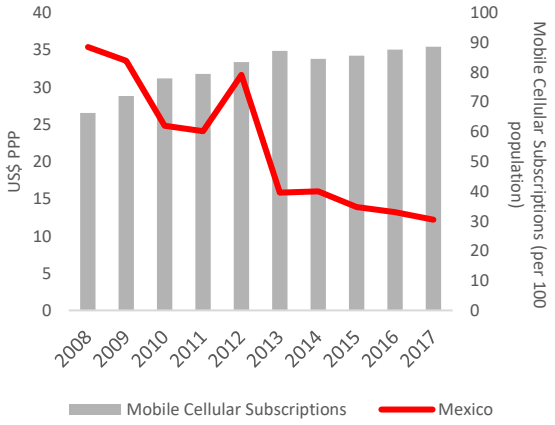
[22] OECD Prices and Termination rates June 2017. Includes 200 gigabyte/month and 25.0 megabytes per second and above.

Figure 2. Mobile cellular and fixed broadband price baskets and coverage in Mexico relative to similar income regions, 2012–17

a. Mobile cellular price basket



b. Mobile cellular price basket vs. subscriptions

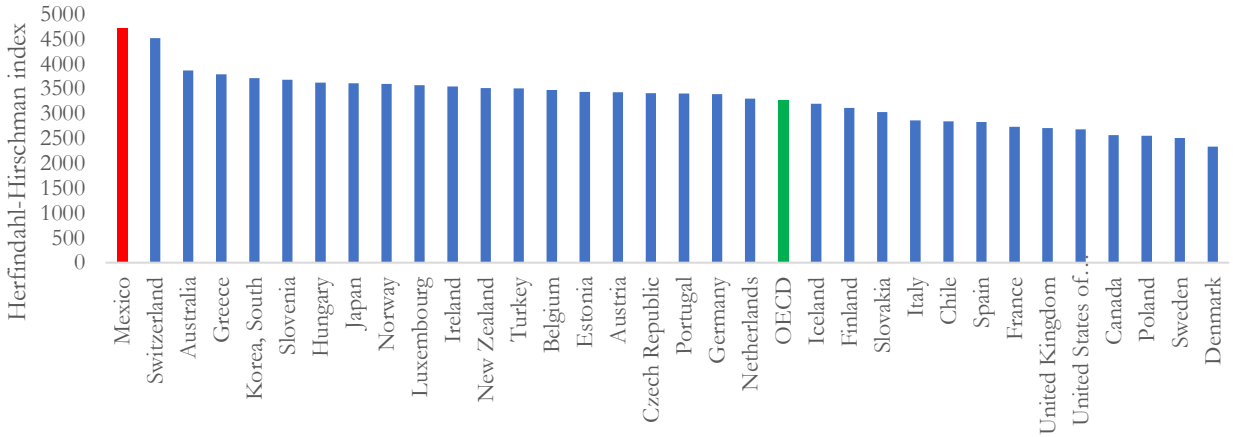


Source: International Telecommunication Union.

Note: LDC = least developed countries. PPP = purchasing power parity. Mobile-cellular basket is composed of the price of standard mobile monthly usage for 30 outgoing calls per month (on-net/off-net to a fixed line and for peak and off-peak times) in predetermined ratios, plus 100 SMS messages. For more information, refer to https://www.itu.int/en/ITU-D/Statistics/Pages/definitions/pricemethodology.aspx.

In 2014, 99.9 percent of the market was divided among four companies: Telcel (66.9 percent), Telefónica (21 percent), Iusacell-Unefon (9.1 percent), and Nextel (2.9 percent). The rest of the market was divided between a few virtual mobile operators that had just entered the Mexican market by 2014.[23] The simulations in this study use data from 2014; hence, they do not consider the full effects of the reforms, but they highlight the potential benefits these reforms could have in the future.

Figure 3. The Herfindahl-Hirschman index in mobile telecommunication, OECD, 2017



Source: GSMA Intelligence 2018.

[23] ITF (2015). Informe Estadístico 4to Trimestre de 2014. Instituto Federal de Telecomunicaciones, July 15, 2015. http://www.ift.org.mx/sites/default/files/comunicacion-y-medios/informes/4ite14-vf-02.pdf

The communication products with highest expenditure shares by households in 2014 were cell phones monthly plans, Internet, cards for the cell phone, and local private lines (Table 1). Three-quarters of the total expenditures in telecommunication services are related to mobile communication. In this paper, the focus will only be on aggregate mobile telecommunication items, composed of cell phones (monthly plan), cards for cell phones, and cell phones and equipment, making up a combined share of 2.17 percent of total expenditures.

