Job Training Determinants, R&D and Effects on Firms' Productivity

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Evidence from Firm-Level Data in Latin America

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Abstract

For many decades, Latin America followed an import-substitution industrialization (ISI) process. Constant technological developments, complex production processes and stronger international competition put in evidence some workforce fragilities, their lack of skills and capabilities. Enhancing investments in both job training and R&D may be a proper reaction for either the more immediate needs or the medium/long run structural demands, in Latin America. Exploring a firm-level dataset from Chile and Argentina, we estimate the firms' training decision (standard probit model) and the productivity effects through OLS, treatment-effects model and instrumental variable, using industry and region fixed effects and clustered standard errors. Using OLS, training estimates on firms' performance are 24% in Chile and 18% in Argentina. Joint investment in training and R&D leads job training to have an effect of 53% in Chile and 22% in Argentina, and R&D a magnitude of 9% in Chile and 5% in Argentina, which seems to evidence a complementarity relationship between these two policies. Although with different magnitudes, conclusions remain consistent using OLS, treatment-effects and IV. Firms' heterogeneity is also accounted for, estimating a quantile model.

JEL Classification: M53, O32, J24, C21, C26,

Keywords: Job Training; Incidence of job training; Firms productivity; Innovation and R&D; firm-level data

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1. Introduction

Inequalities of income and opportunities with a particular emphasis in developing and in transition economies have amplified the discussion around the potential effectiveness of the investment in human capital by boosting firms' performance and promoting economic growth (Lucas 1988, Romer 1990, United Nations 2013). Constant technological developments and complex production processes, stronger international competition and changes on consumer demand are challenges contributing to a faster depreciation of the human capital acquired via formal education[2] (Bauernschuster et al 2009). Exploring complementarities between the education systems, formal job training programs and the investment in new technologies (Baldwin et al. 1995, Tan and Batra 1996) as well as guaranteeing an adequate public support and promoting *lifelong learning* procedures may be a proper reaction to route the workers' upgrading skills[3] (United Nations 2001, Konings 2008, Toner 2011).

The possible success a firm may achieve is dependent on how dynamic, flexible and adaptable its strategy and structure are and on the firm's capacity to hire competencies and to train its workforce such that it is prepared to positively react to new technological products (and services) and organizational schemes (Baldwin et al. 1995, Baldwin 1999). Although the study of the firms' investment in physical capital is still assuming a greater supremacy, there have been a rising number of analyses on the human capital role. Following Barret and O'Connell (1999), we should interpret job training as a production activity, being the output higher human capital that is dependent from the firms' strategy and the workers' commitment in acquiring new skills[4]. The firm decision to train its labor force should be understood as being a particular element within a more multifaceted puzzle, where interactions between firms' characteristics, their

[2] "Continuous training was considered a key to developing human skills in the context of rapid technological change. As East Asian countries became more sophisticated, pressures emerge for governments and firms to provide effective education and training systems." in United Nations (2001), pp. 86.
[3] "Contrary to perception, an abundance of low-wage and low-skill labor is not enough. Even assembling components made elsewhere can be complex, requiring individual skills and social competencies to coordinate and organize on a large scale." in United Nations (2013), pp. 50.
[4] Barret and O'Connell (1999) express that employees should not be seen as "mechanical black-boxes into whom training is injected" meaning that workers' commitment, behavior and effort are likely to influence the final result of the firms' investment in job training programs. Hannum (2009) affirms that "learning requires a context" and so, training effectiveness is better ensured when training environment and workplace are the same. On-the-job training programs permit to answer individually to workers' needs, in contrast with a strategy of "one-size-fits-all".

technological endowments and the workers' skills may occur (Baldwin et al. 1995, Baldwin 1999).

Our study intends to shed some light on the firms' performance resulting from their investments in both job training programs and R&D[5], considering two Latin American countries, Chile and Argentina. Using a firm-level dataset, we conclude that there is a positive impact from investing in job training (individually) as well as a positive impact of the investments in job training and R&D (jointly). In line with some literature[6], supporting R&D individually has a negative influence on productivity. We interpret these results as a complementary relationship between training and R&D.

For many decades, Latin America followed a growth strategy known as import-substitution industrialization (ISI) process, where governments were providing, regulating and defining the content of the training programs. Since the 1980s, the goal has been the modernization of the training programs and the separation of their financing, planning and provision, highlighting a more demand-driven determination of the contents and stronger participation of the private sector (Ibarrarán and Shady 2008). A prominent challenge is to know how combine the supply of vocational education and job training, guaranteeing their quality and adequacy (Crespi and Zuñiga 2010).

Training should not be interpreted as a panacea to achieve stronger productivity and economic growth, and supporting solely R&D activities is not a current solution, considering the lack of workforce capacities to manage the new technologies. Hence, the complementary relationship between training and R&D and between training and education appears to give some space for Latin American governments' intervention, by supporting better education systems that may later stimulate firms to provide formal training programs, qualifying their workforce and allowing for a greater international exposure. Latin American governments have to support the urgent modernization of their production structures, creating endogenous technological competences and stimulating an effective collaboration for innovation. Appendix C, reports a more detailed description of the economy of Latin America, Chile and Argentina.

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[5] "Research and experimental development (R&D) comprise creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of the stock of knowledge to devise new applications", in OECD (2002), *Frascati Manual*, 6th edition, pp. 30.

[6] See for instance, Black and Lynch (1996), Tan and Batra (1996) and Ballot et al. (2001).

The literature has highlighted particularly the training impacts on workers' earnings by using household or employee-level data. Nevertheless, R&D investments, technology endowments and whether or not afford for formal training programs are decisions taken at the firm level. What are the factors underlying the firms' decision to provide formal training programs to their workforce? In the end, has the firm-provided job training a measurable impact on its performance? And, what is role of the firms' investment in R&D? Is it possible to explore any complementarity between job training and R&D in order to enhance firms' performance? We believe that these questions are better portrayed using firm-level data.

Our study estimates a (augmented) Cobb-Douglas production function for two countries - Chile and Argentina – aiming to determine the influence of job training on firms' performance. We intend to minimize two key concerns identified by the literature[7]: endogeneity of job training and sample selection bias. The firms' decision on whether train their workforce is not an exogenous choice, once firms tend to provide training to workers who can benefit more the firm's profitability and productivity. As a result, unobserved workers' specific characteristics (e.g. motivation, ability, the relationship with the employer) are likely to be correlated with the observable characteristics included as explanatory variables. On the other hand, the sample selection bias is common when non-random data is chosen implying an identification problem, since workers who participate in training or who participate more often or for longer time periods are unlikely to have analogous observed and unobserved characteristics as their peers. Then, conclusions may not be generalized, since we would be working with an intentionally predetermined targeted group of individuals or firms. By exploring a firm-level dataset, including both training and non-training firms, we try different approaches in order to minimize those problems and to test the robustness of our results. First, when estimating our productivity equation we add several control variables on firms' and workers' characteristics aiming to reduce a possible omitted variables bias. This procedure would completely solve the problem if we had information for instance on workers' and managers' motivation and abilities. Second, we run a treatment-effects

[7] See for instance, Crépon et al. 1998, Dearden et al. 2000, Zwick 2002 and 2006, Chudnovski et al. 2006, Konings 2008, Álvarez et al. 2011. Some other problems have been identified such as low response rates on questionnaires, monitoring for short time periods, extrapolating from small to large samples, or even informing trainees that their performance is going to be monitored.

model (two-step estimator)[8] through which we compute a selection correction term - the Inverse Mill's Ration - that in turn will be used as an additional explanatory variable in the productivity equation. Third, we use Instrumental Variables, in the same spirit as Tan and Batra (1996) to correct the potential endogeneity of the training variable.

Controlling for industry and region fixed effects, our results present a consistent and positive relationship between training and firms' productivity, being the effect stronger in Chile than in Argentina, 24% and 18%, respectively. We find a complementary relationship between training and R&D. Joint investment in training and R&D leads job training to have an effect of 53% in Chile and 22% in Argentina, and R&D a magnitude of 9% in Chile and 5% in Argentina. Using the treatment-effects model we conclude that we should use this last model in Chile and maintain OLS in Argentina. Regardless the estimation procedure, the investment in R&D (individually) has always a negative effect in both countries. However, if theoretically speaking productivity is defined as the output obtained by using a certain amount of inputs, in practice as it can be seen by Table A.2 and Table A.3 (in Appendix A), it is somehow difficult to interpret the literature, compare its results and generalize conclusions since several estimation procedures and dependent variables have been used.

Our research aims to establish a concrete breakthrough on the existing literature by gathering two research fields - job training and R&D - that are generally covered individually and largely concentrated on industrialized economies. Conclusions on developing countries (and particularly on Latin America) have remained relatively occasional and dubious. At least to the authors' knowledge, this will be one of the first studies on firms' productivity controlling simultaneously for both training and innovation related activities, and using data on these two Latin American economies.

Bearing this in mind, this study can be incorporated in three main strands of the literature. First, it is related with the research on the determinants of the firms'

[8] The treatment-effects model considers the effect of an endogenously selected binary treatment on another endogenous continuous variable, conditional on two sets of independent variables. First, we estimate a selection equation that corresponds to our standard probit model, through which we compute the Inverse Mill's Ratio. In the second step, we estimate the production function using OLS and including the IMR as an explanatory variable. Finally, we run a simple individual significance test on the Inverse Mills ratio testing the null hypothesis that there is no selectivity bias, which means that our model is correctly specified, and therefore OLS can be used without the IMR term. One fundamental condition to guarantee that we can effectively apply this method is the use of our entire sample, considering simultaneously firms that are providing and not providing job training to their workers.

investment in job training programs. Concerning the analysis on developing countries, our estimates are consistent with the prevailing literature, namely firms with higher exposure to international markets, being part of a larger establishment, supporting investments either in fixed assets or in innovation-related activities, implementing quality control programs, receiving public support to training-related activities and larger firms, are more likely to train their workforce. Table A.1 (in Appendix A) explores in more detail the main conclusions from this branch of the literature.

Second, we are within the framework of the firms' performance, resulting from investments either in job training or R&D. Table A.2 and A.3 (in Appendix A) show in more detail the literature for the influence of training and innovation, respectively. Although with distinct magnitudes, the literature has found positive impacts of training on firms' productivity. For instance, Barret and O'Connell (1999) estimate an OLS model in first-differences, for the period 1993-1995, and find positive effects on Irish firms' output per worker, either using the share of trained workers (0.10) or the training days per worker (0.01) or the share of training expenditure (0.01). Zwick (2002 and 2006) using panel data of German firms finds that 1 percent increase in the share of trained employees in 1997 implies an increase of the value-added around 0.76 percent, for the period 1998-2001. The author adds an interaction term between training and ICT investments and concludes that, in fact, they work as complements enhancing firms' productivity more than if working in isolation. Almeida and Carneiro (2008) estimate the internal rate of return of firms' investment in human capital. Implementing a system-GMM estimator for Portugal (1995-1999), they conclude that firms investing in human capital but not in training have on average negative returns, while firms investing in job training obtain a return between 6.7% and 8.6%. Also, they find that an increase of 10 hours in the amount of training implies an increase between 0.6% and 1.3% in the current firms value-added. Using a panel of British industries from 1983 to 1996, Dearden et al. (2000) conclude that 1 percent increase in the share of trained workers is associated with an increase in the value added per worker around 0.8 percent. Konings (2008), using a large data set of 13,000 firms in Belgium, between 1997 and 2005, also finds a positive and significant effect of the share of trained employees, being the magnitude higher for manufacturing than for non-manufacturing firms (0.038 and 0.035, respectively). Tan and Batra (1996) estimating a Cobb-Douglas production function through instrumental variables, separately for five developing countries[9], find as well positive and significant impact for the training variable. Contrary to the previous studies, Black and Lynch (1996) estimating separately the effect of the number of trained workers on sales for manufacturing and non-manufacturing firms do not find any significant effect.

Finally, one needs to consider the relationship between innovation and firms' productivity. Research in this field is mainly based on the model developed by Crépon, Duguet and Mairesse (1998)[10], in which, holding a data set of around 4,000 innovative manufacturing firms, in France, they find that the number of registered patents and the share of innovation sales have a positive and highly significant effect on the value-added per employee. Interestingly, Galia and Legros (2004) establish a circular relationship between R&D investment, innovation input and output, training, quality of labor and firm performance, in France, by estimating a CDM model simultaneously, with five equations. They consider the workforce skills as the firms' competitive advantage, since a more skilled labor force is prepared to execute more complex tasks, and to deal with more sophisticated technology. Generally speaking, results for developed economies show a positive and significant effect either from the investment in R&D or from product and process innovations.

On developing countries, Goedhuys et al. (2006) and Goedhuys (2007) with data on Tanzanian and Brazilian manufacturing firms, respectively, found evidence for the lack of some basic structures in non-industrialized economies, which in turn is retarding the influence of some technological investments. In both analyses process innovation has a negative effect on productivity, and only for Brazil product innovation as a positive though non-significant effect. Álvarez et al. (2011) report no relation between

[9] Tan and Batra (1996) estimate a Cobb-Douglas production function using the predicted value of training (estimated through a standard probit model) as an instrument of the training variable. This procedure is applied to five developing countries, Mexico (0.44), Colombia (0.27), Indonesia (0.71), Taiwan (0.03) and Malaysia (0.28).

[10] The original CDM model considers the whole process of innovation, by estimating multiple equations, simultaneously. Firstly, it is estimated a selection model where the firm's decision to allocate resources in R&D and the intensity of the investment are measured. Secondly, a knowledge production function is estimated, establishing the relationship between the innovation inputs (i.e. R&D incidence and intensity, predicted in the previous step) and the innovation outputs (i.e. the creation of a new or significantly improved product or production process). Finally, a production function is regressed in order to determine the link between the estimated values of the innovation output and the firm productivity (e.g. sales or value-added).

international competition and the investment in R&D, in Chile, for the period 1995-2004. One potential justification is the relatively high specialization of the Chilean economy in sectors where the international competition is not relevant, leading to the lack of incentives to invest in R&D and to the higher concentration of sales at the regional and national level[11].

It is worth mentioning that Ballot et al. (2001) using data on French companies (1987-1993) found negative effects from R&D investments when estimated individually without the interaction with training. This conclusion is obtained using OLS and GMM estimators. Additionally, these authors use random and fixed effects, but R&D estimates are never significant. They conclude that R&D in isolation has no robust effect, and it is positive only when interacted with managers/engineers' training. Similar conclusions are found by Black and Lynch (1996), confirming that the existence of a R&D center anywhere in the enterprise has a negative impact on productivity (sales in logarithm), and by Tan and Batra (1996) with R&D assuming a negative effect on the value-added (logarithm) in Colombia, Indonesia and Malaysia, when instrumenting training through its predicted value.

In summary, although in developed economies productivity growth is obtained through capital and knowledge intensive firms, where technological innovation and international competition are major drivers (Lööf et al. 2003), research on developing countries does not suggest any significant influence coming from direct measures of innovation, as R&D or the creation of new or significantly upgraded products or production processes. According to Goedhuys et al. (2006:1) these last economies are still strengthening their elementary foundations, "Innovation in LDC [Less Developed Countries] has perhaps more to do with adopting existing technologies than creating new technologies, i.e. reaching the technological frontier rather than shifting the frontier". In the medium-long run, continuous training and R&D efforts may be the solution to a more knowledge-based economic growth that should be understood as a continuous learning and developing process, gathering workers, firms and governments.

[11] In a broader conclusion Crespi and Zuñiga (2010) affirm that "In many Latin American economies, firm's innovations consist basically of incremental changes with little or no impact on international markets, and are mostly based on imitation and technology transfer".

The remaining of this paper is organized as follows. Section 2 presents the dataset as well as its statistical analysis. Section 3 explores the firms' training decision. The empirical model and the estimated results are presented, and a robustness check is performed using a different innovation input variable. Section 4 presents the productivity estimations, using OLS, the treatment-effects model and instrumental variables. The last two approaches control for sample selection bias and endogeneity of training. Robustness checks are equally presented. Section 5 estimates a quantile regression aiming to conclude on the heterogeneity of the results between high and low productive firms. Section 6 presents the main limitations of the study and possible future research. Section 7 concludes.

2. Data and Descriptive Statistics

The objective of this section is twofold. On the one hand, it intends to present a general vision of the data set as well as the main variables, and on the other hand it presents the statistical analysis of some of the main questions of the survey.

2.1. Data

This study explores a firm-level data set called *Enterprise Survey*[12], collected by the World Bank and its partners[13], for Chile (2010) and Argentina (2010). After a logical control, the final raw data covers 1,032 firms surveyed in Chile and 1,049 in Argentina.

The *Enterprise Surveys* shape an overview of the country's business environment, and the strength of this survey relates to both the comparability of the information concerning the various firms' characteristics across countries (since the questionnaire is analogous across them) and the availability of information on technology, training,

[12] The *Enterprise Surveys* contain firm-level data of a representative sample of the country's business environment. Surveys cover a wide range of fields such as corruption, regulation and taxes, crime, gender, informality, access to finance, infrastructures and services, innovation and technology, trade, obstacles to business and growth, firm characteristics, performance measures, capacity utilization and business-government relations. Since 2002, the World Bank has collected this data from face-to-face interviews with business owners and top managers. Government services, health care and financial services sectors are not surveyed. Several are the studies using this firm-level data set (e.g. Goedhuys 2007, Almeida and Fernandes 2008, Almeida and Aterido 2008 and 2010). More in depth information can be achieved at http://www.enterprisesurveys.org/.

