WPS6983

Policy Research Working Paper 6983

Public and Private Investments in Innovation Capabilities

Structural Transformation in the Chilean Wine Industry

Mark A. Dutz
Stephen D. O'Connell
Javier L. Troncoso

WORLD BANK GROUP
Trade and Competitiveness Global Practice Group
July 2014

Abstract

This paper assembles novel data on the Chilean wine industry to investigate the role of investments in knowledge capital on sales growth in domestic and international markets. The study uses archival data collected from the Government of Chile to compile and categorize public expenditures and programs supporting the Chilean wine industry over the period of 1990–2012 into investment in different types of knowledge capital. These spending categories are related to industry-level sales growth. The paper finds that the most important correlate is spending on research and development. The study also uses data from a new survey of Chilean wine firms to capture information on firm-specific investments in knowledge capital. The findings show that investments in collaboration capital, in particular hiring foreign consultants, as well as participation in international wine fairs are the strongest correlates of growth in export sales, while spending on aspects of branding (local advertising and brand design) are the strongest correlates of domestic market sales growth.

This paper is a product of the Trade and Competitiveness Global Practice Group. It is part of a larger effort by the World Bank to provide open access to its research and make a contribution to development policy discussions around the world. Policy Research Working Papers are also posted on the Web at http://econ.worldbank.org. The authors may be contacted at mdutz@worldbank.org.

Public and Private Investments in Innovation Capabilities: Structural Transformation in the Chilean Wine Industry

Mark A. Dutz, Stephen D. O'Connell, and Javier L. Troncoso[1]

July 2014

Keywords: Knowledge capital, intangible assets, innovation, productivity, economic growth

JEL Codes: D24, O13, O14, O47, O31, O32, E22, L16, Q16

[1] GTCDR, The World Bank; City University of New York – Graduate Center; and Professor Emeritus, Universidad de Talca, respectively. The authors thank Charles Hulten for helpful comments, including the questions surrounding the accounting and synergies between public and private knowledge capital stocks raised in the concluding section. The authors gratefully acknowledge support from World Bank's DEC Research Support Budget for financing aspects of the underlying empirical work.

I. INTRODUCTION

The process of industrial development, resource reallocation and productivity dynamics can be decomposed into three complementary types of "structural transformation", namely: (1) between-industry structural change, as inputs are reallocated across industrial activities; (2) within-industry structural change, as inputs are reallocated across enterprises within industries; and (3) within-firm structural change, as input reallocation and innovation within enterprises alters the structure and efficiency of the firm. Eichengreen, Park and Shin (2013) speculate that countries often face "middle-income traps" when productivity gains from between-industry structural change are largely exhausted and remaining gains are available primarily via more difficult-to-achieve within-firm structural change. In related work, Bollard, Klenow and Sharma (2013) decompose productivity dynamics in India into this three-way typology. They report that the large speed-up in the productivity of formal Indian manufacturing plants in the 1990s and early 2000s was mainly driven by within-plant productivity growth. Based on employment and productivity growth over the life cycle of Indian and Mexican manufacturing plants relative to the US, Hsieh and Klenow (2014) point to differences in within-plant productivity being more important than gains from resource reallocation across firms, plausibly accounting for about 25 percent of the gap in aggregate manufacturing total factor productivity between rich and poor countries.

This paper builds on a recent literature on "new sources of growth." It directly measures key knowledge-related elements of within-firm productivity in a developing country based on public and private investments in intangible assets, also referred to as knowledge capital (OECD 2013, Hulten 2013, Dutz 2013a). Measurement of business spending on knowledge capital is relatively recent, with seminal work applying direct expenditure methods initially done for the U.S. economy (OECD 1998, Nakamura 2001, Corrado, Hulten and Sichel ("CHS") 2005, 2009). In contrast to the conventional approach of treating spending on knowledge assets as intermediate expenditures and thereby assuming that all their benefits are reflected in the current year's output of tangible goods and services, the knowledge capital approach correctly capitalizes intangible outlays that contribute to production and value beyond the taxable year and treats them as longer-lived investments – using the same cost-based accounting that is used for physical capital. The knowledge capital approach expands the conventional proximate sources of growth beyond human and physical capital to include knowledge investments in the innovation and risk management capabilities of the enterprise. Importantly, these investments go significantly beyond traditionally-measured R&D expenditures to include a range of co-investments required for enterprises to decide what to produce and how, to develop new ideas, to execute and translate these ideas into products, processes, organizational changes and markets, and to manage associated risks. The CHS classification divides knowledge capital into three categories:[2]

(1) ***digital assets*** *("computerized information")* - software and databases

(2) ***intellectual assets*** *("innovative property")* - R&D, entertainment, literary and artistic originals (creative capital), architectural, engineering and other designs, new products and systems in the financial industry, and mineral exploration and evaluation

(3*)* ***human-organizational assets*** *("economic competencies")* - market research, advertising and brand equity (marketing capital), firm-specific human capital (worker skills and managerial capital),

[2] Investments in risk management are here not conceptualized as a separate category of knowledge capital, but a consequence of appropriate investments in these three existing categories of knowledge assets. Risk management is a by-product of investments in these assets.

organizational improvements and new business models (organizational capital) – and an additional-to-CHS sub-category most important for businesses behind the global technological frontier, namely spending on collaboration-related assets to diffuse existing but new-to-the-firm technologies and adapt them to local context, such as outlays on networking and peer-to-peer learning from local clusters and global value chains, foreign buyers and sellers, consultants and study tours, and other forms learning through global networks (collaboration capital).

The acceleration of globalization, technological progress, and increased trade and competition have resulted in rents from new ideas becoming more important for sustained firm-level competitiveness and aggregate growth across countries (Canuto, Dutz and Reis, 2011). In addition, as countries accumulate larger stocks of human capital, the production and use of knowledge capital is both enabled and complemented. The increasing importance of knowledge capital over time is shown by the steady increase in the intangible investment rate in the US as a share of expanded nonfarm business output, from 8 percent in 1977 to 14 percent in 2010, in contrast with a secular decline in the tangible investment rate (Corrado and Hulten 2010, Hulten 2013).

A recent international empirical literature has highlighted investment in intangible assets both as a distinct category of firm investment and as a major driver of growth. In the US and the UK, firms now invest more in intangible than physical capital. Estimates of knowledge capital at the aggregate level across countries—to-date available for high-income OECD countries, Brazil, China and India—highlight that intangibles are an important and dynamic element of aggregate economic growth, with a significant positive correlation between investments in "core" knowledge capital (excluding software and architectural and engineering designs to control for the links with IT equipment investment and real estate bubbles) and PPP-adjusted output per capita (Hulten 2013). Applying this economy-wide methodology to Brazil, Dutz et al. (2012) estimate that during 2000-2008, annual business spending on intangibles averaged about 4 percent of GDP, showing that this investment is positively correlated with recent export growth and total factor productivity estimates across manufacturing industries. Hulten and Hao (2012) estimate China's aggregate intangible expenditures at roughly 7.5 percent of GDP.

Measurement of investment in intangibles at the firm level is at an early stage for several reasons, though mainly because most national industrial surveys have not historically included the distinct questions needed to quantify investment in intangibles. This shortcoming of existing methods is being gradually addressed, but so far only for high-income countries: Haltiwanger, Haskel and Robb (2009) discuss new surveys piloted in the UK (as reported in Awano et al. 2010a, b) and in the US (based on new questions on spending on intangible assets by young firms added in the longitudinal Kauffman Firm Survey). They conclude that R&D is but one measure of knowledge investment: a range of additional questions are essential to fully capture knowledge spending, with complementary questions on depreciation rates of intangible assets yielding helpful insights.

The present study takes an initial step in measuring and quantifying the association between public and private investments in knowledge capital and industry-level and firm-level sales outcomes. It is the first study to take a close look at how knowledge capital works in a specific industry, where institutional details matter. In this paper, we empirically examine the linkages between intangible investments and industry- and firm-level exports in the Chilean wine industry. The study tests two hypotheses: (i) that

spending on knowledge capital is a statistically significant and economically important correlate of growth as reflected in exports, both at industry and firm levels; and (ii) that spending on reputation & branding and on learning through global collaboration and network-building, namely on connecting firms to better existing global technology flows, are both statistically significant and economically more important at the firm level than other types of knowledge capital.

Why focus on the wine industry? Based on an international comparison between Italy and three New World wine producers, namely Argentina, Chile and South Africa, Giuliani et al. (2011) explain why the wine industry (rather than electronics, software, pharmaceuticals or telecommunications) is an ideal industry to investigate technological catch-up in emerging countries, and how R&D and innovation are indeed the main drivers of an agro-food industry such as wine. They document how, as latecomers in the international market, New World producers have radically changed how wine is produced, sold and consumed. Their main argument is that product and process innovations, spurred by investments in innovation capabilities, have played a prominent role in the emergence of New World producers in the international market. Their empirical evidence shows that New World producers have improved the quality of their wines, investing in research in universities and laboratories, strengthening the link between university and industry, and importing external knowledge through experts. They show how a traditional agro-food industry can become highly competitive and catch up in the global market, thereby contributing significantly to the process of growth in these countries – when following a trajectory where investments in R&D and innovation play a prominent role. However, their empirical evidence is based largely on a set of case studies of universities and researchers, public institutions and firms in Argentina, Chile and South Africa. While there exist a number of other empirical studies on the wine industry (for Chile, see for instance Troncoso and Aguirre 2006, Kunc and Bas 2009, and Moreira, Troncoso and Bravo-Ureta 2011), there is no measurement of levels of investment in knowledge capital by firms or by the State—a shortcoming this study seeks to address.

We adopt two complementary methodologies. First, based on a unique data set on public and private knowledge capital investments compiled at the industry level, we categorize individual project expenditures from Government of Chile databases covering all innovation support programs targeted at the wine industry from 1990 to 2012 into different types of intangible assets. We then explore aggregate industry-level time series correlations between bottled wine exports and expenditures on main types of knowledge capital, lagged area planted, and a measure of global demand. Second, the paper reports on the findings of a novel field survey of wine enterprises, based on a specifically-designed "Survey of Investments in Knowledge Capital", adapted to a developing country context and to the wine industry, and pre-tested in the field in Chile. Finally, we explore correlations between export or domestic bottled wine sales and expenditures on main types of knowledge and physical capital. In terms of methodology, the paper is most closely related to enterprise survey work undertaken by the Kauffman Foundation in the US as reported in Haltiwanger, Haskel and Robb (2009), and undertaken by Awano et al. (2010a, b) in the UK.

The paper makes four contributions to the literature. First, in terms of linkages with risk management, we illustrate how specific knowledge capital investments can be interpreted as supports to firms' four pillars of risk management, adapted and extended to include innovation risk, based on a framework suggested for risk management by Ehrlich and Becker (1972): the resilience of development outcomes can be

improved both ex ante, before productivity or demand shocks are realized, by investing in knowledge, protection/enabling and insurance assets, and ex post by investing in coping/leveraging assets after the realization of the shock or after it becomes clear whether the innovation investments are succeeding or failing in the marketplace (Dutz 2013b). Second, at the industry level, the paper documents joint public-private investments across different types of knowledge capital. Total public-private co-investments over the period were sizeable. The strong statistically significant positive correlation of industry-level R&D outlays with bottled wine export sales suggests that investments in intangibles are more important for export competitiveness than an industry-level proxy for investments in tangible capital (area planted). The sizeable and long-term nature of public financing highlights the important role of government support to innovation, as outlined by Janeway (2012) and Mazzucato (2013). Third, the paper is, as far as the authors are aware, the first firm-level application of the knowledge capital approach to a developing country. Finally, in terms of measurement and policy guidance, the paper provides a survey design and analytical methodology for other industries, by quantifying the role of different types of knowledge assets in sales growth and suggesting what policies may matter for business competitiveness.

Section II provides a background to the Chilean wine industry and presents summary statistics on our industry- and firm-level datasets. Section III then presents linkages between investments in knowledge capital and risk management. It provides illustrative examples of how specific investments can be re-interpreted according to firms' four pillars of risk management, as knowledge, protection/enabling, insurance, and coping/leveraging assets. Section IV presents linkages between knowledge capital investments and export (and domestic) sales, first based on industry-level data and then based on firm-level data. The final section concludes and discusses questions for further research.

