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**Innovation and its Effects on Employment
Composition: Microeconomic Evidence from
Colombian Firms**

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Innovation and its Effects on Employment Composition: Microeconomic Evidence from Colombian Firms*

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Abstract

This study analyses the effects of innovation on employment in Colombian firms for the manufacturing and service sectors in two different periods: 2007-2010 for the manufacturing industry, and 2010-2011 for the service industry. Based on the theoretical framework proposed by Harrison et al.(2014), we test this relationship using instrumental variables techniques. Data proceed from *The Annual Manufacturing Survey*, *The Development and Technological Innovation Industrial Survey*, and *The Development and Technological Innovation Services Survey*, all of them collected by the Colombian National Administrative Department of Statistics (DANE). Our empirical results show that sales growth due to new products positively affects employment growth, and process innovation has not a displacement effect on employment growth. This is robust to different specifications and the inclusion of control variables.

JEL Classification: O31, O33

Keywords: Employment Growth, Process Innovation, Product Innovation, Colombian Firms.

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Introduction

Mainstream economic theories and other approaches consider innovation as a fundamental cause of economic growth (e.g. new growth and neo-Schumpeterian theories). Innovation boosts growth through the diffusion of technology from the developed to the less-developed countries; in addition, combined with other factors improves living standards and boosts economic performance ([Verspagen, 2006](#)). Similarly, several studies shed light on the relationship between GDP (Gross Domestic Product) and investment in Research and Development (R & D), suggesting a positive and significant impact on the former. Firms, regions and countries benefit from others R & D processes through international trade, coalitions, foreign ownership of firms, workers mobility, etc ([Coe and Helpman, 1995](#); [Keller, 1998](#); [van Pottelsberghe and Lichtenberg, 2001](#)).

In many countries companies developed the majority of innovations using the networks with other actors of the innovation systems (e.g. universities, research centers, public administration, financial systems etc.). Firms undertake innovations looking for profits: they create new products and gain a higher market share. Later, other firms improve these former innovations or introduce new ones generating a process of creative destruction, enhancing technological progress which generates growth ([Aghion and Howitt, 1992](#)). The levels of uncertainty when companies invest in R & D and innovation activities are high but generate higher rates of returns.

Developed countries base their production systems in science, technology and innovation activities. On the contrary, the majority of developing countries continue producing the same basket of low value added goods and services. Increasing productivity levels is of paramount importance for developing countries, since it leads to spurring innovation and promoting organizational change. Different determinants of innovation have been highlighted in the literature, such as current and past levels of investment in R & D, knowledge flows ([Griliches, 1979](#)), firm size, level of exports, foreign ownership, cooperation and access to funding ([Crespi and Zuniga, 2012](#)).

[Romer \(1990\)](#), and [Aghion and Howitt \(1992\)](#), define innovation as the driving force behind growth which affects the entire economy. Innovations developed by firms have an impact in variables such as productivity, per capita income, distribution, capabilities and opportunities of individuals. The latter two are related to employment. Thus, technological change might generate both job

gains and losses. This effect depends on the dynamics behind innovation and factors such as the speed of adoption, industries and sectors affected, necessary skills, speed of adjustment in the employment which may lead to frictional or technological unemployment, creating mismatches in the job market (Pianta, 2006).

Different empirical studies have tried to identify the impact and the effects of innovation on employment. The direction and magnitude of these effects are related to the type of innovation and the way it is measured. As has been discussed in the literature, there are different channels through which innovation can either generate or destroy jobs.

This paper analyzes the effects of innovation on employment in Colombian firms for the manufacturing and service sectors using *The Annual Manufacturing Survey*, *The Development and Technological Innovation Industrial Survey*, and *The Development and Technological Innovation services Survey*. The discussion around the effects that technological change has on employment is still open. Hence, it is important to highlight that previous studies conducted at different levels -e.g. firms, industries, or at the macroeconomic level- show results that are similar in some cases. In other cases, remarkable differences are present. The latter could be explained by differences in terms of the sample of countries, the period analyzed, and the data availability.

The research question addressed in this paper is of particular interest in a country like Colombia, where the labor market faces structural problems. One indicator of that is the striking level of informality: Approximately, 50% of Colombian workers are employed in the informal economy. Coupled with that, efforts have recently been undertaken in Colombia in terms of investment in science, technology and innovation. This also implies the necessity of understanding the relationship between innovation and employment.

The remainder of the paper is structured as follows. We briefly discuss the literature and most relevant empirical findings related to innovation and its effects on employment. This is followed by a description of our empirical strategy, which is based on Harrison et al. (2014) theoretical framework that assesses the relationship between innovation and employment growth at the firm level. Our results show that *sales growth due to new products* affects positively employment growth, this is robust to different specifications and the inclusion of control variables. Besides that, process

innovations have not a displacement effect on employment growth in Colombia.

1 Literature Review

Firms innovate when they perceive a commercial opportunity in a new project. To transform an invention into an innovation, they need to combine knowledge, resources capabilities, and skills. As noted by [Fagerberg \(2006\)](#) these factors might be combined in different ways, to produce innovations more complex and sophisticated, firms must analyze the social and economic implications of these innovations. The latter taking into account that a radical innovation requires extensive infrastructure investments (e.g. research infrastructure) and the introduction of organizational and social change (e.g relations with the private and public sector, employees skills) to be successful.

Innovation in OECD countries and some emerging economies is mainly carried out by firms. Between 65% and 75% of total I & D activities in countries like Finland, Japan and the United States are undertaken by companies. In China and South Korea, this figure is around 70% , while in Chinese Taipei it is 65% and in Spain, 55% ([OECD, 2013](#)). Policies geared towards promoting innovation at the firm level play a key role in several countries, with the expectation of improving economic performance. However, the effects of innovation on employment might differ across countries -that is, between developed and developing countries-, since the structure of the labor markets and the underlying economic conditions differ deeply.

Hence, it is important to understand the effect of innovation at the firm level on employment generation and its composition. This is of particular interest in Colombia, where the participation of companies in I & D activities is low: 30%, which is the same level of South Korea in the 1970s and China in the 1980s. The Colombian figure is also below the Latin American average, which goes up to 40% ([OECD, 2013](#)).

As it is all around the world, Colombian firms currently face big challenges such as the increasing competition in the majority of industries, in contrast to their low productivity levels. The current economic and political scenario, characterized by globalization and the signature of Free Trade Agreements (FTAs), needs to be carefully considered. Consequently, firms need to increase

their productivity levels if they want to compete in global markets. At the same time, they need to be knowledge processors, requiring significant investment levels in innovation. Despite this reality, the Colombian innovation system is small, inefficient and excessively centralized. It shows a low performance in terms of the required level for a sustainable growth (OECD, 2013). However, new investments in science and technology could boost the innovation system and improve public and private innovation.