Table 1. Expenditure shares on communication services

	All	Poorest			Household income deciles						Richest
Category		1	2	3	4	5	6	7	8	9	10
Total communication	**2.91**	**2.35**	**2.33**	**2.42**	**2.68**	**2.76**	**3.09**	**3.11**	**3.33**	**3.36**	**2.70**
Mobile communication	**2.17**	**1.74**	**1.75**	**1.67**	**1.87**	**1.93**	**2.24**	**2.22**	**2.44**	**2.47**	**2.13**
Cell phones (monthly plan)	*1.09*	*0.28*	*0.27*	*0.40*	*0.49*	*0.54*	*0.72*	*0.81*	*1.05*	*1.27*	*1.45*
Card for cell phone	*0.88*	*1.26*	*1.34*	*1.17*	*1.20*	*1.26*	*1.22*	*1.22*	*1.17*	*1.02*	*0.46*
Cell phones and equipment	*0.20*	*0.20*	*0.14*	*0.11*	*0.18*	*0.14*	*0.31*	*0.19*	*0.22*	*0.18*	*0.22*
Remainder items	**0.73**	**0.61**	**0.58**	**0.75**	**0.81**	**0.82**	**0.84**	**0.90**	**0.89**	**0.89**	**0.57**
Local calls (private line)	*0.39*	*0.20*	*0.28*	*0.41*	*0.46*	*0.46*	*0.45*	*0.51*	*0.49*	*0.48*	*0.30*
Internet	*0.24*	*0.07*	*0.10*	*0.13*	*0.17*	*0.22*	*0.23*	*0.25*	*0.29*	*0.31*	*0.23*
Long distances (private line)	*0.04*	*0.04*	*0.04*	*0.04*	*0.05*	*0.06*	*0.07*	*0.06*	*0.04*	*0.04*	*0.03*
Public internet, public phone	*0.04*	*0.21*	*0.13*	*0.11*	*0.11*	*0.07*	*0.08*	*0.05*	*0.03*	*0.02*	*0.01*
Install. of private line phone	*0.01*	*0.03*	*0.00*	*0.03*	*0.01*	*0.01*	*0.01*	*0.01*	*0.01*	*0.02*	*0.01*
Public phone	*0.01*	*0.05*	*0.03*	*0.03*	*0.01*	*0.02*	*0.01*	*0.01*	*0.03*	*0.01*	*0.00*

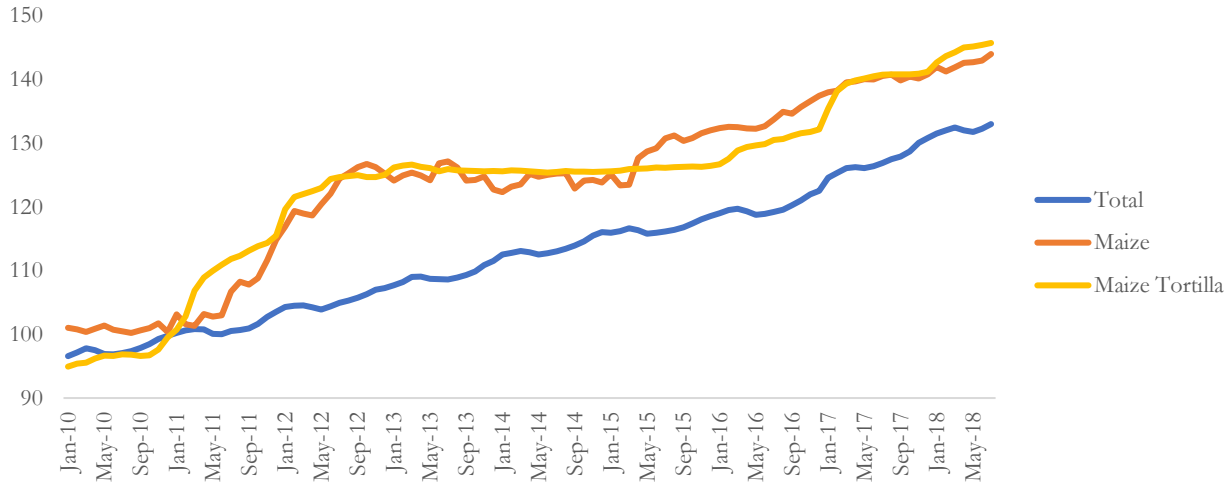
Source: World Bank estimates using ENIGH 2014.
Note: Deciles based on household expenditure per capita.

4.2. The market of corn products

Competition in the food and agriculture markets is a key component in determining food security in developing economies. Market concentration in the food production chain has been growing, driven by retail chains, raising concerns of higher commodity prices for consumers (McCorriston 2016). Mexico is no exception to this trend, with high market concentration among key food items such as corn grains. In 2014, the four largest firms amassed 31.2 percent of total gross production per INEGI's economic census. A closer look at corn flour, an important Mexican dietary staple used to make tortillas, reveals that the firms Gruma and Minsa produced more than 90 percent of corn flour (Zahniser 2004). This concentration resulted in a 26 percent price margin increase due to high market concentration in the tortilla market (Aradillas 2018). Figure 4 shows that Mexico's maize and maize tortilla consumer price index has been consistently greater than the total consumer price index. Since 2010, both have increased significantly in Mexico, suggesting an increase in the consumer food basket.

Corn products are the core of basic food consumption for a large portion of the population (especially among the poor) above other cereals such as wheat or rice (see Table 2). In developing countries, the production of corn products typically escapes monopolistic controls in the first chain of the production since several small farms produce maize. However, the products of these small farms tend to converge into a small number of specialized firms for the stages of storage, processing, and commercialization. At this level, corn product manufacturers can exert market power.

Figure 4. Consumer price index of selected corn products



Source: INEGI 2018.

Table 2 shows the expenditure shares on different cereal products in Mexico. The expenditure shares on corn products are relatively high among the poorest households, where they range from about 13.4 percent for the poorest to about 1.0 percent for the richest decile. Among cereal products, corn products are the most highly consumed, followed by wheat products.