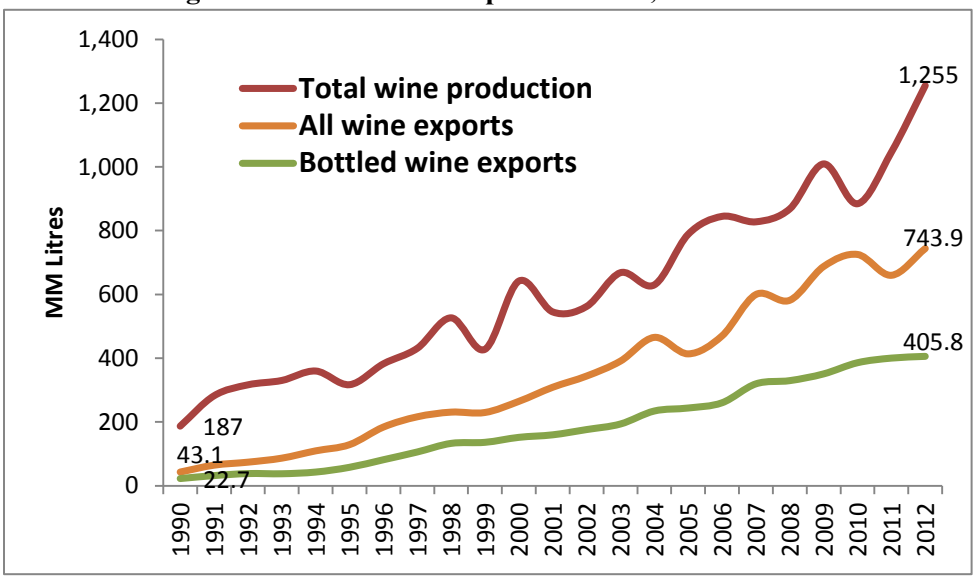
II.1. STRUCTURAL TRANSFORMATION IN THE CHILEAN WINE INDUSTRY

The Chilean wine industry has experienced impressive growth in recent decades. As highlighted in Figure 1a, growth in total wine production increased from 187 to 1,255 million liters between 1990 and 2012—at an average compound annual growth rate of 9.0 percent. During this same time, total area planted with wine grapes increased from 65.2 to 127.0 thousand hectares (3.1 average CAGR).[3] By decomposing this growth rate into two periods, it is evident that the decade of the 1990s saw a faster compound annual growth rate in production of 13.1 percent (from a lower initial base) relative to the subsequent 2000-2012 period of 5.7 percent growth per annum. Total wine exports and the subset of total bottled wine exports,[4] in turn, grew from 43 and 23 to 744 and 406 million liters over the same period, at compound annual growth rates of 13.8 and 14.0 percent respectively. Faster rates of growth of wine exports relative to wine production reflect a gradual shift in sales from domestic to export markets over time. Chile has climbed to be among the top five countries in terms of national shares of world wine export volume and value by the late 2000s (behind France, Italy, Spain and Australia, but ahead of the US, Germany, New Zealand, Argentina and South Africa, among others) (Andersen and Nelgen 2011).

[3] Area planted excludes the area with table grapes. As capital investment is closely related to area planted, this variable can also be used as a proxy of investments in physical capital.

[4] Bottled wine exports include tariff codes 22042110 (wines with Denomination of Origin) and 22041000 (sparkling wines), and exclude codes 22042190 (wine in tetrapack equal to or less than 2.0 litres) and 22042990 (other wine, mainly larger bulk containers). The series were obtained from ODEPA, Ministry of Agriculture's Office of Agrarian Studies and Policies.

Figure 1a: Evolution of export volumes, 1990 to 2012



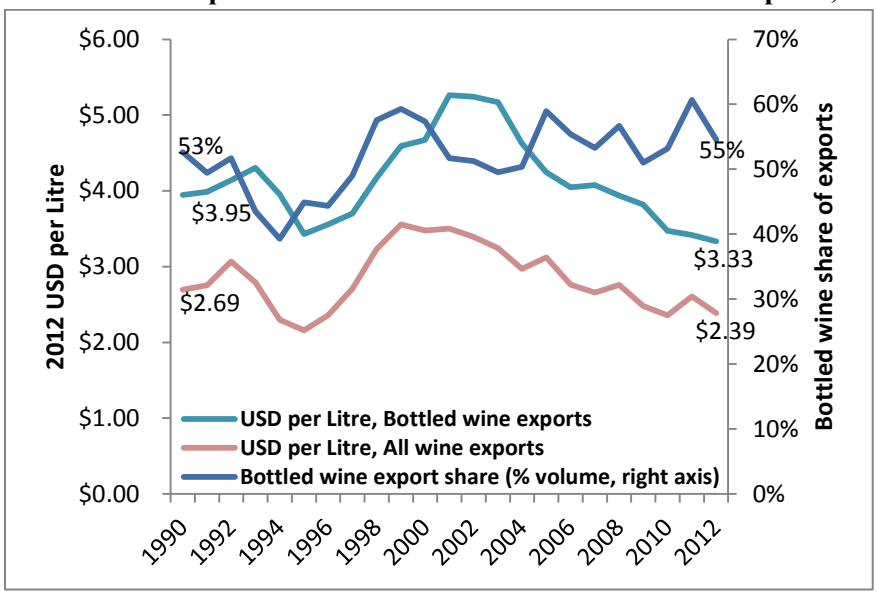
The increase in export volumes between 1990 and 2012 is mirrored by equally spectacular increases in export values[5]: from $116 million to $1.78 billion for total wine exports (or 13.2 percent per annum, 23 percent per annum over the 1990s and 5.6 percent per annum thereafter), and from $89 million to 1.35 billion for bottled wine exports (or 13.1 percent per annum, again 23 percent per annum over the 1990s and 5.5 percent per annum thereafter). Figure 1b shows the evolution of export unit values over time, with a significant price premium for bottled wine over all wine exports (taking into account that the higher-value bottled wine exports are also included in total exports). However, it is striking that bottled wine unit values have not increased further over time, suggestive of the continuing predominant niche of most Chilean wines as relatively low-cost "value for money" products. Figure 1b also shows, on the right axis, the evolution of the share of bottled wine exports in total exports by volume over time, with the share remaining relatively constant at approximately 55 percent, with a low of 39 percent in 1994 and a high of 61 percent in 2011 – highlighting that the mix of export volumes has not shifted significantly toward higher-value wines.[6] [7]

[5] All figures throughout the study are reported in constant (2012) US dollars, unless otherwise noted.

[6] The share of bottled wine exports has also remained fairly constant over time, beginning the period at 77 percent in 1990 and ending at 76 percent in 2012, with a low of 67 percent in 1993 and a high of 82 percent in 2007.

[7] As a signal of what is possible and the global brand image that Chile has attained, Concha y Toro has consistently been rated in the top 3 most valuable wine brands in the world from 2006 through 2013, according to an annual compilation of the top 100 spirits and wine brands (Intangible Business). These global rankings are based on objective measures such as market share, brand growth, price positioning, and number of markets with a significant brand presence, together with a range of subjective measures.

Figure 1b: Evolution of export unit values and bottled wine share of exports, 1990 to 2012



This evolution of the Chilean wine industry was accompanied by significant structural transformation including innovations both in plantations and wineries as well as in the management of firms. The area planted increased substantially in the 1990s and 2000s, and the proportion of traditional cultivars (e.g.'Pais' or Mission) was reduced to the advantage of finer varieties; also vine training systems and pruning methods were improved and wine cellars evolved from traditional winemaking methods (based on fermentation in oak casks) to modern oenological technology using stainless steel vats and equipment. In all these transformations, an important role was played by renowned winemaking companies from other countries, as Miguel Torres Vineyards (Spain), Pernod Ricard or Rothchild-Lafitte (France), Kendall Jackson (U.S.A) and Mildara Blass (Australia), that invested in Chile or developed joint ventures with local wineries (Vergara, 2001). These structural transformations required investments not only in physical capital but also in worker and management training, adaptive R&D, software (including software to manage oenological processes, such as Kupay, developed by the Chilean firm, SONDA), new organizations (e.g. Wines of Chile A.G, with branches in the U.K and the U.S), trademarks recognized in Chile and abroad, and many other intangible investments.

II.2 INDUSTRY-LEVEL DATA

The extent of public sector funding support to intangible investments in the Chilean wine industry was sizeable, sustained, multi-faceted, and growing over 1990-2012. Table 1 shows the magnitude of this funding by knowledge capital type and program funding source, disaggregated into public funding and co-financing by private beneficiaries.[8] Public support and matching private contributions amounted to a

[8] Although public funds are supplied to the wine industry by several governmental programs, FIA ("Fondo de Innovación Agraria" of the Ministry of Agriculture) is charged with keeping a record of the research projects funded with public resources to avoid duplications. FIA provided us with a complete list of the research projects carried out for the wine industry in the period 1990 through 2012, including the funds committed from public and private sources CORFO provided data on remaining public-private support to the different types of knowledge capital.

sizeable total of $120 million, with $87.8 million or 73 percent of the total accounted for by public funding.

Across the different types of knowledge capital receiving public support, R&D projects received by far the largest total support, $79.3 million, and also benefited from the largest share of public support, $59.9 million or over 75 percent of the R&D total. The main public R&D funding source was CORFO, the Chilean Economic Development Agency[9], through its different support programs: INNOVA CHILE, a new agency formed in 2005, and merging the FONTEC program (the National Productivity and Technological Development Fund, created in 1991 to increase local industry competitiveness by supporting technological innovation) and the FDI program (the Innovation Development Fund). The other main funding sources were two-fold: first, CONICYT, the Chilean National Research Council, through FONDEF (the Science and Technology Development Fund, created in 1991 to support public-private partnerships between public research organizations and private firms to work together on R&D projects) and FONDECYT (the National Fund for Scientific and Technological Development, created in 1981 to fund basic scientific and technological research); second, the Ministry of Agriculture, through FIA (the Foundation for Agrarian Innovation to fund innovation in agricultural industries) and SAG (the Agriculture and Livestock Service, supporting agriculture development through improvements in the health and vigor of animals and plants).

Training projects received the next largest public support, $16.1 million or 77 percent of the total recorded public-private funding for training of $20.9 million. Public support for worker training and certification picked up significantly in the 2000s with the public subsidy offered through the Ministry of Labor and Social Security's SENCE program (National Training and Employment Service), which provides a profit tax exemption to firms availing themselves of approved training. For wine firms, SENCE funding was provided largely through OTIC Chile Vinos, an "Intermediary Technical Training Organization" set up by the Vinos de Chile enterprise association. CORFO was another important public funder of training support projects, both directly and through INNOVA CHILE.

[9] CORFO, the Spanish acronym of the Corporacion de Fomento de la Produccion de Chile, is a government agency dedicated to promote entrepreneurship, innovation and economic growth since 1939. CORFO reorganized in 1991, transferring its loan portfolio to the private banking system, and refocused on reducing market failures impeding development, in particular through technology and innovation policy and project support.

Table 1: Total public and private funding of knowledge capital, 1990-2012 (in MM 2012 USD)

Type and Funding Source	Public Funding	Co-financing by beneficiaries
R&D	***59.87***	***19.45***
INNOVA CHILE	21.77	12.18
FONDEF	16.31	-
FIA	5.87	-
FONTEC	5.62	4.66
FDI	4.16	2.61
FONDECYT	3.90	-
SAG	2.25	-
Training	***16.06***	***4.82***
SENCE/ Vinos de Chile - OTIC	9.42	-
CORFO	3.72	2.97
INNOVA CHILE	2.92	1.85
Joint Marketing Support	***6.14***	***5.81***
CORFO	5.38	4.61
INNOVA CHILE	0.77	1.19
Global Collaboration	***4.57***	***1.91***
CORFO	2.45	-
INNOVA CHILE	2.12	1.91
Market Research	***0.21***	***0.14***
CORFO/ INNOVA CHILE	0.21	0.14
Business Process Improvement	***0.98***	***0.75***
CORFO	0.73	0.46
INNOVA CHILE	0.25	0.29
Total	***87.83***	***32.88***