[13] The European Bank for Reconstruction and Development (implementing the Enterprise Surveys in Eastern Europe and Central Asian countries), Inter-American Development Bank (implementing the Enterprise Surveys in Latin America), COMPETE Caribbean (for the Caribbean) and the UK's Department for International Development covering the South Asia.

firms and workforce characteristics. Overall, we are including variables on firm size and age, its geographical location and sector of activity, whether the firm is part of a larger establishment, its type of ownership (domestic versus foreign ownership), the firm total annual sales, or even whether the firm has invested in fixed assets. Exposure to international markets is also assessed by a dichotomous variable equal to one if the firm exports (directly or indirectly) 10% or more of its sales. The empirical analysis includes some proxies of the workforce education level, namely through the average educational attainment and the share of workers who hold at least a bachelor's degree[14].

The survey brings together information on two central fields within the framework of our research. Firstly, the survey meets some information about the presence of formal training programs as well as whether or not the firm received any public support (financial or other types of assistance) for training-related activities, the percentage of full-time permanent production and non-production employees trained, or the main reasons behind the firms' decision to not having provided any training program. In Appendix B, Table B.1 provides the variables' description; Tables B.2 and B.3 report the summary statistics for the main firm level characteristics, in Chile and Argentina, respectively. Lastly, from Table B.4 to Table B.7 the summary statistics for both countries, but differentiating by training and R&D intensity are reported.

Secondly, it documents some useful indicators of innovation and technology adoption, namely whether the firm spent on R&D, whether the firm received public support (financial or other types of assistance) for innovation-related activities, whether the firm used services or programs to improve quality control, whether the firm has an internationally-recognized quality certification, or whether the firm introduced a new or significantly improved product and production process. These measures may be of potential relevance (though we have not used all of them due to collinearity reasons) as we are trying to assess the possible relationship between training and innovation related activities.

Aiming to determine which factors are attracting firms to provide formal job training programs to their workforce, we construct a dummy variable that is equal to one if the

[14] Frazis et al. (2000) also use a similar variable, i.e. the share of bachelor's degree holders.

firm refers having provided formal training to its permanent, full-time employees[15]. Formal training incidence is assessed through the following question: *"Did this establishment have formal training programs for its permanent, full-time employees?"*.[16] The firms' productivity is measured by their sales (per worker), namely using the following survey's question: *"In [the last complete fiscal year] what were the establishment's total annual sales?"*. The final value is depreciated by the consumer price index at the time of the survey and reported in USD.

Before proceeding, the authors are aware of some flaws brought by the data set. Despite the high comparability proportioned by this survey, in fact, firms with different sizes, ages and located in different sectors and geographical regions may potentially differ in how they identify a formal training program as well as its content, purpose, financing scheme and structure. Finally, since we are using data for a particular year, unfortunately we are not able to test the existence of lagged effects in our productivity variable, resulting from accumulated skills and capacities, and from past investments in R&D.

2.2. Descriptive Statistics

Our final sample covers firms placed in both the manufacturing and the services sector, in Chile and Argentina. Summary statistics for the explanatory variables are presented in Tables B.2 and B.3, and from Tables B.4 to Table B.7 the summary statistics differentiated by training and R&D intensity are reported.

Regarding the Chilean sample, 77% of the firms represent the Manufacturing sector, very similar to the Argentinean figure, 76%. The industry's geographical distribution is relatively similar among the two countries, as the Chilean capital city (Santiago Metropolitan Region) and the Argentinean capital city (Buenos Aires) represent 68% and 58% of the firms, respectively. By firm size, in Chile 31% are Small firms, 36% are

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[15] Permanent, full time employees consider all paid employees that are contracted for a term of one or more fiscal years and/or have a guaranteed renewal of their employment contract and that work 8 or more hours per day.

[16] Although, defining a training dichotomous variable is a common procedure in the literature (Bartel 1989, Baldwin et al. 1995, Tan and Batra 1996, Zwick 2002, O'Connell and Byrne 2009), we could have used some other measures as the share of production and non-production full-time permanent workers trained or the number of hours spent in internal training programs. Fundamentally, it was not done due to the lack of sufficient observations in our data set for these variables. See Table B.10 (in Appendix B) to a deeper check of the missing values for some variables, which led to the non-utilization of some of them.

Medium firms and 33% are Large firms, whereas in Argentina Small (35%) and Medium (36%) firms assume slightly higher preponderance than Large firms (29%). The firms' ownership is essentially concentrated at the national level, given that in both countries 86% of the firms are totally detained by private domestic individuals, companies or organizations, and only 8% and 9% are fully detained by private foreign individuals, companies or organizations, in Chile and Argentina, respectively. The share of Chilean (Argentinean) firms deemed as exporters (Table B.1, in Appendix B, presents the variables' definition) is set at 20% (32%)[17], with only 7% (9%) of the firms reporting the international market as the main one for their main product. On the workforce skills, on average, 57% and 58% are classified as skilled workers, and 68% and 66% as production workers, in Chile and Argentina, respectively. These two countries are similar with respect to the average educational attainment (set at 11 years in both countries) and the share of full-time permanent workers who have at least a bachelor's degree (14% in Chile and 13% in Argentina).

Concerning to the existence of formal training programs, 60% and 64% of the firms offered formal job training to their workforce, in Chile and Argentina, respectively. The government's intervention in programs with this specific nature is frequently justified by the existence of important labor market spillover effects, but also most of these training programs are particularly focused on people with negligible human and physical capital. In the Chilean (Argentinean) sample, 39% (11%) of the firms received public support for training-related activities and 14% (17%) received public support for innovation-related activities. In Chile, 69% of the firms have introduced new or significantly improved products or production processes, 43% spent on R&D activities and 38% used services or programs to support innovation, while in Argentina the figures are 83%, 59% and 40%, respectively. Finally, we realize that 55% of the Chilean firms and 50% of the Argentinean firms used services or programs to improve quality control, and 78% and 74% (respectively) envisage using these services or programs, in the next three years.

A preliminary analysis from Table B.4 to Table B.7 (in Appendix B) seems to indicated that there is evidence of an apparently positive relationship between training (and R&D)

[17] In Chile and Argentina, on average and over the last three years, only 18% and 21% of the firms used services or programs to promote exports, and 36% and 44% of the firms are prospecting to use these services or programs, in the next three years, respectively.

and a broad set of variables, for instance the public support to training activities, the firm's support to innovation, quality control, being an exporter firm or even with the workforce education. Lastly, there seems to be a positive relationship between the firms' innovation effort and the availability of job training programs. In Chile, on average, approximately 33% (45% in Argentina) of the firms combine expenditure on R&D and job training, and 30% (31% in Argentina) of the firms use programs or services to support innovation, providing training programs to their workforce at the same time. From a different perspective, 58% and 51% of the Chilean training firms (i.e. restricting the analysis only for those firms that provided job training) invest in R&D and in services or programs to support innovation, respectively. In Argentina, figures are 72% and 49%, respectively.

Understanding the firms' investment in R&D and in formal job training programs, is as important as realizing some alert signals revealed by our data set in Chile and Argentina, respectively: i) 59% and 69% of the firms report that the most difficult skills to find when filling vacancies are the technical skills, such as foreign language skills, problem solving skills, administrative and operational skills; ii) 27% and 25% of the firms do not provide training programs due to lack of information on it, iii) 19% and 18% of the firms consider the labor market regulation as being the biggest obstacle firms have to face, and iv) 19% and 37% of the firms consider the access to finance a major or very severe obstacle to their current activity. More detailed descriptive statistics can be found from Table B.2 to Table B.7, in Appendix B.

3. Determinants of the Firms' Investment in Job Training

This section aims to explore an empirical model in order to conclude on the firms' training decision, i.e. which elements are shaping the final decision of providing job training, considering the analysis for two economies, Chile and Argentina.

3.1. Empirical Modeling

When by some reason skills shortages are felt, when there are some technological changes, and even in a situation in which a firm may follow a policy of hiring highly skilled employees, firms are required to train their workforce. In the end, the decision is dependent on the potential profit a firm may achieve, i.e. on the relative costs and benefits of investing in training programs. The firm f in industry i and region r decides whether to finance formal job training programs if the present value of the expected profits of this investment is positive, as translated by Equation 1.

$$Train_{fir} = \begin{cases} 1 \; if \; \pi^*_{fir} > 0 \\ 0 \; otherwise \end{cases} \qquad (1)$$

$Train_{\,fir}$ specifies a dichotomous variable assuming the value one if firm *f*, performing in industry i[18] and region r[19], provided job training to its workforce, in the last fiscal year[20]. Indeed, we are not able to infer on the firm expected profit π^*_{fir} (unobservable variable) or on the net benefits from supporting job training. We assume it follows a linear function of the firm, sector and region observable characteristics. As a result, π^*_{fir} can be specified as $\pi^*_{fir} = \delta X_{fir} + \mu_i + \mu_r + \varepsilon_{fir}$, where X_{fir} represents a vector of firm observable characteristics, μ_i are industry fixed-effects, μ_r are region fixed-effects and ε_{fir} symbolizes the unobservable or uncontrollable firm characteristics that are correlated with the expected return after having invested in job training programs. The probability of firm *f* provides job training to its workforce can be expressed by:

$$Pr\left(Train_{fir} = 1\right) = Pr\left(\varepsilon_{fir} > -\delta X_{fir} - \mu_i - \mu_r\right) \qquad (2)$$

Considering that the error term ε_{fir} is normally distributed, Equation 2 can be modeled by using a standard probit model in order to determine the factors behind the firms' training decision.

The firm size is incorporated due to the wide evidence of a positive relationship between training provision and firm size (Bartel 1989, Baldwin and Johnson 1995, Frazis et al. 2000, Zwick 2002, O'Connel and Byrne 2009), explained either by the easier access to capital, which facilitates the investment in fixed assets and the exploration of potential economies of scale, or simply because larger firms tend to have a higher number of employees and so higher training probability (Baldwin and Johnson

[18] Our data set provides information on the following two-digit industries/services: Food, Textiles, Garments, Chemicals, Plastics and Rubber, Non-metallic Mineral Products, Basic Metals, Fabricated Metal Products, Machinery and Equipment, Electronics, Other Manufacturing / Retail, Wholesale, Information Technology, Hotel and Restaurants, Services of Motor Vehicles, Construction and Transport.

[19] For the Chilean sample we have information from four regions: Santiago Metropolitan Region (705 firms), X Los Lagos Region (103 firms), II Antofagasta Region (83 firms), V Valparaíso Region (142 firms), and in the Argentinean sample from five regions: Buenos Aires (610 firms), Rosario (129firms), Mendoza (118), Córdoba (125 firms) and Chaco (72 firms).

[20] See Section 2 to confirm the exact question made by the Survey.

1995, Baldwin et al. 1995). Several authors have also found a complementary relationship between the training decision and the workforce education level (Lillard and Tan 1986, Altonji and Spletzer 1991, Chung 2000, Frazis et al. 2000, Budría and Pereira 2004, Zwick 2006), which lead us to estimate training on the share of workers with at least a bachelor's degree. Explanatory variables on the firm's characteristics, as its age, whether the firm is considered as foreign owned or as an exporter, whether the firm is part of a larger establishment and whether the firm is formally registered since the beginning of its operations, are also included.

Concerning the innovation intensity, though the survey reports some potentially important questions to our research, some of them suffer from lack of observations, which somehow invalidates their utilization[21]. We introduce some dichotomous variables on whether the firms invest in fixed assets, whether the firms support innovation-related activities and whether the firms use services or programs to enhance quality control. The existence of public support to training-related activities is also controlled for. As expressed by equation 2, region and sector dichotomous variables are also incorporated.

3.2. Estimation Results

Before proceeding with the estimates, Table B.8 and Table B.9 present the correlation coefficients between training and some explanatory variables, in Chile and Argentina, respectively. Many of the variables that appear to be correlated with training have also a positive and significant influence in the selection equation, as presented below.

In this section, we describe some of our estimation results on the firms' training decision, and how this strategy is dependent from certain firms', workers' and innovation characteristics. Table B.11 and Table B.12 (in Appendix B) present the marginal effects at mean values of several probit estimations of the Equation 2, for Chile and Argentina, respectively. The dependent variable is a training dichotomous variable that is equal to one if the firm provided formal training programs to its permanent, full-time employees.

Considering the small firms as the omitted size group, we find a positive and significant relationship between the firm size and the training probability. In line with an extensive

[21] See Table B.10 (Appendix B), with the missing values of some variables after logical control.

literature, the most significant effect corresponds to the larger firms (with 100 or more employees), as in Chile and Argentina the larger firms are 30 percentage points and 20 percentage points more likely to provide training than the small firms (between 5 and 19 employees), respectively. This relationship may reproduce the existence of some economies of scale or even some managerial features and easier access to credit that deliver higher capacity to larger firms to provide training (Baldwin and Johnson 1995, Baldwin et al. 1995, Tan and Batra 1996). Controlling the firms' age has apparently no effect on the training decision (results not included).

As reported by O'Connell and Byrne (2009), training incidence is positively and significantly related with being part of a larger establishment, namely 10 percentage points in Chile and 12 percentage points in Argentina. Similarly, whether the firm is considered as exporter or whether the firm's capital is owned by private foreign individuals or companies (*Openness*) has a positive effect on the training likelihood, more precisely 11 percentage points in Chile and 8 percentage points in Argentina. From these results, we may conclude that higher exposure to international markets competition either via exports or by opening the firm's capital to foreign companies' participation may be a motivating factor for the provision of training (Tan and Batra 1996, Almeida and Aterido 2010). A strong presence in international markets may also facilitate the adoption of new technologies and the transference of new expertise from other countries and companies[22].

Consistent with the literature, our results appear to point out to a positive relation between the education variable and the training incidence. To some extent, our results appear to support an inverse relation to what would be desirable in order to contest the growing skills gap, i.e. training is exacerbating rather than mitigating the inequalities among workers, once training incidence is increasing with the share of workers with at least a bachelor's degree[23] (Frazis et al. 2000, O'Connell and Byrne 2009). For instance, Tan and Batra (1996), Chung (2000), Kemp et al. (2003) and Gashi et al. (2008) also

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[22] According to Baldwin et al. (1995) foreign ownership may be an easier way to guarantee the transference of knowledge across countries.

[23] We have also estimated the effect of the average years of schooling rather than the share of workers with at least a bachelor degree. In both countries, the results remained positive and significant, which again supports the positive relationship between training and the workforce education level. Zwick (2006) called it "treatment on the treated" in the sense that training is preferentially provided to the more skilled and qualified workers. In Bloom's (1999) terms, "more is given to those that have, and more is taken away from those that have not".

find a complementary relationship between training and education, which may lead the governments assuming the role of improving the initial education level of workers in order to afterwards incentivize firms to provide formal training programs. Hence, concerning the government support, firms that have received public support to training-related activities are 41 percentage points more likely to invest in formal training programs, in Chile, being this value considerably higher as compared with the Argentinean one, 16 percentage points. Almeida and Aterido (2010) considering 99 developing countries from different regions and income levels also conclude on the need of public support to enhance the access to information and external finance, to reduce the uncertainty around the firms' investment in job training and so increase the incidence of the latter on developing countries. The government support may lead firms to have a stronger integration in international markets. Regarding labor market regulation, Almeida and Aterido (2008) using a sample of 66 developing countries find that stricter hiring regulation is associated with stronger investments in job training, but then stricter firing costs will discourage firms to invest in the workforce human capital.[24]

Firms investing in fixed assets as buildings, vehicles, land or machinery are 14 percentage points (in Chile) and 6 percentage point (in Argentina) more likely to provide formal training programs to their workforce, though only in Chile this impact is statistically significant. With a positive and statistically significant influence in both countries, the use of services or programs to support innovation accounts for 8 percentage points and 14 percentage points, in Chile and Argentina, respectively. As found by Baldwin and Johnson (1995) and Tan and Batra (1996), the use of services or programs to enhance quality control has a positive and highly significant effect on the training likelihood (33 percentage points in Chile and 17 percentage points in Argentina). Finally, training is also positively related with those firms that are formally

[24] We also estimate a model by including three additional controls to our baseline probit specification (column 6, Table B.11 and B.12, in Appendix B) in order to conclude on the relationship between the government role and the training likelihood. In doing so, we add i) whether the firm considers the access to finance as a major or very severe obstacle, ii) whether the firm considers the labor market regulations as a major or very severe obstacle and iii) whether the firm considers the tax administration as a major or very severe obstacle to its activity. As expected, our results show that all these last variables have a negative effect on the training likelihood. See Table B.13, in Appendix B. After the inclusion of these last three variables, the conclusions from our baseline specification still remain robust. Although the relationship between government policies and their effect on firms' strategies falls outside the scope of our study, deeper discussion on this issue is provided by Almeida and Aterido (2008 and 2010).

registered since the beginning of their activity, namely 14 percentage points in Chile and 8 percentage points in Argentina.

In summary, firms with higher exposure to international markets, being part of a larger establishment, supporting investments either in fixed assets or in innovation-related activities, implementing quality control programs, receiving public support to training-related activities and larger firms are more likely to allocate their resources to provide training to their workforce. Generally, our results are in accordance with the extensive literature presented in Table A.1 (in Appendix A).