The relationship between innovation and employment has been addressed by different strands in the literature. Moreover, empirical studies have studied this relationship from different perspectives and levels of analysis (firm and industry level). Indirect effects that arise within industries, as well as effects macroeconomic effects, have also been considered. The factors that run between these variables might differ deeply across time and countries, due to national policies, institutions, laws and incentives, market labor and economic conditions, as well as other such as education, training process, firms features, etc.

At first, the effects of innovation on employment can be evaluated from a macroeconomic perspective. This approach allows to measure direct and indirect effects through compensation mechanisms. Economic policies are provided with instruments to assure the recovery of jobs when technological change generates losses. Besides that, the negative effects of innovation in terms of job losses have been considered (Pianta, 2006). Tancioni and Simonetti (2002) developed macroeconomic models where they found different impacts for each country and each compensation mechanism, in those countries where there is a higher rate of investment in innovation activities, innovation in products is high. Consequently, the reduction in prices derived from innovation boosts demand, implying a positive effect in terms of employment. An open economy implies more complexity: since innovations might create and destroy jobs in different countries, the benefits are distributed in several places. Besides that, imports might rise if foreign innovations are more competitive while in the opposite case, exports and local competitiveness can increase (Pianta, 2006).

Moreover, studies that shed light on the relationship between innovation and employment have tended to focus on the analysis at industry and firm level. Antonucci and Pianta (2002) highlight the possibility of technological unemployment, situation that happens when process innovation and weak demand dominates. These authors found for some European countries in the late 1990s job

losses in the manufacturing industry due to technological change; because of an active price competitiveness strategy, technological efforts were associated to restructuring and the market expansion effect of new products was modest. [Greenan and Guellec \(2000\)](#) states that for France, at the firm level, process innovation creates more jobs than product innovation while the opposite occurs at the sectoral level. However, innovative firms perform better than the others on the medium-run.

Besides that, [Evangelista and Savona \(2003\)](#), Carried out estimations related to innovation in services, they found an overall negative impact of innovation on employment, nevertheless results differ vastly depending on the services sector, and at the micro level, depending on the type of strategy implemented by firms. on the other hand, is very common to all the services sectors that high skilled jobs substitute low skilled jobs. Besides that, innovation might generate employment in knowledge-intensive sectors, but can have a negative impact in financial sectors, capital intensive service industries such as transport-related services and traditional services, for instance, trade and waste disposal.

From a microeconomic perspective, the existing literature emphasizes on the different effects associated to product and process innovation where the total effect for each type of innovation remains unclear in theoretical models. Initially, an improvement in technology allows to produce the same amount of output with less productive factors for instance capital and labor, and loss of employment is an outcome of the progress; however, compensation effects as a result of reduction in output prices lead to an increase in demand and a possibility to rise employment; that is, depending on the demand elasticity firms may demand new employment ([van Reenen, 1997](#); [Peters, 2005](#); [Harrison et al., 2014](#)).¹

Most of the research in the field highlights the displacement and compensation effects coming from both types of innovation on employment at the firm level; process innovation improves productivity, firms need fewer inputs. As a result of that, they will be able to produce the same output with less workers leading to the destruction of jobs. From the previous effect could be inferred that process innovation has a negative effect on employment. Nevertheless, due to cost reduction and the increase in productivity, firms can reduce their prices, increase production, finally leading to job generation by means of hiring additional workers.

¹See e.g. [Vivarelli \(2011\)](#) for an overview of the literature.

On the other hand, if the firm introduces product innovations on the market, an increase in demand would be possible, leading again to job creation. On the contrary, it could happen that the firm introduces a product completely new to the market, so until competitors enter with similar or better products, the company can increase price, reduce the quantity sold, and require fewer workers. Concerning these effects at the firm level, studies have been conducted for several countries based on the theoretical model of (Harrison et al., 2014). The proposed model takes into account the effect of process innovation and sales growth (coming from old products and innovation through new products) on employment, empirical estimations were conducted for France, Germany, Spain and the UK for the period 1998-2000. The main findings across countries suggest a positive effect of product innovation on employment, in this case the compensation effect dominates when firms introduce new products -despite old products destruction- boosting employment growth. On the other hand, process innovation effects are not clear because the results vary across countries and sectors, that is, sometimes dominates the displacement effect and in other cases the compensation effect.

Based on the same theoretical model, Peters (2005) conducts a study for German manufacturing and services firms. She finds similar results to those obtained for Spain. Moreover, product innovations new to the firm but not to the market (imitation strategies) stimulate employment, thus, product novelty degree does not affect employment in this case. The process innovations findings are negative in manufacturing, especially innovations that reduce average production costs (rationalization innovations); the result is positive in the services sector but not significant. Other studies have been conducted for Spain (Jaumandreu, 2003) and Italy (Hall et al., 2008) suggesting positive impacts of product innovation in both countries and displacement effects of process innovation only in Spain.

Besides the previous studies, recent studies has been conducted for Latin America. Crespi and Tacsir (2012) conduct estimations for the manufacturing sector in Argentina, Chile, Costa Rica and Uruguay, besides a positive effect of product innovation on employment, they find that process innovation is not significant for all the countries, only for Costa Rica with a positive impact and Uruguay where the displacement effect dominates. Beyond that, Castillo et al. (2011) evaluate the relationship for Argentina, Benavente and Lauterbach (2008) and Alvarez et al. (2011) for Chile,

and [Aboal et al. \(2011\)](#) for Uruguay.

It is common that empirical studies find a positive impact of product innovation on employment and an ambiguous effect of process innovation. In contrast to this line of argumentation, a different estimation strategy is proposed by [Lachenmaier and Rottmann \(2011\)](#). they used a dataset from German manufacturing companies to undertake a dynamic panel analysis including input and output measures for innovation, the results suggest higher positive impacts on employment for process innovation rather than product innovation. These outcomes go in another direction to those obtained in studies mentioned above, proposing that countries should not specialize and invest only in product innovations, process innovations might also play a key role depending on country conditions. [van Reenen \(1997\)](#), [Smolny \(1998\)](#), and [Piva and Vivarelli \(2005\)](#) also carried out estimations with a different theoretical setting. However, The main finding was that technological innovation is associated with higher employment at the firm level. This result showed to be robust when control variables were included and different specifications were tested.