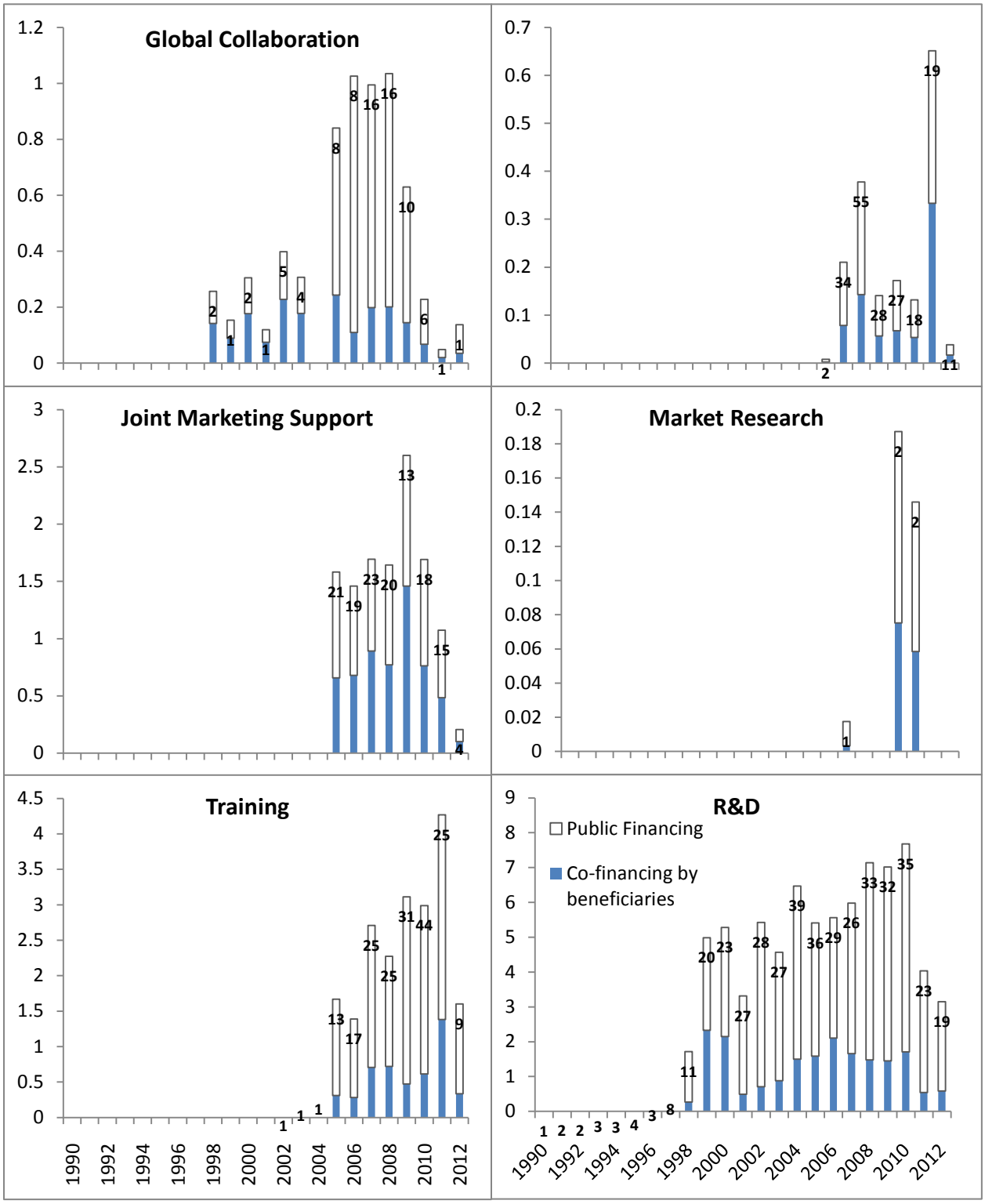
The other main types of knowledge capital receiving public support were funded either directly by CORFO or through INNOVA CHILE. Joint marketing support projects benefited from over $6 million in public funding, with matching private sector funding of almost as much ($5.8 million). Over half of these support projects (74 of 133 projects) were listed as PROFOs or "Associative Promotion Projects", a program created in 1992 managed by CORFO which promoted associations among groups of small and medium enterprises (SMEs), requiring the participation of at least five SMEs to improve technical, financial, managerial and marketing capabilities. In the wine industry, most PROFOs were directed at marketing challenges such as conquering new international markets. Rivas (2012) describes the case of SME wineries that initially produced and sold bulk wine to larger wine firms, and as a result of the program learned to work together to upgrade quality and jointly market own exports directly to global markets.

Global connectivity and knowledge network-building support projects were largely funded from public sources, with $4.6 million or over 70 percent of total public-private funding for these types of learning funded by CORFO. Approximately 60 percent of these projects were "misiones de captura tecnologica" or technology capture trips, for instance a structured study tour to France to learn about the latest technologies for the production of biodynamic wines, or a tour to Australia to learn "about the technologies used by one of our main global competitors". Roughly 20 percent of the projects were "consultoria especializada" or foreign consultant services. And the remaining 20 percent were projects from a program involving the diagnosis of problems of a particular productive chain and the collaborative solution to such problems that typically included expert consultancies to help upgrade outdated technologies. Finally, market research projects were predominantly labeled "Programa de prospección e investigación de mercados", and were typically supporting the national wine associations in their projects to better understand evolving foreign buyer wine tastes. Business process improvement (BPI) projects were predominantly support to enterprises' upgrading with respect to the ISO 9000, 14000 and HACCP (Hazard Analysis and Critical Control Points for food safety) series product process improvement methodologies.

Figure 2 shows the available data on programmatic funding to the Chilean wine industry by knowledge capital type and source. The data are disaggregated on a year-by-year, project, and public-private funding basis. The figures on the bars refer to the number of distinct projects that were active in a given year (a project may be firm-specific, as in BPI support, but typically benefit a group of firms, as in a PROFO project, or eventually most firms in the industry, as in a typical global connectivity or R&D support).

Support for R&D has been the most continuous on a year-by-year basis over the 1990-2012 period. It began with a single support project disbursing $8,000 in 1990, rose to disbursements of $200,000 over 4 projects by 1995, to $5.7 million over 23 projects in 2000, and to a high of $8.3 million over 35 projects in 2010. Public support for most other types of knowledge capital investments began only later, with support for training beginning in 1996, for global collaboration in 1998, and with support for joint marketing, market research and business process improvement only beginning in 2005.

Figure 2: Funding amounts by knowledge capital type and source, 1990-2012



Note: All figures in 2012 USD (MM). Series labels indicate number of distinct funded projects in the category and year.

II.3 FIRM-LEVEL DATA

Between January and April 2013, we collected firm-level information on investments in physical and intangible assets, export and domestic sales, estimated lifespan of intangible assets, and other firm characteristics of a stratified sample of firms in the Chilean wine industry for the three latest available years (2009 through 2011).[10] In particular, the questionnaire included novel, detailed questions on spending (both in-house and purchased through external providers) on the six main types of intangible assets—software, R&D, design, reputation & branding, training and business process improvements—plus collaboration-related economic competencies (collaborative learning through spending on both foreign consultant services and technology capture trips[11]).[12]

Table 2. Chilean wine industry: Universe and sample

	Universe		Survey	
Size strata (ha)	No.	%	No.	%
x≤100	120	50.8	9	37.5
100<x≤500	83	35.2	8	33.3
500<x≤2,000	29	12.3	3	12.5
x>2,000	4	1.7	4	16.7
Total	**236**	**100**	**24**	**100**

The sample frame was drawn from a database of all registered wine-producing enterprises. Table 2 shows the total number of firms in the Chilean wine industry as of end-2011 and the respondent sample according to firm size (proxied by production hectares). As is evident, the stratum of smallest firms (100 hectares and less) is under-represented in the sample, while the largest firms were intentionally oversampled. Initially the identified, intended sample included 50 firms, weighted proportionally to the population, but the survey period coincided with harvest time in the vineyards and many firm managers did not make themselves available to be surveyed.[13] Thus, only 24 firms (or 48 percent of the original sample) responded the questionnaire. In total, the firms sampled represent 53-54 percent and 56-60 percent of Chilean wine exports between 2009 and 2011, measured in export value and physical output, respectively.

Figure 3 shows the incidence of spending by aggregated intangible asset type, broken down by size group (less than versus more than 500 hectares). Our results are similar to what Awano et al. (2010) found for the UK across all industries, namely that the top three asset types were training, software, and reputation & branding, and that R&D had the lowest incidence – with results holding for both large and small

[10] The survey instrument used is available in the Appendix. It is a new survey instrument, adapted from the "Investment in Intangible Assets" survey sent to 2,004 UK firms by Awano et al. (2010), which in turn was modified from a template provided by the Central Bureau of Statistics in Israel. Two surveyors visited the sampled firms to apply the questionnaire.
[11] These were typically structured study tours with local entrepreneurs going abroad.
[12] The questionnaire is attached in the Appendix.
[13] There is no indication that the respondents represented a biased sample. Awano et al. (2010) report that 42 percent of firms to which their survey was sent provided knowledge capital spending information.

firms.[14] Our results confirm that non-R&D intangible spending is much more widespread than outlays on R&D. As in the UK, the average benefit lives for each asset category are greater than one year, strongly supporting the case for capitalizing the assets. Interestingly, our newly-tracked knowledge capital category, spending on learning from global collaboration, is as common as software for smaller firms (71% of firms investing) and as important as design and business process improvements for larger firms (19% of firms investing).

Figure 3: Share of firms engaging in knowledge capital investment, by type and size

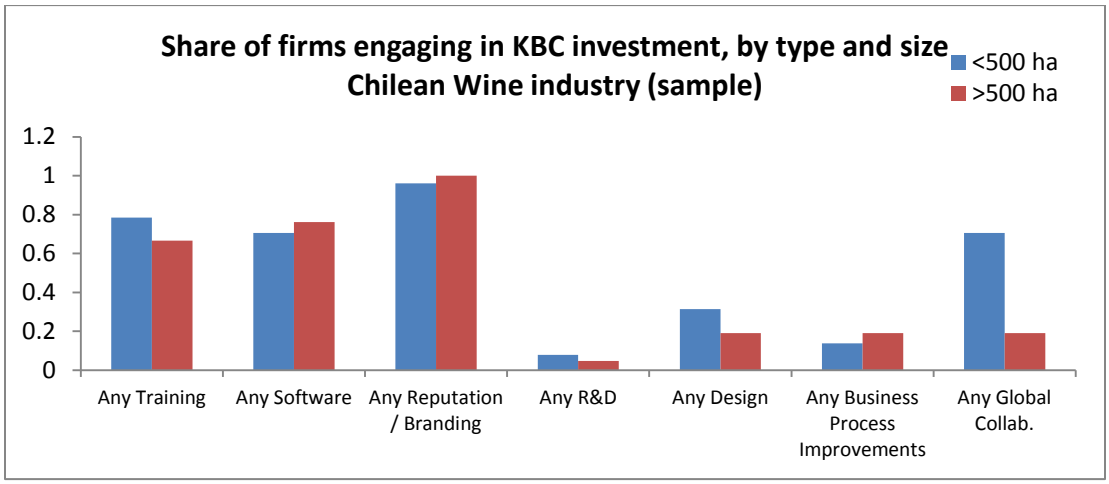


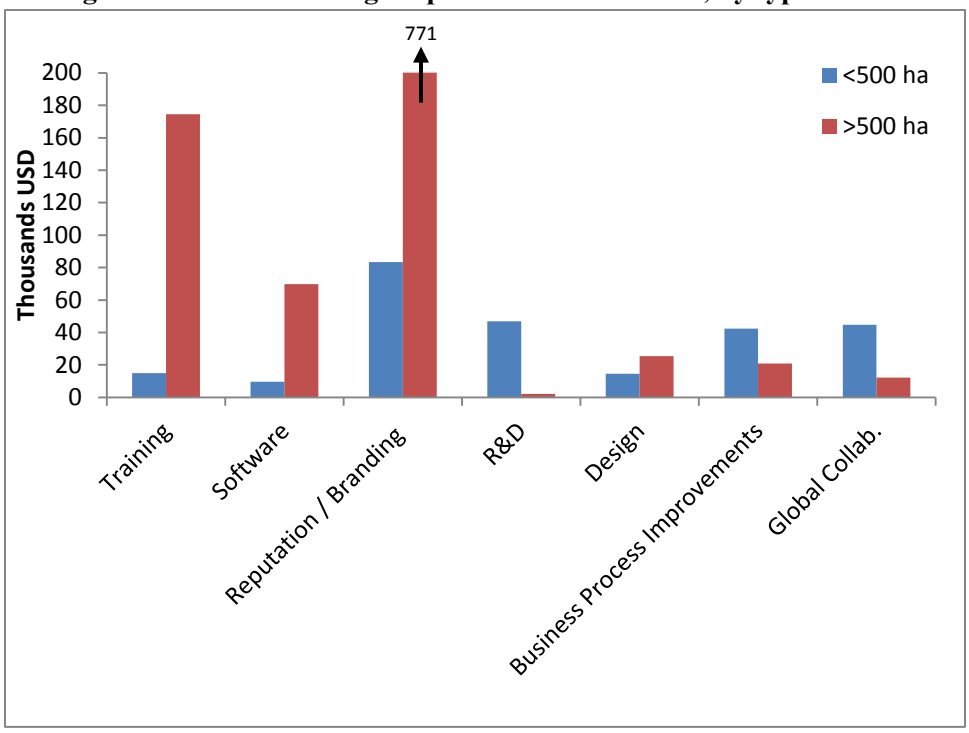
Figure 4 shows average expenditure on each asset type conditional on reporting positive spending, again broken down by size group, for 2011. There are large differences in the average expenditure by asset types and across size classes. In particular, large firms report spending significantly higher spending levels on average than smaller firms for the three most common asset types by incidence, namely reputation & branding, software and training. Spending is especially high for the largest firms on reputation & branding (an average of $771,000), driven by high levels of spending on creating and maintaining brands by the largest firms that are active and need to pay trademark licensing costs in a large number of foreign export markets.[15] Spending is also significantly higher on training for the larger than for the smaller firms ($174,000 versus $15,000). Interestingly, reported average spending on R&D, business process improvements, and learning through global collaboration is higher for the smaller than for the larger firms. This may be due to a number of reasons, including a possible reluctance of the largest firms to reveal their actual spending in these categories as these may be perceived to be important sources

[14] Note that among the top three asset types, the results for the Chilean wine industry are distinct from those across all industries in the UK, with in Chile reputation & branding being the most common asset type (with all large firms, and 96% of smaller firms investing), followed by software (76% of large and 71% of smaller firms investing) and then training (67% of large and 78% of smaller firms investing); the incidence of R&D spending is 8% for small and 5% for large firms. In the UK training was the most common asset type (70% of large and 34% of smaller firms investing), followed by software (57% of large and 30% of smaller firms) and reputation & branding (38 and 22% respectively); the incidence of R&D spending was 8% for small and 19% for large firms. This result is no doubt affected by the importance of reputation and branding for the global wine industry.