Table 2. Expenditure shares on cereal products

	All	Poorest			Household income deciles					Richest
Category		1	2	3	4	5	6	7	8	9	10
TOTAL	**3.37**	**13.37**	**10.05**	**8.38**	**7.09**	**5.89**	**5.13**	**4.28**	**3.48**	**2.52**	**1.04**
CORN	**1.72**	**7.51**	**5.84**	**4.95**	**4.08**	**3.23**	**2.76**	**2.31**	**1.70**	**1.13**	**0.33**
Grain corn	*0.11*	*1.93*	*0.61*	*0.48*	*0.27*	*0.15*	*0.10*	*0.06*	*0.03*	*0.02*	*0.00*
Maize flour	*0.03*	*0.33*	*0.12*	*0.07*	*0.07*	*0.05*	*0.03*	*0.03*	*0.01*	*0.01*	*0.00*
Mass of corn	*0.05*	*0.29*	*0.21*	*0.19*	*0.13*	*0.11*	*0.08*	*0.06*	*0.05*	*0.03*	*0.01*
Corn tortilla	*1.46*	*4.82*	*4.78*	*4.06*	*3.49*	*2.81*	*2.42*	*2.06*	*1.51*	*1.00*	*0.28*
Toast	*0.06*	*0.10*	*0.08*	*0.11*	*0.09*	*0.08*	*0.10*	*0.09*	*0.08*	*0.06*	*0.03*
Other maize products	*0.02*	*0.03*	*0.04*	*0.02*	*0.03*	*0.02*	*0.03*	*0.02*	*0.02*	*0.02*	*0.01*
WHEAT	**1.32**	**4.58**	**3.27**	**2.74**	**2.41**	**2.14**	**1.93**	**1.6**	**1.46**	**1.11**	**0.55**
RICE	**0.15**	**0.93**	**0.61**	**0.44**	**0.32**	**0.25**	**0.21**	**0.17**	**0.14**	**0.09**	**0.04**
OTHER	**0.18**	**0.36**	**0.34**	**0.26**	**0.28**	**0.26**	**0.23**	**0.2**	**0.18**	**0.18**	**0.13**

Source: World Bank estimates using ENIGH 2014.
Note: Deciles based on household expenditure per capita.

5. Results

This section discusses the main results and limitations of the proposed approach to simulate the effects on poverty and inequality of reducing concentration in the markets of mobile telecommunication and corn products in Mexico. The section is organized in four subsections. The first two show the main results of simulating the effects of reducing concentration in the markets of mobile telecommunication and corn products individually (that is, reforming one market at a time). The third subsection shows the aggregate effects of implementing policies to reduce concentration in these two markets simultaneously. In this latter case, since the welfare function is not necessarily linear, the aggregate impact of reforming both markets simultaneously will not necessarily be equal to the sum of the individual impacts. The last subsection discusses some of the limitations of the proposed simulation approach.

5.1. Distributional impacts of market concentration in mobile telecommunication[24]

The simulation assumes that, in 2014, the mobile telecommunication market in Mexico was organized as an oligopoly consisting of four firms. In addition, the results of simulating the movement from a concentrated market to a perfect competitive market in multiple steps are shown. One way to interpret these latter results is that, while the perfectly competitive scenario is a long-run counterfactual, the simulations of the different steps represent the likely scenarios in the short and medium term.[25]

First, Table 3 shows the simulated impacts of moving from the initial scenario (4 incumbent firms) to a market with 6 firms (2 new entrants) in the short run. Then, the impact of moving to 8 firms (4 new entrants) is simulated, and then from 8 to 12 firms (8 new entrants). The final step assumes the impact of moving to perfect competition in the long run (although, in the mobile telecommunication market, the number of firms tends to be rather small). For the price elasticity of demand, the simulation relies on the empirical estimations reported in Hausman and Ros (2013) for mobile telecommunication services ($\eta = -0.476$).

Table 3. Estimated price change and related parameters

Oligopoly (Nash) market	Step 1	Step 2	Step 3	Competitive market
$\boldsymbol{Firms} = 4$	$Firms = 6$	$Firms = 8$	$Firms = 12$	$Firms = \infty$
$\boldsymbol{\eta = -0.476}$	$\eta = -0.377$	$\eta = -0.328$	$\eta = -0.279$	$\eta^* = -0.1808$
$\boldsymbol{p_1 = 1.344}$	$p_1 = 1.306$	$p_1 = 1.275$	$p_1 = 1.229$	$p_0 = 1.0000$

Source: World Bank estimates using ENIGH 2014; Hausman and Ros 2013.

Note: Changes in elasticity occur due to the simulation of a large price drop in the item of interest, resulting in a quantity demanded of larger magnitude and decreasing the absolute value of the elasticity.

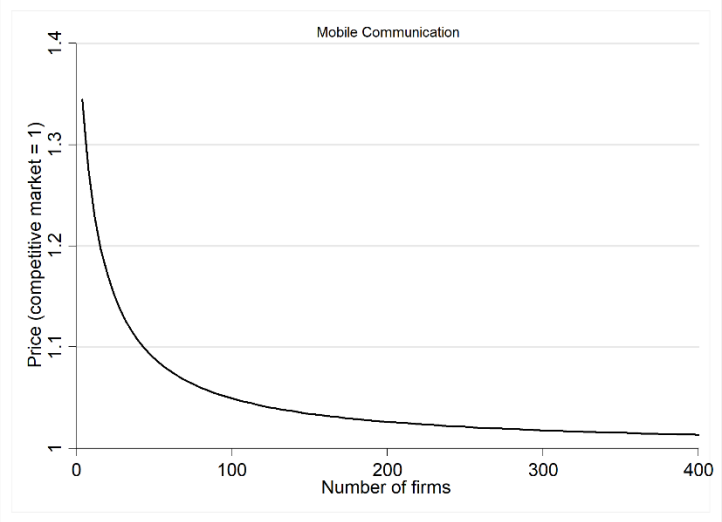
Table 3 shows illustrates the WELCOM prediction that market concentration increases prices in the mobile communication market in Mexico by about 34.4 percent with respect to a scenario of perfect

[24] In this section the term telecommunications and communications will be used to refer to mobile communications services.