2 Methodology

We use ([Harrison et al., 2014](#)) theoretical framework to assess the relationship between innovation and employment growth at the firm level. This approach suggests a theoretic relationship where employment growth is explained by process innovations and *sales growth due to new products*. The model analyzes a firm in two periods, $t = 1$ and $t = 2$, at the beginning of the reference period the firm only produces old products. However, it might introduce product innovations between the periods, in the second period the firm can produce old products and new products. Firms use identical separable production technologies that have constant returns to scale in capital, labor, and intermediate inputs in order to produce old and new products. New products are produced with higher or lower efficiency than old products, thus the firm may affect the efficiency of its production investing in process innovation. Employment growth is going to be affected by the efficiency increase in the production of the old product, the rate of change in the production of the old product, the expansion in production due to new products and the impact of old product unanticipated productivity shocks ([Harrison et al., 2014](#); [Peters, 2005](#)). Real output is not observed,

for that reason nominal sales are used. The first equation to estimate is:

$$\ell_i = \alpha_0 + \alpha_1 d_i + g_{1i} + \beta g_{2i} + \mu_i \quad (1)$$

where

ℓ_i : employment growth rate

α_0 : average efficiency growth

α_1 : average efficiency growth for process innovations

d_i : dummy variable indicating process innovation

g_{1i} : nominal rate of sales growth due to old products

g_{2i} : nominal rate of sales growth due to new products

β : relative efficiency of the production of old and new products

μ_i : unobserved disturbance

Equation 1 suggests that firms that do not innovate in process can also achieve efficiency gains, perhaps due to exogenous technological progress, organizational changes, improvements in human capital, learning or spill-over effects (Peters, 2005). Nominal rate of sales growth due to old products g_1 has a coefficient equal to one, therefore can be subtracted from employment growth rate, thus the new dependent variable is $(\ell_i - g_{1i})$. On the other hand, endogeneity problems may appear since innovation decisions depend on the firms productivity, productivity inherent to each firm which is differentiated out in the theoretical model and unobservable productivity shocks, the latter ones depend on the timing of technological investments (lagged values of the explanatory variables or technological investments can be used as instruments). Other complications may occur because real growth sales of old products are not observed, one way to resolve this problem is using firm-level prices, which in our study are available in *The Annual Manufacturing Survey*. Consequently, the dependent variable will be $\ell_i - (g_{1i} - \pi_i)$ and the equation to estimate is:

$$\ell_i - (g_{1i} - \pi_i) = \alpha_0 + \alpha_1 d_i + \beta g_{2i} + \mu_i \quad (2)$$

We also study the effect that other variables exert on employment such as organizational changes, the latter can boost managerial occupations and reduce the demand for unskilled workers (Caroli and Reenen, 2001). Additionally, according to Dachs and Peters (2014) foreign-owned firms have higher job losses than domestically owned firms because of productivity increases and process

innovations. Moreover, product innovation creates more jobs for foreign-owned firms. Other control variables which have been included in the estimations are a dummy, which takes the value of 1 if the firm exports, and another dummy variable that takes the value of 1 if firms are located in the capital city. Two other dummy variables have been included: one for medium-sized firms, which takes the value of 1 when it is defined by the Colombian legislation as a medium-sized firm. The other dummy takes the value of 1 if it is considered as a large-sized firm.

We take *fixed assets growth* as a proxy for capital formation. The assumption of constant input prices is relaxed, by including *labor costs growth*. Equation 2 is estimated by ordinary least squares and instrumental variables. Firms established during the period of analysis, and firms with sales or employment equal to zero or missing in the initial years were excluded. Additionally, instruments used should be correlated with sales growth due to new products but uncorrelated with price changes.

3 Data

We explore the relationship between innovation and employment for Colombian manufacturing and service firms, using data from *The Annual Manufacturing Survey* for the period 2007-2010, two waves of *The Development and Technological Innovation Industrial Survey* for the periods 2007-2008 and 2009-2010, and *The Development and Technological Innovation services Survey* for the period 2010-2011. These three surveys are conducted by the Colombian National Administrative Department of Statistics -DANE. *The Annual Manufacturing Survey* is a national survey of industrial establishments with information for more than 8,000 plants. We select firms with a balanced panel from 2007 to 2010. The survey collects detailed information on employment disaggregated by gender, professional level, labor costs and expenditures, stocks, investments, assets, production, quantities produced and sold, unit sales and total sales, exports, and intermediate consumption.

The Development and Technological Innovation Industrial Survey has been linked to *The Annual Manufacturing Survey* to obtain detailed information on innovation and technological activities developed by firms in Colombia. The innovation survey for the manufacturing industry is carried out every two years and includes detailed information on innovation outputs, types of innovation, objectives when investing and developing innovations, investment on innovation activities, sources

of ideas, obstacles to innovation, financial sources, access to public funding, relations to other actors of the innovation system and intellectual property. Employment growth is obtained of *The Annual Manufacturing Survey*, which includes information related to skilled, unskilled, full-time, part-time, female and male labor, and the labor costs associated to each type of employment. These costs are defined as the total remuneration plus the social benefits and fiscal contributions that are mandatory to companies in Colombia.

Growth sales due to new and old products for manufacturing firms were calculated with the information available in *The Annual Manufacturing Survey*, comparing the products for each firm in the period 2006-2010. The survey also includes prices for each firm, which allowed calculating growth prices and avoiding endogeneity concerns related to this variable. The rest of the information was obtained from *The Development and Technological Innovation Industrial Survey*.

Concerning employment participation by economic sector, in the year 2013 the manufacturing sector participated with 12% of the total employment in Colombia, while the services sector participation went up to 64% and the agricultural sector contribution was of 18%.² This shows the relevance of the services sector in terms of employment generation in the country. Taking into account this significant participation of the services sector, we also carried out some estimations for the services sector with information available on *The Development and Technological Innovation services Survey 2010-2011*. In the latter survey, we obtained different variables such as employment growth, skilled and unskilled labor growth, sales growth due to new and old products, science and technology expenditure, innovation outputs like process innovations, product innovations, organizational changes and commercialization changes. In the service industry the price changes could not be obtained at the firm level. For that reason, the different components of the Colombian consumer price index have been used as a proxy. Detailed information related to the variables and their definitions is depicted in table 16.