3.3 Robustness Analysis

In this section, we briefly test the robustness of our results, using a different innovation input variable. Now, we assume a dichotomous variable equal to one if the firm spent on R&D, rather than *Firm Support to Innovation* (used in Section 3.2; Table B.1 presents variables' definition). The objective is to test previous results by using a more restrictive and specific definition of the firms' investment in innovation and technology. Table B.14 (in Appendix B) presents the probit model estimates using these two definitions of the innovation support, in Chile and Argentina.

From the new estimations, we can conclude that the innovation input variable has a positive and statistically significant effect, i.e. firms investing in R&D activities are 12 percentage points and 23 percentage points more likely to provide job training, in Chile and Argentina, respectively. Comparing Column 1 and 2, and Column 3 and 4 (Table B.14, in Appendix B), we conclude that *R&D* has a stronger effect than the *Firm Support to Innovation*. Concerning the other explanatory variables, their magnitude and significance remain identical to the baseline estimation, in Chile and Argentina. Motivated by these results, we have decided to use R&D as the innovation variable in the productivity equation (Section 4), and also because R&D is the most used variable in the literature.

4. Impact of Job Training on Firms Productivity

Numerous studies have treated R&D and job training as two policies working in isolation. Hence, one important improvement in our paper is not only to introduce training and R&D in the same equation, but also to include the interaction between them. Additionally, we do this using data on developing economies, which takes our analysis a step further in the existing literature. In this section, we intend to estimate the impact of job training and R&D, individually and jointly, on firms' productivity.

4.1. Empirical Modeling

To conclude on the impact of training, we use a common methodology followed by an extensive literature on the issue (Black and Lynch 1996, Barret and O'Connell 1999, Dearden et al. 2000, Conti 2004, Zwick 2006). We consider a Cobb-Douglas production function, as:

$$Y = AK^{\beta}L^{\alpha} \tag{3}$$

where Y represents the output, A is the Hicks neutral efficiency parameter, K is capital and L is labor. Following Dearden et al. (2000), L is given by $L = L_U + \gamma L_T$, where L_U is the number of untrained workers and L_T the number of trained workers. We expect γ higher than one, or in other terms training having a positive effect on productivity. Replacing L in equation (3), considering $L_U = L - \gamma L_T$ and the share of trained workers given by $Trained = L_T/L$, it comes:

$$Y = A\,K^{\beta}(L_U + \gamma L_T)^{\alpha} \tag{4}$$

$$Y = A\left(\frac{(L_U + \gamma L_T)L}{L}\right)^{\propto} K^{\beta} \tag{5}$$

$$Y = A\left(\frac{L + (\gamma - 1)L_T}{L}\right)^{\propto} L^{\propto}K^{\beta} \tag{6}$$

$$Y = A(1 + (\gamma - 1)\,Trained)^{\propto}L^{\propto}K^{\beta} \tag{7}$$

Applying logarithms to expression (7) and using the approximation $ln(1 + x) = x$, it comes:

$$ln\,Y = ln\,A + \propto (\gamma - 1)\,Trained + \propto ln\,L + \beta\,ln\,K \tag{8}$$

In the end, we estimate the following expression:

$$ln\left(Y_f\right) = \delta_1\,Training_f + \delta_2 R\&D_f + \delta_3 Training * R\&D_f + \alpha \ln\left(L_f\right) + \rho\,V_f + \varepsilon_f \tag{9}$$

where Y_f measure the firm productivity (logarithm of the real sales per worker), $Training_f$ is a dichotomous variable equals to one if firm f has formal training programs to its permanent, full-time employees, $R\&D_f$ is a dichotomous variable equals to one if firm f has spent on research and development activities, $Training * R\&D_f$ is the interaction term between training and R&D, $ln(L_f)$ is the logarithm of the total number of workers in firm f, and V_f is a vector of additional control variables affecting productivity. Unfortunately, due to the substantial lack of observations in the capital stock measure we decide to not incorporate it in our model[25]. In practice, we estimate an augmented Cobb-Douglas production function, since besides both labor and capital (this last not used), there are some other variables explaining firms productivity.

Although we have incorporated additional explanatory variables to the original Cobb-Douglas production function some problems may remain. Firstly, some regions and sectors may provide more training and be more productive than others, which lead us to incorporate a broad set of sector and region dichotomous variables. Secondly, the firms' training decision may be endogenous and dependent on unobservable characteristics. This last constraint is addressed below (Section 4.4). Following Siedschlag et al. (2010) we use clustered standard errors at 2-digit industry level since the error terms may be correlated within industries.

4.2 Estimation Results

Table B.15 and Table B.16 report the estimates of Equation (9). Column (7) represents our baseline estimation. In line with a broad literature, we find a positive impact of training on firms' productivity, in both countries. Although training considered in isolation has a similar magnitude in Chile (24 percentage points) and Argentina (18 percentage points), it is statistically significant only for the former[26]. Somehow surprisingly, when considered individually R&D has a negative effect. Ballot et al. (2001) explain that "training is a necessary factor which may dominate R&D", as an explanation for their negative results on the R&D coefficient, when not interacted with training[27]. At least two other studies find negative signs: Black and Lynch (1996),

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[25] See Table B.10 (in Appendix B) with the missing values of some explanatory variables.

[26] Tan and Batra (1996) find similar results for two other Latin America countries, i.e. training has an effect of 14 percentage points (non-significant) in Colombia and 13 percentage points in Mexico.

[27] Ballot et al. (2001), using data on French companies (1987-1993) find negative effects from R&D investments when estimated individually without the interaction with training. This conclusion is obtained using OLS and GMM estimator. Additionally, authors use random and fixed effects, but R&D estimates are never significant. They conclude that R&D in isolation has no robust effect, and it is positive only when interacted with managers/engineers' training.

confirming that the existence of a R&D center anywhere in the enterprise has a negative impact (non-significant) on productivity (sales in logarithm), and Tan and Batra (1996) for Colombia, Indonesia and Malaysia, considering training instrumented by its predicted value and productivity measured by the logarithm of the value-added. In our case, this may be explained by the potential lack of skills and capabilities of the workforce in such a way that if firms simply invest in new products or technologies their employees may not be able to explore and manage them, which may have a negative impact on productivity. Indeed, when we add an interaction term between training and R&D the coefficient of this last variable comes positive (29 percentage points in Chile and 5 percentage points in Argentina), which may indicate that the firms' investment in R&D has to be preceded by the firms' investment in job training programs, otherwise the R&D effort has no positive impact on productivity. This result appears to bring evidence of a complementary relationship between training and the innovation input variable, given that firms investing in both training and R&D the effect of the former comes equal to 53 percentage points (Chile) and 22 percentage points (Argentina), and the effect of R&D is 9 percentage points (Chile) and 5 percentage points (Argentina). The negative sign of the R&D variable when considered in isolation requires further investigation, for instance to understand which type of R&D is being done, and therefore to realize the adequacy of this investment to either the workforce skills or the firms' activity. Unfortunately, our data set does not provide this type of disaggregated data.

As found by Siedschlag et al. (2010), the use of services or programs to establish business alliances with other suppliers or clients has a positive impact on firms' productivity. For instance, *ceteris paribus*, firms that make use of these programs are 11 percentage points and 15 percentage points more productive, in Chile and Argentina, respectively. In the same spirit as Siedschlag et al. (2010) the firms' international exposition has also a considerable positive influence, by two different ways. Firstly, firms that are classified as exporters are 22 percentage points and 12 percentage points more productive in Chile and Argentina, respectively. Secondly, firms with foreign owned capital are equally more productive, namely 25 percentage points (in Chile) and 46 percentage points (in Argentina). In line with the literature (Bartel 1989, Black and Lynch 1996), our education control variable has also a positive stimulus on firms' productivity in both Chile (2 percentage points) and Argentina (1 percentage point).

Finally, the share of female workers has a highly negative and significant effect, and the labor elasticity has a positive and highly significant impact on firms' productivity.

4.3 Robustness Analysis

Aiming to test the robustness of our OLS results, we re-estimate Equation (9) with a different definition for the firms' support to innovation-related activities. Table B.17 (in Appendix B) presents the results for Chile and Argentina, considering *R&D* and *Firm Support to Innovation*[28] as the two alternative innovation variables (Table B.1 presents variables' definition). We conclude that the effect of training is robust in both countries to different concepts of the innovation input variable. In Chile, the training effect varies from 24 percentage points (using *R&D*) to 30 percentage points (using *Firm Support to Innovation*), while in Argentina the effect varies from 16 percentage points (using *Firm Support to Innovation*) to 18 percentage points (using *R&D*). Concerning the innovation variable, its effects continue to be negative when not interacted with training. But once again, the interaction term between training and the innovation explanatory variable comes positive, which continues to sustain a complementary relationship between training and innovation, either measured by *R&D* or *Firm Support to Innovation*. The effect of the other variables remains equally robust either in their magnitude or in their statistical significance.

We go further to test the strength of our conclusions. In the same spirit as Budría and Pereira (2004), we include four interaction terms between training and firm size, its ownership and the workforce education in order to explore how the training coefficient varies according with different firm and worker characteristics as well as to test the robustness of the interaction term between training and R&D. Column (1) and (2) from Table B.18 and B.19 present the estimates, for Chile and Argentina, respectively.

In both countries there is an important reduction in the training coefficient as we add the interaction terms between *Training* and *Large*, *Medium*, *Bachelor* and *Foreign*. *Training* influence (in isolation) goes from 24 percentage points to 11 percentage points in Chile, and from 18 percentage points to 7 percentage points in Argentina. Yet, our results for the interaction term between training and R&D are relatively stable.

[28] For instance, Masso and Vahter (2008), Crespi and Zuñiga (2010), and Siedschlag et al. (2010) also use a similar broader measure of the firms' effort in innovation, rather than measuring only the investment in R&D.

Concerning the coefficient of the other variables, their values remain considerably unchanged. However, it is worth mentioning that the inclusion of these four interaction terms confirms the positive relationship between training and the firm size, workers' education and foreign owned capital (this last, only in Chile).

4.4 The Problem of Training Endogeneity

As mentioned in Section 1, potential problems of endogeneity may exist since firms may be naturally tempted to provide training only for a restricted group of employees. In other words, firms may provide training to a non-random group of workers, resulting in a selectivity problem. If the firms' decision is dependent on some unobservable worker characteristics as motivation or commitment, then we would obtain an upward biased regression, i.e. δ_1 would be biased.

4.4.1 Treatment Effects Model

To control for this potential endogeneity of training we regress a treatment effects model[29], running a two-step estimator á la Heckman[30]. Firstly, we estimate a standard probit model[31] in order to determine the likelihood of training, and then compute a selection correction term, i.e. the vector of the Inverse Mill's Ratios (IMR), which is defined as:

$$\widehat{IMR}^* = \frac{\emptyset(z)}{\Phi(z)} if\ IMR = 1 \qquad \widehat{IMR}^* = \frac{-\emptyset(z)}{1 - \Phi(z)} if\ IMR = 0$$

where $\Phi(z)$ is the probability density function and $\emptyset(z)$ is the cumulative distribution function. In the second step, we estimate our production function (by OLS) including the IMRs as an additional explanatory variable, such that the equation we estimate is given by:

$$ln\left(Y_f\right) = \delta_1\, Training_f + \delta_2\, R\&D_f + \delta_3\, Training * R\&D_f + \alpha \ln\left(L_f\right) + \rho\, V_f + \delta_4\, \widehat{IMR} + \varepsilon_f \qquad (10)$$

[29] This methodology allows us to avoid the selectivity bias problem as long as the errors of the selection equation are not correlated with the errors of the productivity equation. This is possible if some of the variables in the selection equation (that should be correlated with training but not with productivity) are omitted from the productivity equation. In principle, this question should not be problematic since variables in the selection and productivity equation are considerably different.

[30] See Heckman (1979) for more detailed information.

[31] The probit model corresponds to the selection equation estimated in Section 3.

Table B.18 and Table B.19 (in Appendix B) reveal the results for the OLS model, the treatment effects model and for the Instrumental Variable approach (see Section 4.4.2, below) in Chile and Argentina, respectively, and with and without the inclusion of the abovementioned interaction terms (see Section 4.3).

In Chile, the treatment effects model predicts a highly positive and significant effect of training, and even higher than the OLS results. For instance, from the treatment effects model (Column 3), c*eteris paribus,* firms providing training (i.e. without investing in R&D) are 46 percentage points more productive, while in firms investing in both training and R&D, the training effect increases to 77 percentage points. Concerning the R&D influence, once again the investment in R&D when taken in isolation has a negative effect, although jointly with the investment in job training programs, the R&D effort comes with a positive sign, i.e. 7 percentage points. Finally, the estimated coefficient of the selection correction term is statistically significant at the 5% confidence level, which apparently indicates that trained employees are not a random-selected group, and so we should opt for the treatment effects model. The remaining variables continue to present similar coefficients to the ones reported earlier, and the interaction terms in Column 4 continue to confirm the complementary relationship between *Training* and firm size, *Foreign* and *Bachelor.*

For Argentina, considering the treatment effects model without additional interaction terms (Column (3) of Table B.19, in Appendix B), we conclude that training has now a considerably higher magnitude and becomes statistically significant at the 1% level, such that, *ceteris paribus*, a firm investing solely in job training is 44 percentage points more productive. However, the selection correction term is not statistically significant, and so we should opt for the OLS model.

In summary, using a treatment effects model we continue to confirm the highly positive impact of training on firms' productivity, as found by the OLS regression. However, analyzing the selection correction term, we should opt for the treatment effects model in Chile, and by the OLS model in Argentina. Finally, the selection correction term has a negative sign indicating that the error terms in the selection and productivity equation are negatively correlated or, in other words, unobserved characteristics that make participation in training more likely may be associated with lower productivity.

4.4.2 Instrumental Variable

An alternative to the treatment effects model is to apply for an instrumental variable approach. In the section, we follow the procedure presented by Tan and Batra (1996). Our productivity estimates are done in two steps. First, we re-estimate the training selection equation, but now without the variable *Firm Support to Innovation*, because it is considered as an endogenous decision. Tan and Batra (1996) estimate a probit model without R&D. Second, we proceed to the estimation of our productivity equation, but now using the training predicted value (computed in the first step) as an instrument of the training variable. Table B.18 and B.19 (in Appendix B) report the estimates for the training instrumental variable, with and without interaction terms, in Chile and Argentina, respectively. The model we estimate is given by Equation 11:

$$ln\left(Y_f\right) = \delta_1\, Training\ Instrument_f + \delta_2 R\&D_f + \delta_3 Training * R\&D_f + \alpha \ln\left(L_f\right) + \rho\, V_f + \varepsilon_f \qquad (11)$$

Despite some changes in certain coefficients (for instance, labor elasticity and *Exporter* are no longer statistically significant, in Chile), the main conclusions still remain for both countries, namely training (in isolation) continues to have a positive effect (15 percentage points in Chile and 6 percentage points in Argentina) and the interaction term between training and R&D confirms once more a complementary relationship. By IV, joint investment in training and R&D leads training to have an effect of 51 percentage points in Chile and 25 percentage points in Argentina, and R&D a magnitude of 11 percentage points in Chile and 11 percentage points in Argentina. Generally, results remain stronger in Chile than in Argentina. Finally, in Column 6, the interaction terms confirm the positive relationship between training and the firm size, workers education and foreign owned capital (this last, only in Chile).

5. Firms Heterogeneity: A Quantile Regression

In the same spirit as Almeida and Aterido (2008), one way to measure the robustness and heterogeneity of the results of our main specification would be to divide our data set into different sub-samples (i.e. by geographical location, workforce education, firm size, and so on). However, following this methodology our final number of observations for each group would be considerably negligible.

Alternatively, in this section, we follow Falaris (2003) and Goedhuys et al. (2006), and estimate a quantile model in order to draw conclusions for the potential heterogeneity of the results across firms, distinguishing low and high productive firms. This econometric methodology presents two major advantages. First, this approach is considered as less sensitive than the OLS (mean regression), something particularly important as we are using data on developing countries, i.e. where outliers may be more common (Falaris 2003). Second, the ordinary least squares regression reports results to the average firm, while the quantile regression allows us to assess if the effect of each explanatory variable differs for different points of the conditional productivity distribution. We compute the 0.25, 0.50 and 0.75 quantiles, and estimate bootstrap standard errors with 100 replications. Table B.20 and Table B.21 present the quantile estimates as well as the results from the mean regression (OLS), the treatment effects and the IV model, to facilitate comparisons.

In Chile, for the median firm the effect of training (alone) is lower than compared with the value obtained by the mean firm. However, we continue to confirm the complementary relationship between training and R&D, namely when both policies are implemented together training and R&D have an effect equal to 46 percentage points and 8 percentage points, respectively. Moreover, *Foreign and Exporter* are now significant, rather than only *Exporter*, as for the mean firm case. On the other hand, in Argentina, the training effect for the median firm is quite identical to the one presented by the average firm, and when investments in both training and R&D are considered together training and R&D have an impact of 25 percentage points and 1 percentage points, respectively. For each country and for the median firm, the remaining explanatory variables tend to follow the same magnitude and significance as in the other three econometric procedures presented in Column (1), Column (2) and Column (3), which apparently is a signal of the robustness of our results, in the sense that they are not dependent on the estimation methodology.