[25] The rule that WELCOM follows is to multiply the original number of firms by 1.5 in the first step and then, for the step *n*, multiply the initial number of firms by *n*, when $n \geq 2$.

competition. As counterfactual, in the five years between May 2013 (when Mexico liberalized the mobile industry) and May 2018, the prices of mobiles services fell by 40 percent.[26] In addition, the results of implementing the simulation in multiple steps suggest that the impact of an additional entrant on competition diminishes as the total number of firms increases. For instance, while the entrance of two new additional mobile telecommunication firms reduces prices by 3.8 percentage points from the original four-firm oligopoly, the entry of firms 7 and 8 into the market only affects prices by 2.7 percentage points (Figure 5). Similarly, the absolute impact of an additional firm on poverty and inequality (Table 5) will tend to decrease as the total number of incumbents in the market becomes larger (Figure 6).

Figure 5: Market size and mobile telecommunication prices



Source: WELCOM results

Table 4 shows the estimated distributional impacts of more competition in the mobile communication industry by decile groups. Table 1 in section 4.1 shows that the share of expenditure on mobile telecommunication across the deciles tends to increase slightly at higher income levels, but remains relatively stable across the income distribution (compared, for example, with the share of expenditure in corn products in Table 2). Specifically, the results of the simulations show that the richest deciles will tend to enjoy slightly higher benefits from the reduction in market concentration, since their higher disposable incomes allow them to spend more on mobile telecommunication versus alternative expenditure categories, such as food and beverages.

While the absolute impact on poor groups is relatively smaller, especially relative to households in the higher end of the income distribution, when adjusting over their respective average incomes, one observes that the relative impact is significant, yet not equalizing across all income deciles. For instance, while the relative impact on the 3 bottom deciles is close to 0.50, the impact on deciles 8 and 9 is around 0.6, suggesting that more well off households enjoy relatively larger benefits from the reduction in concentration in the mobile telecommunication market. Finally, these effects are based

[26] https://www.america-retail.com/mexico/mexico-tarifas-de-celulares-caen-44/.

on the consumption of users already participating in the market (that is, households with positive consumption levels), so they might be underestimating potential welfare gains due to the entrance of new consumers, which is more likely to occur among households in the bottom of the income distribution.

Table 4. Expenditure on mobile telecommunication and potential distributive impact of moving to competition

	All	Poorest			Household income deciles						Richest
		1	2	3	4	5	6	7	8	9	10
Average pc income[a]	3,499	558	1,012	1,326	1,634	1,987	2,395	2,933	3,772	5,338	14,041
Absolute impact[b]	19.35	3.01	5.32	6.28	8.43	10.67	14.16	16.65	22.46	32.21	74.32
Relative impact[c]	0.55	0.54	0.53	0.47	0.52	0.54	0.59	0.57	0.60	0.60	0.53

Source: World Bank estimates using ENIGH 2014.

a. According to current income (MX pesos of August of 2014).

b. The average impact on well-being (moving from concentrated to competitive market)

c. The average absolute impact over the average income times 100.

Concerning the impact on poverty and inequality, Table 5 suggests that introducing reforms to enhance competition in the mobile telecommunication market could help reduce different measures of poverty such as the poverty headcount. The results show the upper-bound expected effects, corresponding to the poverty reduction (0.39 percentage points) of simulating a movement from a concentrated market with four firms to a perfectively competitive market. However, the expected impact of firms entrance in the mobile communication market on inequality might be negligible, even in the upper-bound scenario. This occurs partially due to a small share of expenditure on mobile telecommunication services and since the share of expenditure in mobile communication across the income distribution is relatively stable. In contrast, when the relative shares of expenditure in a specific good differ across the distribution, the relative impacts on inequality tend to be larger.

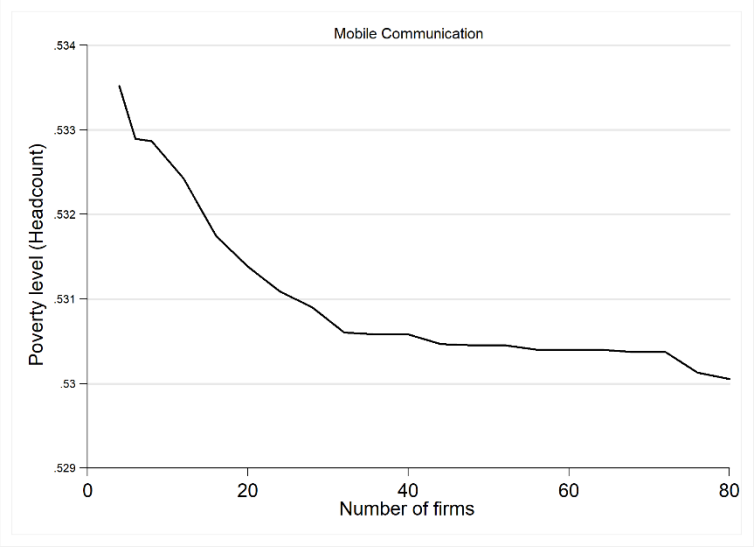
Table 5. Market concentration in mobile telecommunication, poverty, and inequality

	Poverty indicators			Inequality indicators		
	Headcount	Poverty gap	Squared poverty gap	Gini	Atkinson (epsilon=0.5)	Entropy (theta=0.0)
Baseline	53.35	21.09	11.00	0.497	0.2096	0.4328
Moving into competition	52.95	20.92	10.90	0.497	0.2095	0.4328
Difference	-0.39	-0.16	-0.10	0.0000	-0.0001	0.0000

Source: World Bank estimates using ENIGH 2014.