According to the Colombian Observatory for Science and Technology -OCYT, expenditure in scientific, technological and innovation activities as a percentage of the GDP amounted to 0.5% in 2013, while expenditure in R & D was 0.22% for the same year. It should be highlighted that the public sector financed 58% of all the science and technology activities in the country, while the

²This information is based on Colombian great integrated household survey (DANE, 2014)

private sector financed 35%. It is important to notice that the Colombian private sector has shown a decreasing trend of investment in these type of activities since 2009: in 2008, the private sector's share was 47%. Another interesting fact is related to the expenditure in science and technology activities by sector: In 2013, firms invested 30% of these resources, higher education institutions 26%, government organizations 25%, research and technology development centers 13%, and other institutions 6% (OCYT, 2014).

Descriptive statistics are presented in table 17. During the two waves of *The Development and Technological Innovation Industrial Survey* (2007-2008, 2009-2010), manufacturing firms were in high proportion non-innovators, only 4% innovated both in processes and product. In contrast, when analyzing the 2010-2011 wave of *The Development and Technological Innovation services Survey*, it is found that 10% of the firms innovate both in products and processes. As depicted in table 17, another important aspect related to manufacturing firms is that they tend to undertake more innovation just in processes, rather than product innovation. On the other hand, in the service industry firms tend to innovate more introducing new or improved products or services rather than new or improved processes. This is due to the structure of the service industry.

When analyzing the data, we found that the productive structure is somewhat different for both types of industries. In the case of the manufacturing sector, 51% of the companies have between 11 and 50 employees, 34% have between 51 and 200 employees, and 15% have more than 200 employees. In the case of the services sector, small-sized firms represent 35% of the sample, while medium-sized firms represent 37% and large-sized firms, 28%. In spite of that difference, it is striking to notice how in the service industry sector 65% of the firms are also non-innovators.

Regarding employment growth in the period 2007-2010, it was in average of 3% in the manufacturing sector, where skilled labor grew more rapidly than the unskilled labor. The former grew 12% and the latter 4%. Additionally, in the period of time analyzed part-time employment presented an important positive growth rate: it showed an average increase of 47%, while full-time employment just had an average increase of 12%. Furthermore, female employment rose in average 10% almost doubling male employment. In the service industry sample, employment growth was in average of 6%, where the growth of skilled employment went up to 14% and in the case of unskilled labor, 2%.

Here, it is interesting to analyze the behavior of the sales growth derived either from old or new products in both industries. As can be observed in table 17, *sales growth due to old products* is more important in the manufacturing than in the service industry. In the former, sales growth proceeding from new products was of just 4%, while *sales growth due to old products* was of 9.6%. In the case of the service industry, sales growth linked to new products was of 6%, while sales growth of old products was of 2.7%. Besides that, the R & D intensity and the innovation intensity were considerably higher in the service industry in contrast with the manufacturing industry. Nevertheless, it is important to clarify that the periods of analysis are different. Moreover, industries which introduced more process and product innovations during the period of analysis were food products and beverages, printing and reproduction of recorded media, chemical products, and rubber and plastics products. Table 18 presents more detailed information by type of innovation and industry.

4 Results

Concerning the empirical strategy, a pooled OLS (POLS) estimation was first conducted: the same firms were considered in the two waves of the innovation survey. Here, the purpose has been mainly to show some benchmark estimates and to see if results vary considerably when using other methodologies. When the theoretical model with the dependent variable $\ell_i - (g_{1i} - \pi_i)$ is estimated, the *sales growth due to new products* g_2 has a positive impact on employment growth. This means that new products are produced more efficiently than old products and the compensation effect dominates the displacement effect. These results are depicted in table 1, where the variable *process innovation only* is not significant. Innovation in commercialization shows to be positive and significant in equation 9. *Labor costs* exert a negative impact on employment growth and showed to be significant in equations 8 and 16, which goes in line with previous empirical studies. The *fixed assets growth* variable has a negative and significant effect on employment growth. But, as will be shown later, this effect disappears when instrumental variables are included.

As can be observed, the empirical analysis also comprises the inclusion of the variable *process and product innovation*, taking into account that based on the available information, it is not possible to differentiate between process innovations applied to old or new products. According to Peters

(2005) the process innovation dummy may have additional efficiency gains, this dummy could include the effects of changes in the production of the old products. We divide the effect by estimating with *process innovation only*, where the effect corresponds to old products, and estimating with *process and product innovation*, where the changes are related to old and new products. Table 2 suggests a positive and significant effect of the *process and product innovation* variable, and a slight decrease in the coefficient of g_2 , this indicates a lower effect of new products on employment growth.

As has been previously explained in the methodology section, the model presents some endogeneity problems. Hence, it is necessary to conduct estimations instrumenting the variable g_2 . As is shown in table 2, the instruments used were *client*, *innovation intensity* interacted with *increased market share*, *increased range* and the *obstacles to innovate*. Sargan-Hansen overidentification tests were performed and the obtained results validate the instruments. The results are similar to those obtained in table 1. It is also interesting to notice that when estimating using instrumental variables, *process innovation only* showed to be negative and significant -in comparison to OLS, where it was negative but not significant.

Another important aspect is to shed light on the relationship between the innovation variables and the different types of labor. Namely, in table 3 and 4 the results of skilled and unskilled employment are presented. When estimating through pooled OLS (POLS), the effect of g_2 does not vary, maybe due to the possible downward bias in the coefficients. when instruments are used to correct the endogeneity like in the case of table 2, the positive impact of g_2 on employment growth is higher on employees with higher qualifications. In table 4, *process innovation only* has a negative effect but it is not significant, and *labor cost growth* estimated for each type of labor has a negative impact on employment growth. The variables *commercialization change* and *fixed assets growth* have positive and negative impacts respectively. Instrumental variables estimations suggest a larger impact of innovation on employment growth in the case of skilled workers, this also happened with full-time employees as can be seen in table 19 available in the annex. In the case of female and male employment, table 21 and 22 also show some differences suggesting a larger impact of g_2 in male employment growth. This suggests that innovation exerts a stronger effect on male employment, despite of the fact that female employment growth was -in average- higher in the period analyzed.

Table 5 and 6 present the results obtained when the sample for the manufacturing sector is divided between high or low tech firms, this classification is obtained calculating the innovation intensity of each company and after that, estimating the median value. Firms over the median are high tech and below or in the median are low tech. These estimations show some interesting results: in the high tech group *organizational and commercialization changes* always have a positive and significant impact on employment, contrary to low tech firms. Besides that, for low-tech firms (table 6) g_2 are not always significant, and the coefficients suggest that old products are produced more efficiently than new products. In addition, *process and product innovation* always have a positive impact on employment only in high tech firms, *labor cost growth* has a significant and negative effect in low tech firms, and large firms in both cases generate more employment than its counterparts with fewer employees. Instrumental variable estimations also suggest a higher impact of g_2 on employment growth.