Nevertheless, as noted by Goedhuys et al. (2006) the distinctive characteristic of a quantile regression is the possibility we have to compare the results between low-productive and high-productive firms. Looking to the R&D and training effect when operating conjunctly, we conclude that in Chile training and R&D are major determinants for high-productivity firms, as well as international exposure (measured through *Exporter* and *Foreign*) and the existence of alliances with other suppliers and clients. For the low-productive firms, labor elasticity and being an exporter firm are the most significant factors. The interaction between training and R&D and the existence of foreign owned capital also have an important magnitude, though they are not statistically significant. Workforce education is important in both lower and upper quartile.

In Argentina, effects are weaker. For the lower and upper quartile the investment in training (individually) and the joint investment in training and R&D have no statistically significant impact, though positive. Additionally, *ceteris paribus*, the main factor explaining differences in productivity appears to be the existence of foreign owned capital. The firms' capacity utilization and the share of workers with at least a bachelor's degree, though statistically significant do have a negligible magnitude, for both lower and upper quartile. As found in Chile, labor elasticity is found as well crucial for low-productive firms, which may make sense if we consider that low-productive firms may be more labor intensive, while high-productive firms may be more capital or knowledge intensive.

6. Limitations and Future Research

Throughout the study, we have mentioned some limitations or shortcomings in our analysis, which should be understood as a way of improvement and to open the opportunity of future research. First, producing this type of studies is of particular relevance in the context of the emerging and developing economies, aiming to verify whether year-by-year there is effectively a true progress in some key variables (as for instance, job training programs and firms' support to innovation) and in their effects.

Second, it would be particularly relevant to explore a dataset with more detailed or refined information, that is, with more disaggregated data by type, goal and content of each training program or innovation investment. The goal is to optimize the final results, since different firms located in different sectors, regions and countries have naturally different training and R&D needs. Here, the major difficulty is to find a dataset with this level of detail, and particularly to developing economies.

Third, we use data for a specific year. However, this type of research may present higher value-added when using data for a significant number of years in order to control for the accumulated skills and capacities over the years, through the participation in on-the-job training programs or even learning-by-doing.

7. Final Remarks and Policy Implications

The goal of this paper is twofold. First, we examine the factors behind the firms' decision to provide formal training programs to their workforce, and second we explore the effects on firms' performance from investing in both job training and R&D. Firms with higher exposure to international markets, being part of a larger establishment, supporting investments either in fixed assets or in innovation-related activities, implementing quality control programs, receiving public support to training-related activities and larger firms are more likely to provide job training.

On firms' productivity, our estimates indicate a positive effect from supporting training-related activities, with an effect of 24% in Chile and 18% in Argentina. Investing individually in R&D has a negative effect, which may be explained by the possible lack of skills of the workforce such that if firms simply invest in new products or new technologies their employees may not be able to explore and manage them. Perhaps the most important conclusion from this study is the complementary relationship between training and R&D, i.e. firms' productivity is greater when these two policies work together. Although with different magnitudes, these conclusions are independent from the econometric procedure (i.e. OLS, treatment-effects and instrumental variable).

Our analysis casts some important findings for government policies. The Latin America's intention of a solid integration in the international economy has to be followed by a deeper effort concerning some structural concerns such as education, training, infrastructures and innovation. Despite its positive influence, training should not be interpreted as an independent strategy or a panacea to achieve stronger productivity and economic growth, and supporting solely R&D activities is not a current solution, considering the lack of workforce capacities to manage the new technologies. Hence, the complementary relationship between training and R&D and between training and education appears to give some space for Latin American governments' intervention, by supporting better education systems that may later stimulate firms to provide formal training programs, qualifying their workforce and allowing for a greater international exposure. For instance, by easing the access to credit or using tax policies, Latin American governments could subsidize individuals that make efforts to learn new skills and firms that provide job training.

The positive effects deriving from foreign-owned companies, the investment in fixed assets and the existence of alliances with other suppliers or clients may mean that Latin American governments have to support the urgent modernization of their production structures, create endogenous technological competences and stimulate an effective collaboration for innovation that may be eased by the exports diversification and a stronger international integration.

In summary, despite the importance of training and workforce skills for productivity and competitiveness, research on developing countries is still undervalued. Continuous training and R&D efforts and guaranteeing an adequate public support appears to be the proper strategy for these countries that are still developing their basilar structures. Supporting only social policies is neither sufficient nor sustainable. In the medium-long run, structural reforms have to be made in order to foster higher productivity grounded on a more knowledge-based growth that should be understood as a continuous learning and developing process, gathering workers, firms and governments.

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9. Appendices

Appendix A: Literature Review

Table A.1: Determinants of the Firms' Investment in Training/Innovation[32]

Author(s)	Training / Innovation Input	Data Set		Estimation Methodology	Determinants of the Firms' Investment
		Country (Period)	Size (Firms)		
Almeida and Aterido (2010)	Job Training dummy	99 Developing Countries	48, 000 (approximately)	Probit model	Positive relationship between job training and firm size, skills of the workforce, degree of openness and technological innovation. Results are robust within and across countries, with distinct institutions and income levels.
Almeida and Fernandes (2008)	Technological Innovation dummy	43 developing countries (2002-2005)	17,667	Probit model Multinomial logistic regression	Trade, FDI and licenses for technological innovations found as crucial for technology transfers. Strong correlation between trade and technological innovations; majority foreign owned-firms are less likely to innovate than domestic firms and minority foreign-owned firms; technology transfers from multinational parents as an important channel for technology adoption.
Altonji and Spletzer (1991)	Job Training dummy	US (1971-1972)	3,181 individuals	Probit model	Higher incidence of training for women than for men, but women receive a smaller duration of training; Blacks have higher incidence of training and receive more hours than whites, however they are less likely to receive training out of the working hours; College graduates have higher probability of receiving training; high-school characteristics has no significant impact; Individuals in jobs with a higher quantitative/math component are more likely to receive job training.
Álvarez et al. (2011)	R&D Investment dummy R&D Expenditure per Worker	Chile (1995, 1998, 2001, 2004)	1,731	Generalized Tobit Model (by ML)	R&D investment: Larger firms are more likely to invest in R&D; Cooperation between firms and universities has a positive effect; International competition and using public resources have no significant effect on R&D investment. R&D expenditure: Wood, Pulp and Paper, Chemicals and Machinery are the sectors where R&D investment is more likely (and with greater intensity).
Baldwin and Johnson (1995)	I. Job Training dummy II. Share of (formal and informal) Trained Workers III. Training (formal and informal) Expenditure	Canada (1992)	904 SMEs[33]	Multivariate Probit model	Training incidence: positive effect from innovation variables, quality control of products and total quality management, labor skills, larger firms, share of production workers, and capital/labor ratio growth; Women has a negative effect on training incidence. Share of trained Workers: Innovation variables, total quality of management and quality control of products have not a significant effect; Training expenditure: higher for the (male) managers' and professionals' training, quality and innovation variables have not a significant effect.
Bartel (1989)	Training dummy	US (1987)	493	Binary Logit model	Technological change variables, size of the business, product market competition, job tenure and being manager have a positive and significant effect; education has a positive but non-significant effect.
Bauernschuster et al. (2009)	Innovative Activities dummy	Germany (1997-2001)	3,198	Probit model OLS IV (2SLS)	Higher propensity to innovate: Lagged continuous training, larger and younger firms (except for 2SLS). Lower propensity to innovate: The presence of works council has a negative but non-significant effect on the firm's propensity to innovate. Being part of a multi-establishment firm does not have a significant effect on innovation activities.
Budría and Pereira (2004)	Training dummy	Portugal (1998-2000)	27,001 employees	Logit model	Positive effects: Individuals with a second activity, higher education levels, women in culture, sports, leisure, public administration, insurance and finance, and men in construction, food, drinks and tobacco. Negative effect: Older individuals are less likely to be selected. Having a full-time contract and working in the public sector is not significant.
Chung (2000)	Training dummy	Malaysia (1976-1977; 1988)	525 employees	Probit model	Positive effects: Higher levels of education and savings in the bank are related to higher probability of some kind of job training programs. Chinese women are more likely to receive training than the Malays. Marital status has no effect; Analysis considering only females.
Frazis et al. (2000)	Training Dummy Hours of Training Training Expenditures	US (1995)	1,062 firms 1,073 employees	Probit model	Training incidence: Larger firms and firms providing more generous wages and with innovative workplace practices are more likely to provide training; firms with higher shares of temporary workers have less propensity to provide training as well as with the presence of unions; Workers with a bachelor are more likely to receive training. Training intensity: hours of training are positively related with the benefits offered by the firm and its workplace practices; part-time workers, unions' presence, and employees' turnover have a negative effect. Training costs: Larger firms, firms with higher wages and benefits and with innovative workplace practices are more likely to provide job training, while union's presence, employees' turnover rate and the share of part-time workers have a negative impact on training expenditures.

[32] It is worth mentioning that Table A1 only reflects the most significant factors found in each article otherwise it would become an excessively extensive analysis and its purpose (i.e. conclude on the most important factors influencing the firms' investment in innovation or job training) would be lost.

[33] SMEs are defined as firms having less than 500 employees and less than 100 million dollars in assets.

Galia and Legros (2004)	R&D Investment dummy	France (1997)	2,165	Tobit model	Market demand, public subsidies and belong to a foreign group have a positive and significant impact on firms' R&D investment; Firm size has no effect.
Kemp et al. (2003)	Share of Time spent in Innovative Activities	Netherlands (1999)	1,769	OLS	National subsidies, continuous innovation, market research, product innovation, export growth, cooperation with other firms and with research institutions have positive and strong effects on the time put into innovation; Employees turnover has a negative and significant effect. Authors, also split the analysis between Small and Medium size firms, and considering only innovative firms; Conclusions remain relatively unchanged.
Lillard and Tan (1986)	Regular School Training On-the-Job Training	US	-----	Probit model	Regular School Training: it increases with potential work experience and for non-white workers, with the level of schooling, job tenure and with the presence of unions, and decreases in industries with high technological change. On-the-Job Training: it increases with schooling up to a maximum of 16 or less years and for high-technology industries, and decreases in volatile markets with high rates of unemployment and if the worker is a male non-white; for individuals working in high-tech industries, previous company training is not important (i.e. low skills transferability); racial differences are stronger among males than among females.
O'Connell and Byrne (2009)	Training dummy	Ireland (2003)	5,200 employees	Probit model	Positive effects: workers with university education, married individuals (non-significant), public sector workers, firms that are part of a larger establishment, firm's size and high performance work practices (e.g. worker participation and consultation, performance reward systems, progressive employment policies and flexible working arrangements). Female workers and temporary workers are less likely to receive training, although the effects are non-significant
Tan and Batra (1996)	Formal Internal Training dummy	Colombia (1992) Indonesia (1992) Malaysia (1994) Mexico (1992) Taiwan (1986)	Colombia: 500; Indonesia: 300 Malaysia: 2,200; Mexico: 5,072 Taiwan: 56,047	Probit model	Positive effects: firm's size (only significant for Mexico and Malaysia), multi-plants establishments, highly educated workers (complementarity between training and education, except for Indonesia) and firms investing in R&D (for Malaysia, Mexico and Taiwan); R&D investment-training relationship is higher for countries with higher levels of income; Foreign ownership, being an exporter firm (except for Malaysia), the degree of equipment automation and quality control processes, being a female worker (except in Indonesia) and the presence of unions (except in Colombia) have also positive effects on formal job training incidence.
Zwick (2002)	Training dummy	Germany (1997-2000)	1997: 5,675 1998: 6,192 1999: 6,886	Probit model	Positive effect: firms' expectations on skill shortages, continuous training policies, larger firms, collective wage agreements and highly educated workers.
Zwick (2006)	Share of Trained Workers	Germany (1998-2001)	1997: 8.917 1998: 10.284 1999: 11.141 2000: 15.526 2001: 15.537	IV	Positive effect: firms' expectations on skill shortages, smaller firms, highly educated workers, employee participation.

Table A.2: Literature Review of the Training Effects on Firms' Productivity

Author	Productivity Variable	Training Variable	Data Set		Estimation Methodology	Endogeneity Control	Training Effects on Productivity	Comments/Additional Information
			Country (Period)	Size (Firms)				
Alba-Ramirez (1994)	I. Sales per Worker (log) II. Value-Added per Worker (log)	Share of junior and senior workers who receive formal job training	Spain (1988)	600	Probit and Tobit model	No	Senior Workers: 0.25 (I) and 0.30 (II) Junior Workers: -0.10 (I) and -0.01 (II)	Considering only firms with 200 or more workers; authors attempted to find some proper instruments, although all failed the independence requisite from the error term.
Almeida and Carneiro (2008)	Value-Added (log)	Training hours per employee	Portugal (1995-1999)	1,500	SYS-GMM	Yes SYS-GMM (instruments: lagged first differences)	Average return: 8.6% Lower bound: 6.7%	Estimating both a production and a cost function; An increase of 10hours in the amount of training per worker implies an increase between 0.6% and 1.3% in current value-added; Investments in human capital without investing in job training implies on average negative returns.
Ballot et al. (2001)	Value-Added (log)	Annual training expenditures Hours of training	France Sweden (1987–1993)	France: 200 Sweden: 200	OLS Fixed and Random Effects GMM and SYS-GMM	Yes Fixed and Random Effects GMM and GMM-SYS (Instruments: lagged first differences)	France: 0.28 Sweden: -0.01 (by GMM-SYS)	Panel data considering only large firms; using GMM any factor is significant; For France, the R&D coefficient comes negative (OLS and GMM), and it is never significant (OLS, Fixed and Random Effects, GMM and GMM-SYS).
Barret and O'Connell (1999)	Output per Worker (log)	I. Share of Trained Workers II. Training Days per Worker III. Share of Training Expenditure	Ireland (1993-1995)	215	OLS	Yes Productivity function using first differences	Effect of I: 0.10* Effect of II: 0.01** Effect of III: 0.01	Understand how the training provided in 1993 affected the firm's productivity between 1993 and 1995; Authors distinguish between general and specific training; General training has greater positive impact (0.03**) on productivity growth than specific training (-0.02).
Barron et al. (1989)	Rate of Productivity Growth	Hours of Training during the first 3 months of Employment (log)	US (1992)	1,901	OLS	No	Effect: 0.176	Rate of wage growth: 0.04.
Bartel (1991)	Net Sales Growth per Worker (log)	Training dummy for Managers, Professionals, Clerical and Production Workers	US (1983-1986)	495	OLS	Yes Estimating the production function (productivity equation) in first differences	Managers: 0.18 Professionals: 0.27 Clerical: 0.56 Production: 0.20	Data on manufacturing firms.
Black and Lynch (1996)	Sales (log)	I. Number of workers trained in 1993 (log) II. Number of workers trained in 1990 (log)	US (1994)	1,621 manufacturing 1,324 non-manufacturing	OLS	No	I: -0.12 for manufacturing; 0.08 for non-manufacturing II: 0.09 for manufacturing; -0.11 for non-manufacturing	Manufacturing and non-manufacturing estimations, separately; complementarity between education and training; dummies for training content are positive and statistically significant only for non-manufacturing; the existence of a R&D center anywhere in the enterprise comes with a negative effect on productivity.
Conti (2004)	Value-Added per Worker (log)	Share of Trained Workers	Italy (1996-1999)	200,000 individuals 51,760 firms	OLS Fixed Effects GMM SYS-GMM	Yes Fixed Effects GMM and SYS-GMM (instruments: lagged first differences variables)	SYS-GMM: 0.071	GMM estimations are not statistically significant; positive and significant impact of training on productivity but not on wages.
Dearden et al. (2000)	Value-Added per Worker (log)	Share of Trained Workers: current (I) and one year lag (II)	UK (1983-1996)	1,144	IV; SYS-GMM	Yes SYS-GMM (Instruments: lagged first differences variables)	I: 0.80 II: 0.22	The overall effect of training on productivity is around twice as large as the impacts on wages.
Dostie (2010)	Value-Added per Worker (log)	Share of Trained Workers	Canada (1999-2006)	30,563	OLS Fixed Effects GMM estimator	Yes Fixed Effects and GMM (Instruments: first differences of all exogenous variables)	On-the-job Training: 0.02 Classroom Training: 0.07	Workers who receive on-the-job (classroom) training are 3.4% (11%) more productive.
Konings (2008)	Total Factor Productivity	Share of Trained Workers	Belgium (1997-2005)	13,000	Fixed Effects	Yes Fixed Effects	Effect: 0.03***	Regressions on manufacturing and non-manufacturing firms (jointly and separately); Effect on non-manufacturing firms (0.038***) greater than on manufacturing (0.035***).