As suggested in Figure 6, the simulated reduction in the poverty headcount reduction as 2 new firms enter the market is just 0.062 percentage points, followed by a reduction of 0.065 percent when there are 8 firms instead of the original 4, reaching a reduction of 0.11 percent when there is a total of 12 firms in the market. Even though there are relatively small reductions in the poverty headcounts, no significant results are expected on inequality measures (Gini coefficient).

Figure 6: Market size and poverty headcount



Source: WELCOM results.

5.2. Distributional impacts of market concentration in corn products

To simulate the distributional impacts that reducing concentration in the market of corn (including corn tortilla, grain corn, toast, mass of corn, maize flour, and other corn products) would have on Mexican households, this paper assumes that the market of corn products in 2014 was organized under a PCO model. For this simulation, we estimate that the market share of the oligopoly group is $\widetilde{\Phi}_0 = 31.2$, as reported in Table 6, according to the information available in the INEGI economic census of 2014. The elasticity of the corn products, estimated using Deaton's (1988) unit value model and the WELCOM elasticity of demand modules, is equal to $\eta = -0.876$.

Table 6. Estimated price change and related parameters

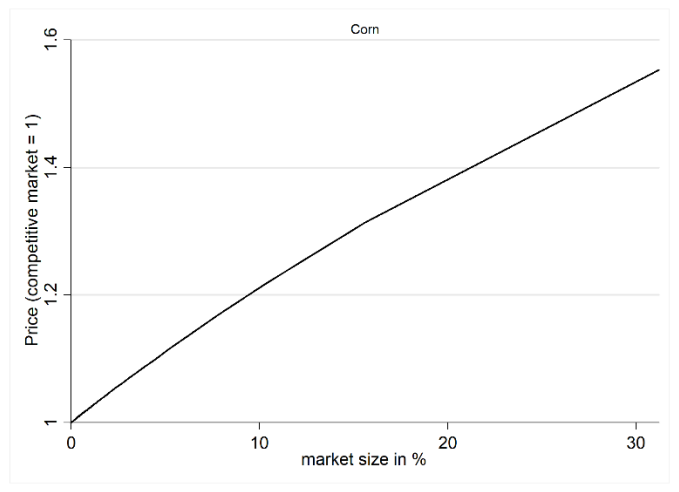
Oligopoly (PCO) market	Step 1	Step 2	Step 3	Competitive market
$\tilde{\phi}_0 = 31.2$	$\tilde{\phi}_0 = 15.60$	$\tilde{\phi}_0 = 10.40$	$\tilde{\phi}_0 = 7.80$	$Firms = 0$
$\eta = -0.876$	$\eta = -0.65$	$\eta = -0.57$	$\eta = -0.54$	$\eta^* = -0.429$
$p_1 = 1.55$	$p_1 = 1.31$	$p_1 = 1.21$	$p_1 = 1.16$	$p_0 = 1.0000$

Source: World Bank estimates using ENIGH 2014.

The simulation results reported in Table 6 show that prices in the concentrated market would be up to 55.0 percent higher relative to prices in the simulated counterfactual of perfect competition. This result corresponds to an upper-bound estimate since it assumes that policy reforms to reduce concentration would effectively foster a scenario of perfect competition in the market of corn. As in the case of the mobile telecommunication market, one also simulates the impact of moving from a concentrated corn market toward perfect competition in several steps. However, in contrast to the case of mobile communication services, where the decrease in concentration was represented by the

entry of new firms, the reduction in concentration in the PCO model is simulated as a decrease in the market share of the oligopoly group. (Although the reduction in the market share might be triggered by the entry of new firms, one does not simulate explicitly the number of firms in the market under the PCO model but focuses on the share of the corn market dominated by the oligopoly group.) More precisely, in the first step, the original market share of the oligopoly group is divided by two; in the second step, by three; in the third step, by four; and so on, as shown in the first row of Table 6. Also, in a perfectly competitive market, each firm supplies only a small part of the market and has no influence over the market price.

Figure 7: Market size and corn product prices



Source: WELCOM results.

One way to interpret the results of reducing market concentration in several steps is that, while the competition scenario represents a long-run counterfactual, the different steps show the simulated results in the short and medium term. For instance, the results in Table 6 suggest that, in the short term, the price is 31.0 percent higher than in perfect competition when the share of the oligopoly group halves (from the original 31.2 percent to 15.6 percent), while it is 21.0 percent higher than the perfect competition counterfactual when the share falls to one-third of the original (10.4 percent). Based on these simulated price variations, one may assess the distributional impact at different steps in the reduction of concentration in the market of corn products.

Table 7 shows the estimated distributional impact by decile group of reducing concentration in the market of corn products. The results of the relative incidence effects suggest that a decrease in market concentration would benefit those households at the bottom of the income distribution more (in relative terms), since households in the lower income deciles allocate a larger share of their consumption to corn products. For instance, improvement among households in the four lowest deciles of moving from a concentrated market to perfect competition would be equivalent to 4, 3, 2, and 2 percent of their consumption, respectively. In contrast, the average relative impact among households in the highest decile is only about 0.58 percent (though the absolute impacts increase as

one moves toward higher income deciles), since corn is a staple in the Mexican diet especially relevant among low-income groups.