In all the manufacturing industry estimations, if the firm exports or not has not an additional effect on employment growth. This is possible, because the number of exporting firms in the Colombian manufacturing sector is not very high. The variables *located in the capital* and *foreign owned* are in almost all the estimations not significant, despite of the differentiation among different types of industries and different types of labor. In some cases, being a large or medium-sized company has an additional effect on employment growth, and it is also very common the negative impact of *labor costs growth* or *fixed assets growth*.

Table 1: Manufacturing firms. OLS estimations. Dependent Variable: $\ell_i - (g_{1i} - \pi_i)$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Constant	0.320 (0.575)	0.328 (0.574)	0.333 (0.574)	0.353 (0.574)	0.306 (0.576)	0.317 (0.559)	-0.066 (0.096)	0.772* (0.454)	0.743* (0.427)	0.313 (0.575)	0.321 (0.575)	0.326 (0.574)	0.346 (0.574)	0.309 (0.576)	0.314 (0.564)	-0.063 (0.096)	0.767* (0.454)	0.740* (0.429)
Process Innovation Only	0.028 (0.060)	0.020 (0.051)	0.015 (0.047)	-0.005 (0.041)	0.009 (0.045)	0.009 (0.046)	-0.002 (0.040)	0.001 (0.039)	-0.008 (0.038)	0.036 (0.062)	0.027 (0.053)	0.023 (0.048)	0.002 (0.042)	0.021 (0.048)	0.020 (0.049)	0.005 (0.042)	0.005 (0.040)	-0.002 (0.038)
Sales growth dt new products	0.307*** (0.094)	0.308*** (0.095)	0.308*** (0.095)	0.306*** (0.094)	0.307*** (0.094)	0.307*** (0.094)	0.306*** (0.094)	0.294*** (0.089)	0.293*** (0.088)	0.295*** (0.090)	0.296*** (0.090)	0.297*** (0.091)	0.297*** (0.091)	0.296*** (0.090)	0.296*** (0.090)	0.297*** (0.091)	0.288*** (0.087)	0.287*** (0.087)
Located in the capital		-0.070 (0.088)	-0.068 (0.086)	-0.066 (0.086)	-0.069 (0.087)	-0.070 (0.088)	-0.064 (0.086)	0.016 (0.038)	0.013 (0.037)		-0.068 (0.087)	-0.066 (0.086)	-0.065 (0.086)	-0.067 (0.087)	-0.068 (0.087)	-0.062 (0.086)	0.017 (0.038)	0.015 (0.037)
Foreign Owned		0.051 (0.050)	0.020 (0.028)	-0.016 (0.031)	0.049 (0.050)	0.049 (0.050)	-0.016 (0.031)	-0.137** (0.054)	-0.101** (0.046)		0.048 (0.050)	0.021 (0.028)	-0.014 (0.031)	0.048 (0.049)	0.048 (0.049)	-0.014 (0.031)	-0.136** (0.054)	-0.102** (0.046)
Exports dummy			0.066 (0.075)									0.060 (0.074)						
Medium size				0.117 (0.081)			0.115 (0.081)	-0.006 (0.032)					0.114 (0.080)			0.111 (0.080)	-0.008 (0.032)	
Big size				0.178** (0.072)			0.176** (0.072)	0.117* (0.063)					0.168** (0.070)			0.166** (0.070)	0.111* (0.064)	
Organizational change					0.033 (0.028)									0.019 (0.026)				
Commercialization Change						0.044 (0.030)			0.077* (0.042)						0.030 (0.028)			0.070 (0.043)
Labor cost Growth							-0.191** (0.082)	-0.049 (0.089)	-0.051 (0.089)							-0.191** (0.082)	-0.049 (0.089)	-0.051 (0.089)
Fixed Assets Growth								-0.768*** (0.125)	-0.768*** (0.125)								-0.768*** (0.125)	-0.768*** (0.125)
Process and Product Innovation										0.173*** (0.067)	0.165*** (0.059)	0.152*** (0.048)	0.122*** (0.046)	0.159*** (0.056)	0.158*** (0.056)	0.124*** (0.046)	0.083** (0.041)	0.089** (0.039)
Number of firms	8266	8266	8266	8266	8266	8266	8264	8240	8240	8266	8266	8266	8266	8266	8266	8264	8240	8240

Robust standard errors are reported in brackets. All regressions include industry dummies.

Significance at the *** 1%, **5% and * 10% level.

Source: Authors' estimations.