Konings and Vanormelingen (2010)	Value-Added per Worker (log)	Share of Trained Workers Training Hours per Employee	Belgium (1997-2006)	170,000	OLS ACF	Yes ACF method [34]	OLS: 0.46 (share of trained workers) ACF: 0.24 (share of trained workers)	Marginal product of trained workers is about 32% higher than the one for the untrained, and productivity premium (23%) higher than wage premium (12%); Robustness checks among sectors and between white and blue-collar workers; estimations for manufacturing and non-manufacturing sub-samples.
Ng and Siu (2004)	Sales (log)	I. Expenditure on Technical Training per Worker (log) II. Expenditure on Managerial Training per Worker (log)	China (1999)	SOEs:224 Non-SOEs: 261	OLS	No	SOE: 9.19 for I and 0.03 for II Non-SOE: 11.80 for I and 0.05 for II	Production function estimated separately by State-Owned and Non-State-Owned companies.
Tan and Batra (1996)	Value-Added (log)	Training dummy	Colombia(1992) Indonesia(1992) Malaysia (1994) Mexico (1992) Taiwan (1986)	Colombia: 500 Indonesia: 300 Malaysia: 2,200 Mexico: 5,072 Taiwan: 56,047	Probit model IV	Yes (Selection function without R&D, and production function using the training predicted value)	Mexico: 0.444***, Colombia: 0.266** Indonesia: 0.711*, Taiwan: 0.028***, Malaysia: 0.282***	Distinction between skilled and unskilled worker training, and between internal and external training; The training impact is higher for skilled workers and for in-house training programs; Using IV, the R&D coefficient comes negative for Colombia, Indonesia and Malaysia.
Thang et al. (2008)	Sales and Sales per Worker (in levels and growth; log)	Share of training costs	Vietnam (2006)	196	OLS	Yes Production function using first differences of all variables	Sales growth: Mfg:-0.90** Non-Mfg:-0.03 Growth of Sales per Worker: Mfg:-0.91** Non-Mfg: 0.01	Manufacturing and non-manufacturing estimations, separately.
Zwick (2002)	Value-Added	I. Share of Trained Workers II. On-the-job Training dummy	Germany (1997-2000)	1997: 5,675 1998: 6,192 1999: 6,886	Fixed Effects IV	Yes Instruments: using lagged training intensity and predicted training intensity (Tobit model)	I: 0.77*** II: 0.01	Data on profit oriented firms; Impact of the trained workers (in 1997) on productivity, for the period 1997-1999.
Zwick (2006)	Value-Added (log)	Share of trained workers	Germany (1998-2001)	1997: 8.917 1998: 10.284 1999: 11.141 2000: 15.526 2001: 15.537	Fixed Effects IV	Yes IV (Instrumenting training intensity using expected skills shortage and personnel department activity)	Training: 0.76*	Firms tend to train during periods of low productivity; training is essentially provided to the more skilled workers.

Note: Significance levels: *** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level

[34] Method applied to control for the endogeneity of inputs and training variable. For more detailed information see Ackerberg, Caves and Frazer (2006).

Table A.3: Literature Review of the Innovation Effects on Firms' Productivity

Authors	Productivity Indicator	Innovation Output	Data Set: Country (Period)	Data Set: Size (Firms)	Estimation Methodology	Endogeneity Control	Innovation Effects on Productivity	Comments/Additional Information
Álvarez et al. (2011)	Sales per worker (log)	Product and process dummies	Chile (1995, 1998, 2001, 2004)	1995: 525 1998: 390 2001: 410 2004: 823	CDM model, sequential IV	Yes Productivity equation instrumenting innovation input and output using their predicted values	Process: 1.04** Product: -0.06	Data on manufacturing firms.
Arza and López (2010)	Sales per Worker (log)	Process and Product dummies	Argentina (1998-2004)	835	CDM model, sequential Probit Random Effects for innovation; Random and fixed Effects for productivity	Yes Productivity equation instrumenting innovation input and output using their predicted values	Product: 0.12** Process: 0.13***	Data on manufacturing firm; Innovation output variables considered separately and jointly; Investments in in-house activities, intangible technologies, ICTs and in embodied technologies are the innovation inputs rather than R&D (as in the original CDM model).
Chudnovski et al. (2006)	Sales per Worker (log)	Process and Product dummies	Argentina (1992-2001)	718	CDM model, sequential; ML logit for innovation Fixed Effects for productivity	Yes Fixed Effects	Product: 0.09 Process: 0.18**	Data on manufacturing firms; Innovation output variables considered separately and jointly; On average, labor productivity of innovators is 14.1% higher than in non-innovators.
Crépon et al. (1998)	Value-added per Worker (log)	Nº of Patents Share of Innovation Sales	France (1986-1990)	4,164	CDM model: ALS	Yes ALS; estimating all equations simultaneously	Patents: 0.089*** Share of Innovative Sales: 0.065***	Data only on innovative manufacturing firms.
Crespi and Zuñiga (2010)	Sales per worker (log)	Product and process dummies	Argentina Chile Colombia Costa Rica Panama Uruguay [35]	Argentina: 1,192 Chile: 1,154 Colombia: 5,934 Costa Rica: 352 Panama: 481 Uruguay: 759	CDM model, sequential Probit model for innovation IV	Yes Productivity equation instrumenting innovation input and output using their predicted values	Argentina: 0.24* Chile: 0.60** Colombia:0.92*** Costa Rica: 0.63 Panama: 1.65*** Uruguay: 0.8***	Selection equation uses a dichotomous variable equal to 1 if the firm decides to invest in innovations activities (rather than R&D investment as in the original CDM model); CDM model is run for all firms (rather than just for innovative firms as in the original CDM model).
Damijan et al. (2008)	Value-added per Worker (log)	Innovation dummy	Slovenia (1996, 1998, 2000, 2002)	1996: 1,454 1998: 1,777 2000: 2,518 2002: 2,564	CDM model: ALS OLS (first-differences) Matching estimator	Yes ALS; estimating all equations simultaneously	Innovation: 0.930***	Innovation output aggregates product and process innovation; OLS is applied to estimate the effect of innovation on productivity growth (1996-2002), and matching estimator as a robustness check between innovating and non-innovating firms with identical characteristics.
Galia and Legros (2004)	Gross operating surplus divided by sales	Product and process dummies	France (1997)	2,165	CDM model: ALS	Yes ALS; estimating all equations simultaneously	R&D: 0.09 Innovation: 0.06 Training: 0.01 Quality: 0.01 Profitability: 36.12	Five equations are estimated, simultaneously; Authors test a virtuous relationship between R&D, innovation, training, quality and profitability.
Goedhuys (2007)	I. Sales Growth II. Total Factor Productivity Index[36]	Process and Product dummies	Brazil (2000-2002)	1,352	Partial Adjustment Model for productivity	Yes Instrumenting Training and R&D variables[37]	I (1997-2002): Product: 0.001 Process: -0.008 II: Product: 0.016 Process: -.0079**	Data on manufacturing firms; Sales growth estimated for the period 2000-2002 and 1997-2002, and for traditional and innovation intensity sectors.

[35] Innovation Survey period: Argentina: 1998-2001; Chile: 2003-2004; Colombia: 2003-2004; Costa Rica: 2008; Panama: 2008; Uruguay: 2004-2006
[36] The firm input and output innovation values are compared to the arithmetic input and output innovation values of the industry. TPF Index is thus the relative productivity of the firm within its sector. For more detailed information see Goedhuys (2007).
[37] Instruments for Training dummy: degree of unionization and dummy equal to 1 if the firm is member of a business association; Instruments for R&D: profitability in 2001 and dummy equal to 1 if the firm's major competitor is an imported product.

Goedhuys et al. (2006)	Value-added per Worker (log)	Product and Process dummies	Tanzania (2003)	187	OLS Quantile Regression	No	Product: -0.087 Process: -0.124	Data on manufacturing firms; Training dummy has a positive but non-significant effect on productivity (0.031); Quartile regression found that manager's education, capital per worker and capacity utilization are the most significant characteristics of low productivity firms , and capital per worker, total number of employees and ISO certification are the ones for the high productivity firms.
Griffith et al. (2006)	Sales per Worker (log)	Product and Process dummies	France, Germany Spain, UK (1998-2000)	France: 3,625 Germany: 1,123 Spain:3,588 UK: 1,904	CDM model, sequential IV	Yes Productivity equation instrumenting innovation input and output using their predicted values	France: Product: 0.060** Process: 0.069*** Germany: Product: -0.053 Process: 0.022 Spain: Product: 0.176** Process: -0.038 UK: Product: 0.055*** Process: 0.029	Data on all manufacturing firms, i.e. innovators and non-innovators (rather than only on innovative firms as in the original CDM model), which helps to control for selection bias/endogeneity; Regressions in 3 steps and for each country, separately.
Hall et al. (2012)	Sales per Worker (log)	Product, Process and Organizational change dummy	Italy (1995-2006)	14,294	CDM model, sequential Quadrivariate Probit model for innovation; IV for productivity	Yes Productivity equation instrumenting innovation input and output using their predicted values	Product: 0.69*** Process: -0.43***	Data on manufacturing firms; innovation input includes R&D and ICT investments (rather than only R&D as in the original CDM model).
Jefferson et al. (2002)	Sales per Worker (log)	Share of Innovation Sales (log)	China (1997-1999)	5,451	CDM model, sequential IV	Yes Instrumenting Sales using size dummies, ownership and sector classifications)	Innovation Sales: 0.035	Data on large-medium size manufacturing firms that are R&D performers and with non-negative profits; No control for innovation selection bias; estimated effect of Innovation Sales on profitability: 0.149.
Kemp et al. (2003)	Turnover and Employment growth, Profit and Productivity	Share of new products in total turnover	Netherlands (1999)	3,000	CDM model, sequential Probit model using Maximum Likelihood; OLS	Yes OLS using the inverse Mill's ratio	Turnover growth: 0.40*** Employment growth: 0.03**	Innovation has only positive effects on turnover growth and employment growth.
Lööf et al. (2003)	Sales per Worker (log)	I. Sales income from product innovation, per worker (log) II. Process Dummy	Germany Sweden (1998-2000)	Germany: 575 Sweden: 474	CDM model, sequential 2SLS for innovation and productivity	Yes IV, Weighted 2SLS.	I. Germany: 0.268*** Sweden: 0.290*** II. Germany: -0.136** Sweden: -0.030	Data on knowledge intensive manufacturing firms; Elasticity of productivity with respect to innovation output is statistically identical between the two countries.
Masso and Vahter (2008)	I. Sales per Worker (log) II. Value-added per Worker (log)	Process and Product dummies Organizational dummies for 2002-2004)	Estonia (1998-2000; 2002-2004)	1998-2000: 1,467 2002-2004: 992	CDM model, sequential Bivariate Probit model for innovation, IV	Yes Productivity equation instrumenting innovation input and output using their predicted values	I. Product: 98-00: 0.168**; 02-04:0.027 Process: 98-00: - 0.027; 02-04: 0.182 Org: 02-04:0.132*** II. Product: 98-00: 0.207**; 02-04:0.002 Process: 98-00: - 0.055; 02-04:0.151*** Org: 02-04:0.097**	Data on manufacturing firms; Expenditure on innovative actives as the innovation input (rather than the R&D expenditure as in the original CDM model).
Siedschlag et al. (2010)	Sales per Worker	Product, Process and Organizational dummies; Share of Innovation Sales	Ireland (2004-2008)	723	CDM model, sequential IV	Yes Productivity equation instrumenting innovation input and output using their predicted values	Product: 0.452*** Process: 0.334*** Organizational: 0.613*** Innovation sales: 0.114***	Data on all firms, i.e. innovators and non-innovators, which helps to control for selection bias/endogeneity; Using innovation expenditure rather than R&D expenditure (as in the original CDM model).

Note: Significance levels: *** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level

Appendix B: Summary Statistics and Econometric Results

Table B.1: Variables' Definition

Variable	Definition
Training	Dummy variable equal to 1 if the firm offered formal training programs to its workers, in the previous year.
Age of the Firm	Year of the survey minus the year when the firm started operations.
Small	Dummy variable equal to 1 if the firm has between 5 and 19 employees.
Medium	Dummy variable equal to 1 if the firm has between 20 and 99 employees.
Large	Dummy variable equal to 1 if the firm has more than 99 employees.
Part of a Larger Firm	Dummy variable equal to 1 if the firm is part of a larger establishment.
Foreign	Dummy variable equal to 1 if more than 10% of the firm's capital is owned by private foreign individuals, companies or organizations.
Domestic	Dummy variable equal to 1 if 100% of the firm's capital is owned by domestic entities.
Exporter	Dummy variable equal to 1 if the firm exports (directly or indirectly) 10% or more.
Openness	Dummy variable equal to 1 if the firm exports (directly or indirectly) 10% or more, or if more than 10% of the firm's capital is owned by private foreign individuals, companies or organizations.
Share of Female Workers	Percentage of female workers in the total permanent, full-time workers.
Bachelor	Percentage of permanent, full-time workers who has at least a bachelor degree at the end of fiscal year 2009.
Investment	Dummy variable equal to 1 if the firm purchased any fixed asset, such as machinery, vehicles, equipment, land or buildings.
Capacity Utilization	Percentage of the firm's capacity being used in production.
Access to Finance	Dummy variable equal to 1 if a firm considers the access to finance a major or very severe obstacle to its current activity.
Public Support to Training	Dummy variable equal to 1 if a firm received any public support (financial or other types of assistance) for training-related activities.
Firm Support to Innovation	Dummy variable equal to 1 if the firm used any services or programs to support innovation, for the last three years.
R&D	Dummy variable equal to 1 if the firm has spent on research and development activities, within the firm or other companies contracted.
Quality Control	Dummy variable equal to 1 if the firm has used any services or programs to improve quality control to obtain quality certification.
Alliances	Dummy variable equal to 1 if the firm has used any services or programs to make business alliances with others suppliers or clients.
Registered	Dummy variable equal to 1 if the firm was registered when it started operations.
Labor Regulations	Dummy variable equal to 1 if the firm considers that the labor market regulations are a major or very severe obstacle to its current activity.
Tax Administration	Dummy variable equal to 1 if the firm considers the tax administration a major or very severe obstacle to its current activity.
Sector	Two-digit industries: food, textiles, garments, chemicals, plastics and rubber, non-metallic mineral products, basic metals, fabricated metal products, machinery and equipment, electronics, other manufacturing, retail, wholesale, IT, hotel and restaurants, services of motor vehicles, construction and transport.
Sales per Worker (log)	Sales divided by total number of permanent, full-time workers.
Workers (log)	Total number of permanent, full-time workers

Source: *Enterprise Surveys* (World Bank), Chile (2010) and Argentina (2010)

Table B.2: Summary Statistics of the Main Firm Level Characteristics (Chile 2010)

	N	Mean	Std. Dev.	Min	Max
Training and Technology					
Share of Firms Training	1,032	0.596	0.491	0	1
Public Support to Training	1,030	0.394	0.489	0	1
Firm Support to Innovation	1,023	0.384	0.487	0	1
R&D	771	0.427	0.495	0	1
Quality Control	1,029	0.545	0.498	0	1
Alliances	1,028	0.377	0.485	0	1
Age of the Firm	1,032	31.598	22.690	1	210
Exporter	1,031	0.203	0.402	0	1
Capacity Utilization	773	0.716	0.208	0.02	1
Investment	1,480	0.535	0.499	0	1
Access to Finance	1,023	0.192	0.394	0	1
Registered	1,029	0.936	0.245	0	1
Size					
Small	1,033	0.307	0.461	0	1
Medium	1,033	0.364	0.481	0	1
Large	1,033	0.329	0.470	0	1
Ownership					
Part of a Larger Establishment	1,033	0.284	0.451	0	1
Foreign	1,032	0.128	0.334	0	1
Domestic	1,032	0.861	0.348	0	1
Openness	1,031	0.272	0.445	0	1
Share of Female Workers	771	0.254	0.236	0	1
Bachelor	1,018	0.137	0.183	0	1
Labor Market Regulation	1,030	0.275	0.447	0	1
Tax Administration	1,015	0.085	0.279	0	1
Region					
Santiago	1,033	0.682	0.466	0	1
Antofagasta	1,033	0.081	0.272	0	1
Los Lagos	1,033	0.100	0.300	0	1
Valparaiso	1,033	0.137	0.345	0	1
Sector					
Food	1,025	0.175	0.380	0	1
Textiles	1,025	0.069	0.254	0	1
Garments	1,025	0.047	0.211	0	1
Chemicals	1,025	0.093	0.290	0	1
Plastics and Rubber	1,025	0.075	0.264	0	1
Non-metallic Mineral Products	1,025	0.028	0.166	0	1
Basic Metals	1,025	0.018	0.131	0	1
Fabricated Metal Products	1,025	0.128	0.335	0	1
Machinery and Equipment	1,033	0.026	0.160	0	1
Electronics	1,025	0.003	0.054	0	1
Other Manufacturing	1,025	0.110	0.313	0	1
Retail	1,025	0.140	0.347	0	1
Wholesale	1,025	0.020	0.142	0	1
IT	1,025	0.037	0.189	0	1
Construction	1,025	0.009	0.093	0	1
Hotel and Restaurants	1,025	0.006	0.076	0	1
Services of Motor Vehicles	1,025	0.003	0.054	0	1
Transport	1,025	0.013	0.112	0	1

Source: Authors' own calculations based on the *Enterprise Surveys* (World Bank)

Table B.3: Summary Statistics of the Main Firm Level Characteristics (Argentina 2010)