Table 7. Expenditures on corn products and potential distributive impact of moving toward a competitive market

	All	Poorest			Household income deciles					Richest	
		1	2	3	4	5	6	7	8	9	10
Average pc income[a]	3,499	558	1,012	1,326	1,634	1,987	2,395	2,933	3,772	5,338	14,041
Absolute impact[b]	33.2	23.0	32.6	36.2	36.9	35.5	36.6	37.5	34.4	33.3	25.4
Relative impact[c]	0.95	4.16	3.23	2.74	2.26	1.79	1.53	1.28	0.94	0.62	0.18

Source: World Bank estimates using ENIGH 2014.
a. According to current income (MX pesos of August of 2014).
b. The average impact on well-being (moving from concentrated to competitive market)
c. The average absolute impact over the average income (in %).

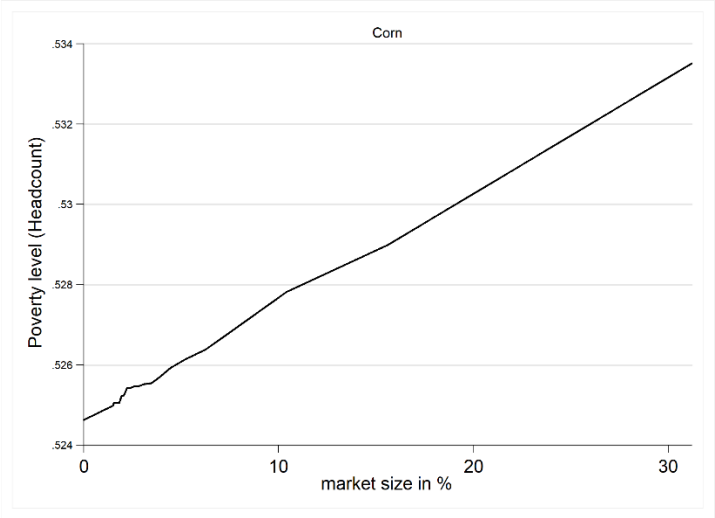
Regarding the impact of reducing concentration on poverty and inequality, Table 8 shows that moving from a concentrated to a perfectly competitive market (and the price changes derived from this change) reduces the poverty headcount by 0.88 percentage points and the poverty gap by 0.76 percentage points. As shown in Figure 8, short-run estimates—corresponding to the first step of the stepwise simulation—suggest that the poverty headcount falls by 0.45 percentage points as the market share of incumbent firms decreases by 50 percent. Inequality will also decline since households at the lower end of the income distribution have larger expenditure shares in corn products than those at the higher end of the distribution. Finally, the improvements in inequality are modest relative to the gains in poverty reduction.

Table 8. Estimated effects on poverty and inequality of changes in competition in corn products

	Poverty indicators			***Inequality indicators***		
	Headcount	Poverty gap	Squared poverty gap	Gini	Atkinson (epsilon=0.5)	Entropy (theta=0.0)
Baseline	53.35	21.09	11.05	0.497	0.2096	0.4328
Moving into competition	52.46	20.32	10.44	0.492	0.2060	0.4236
Difference	−0.88	−0.76	−0.55	−0.00	−0.0036	−0.009

Source: World Bank estimates using ENIGH 2014.

Figure 8: Market size of corn product firms and poverty



Source: WELCOM results.

5.3. The aggregated effects of competition

In the case of Mexico, reducing concentration in both markets is expected to reduce poverty and inequality. Based on the simulations of WELCOM, reducing concentration and moving towards perfect competition in both markets (mobile telecommunication and corn products) would account for a combined effect of 1.26 percentage points on poverty reduction, while income inequality would fall by up to 0.45 Gini points (Table 9). Since the distributional effects of higher competition are not linear, the aggregate effects will not be the same as the summation of the effects of enhanced competition in each of the two sectors of study.

Table 9. Estimated aggregated effects on poverty and inequality of changes in competition in the two markets of analysis

	Poverty indicators			Inequality indicators		
	Headcount	Poverty gap	Squared poverty gap	Gini	Atkinson (epsilon=0.5)	Entropy (theta=0.0)
Baseline	53.35	21.09	11.00	0.497	0.2096	0.4328
Moving into competition	52.09	20.16	10.35	0.492	0.2060	0.4237
Difference	−1.26	−0.92	−0.65	−0.00	−0.0036	−0.009

Source: World Bank estimates using ENIGH 2014.

Although reducing concentration in the markets of mobile telecommunication and corn products would lead to a significant reduction in poverty, the impact of lower concentration on inequality reduction would be more moderate. These results are due to the relative shares of consumption across the income distribution. In particular, the share of expenditure allocated to mobile communication services is relatively consistent across income deciles.

5.4. Limitations

Although the WELCOM tool is a useful application of simulations for ex ante distributional analysis and policy discussions, the methodology is not without limitations. First, the tool follows a partial equilibrium approach that relies on the expenditure of households on the products expected to be affected by the policy reform. In other words, it only captures the first-order effects of competition on welfare. This approach might be adequate for final goods that are not used intensively as intermediate products or inputs in the production of other goods. In contrast, this assumption could pose limitations when analyzing goods that are used as inputs in the elaboration of other products, in which case, alternative approaches that consider the different interactions of the goods with the rest of the economy (such as an input-output matrix) might be more appropriate.

In its current version, WELCOM focuses on the welfare effects of the policies promoting competition through the role of households as consumers. However, the members of a typical household play more than one role in the economy: they may be employees, employers, or firm owners, as well as consumers. Moreover, the current version of WELCOM only analyzes the impacts through the price channel, potentially missing other impacts in alternative channels (for example, labor markets or the value of assets) that could either reinforce or offset the welfare impacts of the policies under study in certain industries.