[15] In 2011, Concha y Toro purchased California's Fetzer Winery for US$ 238 million, adding significantly to its brand portfolio. However, this is not an exceptional outlier, as the other largest firms also spend significantly more than the smaller firms in this asset category.

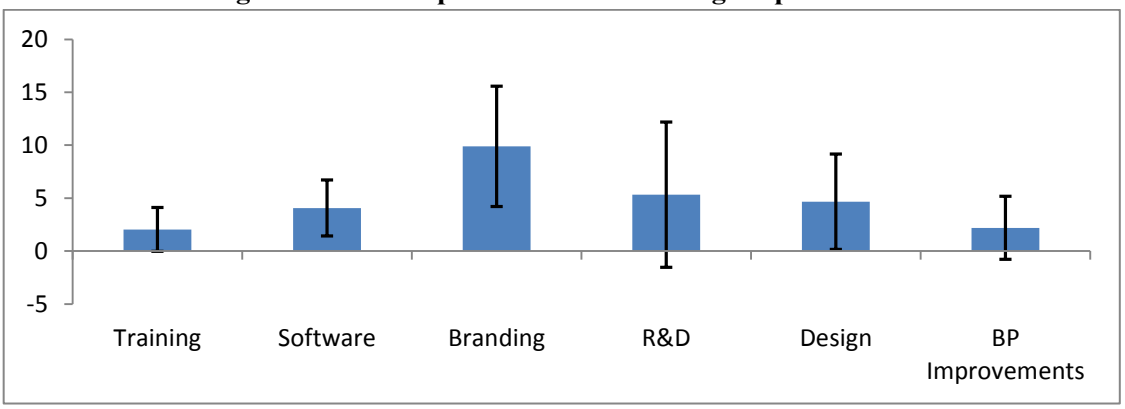
of comparative advantage; as well, especially on R&D, the larger firms may participate mainly through collaborative public-private initiatives as reflected in the industry-level data, or larger firm respondents may systematically have a more restricted view of what is included under the R&D category.

Figure 4: Mean knowledge capital investment levels, by type and size



In addition to the magnitude of spending, the survey asked respondents to estimate the number of years that an investment in a particular asset category would continue to yield benefits. Figure 5 shows the average estimated benefit lives for each asset type (except for investments in global collaboration). Again, there are similarities between the Chilean wine industry and UK industries: training is the asset type with the shortest reported asset life, namely 2.1 years in Chile and 2.7 years in the UK. While R&D was the asset type with the longest reported benefit life in the UK (4.6 years), it was in second place in Chile, with an average asset life of 5.3 years. Interestingly, the asset type with the longest reported asset life in the Chilean wine industry is reputation & branding, with an average benefit life of 9.9 years – a testament to the perceived staying power in the minds of consumers of well-established wine brands. Most importantly, as in the UK, the average life lengths across all assets types are comfortably greater than one year, strongly supporting the case for capitalizing knowledge capital assets.

Figure 5: Mean reported life of knowledge capital assets



Note: Error bars represent 95% confidence intervals.

III. LINKAGES BETWEEN KNOWLEDGE CAPITAL INVESTMENTS AND RISK MANAGEMENT

In addition to being an important source of total investment and growth, different types of enterprise investments in intangibles also can play a critical role as investments in enterprises' pillars of risk management, providing enterprises with essential capabilities to anticipate, absorb and adapt to exogenous risks, and undertake risky activities in pursuit of larger expected profits with higher probabilities of success – empowering firms to learn and execute as enabled information platforms.[16] The main types of intangible investments can be mapped into the four pillars of risk managed initially proposed by Ehrlich and Becker (1972) (see Figure 6):[17]

- Investments in ***knowledge*** of supply and demand trends and the likelihood of shocks, including changes in existing and emerging global technologies and changes in consumer preferences. This includes expenditures on R&D and global connectivity (including investments in knowledge diffusion networks and various search and match mechanisms to learn from and co-create with other local firms, global corporate partners, suppliers and buyers, universities and the diaspora).
- Investments in ***protection/enabling*** to reduce the probability of losses and increase the likelihood of successful input reallocation and innovation. This includes expenditures on market research, branding and advertising to expand product varieties and market reach and thereby diversify location-specific product risks both on production and demand sides. The optimal reallocation of resources under uncertainty may not be to invest all into a high-risk new technology, but to invest some resources in the existing technology and benefit from the option value of waiting until some additional

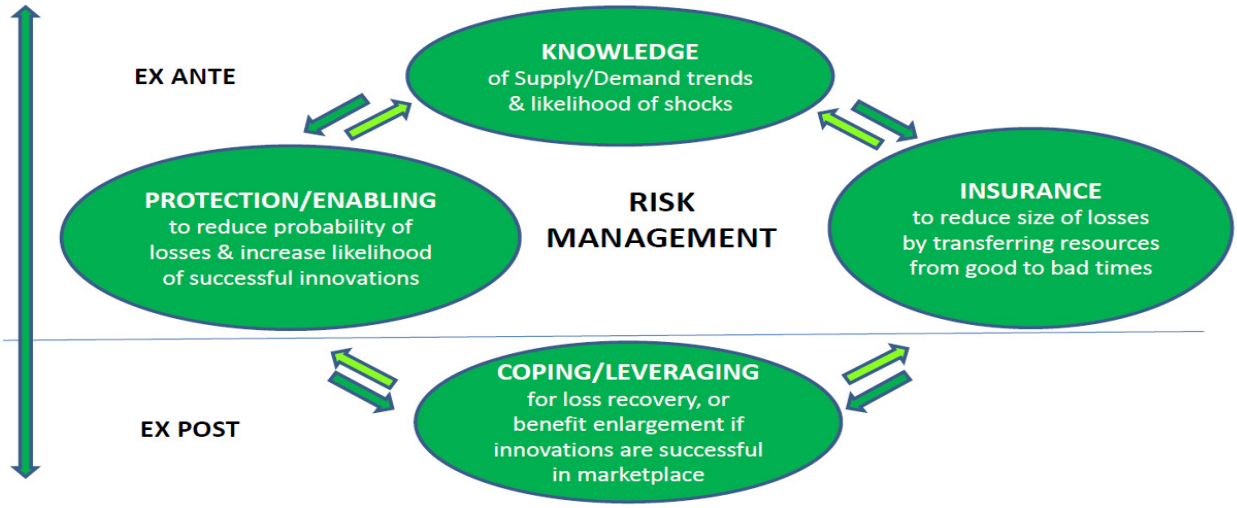
[16] See Hulten (2013) on some policy implications of conceptualizing the firm as an information platform.

[17] Sheffi (2005) surveys a wide range of intangible investments that firms have made to increase knowledge, self-protect, insure against, and cope with low-probability high-impact disruptions, broken down into "reducing vulnerability" (early detection and security investments in databases and software to reduce the likelihood of intentional disruptions from industrial actions, sabotage or terrorism), "building resilience through redundancy" (investments in slack, non-used inventory, capacity and IT systems, and increased holdings of retained earnings) and "building resilience through flexibility" (investments in new business models to allow interchangeability of plants, parts and people, realign supplier relations in supply chains, and modify internal culture towards greater safety, quality, continuous communications, and conditioning for disruptions).

uncertainties are resolved.[18] D'Erasmo and Moscoso Boedo (2012) show that firm-level volatility is negatively correlated with such intangible expenditures: firms that incur higher intangible expenses are able to serve more markets and thereby diversify and reduce market-specific demand risk.[19]

- Investments in ***insurance*** to reduce the size of losses by transferring resources from good to bad times. This includes expenditures on private or public-private partnerships to pool and share risks such as an agreement with an OEM or with a large distribution chain that provides a resource cushion in temporary downturns and signals lower risk to investors, or investments by start-ups in patents to raise their salvage value if they go bust.
- Investments in ***coping/leveraging*** for *ex post* loss recovery or benefit enlargement if the investments in reallocation and innovation are successful in the marketplace. This includes expenditures on worker and management continuous learning, business process improvements, and software and databases to build up enterprise capabilities for more flexible adjustment, facilitating either scaling up or down, depending on the realization of the shock.

Figure 6: Firms' four pillars of risk management



Source: Authors' adaptation from Diagram 2, World Bank (2013)

The main risks facing the Chilean vine-growing and wine-making industry over the past years were shifts in local inputs and in global demand and supply, exchange rate volatility, and natural disaster risks including viticultural pests and disease hazards, water and temperature variability, and earthquakes. Investments in different types of knowledge capital and complementary physical capital by Chile's wine-

[18] Bloom et al. (2007) show that higher uncertainty reduces the responsiveness of investment to demand shocks, with uncertainty increasing real option values and making firms more cautious when investing or disinvesting (firms only hire and invest when business conditions are sufficiently good, and only fire and disinvest when they are sufficiently bad; when uncertainty is higher, this region of inaction expands, as firms become more cautious in responding to business conditions). Investment is also shown to have a convex response to positive demand shocks, magnifying the response, and a concave response to negative demand shocks. Empirically, these 'cautionary' and 'convexity' effects of uncertainty are large and play an economically important role in shaping firm-level investment decisions..

[19] The authors find a significant negative relationship between firm-level idiosyncratic volatility and intangible expenses, based on US data from the Kauffman Firm Survey and Compustat both for a general measure of intangibles (selling, general and administrative expenses) and for advertising expenditures.

producing enterprises may have played an important role in the decrease in monthly volatility of export volumes (and values) over the 1990-2012 period, as highlighted in Figure 7.

Figure 7: Volatility in bottled wine export volumes

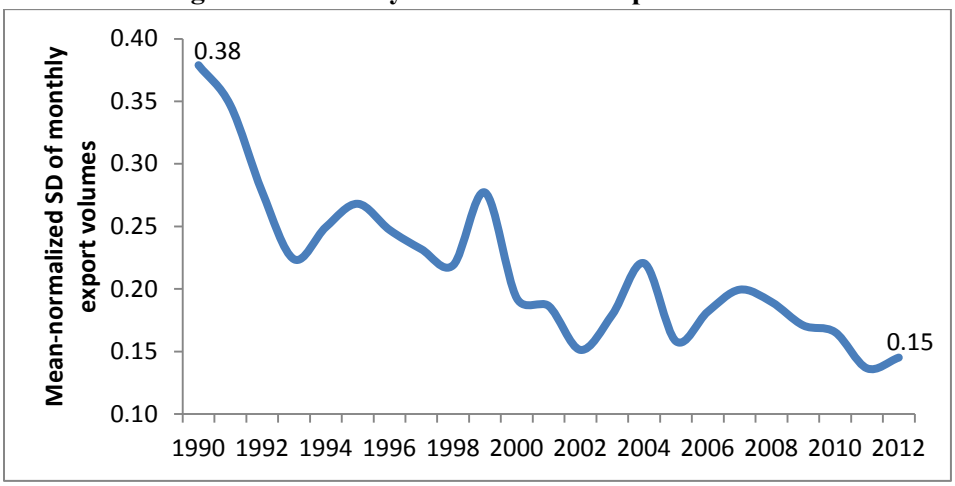
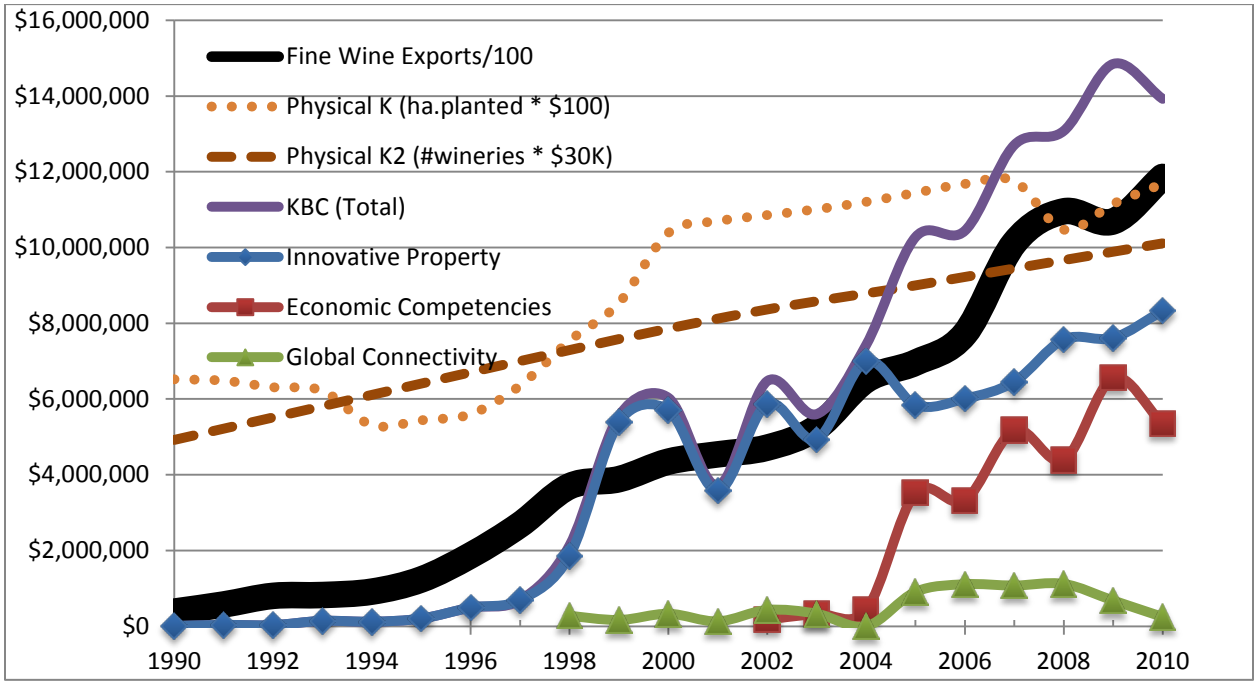


Figure 8 shows the association between investments in knowledge capital relative to investments in tangible assets and changing export levels over the past two decades. In particular, it suggests that total measured investments in knowledge capital, namely the sum of expenditures on innovative property (investments in R&D), traditionally-measured economic competencies (outlays on market research, marketing, training and business process improvements) and global connectivity, are more closely correlated with bottled wine exports than available proxies for investments in physical capital (area planted or number of wineries).