	N	Mean	Std. Dev.	Min	Max
Training and Technology					
Share of Firms Training	1,049	0.643	0.479	0	1
Public Support to Training	1,047	0.110	0.313	0	1
Firm Support to Innovation	1,043	0.395	0.489	0	1
R&D	789	0.594	0.491	0	1
Quality Control	1,052	0.500	0.500	0	1
Alliances	1,048	0.363	0.481	0	1
Age of the Firm	1,045	32.896	23.778	1	143
Exporter	1,052	0.318	0.466	0	1
Capacity Utilization	779	0.718	0.194	0.05	1
Investment	1,051	0.668	0.471	0	1
Access to Finance	1,041	0.372	0.484	0	1
Registered	1,042	0.919	0.272	0	1
Size					
Small	1,054	0.350	0.477	0	1
Medium	1,054	0.360	0.480	0	1
Large	1,054	0.290	0.454	0	1
Ownership					
Part of a Larger Establishment	1,054	0.303	0.460	0	1
Foreign	1,053	0.130	0.337	0	1
Domestic	1,054	0.864	0.343	0	1
Openness	1,052	0.369	0.483	0	1
Share of Female Workers	757	0.231	0.227	0	1
Bachelor	1,022	0.131	0.188	0	1
Labor Market Regulation	1,050	0.512	0.500	0	1
Tax Administration	1,044	0.415	0.493	0	1
Region					
Buenos Aires	1,054	0.579	0.494	0	1
Rosario	1,054	0.122	0.328	0	1
Mendoza	1,054	0.112	0.315	0	1
Córdoba	1,054	0.119	0.315	0	1
Chaco	1,054	0.068	0.252	0	1
Sector					
Food	1,054	0.163	0.370	0	1
Textiles	1,054	0.056	0.230	0	1
Garments	1,054	0.097	0.296	0	1
Chemicals	1,054	0.117	0.321	0	1
Plastics and Rubber	1,054	0.032	0.177	0	1
Non-metallic Mineral Products	1,054	0.010	0.102	0	1
Basic Metals	1,054	0.009	0.092	0	1
Fabricated Metal Products	1,054	0.042	0.200	0	1
Machinery and Equipment	1,054	0.134	0.341	0	1
Electronics	1,054	0.005	0.069	0	1
Other Manufacturing	1,054	0.097	0.296	0	1
Retail	1,054	0.111	0.314	0	1
Wholesale	1,054	0.027	0.161	0	1
IT	1,054	0.037	0.189	0	1
Construction	1,054	0.023	0.149	0	1
Hotel and Restaurants	1,054	0.013	0.115	0	1
Services of Motor Vehicles	1,054	0.017	0.130	0	1
Transport	1,054	0.011	0.106	0	1

Source: Authors' own calculations based on the *Enterprise Surveys* (World Bank)

Table B.4: Summary Statistics by Training Intensity (Chile 2010)

	Training Firms	Non-Training Firms
Training and Innovation		
Number of Firms Training	615	417
Public Support to Training	0.610	0.077
Firm Support to Innovation	0.512	0.197
R&D	0.575	0.231
Quality Control	0.760	0.228
Alliances	0.473	0.237
Age of the Firm	32.663	30.070
Exporter	0.281	0.089
Capacity Utilization	0.744	0.679
Investment	0.757	0.452
Access to Finance	0.403	0.441
Registered	0.944	0.923
Size		
Small	0.149	0.541
Medium	0.351	0.382
Large	0.500	0.077
Ownership		
Part of a Larger Establishment	0.384	0.134
Foreign	0.189	0.038
Domestic	0.799	0.952
Openness	0.377	0.118
Share of Female Workers	0.226	0.290
Bachelor	0.180	0.075
Labor Market Regulation	0.269	0.284
Tax Administration	0.066	0.112
Region		
Santiago	0.665	0.710
Antofagasta	0.083	0.076
Los Lagos	0.112	0.082
Valparaiso	0.140	0.132
Sector		
Foods	0.180	0.167
Textiles	0.041	0.111
Garments	0.026	0.077
Chemicals	0.118	0.056
Plastics and Rubber	0.069	0.086
Non-metallic Mineral Products	0.036	0.017
Basic Metals	0.025	0.007
Fabricated Metal Products	0.118	0.145
Machinery and Equipment	0.024	0.029
Electronics	0.003	0.002
Other Manufacturing	0.103	0.122
Retail	0.139	0.138
Wholesale	0.031	0.005
IT	0.051	0.017
Construction	0.007	0.012
Hotel and Restaurants	0.005	0.007
Services of Motor Vehicles	0.003	0.002
Transport	0.021	0.000
Sales per Worker (log)	15.490	14.822
Workers (log)	4.552	2.955

Source: Authors' own calculations based on the *Enterprise Surveys* (World Bank)
Table reports mean values of the variables.

Table B5: Summary Statistics by Training Intensity (Argentina 2010)

	Training Firms	Non-Training Firms
Training and Innovation		
Number of Firms Training	675	374
Public Support to Training	0.148	0.040
Firm Support to Innovation	0.488	0.226
R&D	0.721	0.372
Quality Control	0.626	0.273
Alliances	0.432	0.241
Age of the Firm	34.201	30.482
Exporter	0.383	0.206
Capacity Utilization	0.728	0.701
Investment	0.741	0.534
Access to Finance	0.335	0.440
Registered	0.934	0.895
Size		
Small	0.252	0.527
Medium	0.388	0.310
Large	0.360	0.163
Ownership		
Part of a Larger Establishment	0.361	0.193
Foreign	0.178	0.045
Domestic	0.813	0.955
Openness	0.453	0.223
Share of Female Workers	0.219	0.252
Bachelor	0.162	0.074
Labor Market Regulation	0.462	0.604
Tax Administration	0.392	0.457
Region		
Buenos Aires	0.573	0.591
Rosario	0.129	0.112
Mendoza	0.124	0.091
Córdoba	0.107	0.134
Chaco	0.067	0.072
Sector		
Foods	0.179	0.131
Textiles	0.041	0.083
Garments	0.049	0.184
Chemicals	0.154	0.048
Plastics and Rubber	0.037	0.024
Non-metallic Mineral Products	0.010	0.011
Basic Metals	0.010	0.005
Fabricated Metal Products	0.040	0.043
Machinery and Equipment	0.130	0.142
Electronics	0.007	0.000
Other Manufacturing	0.087	0.115
Retail	0.111	0.110
Wholesale	0.025	0.029
IT	0.050	0.013
Construction	0.024	0.021
Hotel and Restaurants	0.009	0.021
Services of Motor Vehicles	0.021	0.011
Transport	0.013	0.008
Sales per Worker (log)	13.430	12.943
Workers (log)	4.192	3.187

Source: Authors' own calculations based on the *Enterprise Surveys* (World Bank)
Table reports mean values of the variables.

Table B.6: Summary Statistics by R&D Intensity (Chile 2010)

	Firms Supporting R&D	Firms Non-Supporting R&D
Firm Characteristics		
Number of Firms spending on R&D	329	442
Public Support to Training	0.497	0.274
Public Support to Innovation	0.220	0.077
Quality Control	0.729	0.417
Alliances	0.456	0.249
Age of the Firm	34.860	31.054
Exporter	0.341	0.172
Capacity Utilization	0.726	0.707
Investment	0.766	0.508
Access to Finance	0.168	0.228
Registered	0.942	0.918
Size		
Small	0.158	0.437
Medium	0.395	0.357
Large	0.447	0.206
Ownership		
Part of a Larger Establishment	0.292	0.181
Foreign	0.179	0.093
Domestic	0.812	0.898
Openness	0.405	0.218
Share of Female Workers	0.237	0.267
Bachelor	0.155	0.075
Labor Market Regulation	0.298	0.263
Tax Administration	0.080	0.101
Region		
Santiago	0.696	0.706
Antofagasta	0.064	0.066
Los Lagos	0.122	0.084
Valparaiso	0.119	0.145
Sector		
Foods	0.211	0.240
Textiles	0.052	0.120
Garments	0.049	0.059
Chemicals	0.190	0.061
Plastics and Rubber	0.104	0.095
Non-metallic Mineral Products	0.052	0.025
Basic Metals	0.028	0.016
Fabricated Metal Products	0.144	0.181
Machinery and Equipment	0.040	0.027
Electronics	0.006	0.002
Other Manufacturing	0.107	0.145
Retail	0.012	0.025
Wholesale	0.000	0.000
IT	0.000	0.002
Construction	0.006	0.000
Hotel and Restaurants	0.000	0.000
Services of Motor Vehicles	0.000	0.000
Transport	0.000	0.000
Sales per Worker (log)	15.411	15.955
Workers (log)	4.333	3.409

Source: Authors' own calculations based on the *Enterprise Surveys* (World Bank)
Table reports mean values of the variables.

Table B.7: Summary Statistics by R&D Intensity (Argentina 2010)

	Firms Supporting R&D	Firms Non-Supporting R&D
Firm Characteristics		
Number of Firms Spending on R&D	469	320
Public Support to Training	0.131	0.053
Public Support to Innovation	0.216	0.091
Quality Control	0.655	0.363
Alliances	0.384	0.216
Age of the Firm	35.088	33.731
Exporter	0.459	0.250
Capacity Utilization	0.725	0.709
Investment	0.776	0.542
Access to Finance	0.372	0.386
Registered	0.926	0.906
Size		
Small	0.264	0.456
Medium	0.377	0.331
Large	0.358	0.213
Ownership		
Part of a Larger Establishment	0.320	0.234
Foreign	0.152	0.128
Domestic	0.836	0.872
Openness	0.506	0.297
Share of Female Workers	0.228	0.236
Bachelor	13.038	7.471
Labor Market Regulation	0.489	0.588
Tax Administration	0.418	0.398
Region		
Buenos Aires	0.646	0.622
Rosario	0.124	0.138
Mendoza	0.104	0.091
Córdoba	0.104	0.103
Chaco	0.021	0.047
Sector		
Foods	0.213	0.225
Textiles	0.043	0.116
Garments	0.087	0.188
Chemicals	0.198	0.069
Plastics and Rubber	0.055	0.025
Non-metallic Mineral Products	0.015	0.013
Basic Metals	0.013	0.009
Fabricated Metal Products	0.051	0.063
Machinery and Equipment	0.186	0.156
Electronics	0.006	0.006
Other Manufacturing	0.128	0.125
Retail	0.002	0.000
Wholesale	0.000	0.003
IT	0.000	0.000
Construction	0.000	0.000
Hotel and Restaurants	0.000	0.000
Services of Motor Vehicles	0.002	0.003
Transport	0.000	0.000
Sales per Worker (log)	13.372	13.060
Workers (log)	4.170	3.470

Source: Authors' own calculations based on the *Enterprise Surveys* (World Bank)
Table reports mean values of the variables.

Table B.8: Correlation between Training and some explanatory variables, Chile

	Training
R&D	0.3446***
Firm Support to Innovation	0.3184***
Public Support to Training	0.5358***
Quality Control	0.5241***
Alliances	0.2386***
Investment	0.3108***
Exporter	0.2342***
Foreign	0.2211***
Openness	0.2861***
Part of a Larger Establishment	0.2718***
Capacity Utilization	0.1570***
Registered	-0.0428
Medium	-0.0307
Large	0.4414***
Bachelor	0.2803
Share of Female Workers	-0.1337
Age	0.0561*

Source: Authors' own calculations based on the *Enterprise Surveys* (World Bank)
Table reports the correlation coefficients between Training and several explanatory variables, in Chile. * significant at 10% level , ** significant at 5% level, *** significant at 1% level. Table A1 defines all the variables.

Table B.9: Correlation between Training and some explanatory variables, Argentina

	Training
R&D	0.3426***
Firm Support to Innovation	0.2564***
Public Support to Training	0.1649***
Quality Control	0.3386***
Alliances	0.1895***
Investment	0.2102***
Exporter	0.1811***
Foreign	0.1884***
Openness	0.2281***
Part of a Larger Establishment	0.1764***
Capacity Utilization	0.0673*
Registered	0.0684**
Medium	0.0778***
Large	0.2079***
Bachelor	0.2254***
Share of Female Workers	-0.0690**
Age	0.0749*

Source: Authors' own calculations based on the *Enterprise Surveys* (World Bank)
Table reports the correlation coefficients between Training and several explanatory variables, in Argentina. * significant at 10% level , ** significant at 5% level, *** significant at 1% level. Table A1 defines all the variables.

Table B.10: Missing Values of some Variables after Logical Control

	Chile (N=1,032)		Argentina (N=1,049)	
	Observed	Missing	Observed	Missing
Firms and Workers Characteristics				
Sales*	949	83	970	79
Value-Added*	631	401	547	502
Capital*	617	415	622	427
Capacity Utilization	773	259	779	270
Financing Investments through Banks	640	392	695	354
Share of Skilled Workers	772	260	768	281
Share of Production Workers	774	258	782	267
Share of Female Workers	771	261	757	292
Average Number of Years of Education	762	270	734	315
Innovation and Technology Characteristics				
Cooperation with other Enterprises or Scientific/Technology Institutions	770	262	779	270
Technology License	775	257	785	264
Public Support to Innovation	772	260	789	260
Technological Innovation	774	258	789	260
R&D	771	261	789	260

Source: Authors' own calculations based on the *Enterprise Surveys* (World Bank)
* Variables considered in the logarithmic form and reported in USD at current prices at the time of the Survey
(1USD = 510.25 Chilean Peso and 1USD = 3.912 Argentine Peso)

Table B.11: Probit Regression of Job Training Incidence, Chile

	(1)	(2)	(3)	(4)	(5)	(6)
Firm Support to Innovation	0.180***	0.110***	0.091**	0.088**	0.081**	0.077*
	[0.036]	[0.040]	[0.040]	[0.041]	[0.041]	[0.043]
Quality Control	0.479***	0.389***	0.335***	0.331***	0.314***	0.329***
	[0.031]	[0.035]	[0.038]	[0.038]	[0.040]	[0.041]
Public Support to Training		0.449***	0.398***	0.396***	0.399***	0.405***
		[0.030]	[0.033]	[0.033]	[0.034]	[0.035]
Investment		0.175***	0.149***	0.146***	0.139***	0.140***
		[0.039]	[0.039]	[0.039]	[0.040]	[0.040]
Medium			0.115***	0.100**	0.105***	0.107**
			[0.040]	[0.041]	[0.042]	[0.044]
Large			0.348***	0.294***	0.288***	0.301***
			[0.038]	[0.043]	[0.044]	[0.046]
Openness				0.122***	0.103**	0.113**
				[0.044]	[0.045]	[0.046]
Part of a Larger Establishment				0.134***	0.116**	0.099**
				[0.045]	[0.046]	[0.048]
Registered				0.105	0.129*	0.141**
				[0.070]	[0.070]	[0.071]
Bachelor					0.004**	0.003**
					[0.002]	[0.002]
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	No
Region Fixed Effects	Yes	Yes	Yes	Yes	Yes	No
Industry-Region Fixed Effects	No	No	No	No	No	Yes
Observations	1000	994	994	989	975	938
Pseudo R^2	0.27	0.41	0.45	0.46	0.46	0.47

Source: Authors' own calculations based on the *Enterprise Surveys* (World Bank)

Dependent variable is a dichotomous variable equal to 1 if the firm has formal training programs for its permanent, full-time employees.

Table reports the marginal effect on the firms' propensity to provide formal training programs to their employees by estimating several probit models. Robust standard errors are in brackets. * significant at 10% level , ** significant at 5% level, *** significant at 1% level. Table A1 defines all the variables. The size categories are defined with respect to small firms (i.e. firms with up to 19 employees). Firm age and its square are also included in the regressions (not reported). Industry fixed effects refer to the 2-digit industry or service.

Table B.12: Probit Regression of Job Training Incidence, Argentina

	(1)	(2)	(3)	(4)	(5)	(6)
Firm Support to Innovation	0.165***	0.138***	0.126***	0.128***	0.122***	0.138***
	[0.032]	[0.033]	[0.033]	[0.034]	[0.035]	[0.037]
Quality Control	0.236***	0.221***	0.186***	0.172***	0.162***	0.169***
	[0.033]	[0.033]	[0.034]	[0.034]	[0.035]	[0.037]
Public Support to Training		0.158***	0.155***	0.147***	0.157***	0.163***
		[0.051]	[0.049]	[0.050]	[0.050]	[0.053]
Investment		0.116***	0.076**	0.059*	0.049	0.055
		[0.035]	[0.036]	[0.036]	[0.036]	[0.038]
Medium			0.184***	0.173***	0.171***	0.169***
			[0.034]	[0.034]	[0.035]	[0.038]
Large			0.239***	0.186***	0.182***	0.201***
			[0.036]	[0.041]	[0.043]	[0.044]
Openness				0.090***	0.069*	0.075*
				[0.037]	[0.039]	[0.041]
Part of a Larger Establishment				0.116***	0.110***	0.119***
				[0.037]	[0.039]	[0.041]
Registered				0.065*	0.074	0.083
				[0.064]	[0.067]	[0.071]
Bachelor					0.004***	0.005***
					[0.001]	[0.002]
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	No
Region Fixed Effects	Yes	Yes	Yes	Yes	Yes	No
Industry-Region Fixed Effects	No	No	No	No	No	Yes
Observations	1,036	1,028	1,028	1,014	984	926
Pseudo R^2	0.15	0.17	0.20	0.21	0.23	0.24

Source: Authors' own calculations based on the *Enterprise Surveys* (World Bank)

Dependent variable is a dichotomous variable equal to 1 if the firm has formal training programs for its permanent, full-time employees.

Table reports the marginal effect on the firms' propensity to provide formal training programs to their employees by estimating several probit models. Robust standard errors are in brackets. * significant at 10% level , ** significant at 5% level, *** significant at 1% level. Table A1 defines all the variables. The size categories are defined with respect to small firms (i.e. firms with up to 19 employees). Firm age and its square are also included in the regressions (not reported). Industry fixed effects refer to the 2-digit industry or service.