It is critical to understand that the consequences of product market concentration are not always confined to the product market and may impact other, related markets. Ultimately, an analysis of the ways reforms to promote competition affect household welfare would need to consider the direct effects through price and other channels, such as wages, employment, and profit shares, to determine the distributional effects of competition through its impact on three overlapping groups of economic agents, that is, consumers, workers, and capital owners. The competition conditions among firms affect the welfare of households in their role as consumers through changes in the prices, quality, and diversity of alternatives available for purchase (Atkin et al. 2016; Begazo and Nyman 2016). Although desirable, changes in the quality and diversity of products, as well as the effects of new consumers that were previously priced out, are not within the scope of analysis of WELCOM. The first is due to the use of household surveys, which do not account for the quality of the products consumed. An appropriate method is currently in development in an updated version of the tool and will be incorporating potential welfare gains in the extensive margin of the products of interest.

It is also important to highlight other channels, such as wages, employment, profit, and capital income. For instance, competition can affect household welfare through labor market adjustments induced by competition and the resulting effect on nominal wages, the number and composition of firms demanding labor (due to the potential entry or exit of firms), and labor's bargaining power or the presence of oligopsonies in factor markets such as labor (CEA 2016b). Moreover, competition affects household welfare through capital gains due to changes in firm profits (Outreville 2015). The specialization of productive activities implies that, unlike the price channel that tends to affect all consumers, the other channels have localized impacts on a specific group of firms and workers belonging to the affected industry. Finally, competition reforms also might have dynamic effects by reallocating resources to more productive activities and higher growth industries (World Bank 2016). All these additional mechanisms have not yet been incorporated into the simulation approach.

The application of the tool to Mexican data is not aimed at any specific discussion of regulatory reform, nor does it imply that the firms in the markets discussed in this paper have or are abusing their market power (that is, that they are involved in anticompetitive practices). Instead, this paper focuses on the potential distributional impacts of abstract policy interventions or changes in market conditions affecting competition in specific markets, taking as a given the policies or behaviors under analysis. Similarly, this paper does not deal with the question of what type of behavior constitutes an abuse of market power or what the best policies are to remedy it (see Motta 2004; Buccirossi 2008 for discussions on these topics), nor with firms that may behave outside the conventional norm established in the microeconomic literature, such as public monopolies that provide subsidized services. Users of WELCOM should be aware of public sector participation in certain industries, such as energy, as this can have significant implications in measuring welfare effects. Users should therefore focus on products and services that are not provided by public entities, specifically because redistributive policies that are channeled through public entities are currently outside the scope of study of WELCOM.

6. Conclusion

The labor share of income has declined consistently across the world over recent decades. In advanced economies, this share reached its lowest point between 2007 and 2008 (49.9 percent), while, among emerging markets, it reached only 34.7 percent in 2006 (IMF WEO 2017). Data from the U.S. Bureau of Labor Statistics also show a decline in the labor share of income (in the nonfarm business sector), which implies that the share of income going to capital has risen (Furman and Orzag 2015). The empirical evidence suggests that the profit rate (measured as markups) has also risen globally (De Loecker and Eekhout 2017). Such an increase in the profit rate and capital share of incomes has been associated with rising inequality (Crane 2016; Khan and Vaheesan 2017; Stiglitz 2012). These recent trends indicating a global rise in market power and market concentration demand analytical tools that allow to assess in a rapid and cost-efficient manner the distributional effects of changes in market concentration. However, current empirical studies that rigorously evaluate the distributional effects of variations in competition are time consuming, costly, and intensive in data requirements.

To fill this gap, this paper introduces a simple, yet novel microsimulation approach to assess the distributional impact of competition that combines expenditure data from household surveys with parameters on market structure in certain industries. This simulation approach adapts a set of flexible theoretical models (monopoly, oligopoly with a homogeneous good, and partial collusive oligopoly) into a user-friendly interphase, WELCOM, which can be used to assess the impact of variations in market concentration on household welfare, poverty, and inequality. WELCOM provides a sound, rapid, and efficient option for predicting ex ante likely distributional impacts of competition in a user-friendly manner. While WELCOM is not meant to be a substitute for more detailed empirical analyses, it is useful for informing policy dialogue. WELCOM aims to simplify the estimation of reform scenarios and become the first building block of a broader project by focusing on the price channel and using data sources that are readily available in developing countries.

The results in the Mexican case study included in this paper could also be a useful illustration to inform policy makers and academics on the potential benefits of reducing concentration in key markets

through competition-enhancing policies. The hypothetical case study shows that market concentration in key sectors of the Mexican economy has adverse effects on welfare, especially among poor and vulnerable households. Moving toward competitive markets is among the main objectives of the Mexican government, and this requires removing market imperfections and economic distortions to enhance economic performance. WELCOM illustrates the likely poverty and inequality impacts of reducing concentration in the corn and mobile telecommunication markets. The combined effect of expanding competition from 4 to 12 firms in the mobile telecommunications industry and reducing the market share of the dominant oligopoly in corn products from 31.2 percent to 7.8 percent would achieve an effect on poverty reduction of 0.8 percentage points and a drop of 0.32 Gini points.

Although this novel simulation method is not free of limitations, including that it does not incorporate into the analysis other relevant welfare-enhancing channels that directly affect consumers, such as the quality and diversity of products, and new consumers that were previously priced out, WELCOM yields reasonable results using readably available household survey data and minimum information on market structure parameters. The value added of WELCOM is thus its ability to estimate, in a time- and cost-efficient manner, the potential distributional effects of variations in product market competition, linking these changes directly to poverty and inequality. Forthcoming extensions of this simulation approach include modules to estimate price and income elasticities empirically, based on household survey data, and exploring additional extensions to include labor market impacts.