Table 2: Manufacturing firms. IV estimations. Dependent Variable: $\ell_i - (g_{1i} - \pi_i)$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Constant	0.389 (0.454)	0.387 (0.455)	0.387 (0.455)	0.387 (0.454)	0.383 (0.455)	0.380 (0.455)	0.391 (0.454)	0.387 (0.454)	0.380 (0.454)	0.372 (0.454)	0.371 (0.454)	0.371 (0.454)	0.371 (0.454)	0.370 (0.455)	0.365 (0.454)	0.376 (0.453)	0.371 (0.454)	0.364 (0.454)
Process Innovation Only	-0.041* (0.023)	-0.039* (0.023)	-0.039* (0.023)	-0.038* (0.023)	-0.039* (0.023)	-0.041* (0.023)	-0.037 (0.023)	-0.037 (0.023)	-0.040* (0.023)	-0.024 (0.023)	-0.022 (0.023)	-0.022 (0.023)	-0.023 (0.023)	-0.022 (0.023)	-0.024 (0.023)	-0.021 (0.023)	-0.022 (0.023)	-0.023 (0.023)
Sales growth dt new products	0.295*** (0.101)	0.302*** (0.100)	0.303*** (0.100)	0.306*** (0.100)	0.302*** (0.100)	0.301*** (0.100)	0.306*** (0.100)	0.306*** (0.100)	0.300*** (0.100)	0.294*** (0.101)	0.300*** (0.100)	0.300*** (0.100)	0.304*** (0.100)	0.301*** (0.100)	0.299*** (0.100)	0.305*** (0.100)	0.304*** (0.100)	0.299*** (0.100)
Located in the capital		0.021 (0.022)	0.021 (0.022)	0.023 (0.022)	0.021 (0.022)	0.021 (0.022)	0.025 (0.022)	0.025 (0.022)	0.022 (0.022)		0.023 (0.022)	0.023 (0.022)	0.024 (0.022)	0.023 (0.022)	0.022 (0.022)	0.026 (0.022)	0.026 (0.022)	0.024 (0.022)
Foreign Owned		0.006 (0.033)	0.004 (0.035)	-0.017 (0.035)	0.006 (0.033)	0.005 (0.033)	-0.019 (0.035)	-0.018 (0.035)	0.005 (0.033)		0.005 (0.033)	0.005 (0.035)	-0.015 (0.035)	0.005 (0.033)	0.005 (0.033)	-0.017 (0.035)	-0.016 (0.035)	0.004 (0.033)
Exports dummy			0.005 (0.023)									0.001 (0.023)						
Medium size				0.005 (0.024)			0.002 (0.024)	0.002 (0.024)					0.003 (0.024)			-0.000 (0.024)	-0.000 (0.024)	
Big size				0.061** (0.029)			0.060** (0.029)	0.060** (0.029)					0.055* (0.030)			0.054* (0.029)	0.053* (0.030)	
Organizational change					0.004 (0.022)									0.001 (0.022)				
commercialization Change						0.017 (0.024)			0.019 (0.024)						0.014 (0.024)			0.016 (0.024)
Labor cost Growth							-0.120*** (0.032)	-0.122*** (0.032)	-0.122*** (0.032)							-0.120*** (0.032)	-0.122*** (0.032)	-0.122*** (0.032)
Fixed Assets Growth								0.009 (0.007)	0.010 (0.007)								0.010 (0.007)	0.010 (0.007)
Process and Product Innovation										0.104** (0.044)	0.104** (0.044)	0.104** (0.045)	0.096** (0.045)	0.104** (0.045)	0.103** (0.045)	0.096** (0.045)	0.098** (0.045)	0.104** (0.045)
Number of firms	3812	3812	3812	3812	3812	3812	3810	3802	3802	3812	3812	3812	3812	3812	3812	3810	3802	3802
Sargan test	0.473	0.835	0.809	0.509	0.818	0.737	0.447	0.446	0.643	0.368	0.642	0.641	0.414	0.639	0.596	0.360	0.354	0.515
P-value	0.925	0.841	0.847	0.917	0.845	0.865	0.930	0.931	0.886	0.947	0.887	0.887	0.937	0.887	0.897	0.948	0.950	0.916
Durbin-Wu-Hausman test	0.778	0.915	0.931	0.957	0.912	0.879	0.968	0.962	0.878	0.960	1.100	1.100	1.140	1.106	1.074	1.155	1.153	1.082
P-value	0.378	0.339	0.335	0.328	0.340	0.348	0.325	0.327	0.349	0.327	0.294	0.294	0.286	0.293	0.300	0.282	0.283	0.298

Robust standard errors are reported in brackets. All regressions include industry dummies.

Significance at the *** 1%, **5% and * 10% level.

instruments used are client, increase market share interacted with innovation intensity, increased range and obstacles to innovate

Source: Authors' estimations.

Table 3: Manufacturing firms. OLS estimations by Type of Labor (Skilled and Unskilled).
Dependent Variable: $\ell_i - (g_{1i} - \pi_i)$

	Skilled Employment						Unskilled Employment					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
Constant	-0.146 (0.168)	-0.098 (0.187)	-0.271 (0.190)	0.378 (0.587)	1.136 (1.060)	1.290 (1.070)	0.170 (0.168)	0.186 (0.167)	0.081 (0.182)	0.094 (0.175)	1.472* (0.873)	1.552* (0.879)
Process Innovation Only	0.016 (0.063)	0.005 (0.055)	-0.025 (0.047)	-0.022 (0.047)	-0.035 (0.041)	-0.043 (0.035)	0.041 (0.063)	0.033 (0.054)	0.012 (0.044)	0.012 (0.044)	0.017 (0.043)	0.003 (0.042)
Sales growth dt new products	0.343*** (0.076)	0.343*** (0.076)	0.342*** (0.074)	0.338*** (0.075)	0.328*** (0.070)	0.326*** (0.069)	0.348*** (0.103)	0.349*** (0.104)	0.347*** (0.104)	0.346*** (0.103)	0.334*** (0.097)	0.332*** (0.097)
Located in the capital		-0.105 (0.091)	-0.100 (0.089)	-0.091 (0.090)	0.008 (0.044)	0.005 (0.044)		-0.073 (0.090)	-0.070 (0.087)	-0.071 (0.088)	0.009 (0.039)	0.007 (0.038)
Foreign Owned		0.025 (0.056)	-0.063 (0.042)	-0.060 (0.045)	-0.185*** (0.064)	-0.129** (0.052)		0.054 (0.056)	-0.006 (0.032)	0.000 (0.037)	-0.128** (0.060)	-0.101* (0.052)
Exports dummy			0.023 (0.072)					0.016 (0.063)				
Medium size			0.117 (0.074)	0.121 (0.086)	0.012 (0.040)			0.103 (0.072)	0.106 (0.083)	-0.018 (0.034)		
Big size			0.215** (0.085)	0.219** (0.090)	0.175** (0.083)			0.133** (0.053)	0.141** (0.072)	0.083 (0.063)		
Commercialization Change					0.097** (0.045)							0.079* (0.044)
Labor cost Growth				-0.133** (0.052)	-0.138*** (0.050)	-0.140*** (0.052)				-0.043 (0.083)	-0.000 (0.084)	0.000 (0.084)
Fixed Assets Growth					-0.781*** (0.117)	-0.781*** (0.117)					-0.769*** (0.125)	-0.769*** (0.125)
Number of firms	8213	8213	8213	8145	8127	8127	8101	8101	8101	8071	8047	8047

Robust standard errors are reported in brackets. All regressions include industry dummies.
Significance at the *** 1%, **5% and * 10% level.
Source: Authors' estimations.