Table B.13: Probit Regression of Job Training Incidence, with additional controls (Chile and Argentina)

	Baseline Specification Chile (1)	Baseline Specification Argentina (2)	Additional Controls Chile (3)	Additional Controls Argentina (4)
Firm Support to Innovation	0.077*	0.138***	0.077*	0.139***
	[0.043]	[0.037]	[0.433]	[0.037]
Quality Control	0.329***	0.169***	0.320***	0.163***
	[0.041]	[0.037]	[0.041]	[0.037]
Public Support to Training	0.405***	0.163***	0.418***	0.158***
	[0.035]	[0.053]	[0.035]	[0.053]
Investment	0.140***	0.055	0.147***	0.039
	[0.040]	[0.038]	[0.041]	[0.038]
Medium	0.107**	0.169***	0.110**	0.174***
	[0.044]	[0.038]	[0.045]	[0.038]
Large	0.301***	0.201***	0.309***	0.206***
	[0.046]	[0.044]	[0.045]	[0.044]
Openness	0.113**	0.075*	0.111**	0.075*
	[0.046]	[0.041]	[0.047]	[0.042]
Part of a Larger Establishment	0.099**	0.119***	0.092**	0.113***
	[0.048]	[0.041]	[0.050]	[0.042]
Registered	0.141**	0.083	0.158**	0.090
	[0.071]	[0.071]	[0.071]	[0.072]
Bachelor	0.003**	0.005***	0.004**	0.005***
	[0.002]	[0.002]	[0.002]	[0.001]
Access to finance	-	-	-0.008	-0.025
			[0.052]	[0.038]
Labor Market Regulation	-	-	-0.002	-0.065*
			[0.046]	[0.039]
Tax Administration	-	-	-0.139**	-0.035
			[0.067]	[0.039]
Industry Fixed Effects	No	No	No	No
Region Fixed Effects	No	No	No	No
Industry-Region Fixed Effects	Yes	Yes	Yes	Yes
Observations	938	926	917	908
Pseudo R^2	0.47	0.24	0.48	0.25

Source: Authors' own calculations based on the *Enterprise Surveys* (World Bank)

Dependent variable is a dichotomous variable equal to 1 if the firm has formal training programs for its permanent, full-time employees. Table reports the marginal effect on the firms' propensity to provide formal training programs to their employees by estimating several probit models. Robust standard errors are in brackets. * significant at 10% level , ** significant at 5% level, *** significant at 1% level. Table A1 defines all the variables. The size categories are defined with respect to small firms (i.e. firms with up to 19 employees). Firma age and its square are also included in the regressions (not reported). Industry fixed effects refer to the 2-digit industry or service. Column (1) corresponds to the job training baseline estimation as in Column (6) of Table B.11. Column (2) corresponds to the baseline specification as in Column (6) of Table B.12. Column (3) adds three variables to Column (6) of Table B.11. Column (4) adds three variables to Column (6) of Table B.12.

Table B.14: Probit Regression of Job Training Incidence, using two different concepts for the innovation input variable (Chile and Argentina)

	Baseline Specification Chile (1)	Innovation Variable: R&D Chile (2)	Baseline Specification Argentina (3)	Innovation Variable: R&D Argentina (4)
Innovation Variable	0.077*	0.116**	0.138***	0.232***
	[0.043]	[0.051]	[0.037]	[0.044]
Quality Control	0.329***	0.341***	0.169***	0.161***
	[0.041]	[0.047]	[0.037]	[0.043]
Public Support to Training	0.405***	0.425***	0.163***	0.220***
	[0.035]	[0.040]	[0.053]	[0.058]
Investment	0.140***	0.166***	0.055	0.053
	[0.040]	[0.047]	[0.038]	[0.045]
Medium	0.107**	0.098*	0.169***	0.191***
	[0.044]	[0.053]	[0.038]	[0.045]
Large	0.301***	0.307***	0.201***	0.255***
	[0.046]	[0.054]	[0.044]	[0.051]
Openness	0.113**	0.140**	0.075*	0.070
	[0.046]	[0.051]	[0.041]	[0.047]
Part	0.099**	0.078	0.119***	0.097**
	[0.048]	[0.061]	[0.041]	[0.049]
Registered	0.141**	0.121*	0.083	0.038
	[0.071]	[0.076]	[0.071]	[0.077]
Bachelor	0.003**	0.004	0.005***	0.004**
	[0.002]	[0.002]	[0.002]	[0.002]
Industry Fixed Effects	No	No	No	No
Region Fixed Effects	No	No	No	No
Industry-Region Fixed Effects	Yes	Yes	Yes	Yes
Observations	938	727	926	702
Pseudo R^2	0.47	0.50	0.24	0.27

Source: Authors' own calculations based on the *Enterprise Surveys* (World Bank)

Dependent variable is a dichotomous variable equal to 1 if the firm has formal training programs for its permanent, full-time employees. Table reports the marginal effect on the firms' propensity to provide formal training programs to their employees by estimating several probit models. Robust standard errors are in brackets. * significant at 10% level , ** significant at 5% level, *** significant at 1% level. Table A1 defines all the variables. The size categories are defined with respect to small firms (i.e. firms with up to 19 employees). Firm age and its square are also included in the regressions (not reported). Industry fixed effects refer to the 2-digit industry or service. Column (1) presents the same results as Column (6) of Table B.11. Column (2) corresponds to the baseline specification, but using *R&D* rather than *Firm Support to Innovation*, as the innovation variable, in Chile. Column (3) presents the same results as Column (6) of Table B.12. Column (4) corresponds to the baseline specification, but using *R&D* rather than *Firm Support to Innovation*, as the innovation variable, in Argentina.

Table B.15: The Impact of Job Training in the Chilean Firms' Productivity, OLS

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Training	0.668***	0.649***	0.581***	0.356***	0.313***	0.248**	0.239**
	[0.098]	[0.104]	[0.102]	[0.100]	[0.104]	[0.095]	[0.094]
R&D		0.012	-0.031	-0.096	-0.100	-0.189**	-0.201**
		[0.095]	[0.055]	[0.067]	[0.074]	[0.074]	[0.083]
Training*R&D		0.283**	0.253**	0.230**	0.220**	0.277***	0.290***
		[0.137]	[0.117]	[0.098]	[0.098]	[0.078]	[0.081]
Number of Workers (log)				0.153***	0.106***	0.050**	0.062***
				[0.031]	[0.033]	[0.022]	[0.015]
Alliances				0.194**	0.189**	0.134	0.113
				[0.083]	[0.080]	[0.081]	[0.075]
Exporter					0.251**	0.223*	0.223*
					[0.098]	[0.110]	[0.111]
Foreign					0.289	0.255	0.245
					[0.184]	[0.189]	[0.205]
Capacity Utilization					0.002*	0.003**	0.004***
					[0.001]	[0.001]	[0.001]
Bachelor						0.193**	0.019**
						[0.008]	[0.008]
Share of Female Workers						-0.684***	-0.707***
						[0.146]	[0.160]
Industry Fixed Effects	No	No	Yes	Yes	Yes	Yes	No
Region Fixed Effects	No	No	Yes	Yes	Yes	Yes	No
Industry-Region Fixed Effects	No	No	No	No	No	No	Yes
Observations	941	703	703	702	700	692	692
Pseudo R^2	0.14	0.18	0.25	0.29	0.31	0.38	0.43

Source: Authors' own calculations based on the *Enterprise Surveys* (World Bank)

Dependent variable is the logarithm of sales per worker in USD at current prices at the time of the Survey. Table reports the effect of several explanatory variables on the Chilean firms' productivity (log). Robust standard errors, clustered at the industry level, are in brackets. * significant at 10% level , ** significant at 5% level, *** significant at 1% level. Table A1 defines all the variables. Industry fixed effects refer to the 2-digit industry or service.

Table B.16: The Impact of Job Training in the Argentinean Firms' Productivity, OLS

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Training	0.487***	0.595***	0.451***	0.265*	0.192	0.198	0.175
	[0.072]	[0.156]	[0.160]	[0.145]	[0.127]	[0.123]	[0.134]
R&D		0.222	0.083	-0.030	-0.032	-0.000	-0.002
		[0.163]	[0.162]	[0.146]	[0.124]	[0.104]	[0.113]
Training*R&D		-0.152	-0.055	-0.007	0.069	0.031	0.048
		[0.215]	[0.194]	[0.195]	[0.149]	[0.117]	[0.125]
Number of Workers (log)				0.165***	0.080**	0.076**	0.072**
				[0.033]	[0.032]	[0.031]	[0.029]
Alliances				0.224***	0.169***	0.154***	0.146***
				[0.037]	[0.043]	[0.050]	[0.050]
Exporter					0.137	0.124	0.121
					[0.125]	[0.105]	[0.109]
Foreign					0.580***	0.464***	0.457***
					[0.107]	[0.132]	[0.135]
Capacity Utilization					0.008***	0.008***	0.008***
					[0.001]	[0.001]	[0.001]
Bachelor						0.009*	0.010*
						[0.005]	[0.005]
Share of Female Workers						-0.812***	-0.825***
						[0.207]	[0.204]
Industry Fixed Effects	No	No	Yes	Yes	Yes	Yes	No
Region Fixed Effects	No	No	Yes	Yes	Yes	Yes	No
Industry-Region Fixed Effects	No	No	No	No	No	No	Yes
Observations	967	725	725	721	712	679	679
Pseudo R^2	0.06	0.09	0.19	0.26	0.33	0.36	0.39

Source: Authors' own calculations based on the *Enterprise Surveys* (World Bank)

Dependent variable is the logarithm of sales per worker in USD at current prices at the time of the Survey. Table reports the effect of several explanatory variables on the Chilean firms' productivity (log). Robust standard errors, clustered at the industry level, are in brackets. * significant at 10% level , ** significant at 5% level, *** significant at 1% level. Table A1 defines all the variables. Industry fixed effects refer to the 2-digit industry or service.

Table B.17: The impact of Job Training in the Chilean and Argentinean Firms' Productivity, different definitions of innovation support (OLS)

	R&D Chile (1)	Firm Support to Innovation Chile (2)	R&D Argentina (4)	Firm Support to Innovation Argentina (5)
Training	0.239**	0.296**	0.175	0.163
	[0.094]	[0.112]	[0.134]	[0.115]
Innovation Variable	-0.201**	-0.250**	-0.002	-0.074
	[0.083]	[0.103]	[0.113]	[0.152]
Training**Innovation Variable*	0.290***	0.216***	0.048	0.155
	[0.081]	[0.137]	[0.125]	[0.203]
Number of Workers (log)	0.062***	0.064***	0.072**	0.072**
	[0.015]	[0.014]	[0.029]	[0.030]
Alliances	0.113	0.112	0.146***	0.148***
	[0.075]	[0.075]	[0.050]	[0.053]
Exporter	0.223*	0.222*	0.121	0.127
	[0.111]	[0.115]	[0.109]	[0.108]
Foreign	0.245	0.264	0.457***	0.442***
	[0.205]	[0.192]	[0.135]	[0.139]
Capacity Utilization	0.004***	0.004***	0.008***	0.008***
	[0.001]	[0.001]	[0.001]	[0.001]
Bachelor	0.019**	0.019**	0.010*	0.010*
	[0.008]	[0.008]	[0.005]	[0.005]
Share of Female Workers	-0.707***	-0.690***	-0.825***	-0.842***
	[0.160]	[0.164]	[0.204]	[0.207]
Industry Fixed Effects	No	No	No	No
Region Fixed Effects	No	No	No	No
Industry-Region Fixed Effects	Yes	Yes	Yes	Yes
Observations	692	690	679	677
Pseudo R^2	0.43	0.44	0.39	0.39

Source: Authors' own calculations based on the *Enterprise Surveys* (World Bank)

Dependent variable is the logarithm of sales per worker in USD at current prices at the time of the Survey. Table reports the effect of several explanatory variables on the Chilean and Argentinean firms' productivity (log), considering two different variables to measure the firms' innovation support. Robust standard errors, clustered at the industry level, are in brackets. * significant at 10% level , ** significant at 5% level, *** significant at 1% level. Table A1 defines all the variables. Industry fixed effects refer to the 2-digit industry or service. The first line of Table corresponds to the innovation variable being tested. Column (1) uses R&D as the innovation measure in Chile and corresponds to Column (7) of Table B.15. In Column (2) innovation is measured by the use of programs or services to support innovation, in Chile. Column (3) uses R&D as the innovation measure in Argentina and corresponds to Column (7) of Table B.16. In Column (4) innovation is measured by the use of programs or services to support innovation, in Argentina.

Table B.18: The Impact of Job Training in the Chilean Firms' Productivity, OLS, Treatment Effects model and IV, with and without interaction terms

	OLS (1)	OLS (2)	Treatment Effects (3)	Treatment Effects (4)	IV (5)	IV (6)
Training [38]	0.239**	0.113	0.463***	0.326**	0.149***	0.113***
	[0.094]	[0.136]	[0.133]	[0.159]	[0.028]	[0.025]
R&D	-0.201**	-0.148**	-0.232**	-0.171	-0.259***	-0.170**
	[0.083]	[0.069]	[0.105]	[0.108]	[0.073]	[0.065]
Training*R&D	0.290***	0.221*	0.302**	0.224*	0.364***	0.234*
	[0.081]	[0.114]	[0.129]	[0.133]	[0.073]	[0.125]
Number of Workers (log)	0.062***	0.016	0.025	-0.049	0.000	-0.056*
	[0.015]	[0.031]	[0.033]	[0.042]	[0.020]	[0.032]
Alliances	0.113	0.103	0.095	0.087	0.095	0.088
	[0.075]	[0.072]	[0.066]	[0.066]	[0.072]	[0.067]
Exporter	0.223*	0.207*	0.200***	0.184**	0.164	0.159
	[0.111]	[0.106]	[0.078]	[0.077]	[0.102]	[0.102]
Foreign	0.245	0.178	0.242***	0.080	0.235	0.101
	[0.205]	[0.152]	[0.098]	[0.238]	[0.195]	[0.155]
Capacity Utilization	0.004***	0.004***	0.004***	0.004***	0.004***	0.004**
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Bachelor	0.019**	0.015**	0.019***	0.014***	0.017**	0.014**
	[0.008]	[0.006]	[0.002]	[0.005]	[0.007]	[0.006]
Share of Female Workers	-0.707***	-0.733***	-0.691***	-0.715***	-0.689***	-0.712***
	[0.160]	[0.162]	[0.152]	[0.152]	[0.158]	[0.167]
Selection Term	-	-	-0.197**	-0.199**	-	-
			[0.084]	[0.086]		
Training*medium	-	0.107	-	0.105	-	0.091
		[0.102]		[0.129]		[0.076]
Training*large	-	0.405**	-	0.380**	-	0.314**
		[0.148]		[0.161]		[0.138]
Training*bachelor	-	0.004	-	0.006	-	0.004
		[0.008]		[0.005]		[0.007]
Training*foreign	-	0.047	-	0.159	-	0.137
		[0.156]		[0.257]		[0.151]
Industry Fixed Effects	No	No	No	No	No	No
Region Fixed Effects	No	No	No	No	No	No
Industry-Region Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	692	692	684	684	675	675

Source: Authors' own calculations based on the *Enterprise Surveys* (World Bank)

Dependent variable is the logarithm of sales per worker in USD at current prices at the time of the Survey. Table reports the effect of several explanatory variables on the Chilean firms' productivity (log), considering different methodological approaches. Robust standard errors, clustered at the industry level, are in brackets. * significant at 10% level , ** significant at 5% level, *** significant at 1% level. Table A1 defines all the variables. Industry fixed effects refer to the 2-digit industry or service. Column (1) reports the OLS results of the baseline specification presented in column (7) of Table B.15. Column (2) adds four interaction terms to the OLS baseline specification. Column (3) presents the results for the treatment effects model. Column (4) presents the treatment effects model including four interaction terms. Column (5) presents the results for the IV model. Column (6) presents the results for the IV model including four interaction terms.

[38] In the case of IV methodology, this variable represents the *predicted training* (see text) rather than the variable Training.