Figure 8: Knowledge capital and Chilean wine exports (2012 USD)



Examples of investments in knowledge capital that support enterprise risk management include:

(i) **Investments in knowledge**. An example of expenditures on knowledge related to changing global technologies and effectively adjusting to the risk of losing market share when foreign competitors innovate is Miguel Torres' (a Spanish-owned FDI firm) first introduction in Chile of temperature-controlled stainless steel vats (in widespread use in high-income countries by then). They replaced the traditional concrete fermenting vats that did not allow temperature control and that retained residues adversely affecting taste and smell. This led Chilean-owned vineyards to introduce them – and required additional investments in technical support and local learning, as no one in Chile knew how to assemble them. To further lower the risk of falling behind the evolving technological frontier, CORFO and participating enterprises co-invested $5.1 million between 2005 and 2010 in 48 "technology capture" foreign trips and in 15 "foreign consultant service engagements" by oenologists, viticulturalists and other global experts. And to lower the risk of volatile exports for smaller producers with less widespread distribution networks as well as to increase export levels, CORFO's PROFO program and participating enterprises co-invested $11.5 million between 2005 and 2010 in a range of initiatives to learn how to best promote local wine regions. Through these investments, they developed a ready buyers' market and strengthened customer loyalty, reducing demand volatility by making it more price-inelastic.

(ii) **Investments in protection/enabling**. Chile's ideal geographical isolation (desert in the North, mountains to the East, Antarctic to the South, and Pacific to the West) has historically protected it from viticulture hazards such as the phylloxera louse. To protect this natural low-risk factor underpinning its agricultural competitiveness, Chile's government, through its Agriculture and Livestock Service (SAG), invested in rigorous zoo- and phyto-sanitary border control. An example of knowledge capital expenditures to protect vine production against disaster risks such as pests and diseases as well as climate change-induced drought and temperature variability is the co-investment of $1.2 million between 2004 and 2012 by FONDEF. The co-investment financed a major study on adapting root stock and cultivar grafting to local conditions, generating the know-how to graft local vines on North American grapevine rootstocks and thereby provide resistance to parasites. It also ensured local adaptation to changing water and temperature conditions, helped regulate the vigor of vine foliage to changing external conditions, and allowed lower-cost adaptation to changing soil salinity conditions. Other protection against increasing drought (as melt-water from the Andes diminishes) was provided by investments in drip irrigation, which also enables more precise computer control of both watering and fertilizer, but required complementary investment in worker training.

(iii) **Investments in insurance**. An example of insurance-related expenditures on knowledge capital is an investment in 2003 in a detailed census of all winemaking enterprises to document and benchmark their existing storage capacity. This stimulated investment in storage capacity as a shock absorber of volatile world wine prices together with exchange rate risk – allowing smoothing of export supply to markets depending on varying earnings potential from year to year. Investment in additional storage capacity also serves as insurance against the risk of loss of product from leaking vats as a result of unpredictable earthquakes, minimizing the marketing risks associated with foreign customers not being assured of continuous de livery of product and possibly switching to other countries' product. Finally, an example of expenditures on knowledge capital to insure against the risk of further appreciation of the exchange rate is

the co-investment of $725,000 between 2008 and 2011 by FIA and participating enterprises in R&D and an economic evaluation of sparkling wine based on a traditional low-value grape variety (Pais, or Mission in California) – which dramatically lowered the local cost of producing a good-quality sparkling export wine.

(iv) **Investments in coping/leveraging**. An example of expenditures on coping/leveraging-related knowledge capital is the $15.3 million joint public-private investment in training between 2005 and 2010 to upgrade worker skills by introducing them to increasingly sophisticated vineyard farming and winemaking techniques.

IV. LINKAGES BETWEEN KNOWLEDGE CAPITAL INVESTMENTS AND EXPORTS

IV.1 INDUSTRY-LEVEL ANALYSIS

We hypothesize that higher investments in knowledge capital over time are associated with higher exports, controlling for investments in physical capital (proxied by vine area planted) and external demand (proxied by average GDP per capita of main wine purchasing countries). To motivate the regression analysis, Figure 9 presents a scatter plot of the logged values of wine exports and R&D spending across the entire Chilean wine industry for our period of study.

Figure 9: Scatterplot of ln[R&D spending] and ln[Export Values] (1990-2012)

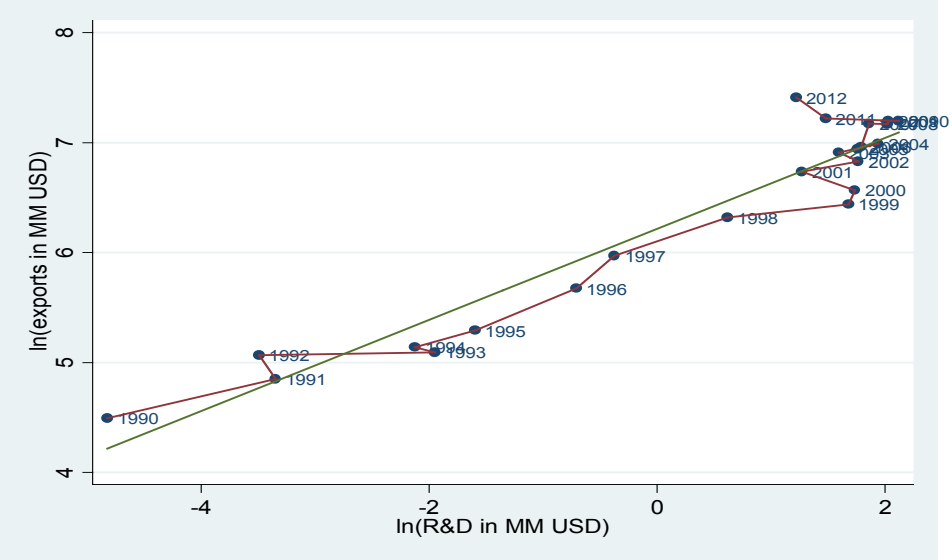
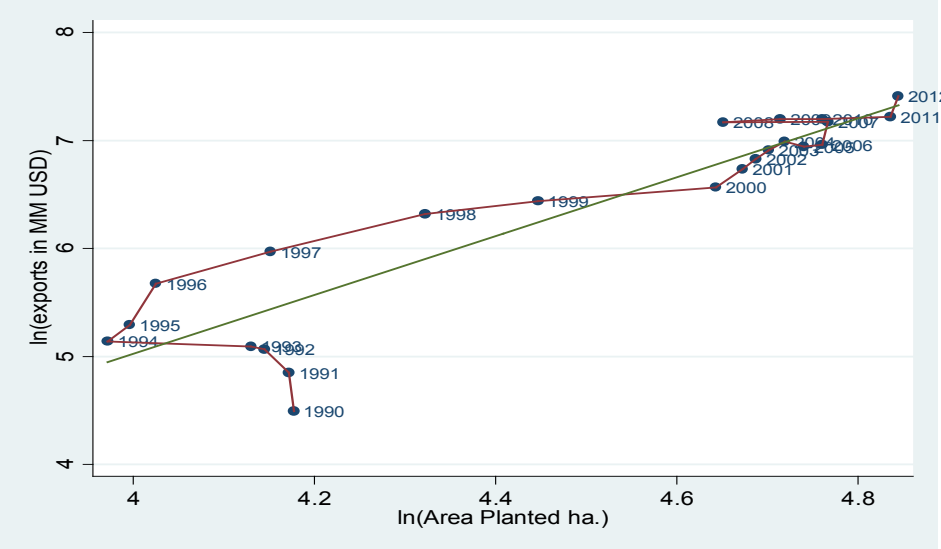


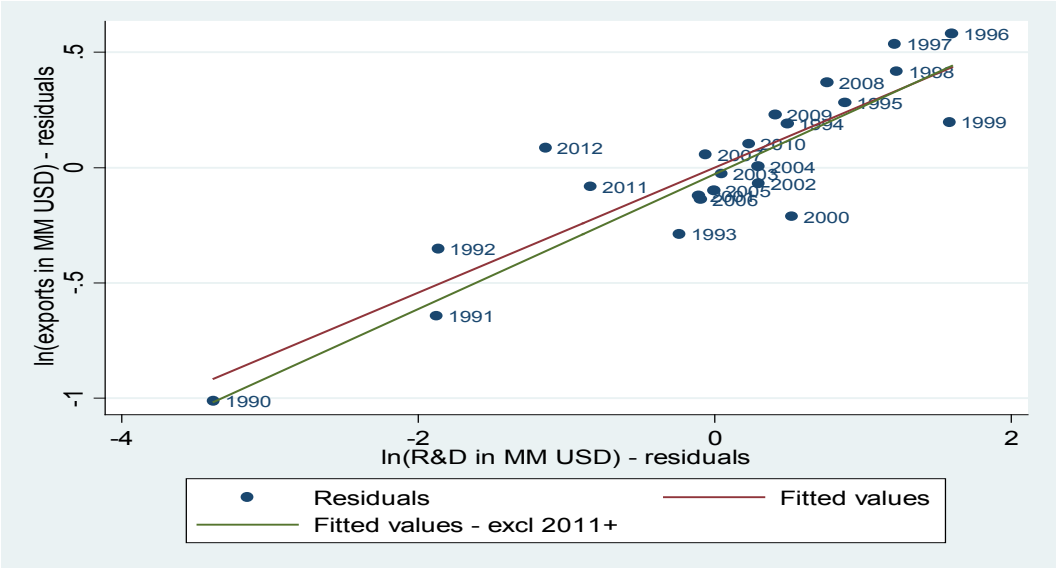
Figure 9 highlights a strong time-series trend among both export values and R&D spending. Interestingly, a sharp reduction in R&D spending in 2011 and 2012 coincides with almost no increase in exports between 2010 and 2012. Since this shows a strong time-series component, we check whether one of our main control variables, area planted, is also correlated to exports in a similar way in Figure 10. Area planted (in natural log) also has a strong time-series component; a concern is thus that the effect of R&D (or other knowledge capital variables) may just capture correlations with other determinants of exports.

Figure 10: Scatterplot of ln[Area planted] and ln[Export Values] (1990-2012)



A plot of residuals in Figure 11 of exports and R&D (after controlling for area planted) suggests that even once area planted is controlled for, there is a strong relationship between R&D and exports. Thus even after controlling for important input factors that appear similarly correlated such as area planted, R&D spending appears to remain an important determinant of export values.

Figure 11: Residuals scatterplot of ln[R&D spending] and ln[Export Values] (1990-2012) controlling for Area Planted



We now investigate the association between aggregate industry-level exports and joint public-private spending on knowledge capital via multivariate OLS regression. Our estimation approach includes values of bottled wine exports, the public policy-supported aggregated intangible expenditure types (R&D,

reputation & branding, training, and global connectivity) and two controls (area planted and a population-weighted average GDP per capita across the US, Canada, EU countries, and China to proxy for international demand). All variables are in natural logs. We vary specification choices over aggregated versus more disaggregated knowledge capital types, with separate regressions for increasing years for different lagged specifications for the area planted variable (as current-year planted area likely is only associated with exports in subsequent years, with a typical three-year or even four-year period before new vine seedlings become productive and generate bottled wine).[20] The results of these estimations are in Tables 3 and 4.