Table 4: Manufacturing firms. IV estimations by Type of Labor (Skilled and Unskilled).
Dependent Variable: $\ell_i - (g_{1i} - \pi_i)$

	Skilled Employment						Unskilled Employment					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0.411 (0.905)	0.411 (0.906)	0.409 (0.906)	0.410 (0.905)	-0.177 (0.644)	0.392 (0.906)	0.212 (0.402)	0.212 (0.403)	0.196 (0.405)	0.178 (0.404)	0.175 (0.405)	0.204 (0.404)
Process Innovation Only		-0.062 (0.045)	-0.061 (0.046)	-0.057 (0.046)	-0.058 (0.046)	-0.059 (0.046)	-0.015 (0.029)	-0.014 (0.029)	-0.015 (0.029)	-0.013 (0.029)	-0.013 (0.029)	-0.017 (0.029)
Sales growth dt new products	0.441** (0.194)	0.450** (0.194)	0.459** (0.194)	0.459** (0.194)	0.457** (0.194)	0.454** (0.194)	0.418*** (0.126)	0.423*** (0.126)	0.421*** (0.126)	0.418*** (0.126)	0.418*** (0.126)	0.413*** (0.126)
Located in the capital		-0.012 (0.044)	-0.007 (0.044)	-0.003 (0.044)	-0.005 (0.044)	-0.009 (0.044)		0.002 (0.028)	0.002 (0.028)	-0.000 (0.028)	-0.001 (0.028)	-0.001 (0.028)
Foreign Owned		-0.036 (0.066)	-0.074 (0.071)	-0.068 (0.069)	-0.064 (0.069)	-0.037 (0.066)		-0.003 (0.043)	-0.013 (0.046)	-0.015 (0.045)	-0.015 (0.045)	0.001 (0.043)
Exports dummy			0.040 (0.049)					-0.024 (0.031)				
Medium size			0.034 (0.049)	0.040 (0.048)	0.039 (0.048)			-0.028 (0.031)	-0.034 (0.030)	-0.035 (0.030)		
Big size			0.064 (0.063)	0.078 (0.059)	0.077 (0.059)			0.045 (0.040)	0.035 (0.037)	0.034 (0.037)		
Commercialization Change					0.010 (0.047)							0.032 (0.030)
Labor cost Growth				-0.103*** (0.029)	-0.102*** (0.029)	-0.103*** (0.029)				0.025 (0.029)	0.025 (0.029)	0.026 (0.029)
Fixed Assets Growth					0.027 (0.017)	0.027 (0.017)					0.003 (0.009)	0.003 (0.009)
Number of firms	3795	3795	3795	3783	3776	3776	3747	3747	3747	3736	3728	3728
Sargan test	4.237	5.010	4.307	4.051	3.993	4.433	1.912	2.289	2.226	2.022	2.097	1.892
P-value	0.237	0.171	0.230	0.256	0.262	0.218	0.591	0.515	0.527	0.568	0.552	0.595
Durbin-Wu-Hausman test	0.783	0.886	0.973	0.995	0.974	0.947	1.931	2.064	1.977	1.927	1.921	1.845
P-value	0.376	0.347	0.324	0.319	0.324	0.331	0.165	0.151	0.160	0.165	0.166	0.174

Robust standard errors are reported in brackets. All regressions include industry dummies.
Significance at the *** 1%, **5% and * 10% level.
instruments used are client, innovation intensity interacted with increased market share, increased range and obstacles to innovation
Source: Authors' estimations.

Table 5: Manufacturing firms. OLS estimations by Type of sector (low-Tech and High-Tech).
Dependent Variable: $\ell_i - (g_{1i} - \pi_i)$

Low-Tech												
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Constant	-0.174 (0.183)	-0.187 (0.185)	-0.243 (0.185)	-0.178 (0.191)	-0.185 (0.188)	-0.226 (0.193)	-0.183 (0.177)	-0.198 (0.179)	-0.247 (0.182)	-0.188 (0.185)	-0.196 (0.182)	-0.230 (0.189)
Process Innovation Only	-0.035 (0.033)	-0.032 (0.034)	-0.045 (0.034)	-0.024 (0.029)	-0.029 (0.031)	-0.041 (0.034)	-0.033 (0.033)	-0.031 (0.034)	-0.044 (0.035)	-0.020 (0.030)	-0.026 (0.031)	-0.040 (0.034)
Sales growth dt new products	0.623*** (0.065)	0.623*** (0.065)	0.619*** (0.064)	0.624*** (0.065)	0.623*** (0.065)	0.622*** (0.063)	0.616*** (0.065)	0.615*** (0.065)	0.616*** (0.064)	0.615*** (0.065)	0.615*** (0.065)	0.618*** (0.064)
Located in the capital		0.026 (0.026)	0.030 (0.026)	0.025 (0.027)	0.026 (0.026)	0.031 (0.026)		0.027 (0.026)	0.031 (0.026)	0.026 (0.027)	0.027 (0.026)	0.031 (0.026)
Foreign Owned		0.014 (0.034)	-0.022 (0.041)	0.015 (0.034)	0.014 (0.034)	-0.034 (0.041)		0.014 (0.034)	-0.022 (0.042)	0.016 (0.035)	0.014 (0.034)	-0.033 (0.041)
Exports dummy			-0.044 (0.048)						-0.045 (0.048)			
Medium size			0.054 (0.036)			0.043 (0.029)			0.053 (0.036)			0.043 (0.029)
Big size			0.160** (0.067)			0.138*** (0.053)			0.158** (0.067)			0.137** (0.054)
Organizational change				-0.023 (0.033)						-0.029 (0.033)		
commercialization Change					-0.012 (0.040)						-0.016 (0.041)	
Labor cost Growth						-0.225* (0.117)						-0.225* (0.117)
Fixed Assets Growth						-0.014 (0.024)						-0.014 (0.024)
Process and Product Innovation							0.046 (0.034)	0.050 (0.035)	0.023 (0.038)	0.061* (0.036)	0.054 (0.036)	0.024 (0.037)
Number of firms	4217	4217	4217	4217	4217	4203	4217	4217	4217	4217	4217	4203
high-tech												
	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
Constant	0.251 (0.583)	0.272 (0.580)	0.305 (0.577)	0.209 (0.585)	0.249 (0.549)	-0.284 (0.234)	0.238 (0.584)	0.259 (0.581)	0.294 (0.577)	0.210 (0.585)	0.242 (0.557)	-0.281 (0.236)
Process Innovation Only	0.097 (0.110)	0.076 (0.089)	0.043 (0.067)	0.046 (0.075)	0.054 (0.081)	-0.042 (0.039)	0.111 (0.116)	0.090 (0.094)	0.054 (0.070)	0.064 (0.083)	0.071 (0.088)	-0.036 (0.041)
Sales growth dt new products	0.231*** (0.084)	0.233*** (0.086)	0.231*** (0.087)	0.232*** (0.085)	0.232*** (0.086)	0.218*** (0.075)	0.218*** (0.077)	0.221*** (0.079)	0.223*** (0.083)	0.221*** (0.079)	0.221*** (0.079)	0.214*** (0.073)
Located in the capital		-0.168 (0.177)	-0.165 (0.174)	-0.167 (0.177)	-0.167 (0.177)	0.052 (0.037)		-0.165 (0.176)	-0.164 (0.174)	-0.165 (0.176)	-0.165 (0.176)	0.052 (0.037)
Foreign Owned		0.082 (0.090)	-0.035 (0.030)	0.080 (0.089)	0.079 (0.089)	-0.190* (0.104)		0.076 (0.087)	-0.032 (0.030)	0.075 (0.087)	0.074 (0.087)	-0.189* (0.104)
Exports dummy			0.085 (0.120)						0.080 (0.119)			
Medium size			0.176 (0.139)			0.023 (0.036)			0.171 (0.138)			0.020 (0.036)
Big size			0.186** (0.091)			0.223** (0.111)			0.173** (0.088)			0.216* (0.114)
Organizational change				0.094* (0.051)						0.074* (0.044)		
commercialization Change					0.091** (0.043)						0.071* (0.037)	
Labor cost Growth						-0.041 (0.106)						-0.041 (0.106)
Fixed Assets Growth						-0.864*** (0.041)						-0.864*** (0.041)
Process and Product Innovation							0.248** (0.122)	0.236** (0.109)	0.163*** (0.062)	0.214** (0.100)	0.218** (0.103)	0.077 (0.065)
Number of firms	4049	4049	4049	4049	4049	4037	4049	4049	4049	4049	4049	4037