Table B.19: The Impact of Job Training in the Argentinean Firms' Productivity, OLS, Treatment Effects model and IV, with and without interaction terms

	OLS (1)	OLS (2)	Treatment Effects (3)	Treatment Effects (4)	IV (5)	IV (6)
Training [39]	0.175	0.072	0.443***	0.359*	0.063	0.012
	[0.134]	[0.171]	[0.186]	[0.213]	[0.054]	[0.071]
R&D	-0.002	0.009	-0.007	0.008	-0.079	0.001
	[0.113]	[0.105]	[0.101]	[0.102]	[0.099]	[0.075]
Training*R&D	0.048	0.023	-0.005	-0.031	0.190***	0.029
	[0.125]	[0.114]	[0.130]	[0.131]	[0.065]	[0.059]
Number of Workers (log)	0.072**	0.048	0.051**	0.029	0.066*	0.040
	[0.029]	[0.044]	[0.029]	[0.033]	[0.038]	[0.043]
Alliances	0.146***	0.144***	0.149**	0.147**	0.149**	0.145**
	[0.050]	[0.051]	[0.065]	[0.065]	[0.053]	[0.053]
Exporter	0.121	0.113	0.096	0.088	0.108	0.111
	[0.109]	[0.103]	[0.067]	[0.067]	[0.099]	[0.095]
Foreign	0.457***	0.627***	0.439***	0.610***	0.458***	0.639***
	[0.135]	[0.165]	[0.098]	[0.214]	[0.150]	[0.178]
Capacity Utilization	0.008***	0.008***	0.008***	0.008***	0.008***	0.007***
	[0.001]	[0.001]	[0.002]	[0.002]	[0.001]	[0.001]
Bachelor	0.010*	0.005	0.009***	0.004	0.009*	0.004
	[0.005]	[0.005]	[0.002]	[0.005]	[0.005]	[0.005]
Share of Female Workers	-0.825***	-0.825***	-0.837***	-0.840***	-0.803***	-0.813***
	[0.204]	[0.210]	[0.157]	[0.156]	[0.208]	[0.213]
Selection Term	-	-	-0.149	-0.148	-	-
			[0.106]	[0.111]		
Training*medium	-	0.109	-	0.057	-	0.154*
		[0.090]		[0.106]		[0.082]
Training*large	-	0.175	-	0.149	-	0.238*
		[0.139]		[0.132]		[0.132]
Training*bachelor	-	0.006	-	0.007	-	0.008
		[0.009]		[0.005]		[0.009]
Training*foreign	-	-0.221	-	-0.224	-	-0.262
		[0.263]		[0.234]		[0.288]
Industry Fixed Effects	No	No	No	No	No	No
Region Fixed Effects	No	No	No	No	No	No
Industry-Region Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	679	679	658	658	629	629

Source: Authors' own calculations based on the *Enterprise Surveys* (World Bank)

Dependent variable is the logarithm of sales per worker in USD at current prices at the time of the Survey. Table reports the effect of several explanatory variables on the Argentinean firms' productivity (log), considering different methodological approaches. Robust standard errors, clustered at the industry level, are in brackets. * significant at 10% level , ** significant at 5% level, *** significant at 1% level. Table A1 defines all the variables. Industry fixed effects refer to the 2-digit industry or service. Column (1) reports the OLS results of the baseline specification presented in column (7) of Table B.16. Column (2) adds four interaction terms to the OLS baseline specification. Column (3) presents the results for the treatment effects model. Column (4) presents the treatment effects model including four interaction terms. Column (5) presents the results for the IV model. Column (6) presents the results for the IV model including four interaction terms.

[39] In the case of IV methodology, this variable represents the *predicted training* (see text) rather than the variable Training.

Table B.20: The Impact of Job Training in the Chilean Firms' Productivity, Quantile Regression

	OLS (Mean) (1)	Treatment Effects (2)	IV (3)	Lower Quartile (4)	Median (5)	Upper Quartile (6)
Training	0.239**	0.463***	0.149***	0.151	0.162*	0.213*
	[0.094]	[0.133]	[0.028]	[0.112]	[0.094]	[0.124]
R&D	-0.201**	-0.232**	-0.259***	-0.161	-0.216**	-0.304**
	[0.083]	[0.105]	[0.073]	[0.128]	[0.109]	[0.131]
Training*R&D	0.290***	0.302**	0.364***	0.226	0.295**	0.339**
	[0.081]	[0.129]	[0.073]	[0.162]	[0.135]	[0.160]
Number of Workers (log)	0.062***	0.025	0.000	0.150***	0.090***	0.087*
	[0.015]	[0.033]	[0.020]	[0.041]	[0.034]	[0.051]
Alliances	0.113	0.095	0.095	0.114	0.120	0.185**
	[0.075]	[0.066]	[0.072]	[0.089]	[0.075]	[0.098]
Exporter	0.223*	0.200***	0.164	0.084***	0.229**	0.449***
	[0.111]	[0.078]	[0.102]	[0.101]	[0.108]	[0.132]
Foreign	0.245	0.242***	0.235	0.154	0.286**	0.255*
	[0.205]	[0.098]	[0.195]	[0.154]	[0.150]	[0.166]
Capacity	0.004***	0.004***	0.004***	0.003*	0.002	0.003
	[0.001]	[0.001]	[0.001]	[0.002]	[0.002]	[0.002]
Bachelor	0.019**	0.019***	0.017**	0.013***	0.014***	0.019***
	[0.008]	[0.002]	[0.007]	[0.004]	[0.004]	[0.004]
Share of Female Workers	-0.707***	-0.691***	-0.689***	-0.365**	-0.672***	-0.528***
	[0.160]	[0.152]	[0.158]	[0.175]	[0.205]	[0.193]
Industry Fixed Effects	No	No	No	No	No	No
Region Fixed Effects	No	No	No	No	No	No
Industry-Region Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R^2	0.43		0.41	0.25	0.27	0.33
Observations	692	684	675	692	692	692

Source: Authors' own calculations based on the *Enterprise Surveys* (World Bank)

Dependent variable is the logarithm of sales per worker in USD at current prices at the time of the Survey. Table reports the effect of several explanatory variables on the Chilean firms' productivity (log), considering different methodological approaches. Robust standard errors, clustered at the industry level, are in brackets. * significant at 10% level , ** significant at 5% level, *** significant at 1% level. Table A1 defines all the variables. Industry fixed effects refer to the 2-digit industry or service. Column (1) presents the same results as column (7) of Table B.15. Column (2) presents the same results as column (3) of Table B.18. Column (3) reports the same results as column (5) of Table B.18. Column (4) to (6) presents the quantile regression for the 0.25, 0.50 and 0.75 quantiles.

Table B.21: The Impact of Job Training in the Argentinean Firms' Productivity, Quantile Regression

	OLS (Mean) (1)	Treatment Effects (2)	IV (3)	Lower Quartile (4)	Median (5)	Upper Quartile (6)
Training	0.175	0.443***	0.063	0.152	0.156	0.229
	[0.134]	[0.186]	[0.054]	[0.167]	[0.150]	[0.182]
R&D	-0.002	-0.007	-0.079	-0.006	-0.076	-0.013
	[0.113]	[0.101]	[0.099]	[0.128]	[0.120]	[0.141]
Training*R&D	0.048	-0.005	0.190***	0.056	0.089	0.020
	[0.125]	[0.130]	[0.065]	[0.189]	[0.160]	[0.228]
Number of Workers (log)	0.072**	0.051**	0.066*	0.120***	0.083**	0.034
	[0.029]	[0.029]	[0.038]	[0.032]	[0.078]	[0.036]
Alliances	0.146***	0.149**	0.149**	0.109	0.159**	0.109
	[0.050]	[0.065]	[0.053]	[0.084]	[0.076]	[0.082]
Exporter	0.121	0.096	0.108	0.126	0.082	0.102
	[0.109]	[0.067]	[0.099]	[0.080]	[0.078]	[0.101]
Foreign	0.457***	0.439***	0.458***	0.468***	0.441***	0.485***
	[0.135]	[0.098]	[0.150]	[0.141]	[0.095]	[0.138]
Capacity	0.008***	0.008***	0.008***	0.006***	0.006***	0.007***
	[0.001]	[0.002]	[0.001]	[0.002]	[0.002]	[0.002]
Bachelor	0.010*	0.009***	0.009*	0.008**	0.011***	0.011***
	[0.005]	[0.002]	[0.005]	[0.004]	[0.003]	[0.004]
Share of Female Workers	-0.825***	-0.837***	-0.803***	-0.692***	-0.660***	-0.922***
	[0.204]	[0.157]	[0.208]	[0.238]	[0.184]	[0.216]
Industry Fixed Effects	No	No	No	No	No	No
Region Fixed Effects	No	No	No	No	No	No
Industry-Region Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R^2	0.39		0.37	0.26	0.28	0.27
Observations	679	658	629	679	679	679

Source: Authors' own calculations based on the *Enterprise Surveys* (World Bank)

Dependent variable is the logarithm of sales per worker in USD at current prices at the time of the Survey. Table reports the effect of several explanatory variables on the Argentinean firms' productivity (log), considering different methodological approaches. Robust standard errors, clustered at the industry level, are in brackets. * significant at 10% level , ** significant at 5% level, *** significant at 1% level. Table A1 defines all the variables. Industry fixed effects refer to the 2-digit industry or service. Column (1) presents the same results as column (7) of Table B.16. Column (2) presents the same results as column (3) of Table B.19. Column (3) reports the same results as column (5) of Table B.19. Column (4) to (6) presents the quantile regression for the 0.25, 0.50 and 0.75 quantiles.

Appendix C: Latin America, Chile and Argentina: Brief Overview

Between the 1950s and 1980s, many Latin American countries followed a strategy called Import Substitution Industrialization (ISI), which corresponded to a model where countries' imports were replaced by domestic production aiming to reduce their international dependence and exposition. This policy intended to create a self-sufficient growth, based on primary-sector local industries, protectionism, nationalizations and subsidies to some key national industries. However, this model implied some negative consequences, since basically it fits only for large economies such as Brazil, Argentina, Mexico or even Chile and Uruguay, because they have larger populations and so higher capacity to drain their national production. Protectionism led to overvalued exchanges rates (reducing exports) at the same time that countries were importing industrialized and high value-added goods, implying automatically public indebtedness and trade deficits. International competition was restricted and so the firms possibility to become more efficient and benefit from potential economies of scale.

Since then, this model has changed and the economic activity is now essentially market driven, with governments assuming the role of regulators and as supporters and promoters of some important investments in innovation, technology, vocational and on-the-job training programs. Predictions from several international organizations as the World Bank, the OECD or the IMF tend to point out to a moderate economic growth in Latin America, although secure projections are still difficult to obtain essentially due to the high uncertainty characterizing the external context. Table C.1 (below) presents some macroeconomic indicators. Low external debt, prudent macroeconomic policies and controlled inflation rates appear to give some room (in the short-term) to Latin America to apply fiscal and monetary countercyclical (i.e. expansionary) measures. However, the major problems are equated at medium to long term, since an international slowdown would have considerable repercussions in most of the Latin American countries, particularly via the deterioration of the commodity prices and so, of the terms of trade.

Supporting only social policies is neither sufficient nor sustainable. Stronger government interventions are needed to promote education, investment and development. Indeed, a more endogenous economic growth is advocated by international organizations through three ways: education, infrastructures and innovation. These factors are seen as crucial for the transformation and diversification of the productive structures of Latin America. Sooner or later, higher productivity, better jobs for a better prepared workforce and more equitable economic and social systems have to be concrete returns. Table C.2 (below) presents some studies assessing some active labor market programs that have been implemented in Latin America. These programs have been financed and managed by each national government in cooperation with some organizations, such as the World Bank or the Inter-American Development Bank (IDB).There appears to be important positive effects on job quality (measured by wages) and on the possibility of getting formal jobs, with a contract or even receiving health insurance.

Labor productivity continues to be a major problem in Latin America and the Caribbean, as a result of the low diversification of the exports, the low-technology-intensive products and the notorious lack of investment in R&D activities. The region is still highly linked with the exploration of its natural resources and raw materials. For instance, around 60% of the region's manufacturing value-added is coming from natural-resource-intensive sectors and 50% of the Latin America's exports are constituted by primary goods and natural resources.

Chile's economy is an open-market economy that is essentially concentrated on agriculture (which accounts for about 15% of the population) and on minerals exports, which represent approximately half of the total value of exports. Chile has a considerably high level of foreign trade, where exports account for more than one-third of its GDP, and copper individually represents around 19% and 60% of the government revenue and total exports, respectively[40]. Petroleum and petroleum products, electrical and telecommunications equipment, industrial machinery, vehicles and natural gas are the main imported products. Following an expansionary fiscal policy since 2009, Chile has been recognized as a fast growth country trying to diversify its economy, to reduce its dependence from mineral exports, and attracting hundreds of start-up companies.

On the other hand, the Argentinean economy is well-recognized by its switching between strong recessions and expansion periods. The country has followed a debt restructuring policy since 2003, after having declared the default of its sovereign debt payments. Argentina has also assumed a clear distinction through its particularly high

[40] Chile is internationally recognized by its copper exports, being CODELCO (a state-owned company) the largest copper-producing firm in the world.

inflation rates. To reduce its exposure to the external obligations, the country has taken advantage from its rich and diversified natural resources (for instance, copper, iron petroleum, uranium, zinc, gold and silver), having fostered an important industrial base in agriculture, automotive, pharmaceuticals, refinery products, chemicals and petrochemicals sectors. The agricultural sector is one of the most productive in the world, exporting several products, such as beef, fruit, grapes or honey. For instance, around 60% of the Argentinean soil is occupied by agricultural production, the manufacturing industry represents 21% of the domestic economy and 60% of the economy is represented by the services industry (financial, insurance, tourism, telecommunications, real estate). The Argentina's participation in the international trade is relatively diversified, with raw materials accounting for 20% of total exports in 2011 and the industrial products for around one-third. The country's imports are essentially dominated by industrial and technological goods, machinery and motor vehicles.

In summary, both economies have experienced fast economic growth since the 2009's recession and have strengthened their international presence through exports of raw materials and mineral ores. Imports are essentially dominated by high value-added products that both countries are still not able to produce due to some structural deficiencies in their infra-structures, workforce education and skills. This works as a constraint to a more knowledge-based economic growth. Some urgent reforms are needed to foster higher productivity and competition, technology adoption and better education systems. For instance, the Chilean government created an "Agenda to Boost Competitiveness" aiming at fostering competition, reducing the time to create a new company, providing some R&D tax credit benefits, extending student loans and scholarship schemes. It was also created the Corporación de Fomento de la Producción (CORFO) corresponding to a business angels network supporting incubators, seed capital, angel investors and risk capital to promote future investments; and in Argentina, the Ministry of Science, Technology and Productive Innovation was created, in 2007.

Table C.1: Macroeconomic Overview

	Chile		Argentina		Latin America		OECD	
	2009	2011	2009	2011	2009	2011	2009	2011
Economy								
GDP Growth (%)	-0.9	5.9	0.9	8.9	-1.6	4.7	-3.9	1.5
Gross Fixed Capital Formation (% of GDP)	21.7	23.2	20.9	22.6	20.0	20.7	18.1	17.9
Final Consumption Expenditure (% of GDP)	72.2	72.0	73.7	75.1	-	-	-	-
Inflation (%)	1.4	3.3	6.3	9.8	2.8	5.1	0.9	3.3
Exports (% of GDP)	37.0	38.0	21.4	21.8	22.2	23.5	22.6	26.3
Imports (% of GDP)	29.5	34.7	16.0	19.5	23.8	22.4	23.0	27.3
FDI, net inflows (% of GDP)	7.5	7.0	1.3	1.9	2.2	2.9	1.5	1.8
FDI, net outflows (% of GDP)	4.2	4.8	0.2	0.3	0.3	0.4	2.8	3.6
External Debt Stocks (% of GNI)	43,3	41.0	42.6	26.4	-	-	-	-
Agriculture, Value-Added (% of GDP)	3.6	3.4	7.5	10.6	5.9	6.1	1.4	-
Industry, Value-Added (% of GDP)	31.8	30.8	31.8	30.8	31.9	32.4	23.2	-
Manufacturing, Value-Added (% of GDP)	12.2	11.9	21.2	20.6	17.6	16.8	14.6	-
Services, Value-Added (% of GDP)	58.6	57.5	60.7	58.5	62.2	61.5	75.4	-
Labor and Education								
Public Spending on Education (% of GDP)	4.2	-	6.0	-	4.4	-	5.6	-
Net Enrollment Rates: Primary Education	99.1	99.3	98.1	99.3	93.9	93.9	97.4	97.0
Net Enrollment Rates: Secondary Education	83.1	84.0	82.0	84.4	73.5	73.6	87.6	87.7
Net Enrollment Rates: Tertiary Education	29.9	33.4	30.0	30.9	39.5	40.5	64.9	66.6
Unemployment (% total labor force)	9.7	7.1	8.6	7.2	8.0	-	8.2	-

Source: World Bank's 2013 *World Development Indicators*; IMF's 2012 *World Economic Outlook*; SEDLAC

Table C.2: Assessing some Active Labor Market Programs in Latin America

Author(s)	Country	Program	Number of beneficiaries	Employment Rate	Formality	Wages
Alzua and Brassiolo (2006)	Argentina	*Proyecto Joven*	130,000	In general, between 0 percent and 11 percent; Not statistically significant.	Increase in the likelihood of formal employment by 5-10 p.p.	Not statistically significant.
Attanasio *et al.* (2007)	Columbia	*Jóvenes en Acción*	80,000	5 percent for women and none for men.	Increase in the probability of having a written contract: 5.5 p.p. for women and 7.7 p.p. for men.	More significant effects for women than men; increase in earnings: 18.1 percent for women and 8.3 percent for men.
Card *et al.* (2007)	Dominican Republic	*Juventud y Empleo*	30, 000	In general, no significant impact; positive and significant impact for the youngest age group (17 to 19 years old) and for individuals in the East and Santo Domingo regions.	Health insurance access: 43 percent for men and 34 percent for women.	Total monthly labor income is 17 percent higher, with greater impact for the youngest age group (17 to 19 years old); larger effects for the youngest age group and for those in Santo Domingo.
Delajara *et al.* (2006)	Mexico	*PROBECAT/ICAT*	5 million	Robust positive effect, between 12 and 30 percent, particularly since 2002.	Positive effects since 2002, between 10 and 20 percent.	Small positive effects for salaried workers and positive for self-employed; No consistent patterns, being dependent from the estimation methodology.
Diaz and Jaramillo (2006)	Peru	*Projoven*	160,000	In general, 13 percent; 20 percent for women and not significant for men.	Higher impacts to female youngsters and 16-20 year old; in general, 11 percent; 14 percent for women and 5 percent for men.	Positive effects between 12 percent and 30 percent.
Ibarrarán and Shady (2008)	Panama	*PROCAJOVEN*	11,400	In general, no statistically significant effects. Significant effect for women and particularly for those living in Panama City.	Not statistically significant.	No apparent impacts.

Source: Authors' own compilation based on Ibarrarán and Shady (2008)