Table 3: Association of knowledge capital aggregated by type with industry-level exports

	(1)	(2)	(3)	(4)	(5)	(6)
Export output (natural log):	**Values in 2012 USD**			**Litres**		
Area planted lag:	Current	2 yrs	4 yrs	Current	2 yrs	4 yrs
Area Planted	-0.157	0.098	0.165	-0.645+	-0.473	-0.094
	(0.313)	(0.330)	(0.415)	(0.315)	(0.358)	(0.482)
R&D	0.150+++	0.161+++	0.161+++	0.133++	0.126++	0.150++
	(0.048)	(0.051)	(0.050)	(0.048)	(0.055)	(0.058)
Training	0.219	0.160	0.150	0.203	0.122	0.051
	(0.139)	(0.129)	(0.134)	(0.140)	(0.139)	(0.156)
Business Processes	-0.012	-0.006	-0.006	-0.000	-0.004	0.010
	(0.036)	(0.037)	(0.036)	(0.036)	(0.040)	(0.042)
Reputation & Branding	-0.172	-0.153	-0.158	-0.112	-0.052	-0.041
	(0.116)	(0.112)	(0.112)	(0.117)	(0.121)	(0.130)
Global Collaboration	0.019	0.004	0.007	-0.044	-0.024	-0.063
	(0.044)	(0.052)	(0.045)	(0.044)	(0.056)	(0.052)
GDP Per Capita	2.120	1.885	1.931	2.842	3.963+	2.939
(weighted average)	(1.848)	(2.021)	(1.914)	(1.860)	(2.192)	(2.225)
R-sq	0.994	0.994	0.994	0.993	0.992	0.991

Specifications have 23 observations and include an unreported constant term.

Standard errors in parentheses.

+ p<0.1, ++ p<.05, +++ p<.01

In Table 3, the only aggregate knowledge capital type that is statistically significantly positively correlated with bottled wine exports over time is R&D spending (at the 1% level). For R&D, the coefficient is relatively stable across the different lag periods, suggesting that a 10 percent increase in R&D expenditures is correlated with a 1.5-1.6 percent increase in export values, and a 1.3-1.5 percent

[20] We dummy out missing observations for the few cases in which our time series data do not extend to the beginning of analysis period.

increase in volumes. Note that the elasticity of R&D is higher for value than for volume, which suggests a positive effect of R&D on price and consumer satisfaction.

Table 4: Association of knowledge capital disaggregated by type with industry-level exports

	(1)	(2)	(3)	(4)	(5)	(6)
Export output (natural log):	**Values in 2012 USD**			**Litres**		
Area planted lag:	Current	2 yrs	4 yrs	Current	2 yrs	4 yrs
Area Planted	0.095	0.200	0.204	-0.453	-0.366	0.010
	(0.392)	(0.382)	(0.490)	(0.366)	(0.368)	(0.490)
R&D	0.118++	0.125++	0.120++	0.106++	0.108++	0.132++
	(0.049)	(0.049)	(0.047)	(0.046)	(0.047)	(0.047)
Training	0.013	-0.004	-0.006	0.044	0.012	-0.060
	(0.124)	(0.113)	(0.131)	(0.116)	(0.109)	(0.131)
Business Processes	-0.029	-0.025	-0.029	-0.012	-0.005	0.012
	(0.040)	(0.038)	(0.035)	(0.037)	(0.036)	(0.035)
Market Research	0.049	0.050	0.046	0.057	0.084	0.104
	(0.080)	(0.071)	(0.071)	(0.074)	(0.069)	(0.071)
Global Collaboration	-0.012	-0.028	-0.020	-0.061	-0.030	-0.057
	(0.041)	(0.049)	(0.044)	(0.038)	(0.047)	(0.044)
GDP Per Capita	4.440+++	4.047++	4.361+++	4.661+++	5.094+++	4.187+++
(weighted average)	(1.333)	(1.570)	(1.334)	(1.243)	(1.511)	(1.335)
R-sq	0.993	0.993	0.993	0.994	0.993	0.993

Specifications have 23 observations and include an unreported constant term.

Standard errors in parentheses.

+ p<0.1, ++ p<.05, +++ p<.01

In Table 4 we disaggregate spending on knowledge capital by type for the only expenditure type for which we have disaggregated data, reputation and branding. We include only one of the two sub-components, market research, as expenditures on market research and joint marketing support are highly correlated. Again, the coefficient for R&D is relatively stable across lag periods, suggesting that a 10 percent increase in R&D expenditures is correlated with a 1.2 percent increase in export values and a 1.1-1.3 percent increase in volumes.

IV.2 FIRM-LEVEL ANALYSIS

Firms with higher investments in knowledge capital may have higher export and domestic sales, controlling for investments in physical capital. We investigate the association between firm-level exports (and also domestic sales) and spending on knowledge capital by multivariate OLS regression, taking advantage of the constructed panel nature of the data using producer fixed effects. All variables are in natural logs. We vary specification choices over the output measure (values of exports and domestic sales) and the extent of disaggregation of our knowledge capital variables.[21] The results of these estimations are in Table 5.

In columns 1 and 2, we estimate the association of knowledge capital with export and domestic sales, aggregated according to seven types of intangibles spending, namely software, R&D, design, reputation & branding, training, business process improvements, and global collaboration. None of the seven types has a statistically significant relationship with either export or domestic sales.

In columns 3 and 4, we estimate a second (and preferred) specification in which we disaggregate spending on knowledge capital types according to available and conceptually distinct components. In particular, reputation & branding is disaggregated into spending on branding (brand creation and protection, including quality certification, brand naming, trademark registration and license fees per country), spending on local advertising (including ad outlays in local newspapers and specialized magazines, radio/TV and Internet/social networking), and spending on international wine fairs (including participation in international wine shows in the US, UK, China, Germany, Japan, Russia and Brazil). And spending on learning through global collaboration is disaggregated into outlays on foreign consultant services (with global expertise coming in-country) and technology capture trips (structured study tours with local entrepreneurs going abroad). With this additional variation in the data, spending on international wine fairs and on foreign consultant services are both statistically significantly positively correlated with export sales (with the former at the 1% level), while spending on local advertising is statistically significantly positively correlated with domestic sales. Interestingly, spending on international wine fairs has a negative correlation with domestic sales, though this is only at the 10% level of significance; in principle, enterprises that spend more on global brand promotion could be doing so in response to a product mix shift from local to foreign sales. Alternatively, the spending on global brand promotion itself could be resulting in an increase in export demand over time with a diversion in production from domestic to export sales. One additional statistically significant variable is spending on design, which is positively associated with local sales while negatively associated with exports (though only at the 10% level of significance). This could reflect design expenditures (outlays on label, bottle shape design and other elements that provide a distinct image beyond the "name brand") being more sensitive to local than global tastes. Finally, it is interesting that the sizeable spending by firms on branding does not have a statistically significant association with either export or domestic sales in these data. However, this could reflect the much longer asset life of brands; with an average asset life of ten

[21] We dummy out missing observations for the few cases in which enterprise respondents did not supply a response.

years, it is conceivable that spending in prior years would be influencing 2009-2011 sales, and that current spending would be contributing to asset values and sales over the subsequent years.[22]

Table 5: Association of knowledge capital with firm-level export/ domestic sales

	(1)	(2)	(3)	(4)
Sales (natural log in 2012 USD):	Export	Domestic	Export	Domestic
Physical Capital Investment	-0.005	0.097	0.057	0.101
	(0.137)	(0.211)	(0.121)	(0.193)
Software	0.017	-0.066	-0.010	-0.073
	(0.040)	(0.062)	(0.038)	(0.061)
R&D	-0.020	-0.002	-0.056	-0.200
	(0.264)	(0.407)	(0.233)	(0.372)
Business Process Improvement	-0.023	-0.054	0.021	-0.024
	(0.153)	(0.236)	(0.136)	(0.217)
Design	-0.084	0.206	-0.213+	0.599+++
	(0.105)	(0.162)	(0.120)	(0.192)
Training	-0.000	0.078	0.021	0.075
	(0.077)	(0.119)	(0.067)	(0.106)
Reputation and Branding	0.038	-0.008		
	(0.046)	(0.071)		
Branding			-0.029	-0.020
			(0.051)	(0.081)
Local Advertising			-0.180	1.734+++
			(0.354)	(0.566)
International Wine Fairs			0.464+++	-0.329+
			(0.121)	(0.193)
Global Collaboration	0.124	-0.062		
	(0.079)	(0.122)		
Foreign Consultant Services			0.199++	0.042
			(0.086)	(0.138)
Technology Capture Trips			0.016	-0.179
			(0.094)	(0.150)
R-squared	0.077	0.069	0.377	0.325

Specifications have 72 observations and include an unreported constant term.

Standard errors in parentheses.

+ p<0.1, ++ p<.05, +++ p<.01

[22] In an unreported alternative specification, we disaggregate total spending on training into outlays on management versus worker upgrading. While neither of these expenditures is statistically significantly associated with either export or domestic sales, all the other statistically significant results are preserved in this specification.

A key conclusion of the enterprise-level analysis is the importance of carefully disaggregating intangible asset expenditures into specific components that are likely to have an association either with export or domestic sales. An exploration of correlates at too high a level of aggregation may mask statistically significant associations in the underlying constituent variables.

V. CONCLUSIONS

This study has examined the extent to which firms in a developing country invest in particular types of knowledge capital, and the association between these investments and key outcome variables. The study has assembled novel data at the industry and firm levels to test two hypotheses: (i) that spending on knowledge capital is a statistically significant and economically important correlate of growth as reflected in exports, both at industry and firm levels; and (ii) that spending on reputation & branding and on learning through global collaboration that connects firms to better existing knowledge are both statistically significant and economically more important at the firm level than other types of knowledge capital. Our findings support these hypotheses.

The paper began by documenting the extent of within-firm structural change in the Chilean wine industry as reflected in the evolution of export volumes and values over time. We also documented the extent of public and private investments in innovation capabilities through seven key types of knowledge assets, namely software, R&D, design, reputation & branding (outlays on market research, branding, local advertising and international wine fairs; joint marketing support), training (outlays on worker and manager skills upgrading), business process improvement, and learning through global collaboration (primarily outlays on foreign consultant services and technology capture trips). We found that the extent of public sector funding of knowledge capital in the Chilean wine industry over the period 1990-2012 was large, sustained, multi-faceted, and growing over time. Based on firm-level responses, we found that the average life lengths across all assets types are comfortably greater than one year, strongly supporting the case for capitalizing these intangible assets. We also documented linkages between investments in knowledge capital and enterprise risk management. We provided evidence that there may be an important association between investments in knowledge, protection/enabling, insurance and coping/leveraging assets in the Chilean wine industry and the decrease in the monthly volatility of export volumes (and values) over the 1990-2012 period.

We explored empirically the association between investments in different types of knowledge capital and export growth at both industry and firm levels. At the industry level, our findings suggest that a 10 percent increase in R&D spending is correlated with a 1.2 percent increase in export values and a similar increase in volumes, with a significant role played by a demand side control variable (GDP per capita of major export destinations). At the firm level, we find that expenditures on international wine fairs (a component of reputation & branding) and foreign consultant services (a component of global collaboration outlays) are both statistically significantly positively correlated with export sales.

The study raises a number of issues for further study. It suggests that more carefully measuring intangible investments across a more detailed breakdown of types of assets and across more firms would be beneficial. In particular, the large magnitude and statistical significance of R&D investments at the

industry level (mainly public but also private outlays) relative to the small magnitude and lack of statistical significance at the firm level suggest that a more disaggregated and more carefully posed set of questions on research expenditures and particularly on development outlays (the "D" side of R&D) may be required to better capture different types of R&D expenditures at the firm level. Finally, aggregated outlays across different sub-types of investments in reputation & branding and global collaboration are not statistically significant. But more disaggregated outlays allow the relative impact on domestic versus export sales to be disentangled—suggesting the importance of collecting data on more narrowly-defined intangible variables in better understanding the various drivers of within-firm productivity.

The methodologies developed to measure and analyze public and private investments in knowledge capital at the industry and firm levels are more broadly applicable. First, a modified version of the firm-level questionnaire developed and tested as part of this study should in principle be relevant for a better understanding of the within-firm knowledge-related productivity drivers of other agriculture, manufacturing and service industries. This may be particularly insightful for commodity-based industries—such as agro-food processing industries including key agricultural crops, meat and milk products as well as forestry and mining processing industries—where there may not be a sufficient appreciation of the value for business competitiveness of investing in knowledge assets. It is hoped that this study may provide inspiration for future work seeking to better understand the association between knowledge capital and industry- and firm-level productivity. Second, the public-private dimension of the paper raises questions about the appropriability of the publicly-generated benefits by individual firms. There is little doubt that a public program to increase the visibility of Chilean wines in world markets, if successful, would help the representative private firm, but by how much and in what form? Would a positive impact of such investment be captured in the return to existing categories of knowledge capital or would this be more appropriately measured through a new additional category of knowledge capital? Should investments in public asset stocks for the industry be measured separately from the private stocks, and if so, how do they overlap with the private stocks? These are questions to be addressed in further work. Finally, it is hoped that this study may assist in the design of more effective policies to stimulate productivity in a way that helps build shared prosperity for the bottom 40 percent of each country's population – by spurring further studies to better understand the linkages between support policies and investments in particular types of knowledge capital that help generate more and better jobs over time for the less well-off people in each country.