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7. Annex

Annex 1

The monopolist decision problem consists in choosing the level of output that it desires to sell, $q_{MONO} \geq 0$, given the *inverse demand function*[27] "$p(q)$"—the price that must be charged to sell q units of output—and a known cost function, $c(q)$:

$$\underset{q \geq 0}{\text{Max}}\, p(q) \cdot q - c(q)$$

Assuming differentiability conditions (that is, both the inverse demand $p(q)$ and the cost function $c(q)$ are continuous and twice differentiable for any non-negative level of output), the monopolist optimal output (q_{MONO}) must satisfy the following first order condition:

$$p'(q_{MONO}) \cdot q_{MONO} + p(q_{MONO}) = c'(q_{MONO})$$

The left-hand side of the previous equation represents the marginal revenue from a differential increase in q at the point q_{MONO}, while the right-hand side corresponds to the *marginal cost,* $c'(q_{MONO})$, at a similar level of output. The previous results can be reorganized such that:

$$p'(q_{MONO}) \cdot q_{MONO} + p(q_{MONO}) = c'(q)$$

$$p(q_{MONO}) \cdot \left[p'(q_{MONO}) \cdot \frac{q_{MONO}}{p(q_{MONO})} + 1\right] = c'(q)$$

$$p(q_{MONO}) \cdot \left[\frac{1}{\eta} + 1\right] = c'(q)$$

Where η denotes the own-price elasticity of demand faced by the monopolist, given by $= \frac{\partial q / \partial p}{q / p}$. In a competitive market the elasticity of demand faced by an individual firm, η, would approach infinity in the limit (that is, a firm raising prices above the market price it would lose all its market share). This implies that in a competitive market the price should be equal to the marginal cost of producing an additional unit ($p = c'(q)$).[28] Using the previous equation, we could further show that:

$$p(q_{MONO}) = \frac{\eta}{1+\eta} \cdot c'(q)$$

Now, assume a simple model of constant returns to scale such that the marginal cost, $c'(q)$, is a constant term (MC), that is, is not a function of q. Then, under a monopoly the equilibrium price is given by the following expression:

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[27] Following Mas-Colell et al. (1995), the monopolist faces a demand function given by $x(p)$ that is continuous and strictly decreasing at all p such that $x(p) > 0$. Then, the *inverse demand function* would be given by $p(\cdot) = x^{-1}(\cdot)$.

[28] In addition, note that equation (2.3) could be used to show that the **monopoly mark-up** (how much can a monopolist charge above the marginal cost) is given by the following relationship, also known as the *inverse elasticity pricing rule*: $\frac{p(q_{MONO}) - c'(q)}{p(q_{MONO})} = -\frac{1}{\eta}$.

$$p_{MONO} = \frac{\eta}{1+\eta} \cdot MC$$

Remember that, in the case of perfect competition (P_{PERC}) we have that prices must equal marginal costs:

$$p_{COMP} = MC$$

Therefore, it follows that the price change (in percentage) of moving from a competitive equilibrium to a monopolistic structure is equal to:

$$dp = \frac{p_{MONO} - p_{COMP}}{p_{COMP}}$$

$$dp_{MONO} = \frac{p_{MONO}}{p_{COMP}} - 1 = (p_{MONO}).\frac{1}{p_{COMP}} - 1 = \left(\frac{\eta}{1+\eta} \cdot MC\right).\frac{1}{MC} - 1$$

Where η denotes the own-price elasticity of demand at the monopoly equilibrium. A key assumption is that the demand function is linear. Notice that the price change (in percentage) of moving from a monopolistic structure to a competitive equilibrium will also be a function just of the elasticity of demand:

$$dp_{MONO} = \frac{\eta}{1+\eta} - 1 = -\frac{1}{1+\eta}$$

Annex 2

Assume that all what we dispose is the price elasticity of demand, $\eta = \frac{\partial q/}{q/_p}$. Given the quantity of the rest of firms, producer "n" maximizes the profits function:

$$\pi_n = p(Q) \cdot q_n - Cq_n$$

For simplicity, assume that $AC = MC = C$

$$\begin{aligned} \frac{\partial \pi_n}{\partial q_n} &= \frac{\partial p(Q)}{\partial q_n} \cdot q_n + p - c = 0 \\ &= \frac{q_n p}{Q} \cdot \left(\frac{\partial p(Q)}{\partial Q} \cdot \frac{\partial Q}{\partial q_n} \cdot \frac{Q}{p} \right) + p - c = 0 \\ &= \frac{q_n}{Q} \cdot \frac{p}{\eta} + p - c = 0 \end{aligned}$$

Under the assumption that all firms are identical, each firm will produce the same amount of output in equilibrium, such that: $q_n = \frac{Q}{N}$, so it is possible to reorganize equation (2.19) to obtain:

$$-\frac{q_n}{Q} \cdot \frac{p}{\eta} = p - c$$

$$-\frac{1}{N} \cdot p = \eta \cdot (p - c)$$

$$-\frac{1}{N} \cdot p = \eta \cdot p - \eta \cdot c$$

$$p + N \cdot \eta \cdot p = N \cdot \eta \cdot c$$

Using equation (2.20) and denoting the results from this model with the subscript $OLI - NASH$ is possible to find that at equilibrium:

$$p_{OLI-NASH} = \frac{\eta N}{1 + \eta N} \cdot MC$$

Relying in (2.21) and if in competitive markets prices are equal to the marginal cost (which we suppose is constant) is possible to find that:

$$dp = \frac{p_{OLI-NASH} - p_{COMP}}{p_{COMP}}$$

$$dp_{OLI-NASH} = \frac{\frac{\eta N}{1 + \eta N} \cdot MC - MC}{MC} = -\frac{1}{1 + \eta \cdot N}$$