REFERENCES

Andersen, Kym and Signe Nelgen (2011). *Global wine markets, 1961 to 2009: A statistical compendium,* Adelaide: University of Adelaide Press.

Awano, Gaganan, Mark Franklin, Jonathan Haskel and Zafeira Kastrinaki (2010a). "Measuring investment in intangible assets in the UK: Results from a new survey", *Economic & Labour Market Review,* 4(7), 66-71, July.

Awano, Gaganan, Mark Franklin, Jonathan Haskel and Zafeira Kastrinaki (2010b). "Investing in innovation: Findings from the UK investment in intangible asset survey", London: UK NESTA Index Report, July.

Bartelsman, Eric J. (2012). "Social and Labor Market Policy in a World of Affluence and Abundance", Mimeo, August.

Bloom, Nicholas, Stephen Bond and John Van Reenen (2007). "Uncertainty and Investment Dynamics", *Review of Economic Studies*, 74: 391-415.

Bollard, Albert, Peter Klenow and Gunjan Sharma (2013). "India's Mysterious Manufacturing Miracle", *Review of Economic Dynamics*, 16: 59-85.

Canuto, Otaviano, Mark Dutz and Jose Guilherme Reis (2010), "Technological Learning and Innovation: Climbing a Tall Ladder", Chapter 2 in Otaviano Canuto and Marcelo Giugale (eds.), *The Day After Tomorrow: A Handbook on the Future of Economic Policy in the Developing World*, Washington, DC: The World Bank.

Corrado, Carol and Charles Hulten (2010). "How do you measure a 'Technological Revolution'?" *American Economic Review* 100 (5): 99-104.

Corrado, Carol, Charles Hulten and Daniel Sichel (2005). "Measuring Capital and Technology: An Expanded Framework", In Corrado, D., Haltiwanger, J. and Sichel D. (eds.), *Measuring Capital in the New Economy, Studies in Income and Wealth*. Vol 65, 11-45. Chicago: The University of Chicago Press.

Corrado, Carol, Charles Hulten and Daniel Sichel (2009). "Intangible Capital and Economic Growth". *Review of Income and Wealth*. 55 (3): 661-85.

D'Erasmo, Pablo N. and Hernan J. Moscoso Boedo (2012). "Intangibles and Endogenous Firm Volatility over the Business Cycle", mimeo, University of Maryland.

Dutz, Mark A. (2013a). "Investments in Productivity: KBC as a driver of Growth and Structural Change", *PRMED Growth FAQ Note*, The World Bank.

Dutz, Mark A. (2013b). "Resource Reallocation and Innovation: Converting Enterprise Risks into Opportunities", Background paper for WDR 2014: Managing Risk for Development, *Policy Research Working Paper 6534*, Washington, DC: The World Bank.

Dutz, Mark A., Sergio Kannebley, Jr., Maira Scarpelli and Siddharth Sharma (2012). "Measuring intangible assets in an emerging market economy: An application to Brazil", *Policy Research Working Paper 6142,* July, Washington, DC: The World Bank.

Eichengreen, Barry, Donghyun Park and Kwanho Shin (2013). "Growth Slowdowns Redux: New Evidence on the Middle-Income Trap", *NBER Working Paper 18673*, Cambridge MA.

Ehrlich, Isaac and Gary S. Becker (1972), "Market Insurance, Self-Insurance, and Self-Protection", *Journal of Political Economy* 80(4): 623-48.

Giuliani, Elisa, Andrea Morrison and Roberta Rabellotti (2011). *Innovation and technological catch-up: The changing geography of wine production*. Cheltenham, UK: Edward Elgar.

Haltiwanger, John, Jonathan Haskel and Alicia Robb (2009). "Extending firm surveys to measure intangibles: Evidence from the United Kingdom and United States", December, mimeo, University of Maryland.

Hsieh, Chang-Tai and Peter J. Klenow (2014). "The Life Cycle of Plants in India and Mexico", *Quarterly Journal of Economics*, forthcoming.

Hulten, Charles (2013). "Stimulating Economic Growth through Knowledge-based Investment", *STI Working Paper 2013/2*, DSTI/DOC (2013)2, Paris, OECD.

Hulten, Charles and Janet Hao (2012). "The Role of Intangible Capital in the Transformation and Growth of the Chinese Economy", *NBER Working Paper 18405*, September.

Intangible Business (2013, 2012, 2011.. 2006). *The Power 100: The world's most powerful spirit and wine brands",* UK: Intangible Brands.

Janeway, William H. (2012). *Doing Capitalism in the Innovation Economy: Markets, Speculation and the State*, Cambridge UK: Cambridge University Press.

Kunc, Martin and Tomas G. Bas (2009). "Innovation in the Chilean wine industry: The impact of foreign direct investments and entrepreneurship on competitiveness", *American Association of Wine Economists Working Paper 46*, September.

Mazzucato, Mariana (2013). *The Entrepreneurial State: Debunking Public vs Private Myths in Risk and Innovation*, UK: Anthem Press.

Moreira, Victor H., Javier L. Troncoso and Boris E. Bravo-Ureta (2011). "Technical efficiency for a simple of Chilean wine grape producers: A stochastic production frontier analysis", *Ciencia e Investigacion Agraria*, 38 (3), 321-9.

Nakamura, Leonard (2001). "What Is The U.S. Gross Investment In Intangibles? (At Least) One Trillion Dollars A Year!" *Federal Reserve Bank of Philadelphia Working Paper No. 01–15*.

OECD (2013). *New Sources of Growth: Knowledge-Based Capital Key Analyses and Policy Conclusions*, Meeting of the Council at Ministerial Level, May, Paris (C/MIN(2013)6).

OECD (1998). *Measuring Intangible Investment: National Efforts to Measure Intangible Investment*, OECD Secretariat.

Rivas, Gonzalo (2012). *La experiencia de CORFO y la transformacion productive de Chile: Evolucion, aprendizaje y lecciones de desarollo.* Serie Politicas Publicas y Transformacion Productiva. Interamerican Bank for Development.

Sheffi, Yossi (2005). *The Resilient Enterprise: Overcoming Vulnerability for Competitive Advantage*, Cambridge, MA: MIT Press.

Troncoso, Javier L., and M. Aguirre (2006). "Price determination of Chilean wines in the US market: A hedonic approach", *Spanish Journal of Agricultural Research*, 4(2): 124-9.

Vergara, Sebastián (2001). "El mercado vitivinícola mundial y el flujo de inversión extranjera en Chile". Serie de Desarrollo Productivo No. 102, Comisión Económica para América Latina y El Caribe (CEPAL). Santiago de Chile.

World Bank (2013). *World Development Report 2014: Risk and Opportunity – Managing Risk for Development,* Washington, DC: The World Bank.

Appendix: Survey of Investments in Knowledge Capital

Purpose of this survey

ODEPA and the World Bank, with the sponsorship of Vinos de Chile, are seeking to develop a more complete view of the wine industry's spending on knowledge-intensive intangible or "soft" assets that have no physical embodiment and that contribute to the firm's productivity and profits over the longer term, namely spending on improvements in skills, better software, improved reputation and branding, R&D, better design, business process improvements, and other investments that connect your firm to better existing global product knowledge. We are interested in measuring all spending on such knowledge-based assets whenever today's resources are invested in order to increase profits in the future, irrespective of your existing accounting practices (even if many of these expenditures are not currently measured or treated by you or by other firms in your country as capital investments). Your help is very much appreciated in collecting these data on knowledge building. Summary results of this survey will be made available to you. It is hoped that they will both help you directly (to benchmark yourself against other firms in the industry) and help to develop improved support policies for your industry. This is your opportunity to contribute.

Coverage and Reporting period

This survey exclusively covers firms that produce bottled wine for the domestic and/or export markets. Please report figures for calendar (January through December) years 2009, 2010 and 2011 wherever relevant and available; otherwise, please indicate time period coverage.

Section A – Professional qualifications of the interviewee and Status of the firm

1.1 Name: Company:

Position:

Professional degree: University:

Graduation year:

1.2 Language skills:

Mother tongue: _____

Please mark one of the alternatives for each non-Spanish language:

	English	French	German	Other: _____
No knowledge of language				
Rudimentary knowledge of written and spoken language. Limited vocabulary				
Average command of the language, written and spoken. Can follow instructions, prepare reports and communicate effectively				
Fluent. Communicates with no difficulty in the written and spoken language				

2.1. Specify the **total production size** of your firm:
2009: area planted_____ (hectares); wine processing capacity_____ (mn litres)
2010: area planted_____ (hectares); wine processing capacity_____ (mn litres)
2011: area planted_____ (hectares); wine processing capacity_____ (mn litres)

2.2a Specify the **total domestic and export sales revenues** of your firm's wine production:
2009: _____(domestic sales, mn pesos); _____(exports, thous. USD)
2010: _____(domestic sales, mn pesos); _____(exports, thous. USD)
2011: _____(domestic sales; mn pesos); _____(exports, thous USD)

2.2b Specify the breakdown of your TOTAL revenues from your wine sales (in rough %) according to the following categorization of **wine quality**:

Quality (US$/case of 12 bottles)	National market (%)	Export market (%)
More than 100		
80 – 99		
60 – 79		
40 – 59		
20 – 39		
Less than 20		

2.3 Specify the percentage of your 2011 exports that your firm made through direct negotiations with the following intermediaries (to provide a sense of the extent of learning through your marketing channels, etc.):

2011 exports (%)

(a) Stores specializing in wines and liquors
(b) Supermarkets
(c) Wholesale firms
(d) Importers

2.4 Extent of firm's **foreign ownership** (%):
2009: _____
2010: _____
2011: _____

2.5 Specify the **total foreign investment** of your firm in foreign wine production, if any:
2009: _____(thous. USD)
2010: _____(thous. USD)
2011: _____(thous USD)

2.6 Specify **the total annual investment in physical (tangible) capital** of the firm (including any investments in vineyard establishment/upgrading, equipment and tools, vehicles, irrigation and mechanical pruning/ harvesting, winery plant, machinery and buildings, **but not land**):
2009: _____(thous USD)
2010: _____(thous USD)
2011: _____(thous USD)

2.7 **Year of construction** of firm's first winery (bodega): _____

2.8 **Geographic valley of location** of firm's main vineyard(s)/ most important grape purchases:
(i) _____; (ii) _____
(iii) _____; (iv) _____

Section B – Investments in intangible assets

3. In your firm's Balance Sheet (current and recent years), please respond to the following questions if the concept of "intangible assets" appears in your financial accounts:

3.1 Indicate with an X the concepts included as "intangible assets":

Patents and brands _____

Software and information systems _____

Water rights _____

Other (please specify) _____

3.2 Please include, based on your firm's financial accounts, the values of intangible assets over the years 2009-2011.

Year	Patents and brands ($, 000s)	Software and info systems ($, 000s)
2009		
2010		
2011		

Section C – Enterprise-funded Training and Staff Development

4. During the past three years, did your firm fund any training of your employees? This refers to training of managers, staff and field labourers, whether purchased from external organizations (with training provided on-site or elsewhere), or in-house spending by the firm's own personnel. Examples include training in IT systems, new production equipment, ISO or EUREPGAP accreditation, etc.
Yes → Go to question 5
No → Go to question 9

5. Refer first to the purchased, externally-provided training provided by other organizations received by your managers, and your vineyard (field) and winery workers.
5.1 Specify the external training programs offered to your workers.
2009: _____
2010: _____
2011: _____

5.2 Indicate the ***total cost of this training by external suppliers, and the percentage that can be attributed to Government subsidies (e.g. Sence),*** for those cases where subsidies apply (so that we can calculate the actual expenditures incurred by your firm for the training). Include tuition payments by the firm for job-related education at universities and other schools.

	Total Cost ($'000)	Subsidy (%)
2009		
2010		
2011		

5.3 Specify the external training programs offered to your managerial staff and office clerks.
2009: _____
2010: _____
2011: _____

5.4 Indicate the ***total cost of this training by external suppliers, and the percentage that can be attributed Government subsidies (e.g. Sence),*** for those cases where subsidies apply.

	Total Cost ($'000)	Subsidy (%)
2009		
2010		
2011		

6a. What, if any, was the firm´s <u>in-house spending</u> on staff training carried out by its own staff, for both vineyard and winery workers, and managerial staff and clerks?

Indicate the ***total cost of this training by the firm's own personnel, and the percentage that can be attributed Government subsidies (e.g. Sence),*** for those cases where subsidies apply. Include staff costs for the development and delivery of training, any travel and subsistence payments, wage costs for the time employees participate in both externally-provided and in-house developed training, books/magazines and newsletters, and associated costs such as providing facilities, overheads and materials but not capital costs.

	Total Cost ($'000)	Subsidy (%)
2009		
2010		
2011		

6b. On average, how many TOTAL days training (both externally purchased and in-house provided) did your personnel receive during the period 2009-2011?

- Vineyard and winery workers: 2009 _____
  2010 _____
  2011 _____

- Managerial staff and clerks: 2009 _____
  2010 _____
  2011 _____

7. On average what is your estimate of the time in years that your firm will benefit from investments in a given year in training?

- Years: _____

<u>Section D – Software</u>

8. During the past three years, did your firm purchase or develop any software? This refers to the purchase of external software and in-house software development. Include operating systems, commercial general purpose applications (e.g. Office, Softland, Defontana ERP) and customized software systems, databases, the design of new types of software, etc. Exclude software development conducted as part of R&D, which should be included in Section E.

Yes → Go to question 9

No → Go to question 12

9. What was your firm's expenditure on <u>purchased, externally-provided</u> software by other organizations? Include off-the-shelf software, software licenses and license renewals, for generic as well as customized software. Exclude software embedded in other items of current or capital expenditure, such as software pre-installed on IT hardware.

9.1 Specify the software purchased by your firm in the years:

- 2009: _____
- 2010: _____
- 2011: _____

9.2 Estimate the total cost of these purchases:

- 2009: _____ (MM$)
- 2010: _____ (MM$)
- 2011: _____ (MM$)

10. What was your firm's expenditure on software <u>developed in-house</u> by your own staff? Include: (i) Staff costs of all staff involved; (ii) Associated costs, including office facilities, overheads and materials but not capital costs. Estimates based on proportions of staff time are acceptable.

- 2009: _____ (MM$)
- 2010: _____ **(**MM$)
- 2011: _____ (MM$)

11. On average what is your estimate of the time in years that your firm will benefit from investments in a given year in software?

- Years: _____

<u>Section E – Reputation and Branding</u>

12. During the past three years, did your firm spend on any external or internal work intended to enhance the firm's reputation or the value of its existing or new brands (sales and marketing expenditures, including quality and standard certification)? This refers to spending related to international trade fairs, product launches, promotion campaigns, the development of promotional materials, etc. We would appreciate obtaining the separated costs for firm-specific advertising, and your contribution to collective/public advertising/branding of Chilean wine (e.g. your region, organic/ecological, high-quality wines, generic "Chilean wine"). Exclude expenditures on graphic/physical design, which should be included in Section F.

Yes → Go to question 13

No → Go to question 16

13. List and estimate the <u>purchased, external costs</u> of the different activities provided by other organizations to enhance the reputation or brand value of your wines. Include all external costs paid for by your firm for support service providers and trade fair providers, advertising and marketing campaign providers, media organizations, suppliers of market research and marketing databases, etc, in Chile and abroad, for: (i) wine fairs and shows; (ii) media advertising and marketing campaigns, (iii) branding.

13.1.1 <u>Wine fairs and shows</u>:

- 2009: _____
- 2010: _____
- 2011: _____

13.1.2 Estimate the total external cost of these activities to your firm. If there are subsidies from Prochile or other Governmental institutions, estimate the value of these contributions.

	Cost for my firm ($'000)		Subsidy ($'000)
	(i) for own products	(ii) contribution to collective advertising	
2009			
2010			
2011			

13.2.1 Media advertising campaigns: Indicate the media where you have advertised your wines (TV, radio, specialized magazines, websites, other) in the years indicated below:

- 2009: _____
- 2010: _____
- 2011: _____

13.2.2 Estimate the total external cost of these activities for your firm. If there are subsidies from Prochile or other Governmental institutions, estimate the value of these contributions.

	Cost for my firm ($'000)		Subsidy ($'000)
	(i) for own products	(ii) contribution to collective advertising	
2009			
2010			
2011			

13.3.1 Branding: List below the different brands your firm owns.

- List of Brands: _____
- Brands created within the period 2009-2011: _____

13.3.2 Estimate of the external cost of creating all new brands over the past three years, if any: Include here the fees charged by the advertising agencies, the cost of registering a trademark in the Departamento de Patentes y Marcas, the cost of certifying specific quality attributes (e.g. specific denomination, quality control, organic, etc.) and all other related external expenditures.

	Cost for my firm ($'000)		Subsidy ($'000)
	(i) for own products	(ii) contribution to collective branding	
2009			
2010			
2011			

14. What were your firm's total <u>in-house expenditures</u> on reputation and branding by your own staff? Include: (i) Staff costs of all staff involved, e.g. any sales and marketing personnel and product managers, or the proportional cost of staff spent on reputation and branding activities, including staff time attending wine fairs, working on media campaigns, and helping develop brands; (ii) Associated costs, including office facilities, overheads and materials but not capital costs. Estimates based on proportions of staff time are acceptable.

- 2009: _____ (MM$)
- 2010: _____ **(**MM$)
- 2011: _____ (MM$)

15. On average what is your estimate of the time in years that your firm will benefit from investments in a given year intended to enhance the reputation and branding of your wines?

- Years: _____

<u>Section F – Research and Development (R&D)</u>

16. During the past three years, did your firm fund any external or internal R&D work to create and apply <u>new knowledge</u>? This refers to original investigation or experimentation to acquire new knowledge, or adapt and apply existing knowledge to new contexts (e.g. different soil or climate conditions), or the design of new mixes of wines or yeasts or new strains of grapes (e.g. new fermentation or enzyme technology, technologies controlling grape vine growth rates, adaptation and calibration of weather and irrigation systems to local conditions, soil conservation techniques, etc.).
Yes → Go to question 17.1
No → Go to question 20

17.1 **List <u>external, purchased</u> R&D projects undertaken by other organizations,** either local or international universities, public research organizations, or other entities (technology transfer organizations, research consortia, consultants, etc.). Include bought-in R&D services.

- 2009: _____
- 2010: _____
- 2011: _____

17.2 Estimate your firm's spending on all such projects, if any, and other external R&D costs including licenses and related fees paid for any intellectual property or other forms of R&D-driven technology transfer:

- 2009: _____ (MM$)
- 2010: _____ **(**MM$)
- 2011: _____ (MM$)

18. What was your firm's expenditure on R&D <u>conducted in-house</u> by your own staff? Include: (i) Staff costs of all staff involved; (ii) Associated costs, including use of laboratory facilities, overheads and materials but not capital costs. Estimates based on proportions of staff time are acceptable.

18.1 List the projects developed during 2009 through 2011, either funded entirely by your firm or co-funded by Governmental institutions (e.g. Fondef, Fondecyt, Innova, FIA).

- 2009: _____
- 2010: _____
- 2011: _____

18.2 Estimate your firm's spending on all such projects, if any:

- 2009: _____ (MM$)
- 2010: _____ (MM$)
- 2011: _____ (MM$)

19. On average what is your estimate of the time in years that your firm will benefit from investments in a given year in R&D?

- Years: _____

Section F – Design

20. During the past three years, did your firm fund any external or internal design work? This refers to design work including (i) label design; (ii) bottle design; (iii) any other graphic product aimed at providing a distinct image to your wines. Exclude design of new mixes of wines or yeasts (part of R&D) and design of software (part of software).

Yes → Go to question 21

No → Go to question 24

21. What was your firm's spending on purchased, externally-provided design services by other organizations? Include costs of bought-in design services. Exclude costs of design embedded in other items of current or capital expenditures.

- 2009: _____ (MM$)
- 2010: _____ (MM$)
- 2011: _____ (MM$)

22. What was your firm's spending on design work developed in-house by your own staff? Include: (i) Staff costs of all staff involved, e.g. graphic designers, product designers, etc.; (ii) Associated costs, including office facilities, overheads and materials but not capital costs. Estimates based on proportions of staff time are acceptable.

- 2009: _____ (MM$)
- 2010: _____ (MM$)
- 2011: _____ (MM$)

23. On average what is your estimate of the time in years that your firm will benefit from investments in a given year in design?

- Years: _____

Section H – Business Process Improvement

24. During the past three years, did your firm fund any external or internal work on business process (or organizational) improvement? This refers to work on improving the efficiency and effectiveness of the business, including business strategy development and implementation, improved inventory systems, changes in the organizational layers of the firm and greater worker empowerment, etc. Exclude software spending included in Section C.

Yes → Go to question 25

No → Go to question 28

25. What was your firm's spending on purchased, externally-provided business process improvement services undertaken by other organizations? Include costs of bought-in management consulting services.

- 2009: _____ (MM$)
- 2010: _____ (MM$)
- 2011: _____ (MM$)

26. What was your firm's spending on business process improvement work developed in-house by your own staff? Include: (i) Staff costs including those who do this as part of their everyday jobs, e.g. managers working to improve general business processes; (ii) Associated costs, including office facilities and overheads for staff but not capital costs. Estimates based on proportions of staff time are acceptable.

- 2009: _____ (MM$)
- 2010: _____ (MM$)
- 2011: _____ (MM$)

27. On average what is your estimate of the time in years that your firm will benefit from investments in a given year in business process improvement?

- Years: _____

Section I – Connecting and Collaboration with global product knowledge

28. During the past three years, did your firm fund any other (non-training, non-reputation and branding, non-R&D, non-business process) investments to learn about and apply better global practices and other relevant existing knowledge? This refers to spending on external viticulture and oenology consultants, on university and public research organization experts, on laboratory and testing service contracts for certification, on global value chains and corporate partners, on wholesale/retail distributors and other marketing channel providers, and other individuals and organizations that facilitate learning and transfer of existing technologies, as well as in-house spending by the firm's own personnel to learn from global knowledge, such as travel for the purpose of learning about better existing practices. "Global" knowledge explicitly includes better existing local, regional, national and international knowledge. Exclude tuition payments by the firm for job-related education at universities and other schools, which should be included in Section B.

Yes → Go to question 29

No → Go to question 31

29. What was your firm's spending on <u>purchased, externally-provided</u> global knowledge services undertaken by other organizations?

29.1 List here the viticulture and oenology consultants (not management consultants, but including university researchers that serve as bridges to global knowledge) or other external expert individuals or organizations your firm hired to connect you to existing global knowledge about your products (related to vineyards and wineries) and their specialties:

- 2009:
  Expert: _____ Specialty: _____
  Expert: _____ Specialty: _____
  Expert: _____ Specialty: _____
  Expert: _____ Specialty: _____
- 2010:
  Expert: _____ Specialty: _____
  Expert: _____ Specialty: _____
  Expert: _____ Specialty: _____
  Expert: _____ Specialty: _____
- 2011:
  Expert: _____ Specialty: _____
  Expert: _____ Specialty: _____
  Expert: _____ Specialty: _____
  Expert: _____ Specialty: _____

29.2 Estimate the total cost of all such external expert-related activities for your firm. If you participated of the FAT ("Fondo de Asistencia Técnica") program of Corfo, estimate the value of their contribution.

	Cost for my firm ($'000)	Subsidy ($'000)
2009		
2010		
2011		

30. What was your firm's spending on connecting to and learning about global knowledge <u>conducted in-house</u> by your own staff?

30.1 Has your firm made use of technological capture missions and conference participation in the period 2009-2011?
Yes → Go to question 30.2
No → Go to question 30.4

30.2 List the firms/conferences and countries visited:

- 2009:
  Firm/Conf: _____ Country: _____
  Firm/Conf: _____ Country: _____
  Firm/Conf: _____ Country: _____
- 2010:
  Firm/Conf: _____ Country: _____
  Firm/Conf: _____ Country: _____
  Firm/Conf: _____ Country: _____
- 2011:
  Firm/Conf: _____ Country: _____
  Firm/Conf: _____ Country: _____
  Firm/Conf: _____ Country: _____

30.3 Estimate the total cost of these investments for your firm. If you participated in the "Viajes de captura tecnológica" program of Corfo, estimate the value of their contribution.

	Cost for my firm ($'000)	Subsidy from CORFO ($'000)
2009		
2010		
2011		

30.4 Does your firm belong to a wine-related trade association (e.g. Vinos de Chile, Corporación Chilena del Vino, etc)?
Yes → Go to question 30.5
No → Go to question 30.7

30.5. List the associations you are a member of:

- _____
- _____
- _____

30.6 Estimate the total annual cost to your firm that belonging to the associations named above imply to your firm. If you are part of a Profo, estimate the amount of the annual subsidy.

	Cost for my firm ($'000)	Subsidy ($'000)
2009		
2010		
2011		

30.7 Estimate any other spending by your firm on connecting to and learning about global knowledge conducted in-house, including any additional network-building investments by your own staff, including any investments associated with learning from your own foreign investments in vineyards and/or wineries, if any?

- 2009: _____ (MM$)
- 2010: _____ (MM$)
- 2011: _____ (MM$)

We thank you for completing our questionnaire.