Robust standard errors are reported in brackets. All regressions include industry dummies.

Significance at the *** 1%, **5% and * 10% level.

Source: Authors' estimations.

Table 6: Manufacturing firms. IV estimations by Type of sector (low-Tech and High-Tech).
Dependent Variable: $\ell_i - (g_{1i} - \pi_i)$

low-Tech												
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Constant	-0.000 (0.411)	-0.148 (0.529)	-0.245 (0.550)	-0.137 (0.532)	-0.151 (0.529)	-0.285 (0.548)	0.021 (0.435)	-0.069 (0.544)	-0.243 (0.616)	-0.074 (0.555)	-0.072 (0.547)	-0.262 (0.594)
Process Innovation Only	0.102 (0.143)	0.236 (0.199)	0.245 (0.205)	0.239 (0.197)	0.239 (0.199)	0.248 (0.207)	0.074 (0.132)	0.155 (0.164)	0.182 (0.185)	0.159 (0.165)	0.158 (0.166)	0.175 (0.180)
Sales growth dt new products	2.830 (1.912)	4.641* (2.670)	4.756* (2.744)	4.655* (2.656)	4.645* (2.673)	4.767* (2.752)	3.451 (2.762)	5.154 (3.401)	5.785 (3.873)	5.251 (3.507)	5.191 (3.472)	5.574 (3.714)
Located in the capital		0.065 (0.057)	0.072 (0.059)	0.063 (0.057)	0.066 (0.057)	0.066 (0.058)		0.047 (0.056)	0.062 (0.063)	0.048 (0.057)	0.048 (0.056)	0.054 (0.060)
Foreign Owned		0.031 (0.080)	-0.009 (0.087)	0.034 (0.080)	0.031 (0.080)	0.001 (0.085)		0.012 (0.086)	-0.060 (0.110)	0.011 (0.088)	0.012 (0.086)	-0.042 (0.103)
Exports dummy			0.017 (0.057)						0.036 (0.069)			
Medium size			-0.022 (0.062)			-0.027 (0.061)			-0.023 (0.070)			-0.022 (0.065)
Big size			0.090 (0.076)			0.092 (0.073)			0.146 (0.105)			0.152 (0.105)
Organizational change				-0.027 (0.051)						0.004 (0.066)		
commercialization Change					-0.035 (0.054)						-0.012 (0.059)	
Labor cost Growth						-0.316*** (0.109)						-0.316*** (0.120)
Fixed Assets Growth						0.023 (0.016)						0.022 (0.017)
Process and Product Innovation							-0.507 (0.518)	-0.817 (0.637)	-0.957 (0.736)	-0.836 (0.662)	-0.823 (0.651)	-0.911 (0.704)
Number of firms	1789	1789	1789	1789	1789	1785	1789	1789	1789	1789	1789	1785
Sargan test	1.173	0.493	0.326	0.460	0.543	0.392	1.124	0.700	0.310	0.680	1.297	0.447
P-value	0.760	0.920	0.955	0.928	0.909	0.942	0.771	0.873	0.958	0.878	0.730	0.930
Durbin-Wu-Hausman test	1.776	4.873	5.035	4.994	4.882	5.054	1.607	4.240	4.899	4.279	1.584	4.727
P-value	0.183	0.027	0.025	0.025	0.027	0.025	0.205	0.039	0.027	0.039	0.208	0.030
High-Tech												
	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
Constant	-0.503 (0.598)	-0.511 (0.600)	-0.549 (0.600)	0.307 (0.424)	-0.507 (0.599)	-0.557 (0.600)	0.330 (0.423)	0.329 (0.423)	0.332 (0.423)	-0.557 (0.599)	-0.505 (0.599)	0.336 (0.423)
Process Innovation Only	-0.006 (0.029)	-0.005 (0.029)	-0.006 (0.029)	-0.012 (0.029)	-0.011 (0.029)	-0.004 (0.029)	0.018 (0.029)	0.020 (0.029)	0.017 (0.029)	0.012 (0.029)	0.013 (0.029)	0.018 (0.029)
Sales growth dt new products	0.260*** (0.090)	0.257*** (0.090)	0.257*** (0.090)	0.251*** (0.090)	0.254*** (0.090)	0.259*** (0.090)	0.262*** (0.090)	0.259*** (0.090)	0.256*** (0.090)	0.253*** (0.089)	0.255*** (0.090)	0.260*** (0.090)
Located in the capital		0.021 (0.028)	0.020 (0.028)	0.021 (0.028)	0.020 (0.028)	0.025 (0.028)		0.021 (0.028)	0.020 (0.028)	0.021 (0.028)	0.020 (0.028)	0.025 (0.028)
Foreign Owned		-0.014 (0.041)	-0.036 (0.044)	-0.014 (0.041)	-0.016 (0.041)	-0.047 (0.043)		-0.016 (0.041)	-0.034 (0.044)	-0.016 (0.041)	-0.018 (0.041)	-0.046 (0.043)
Exports dummy			-0.025 (0.032)						-0.030 (0.032)			
Medium size			0.003 (0.032)			-0.005 (0.031)			0.001 (0.032)			-0.009 (0.031)
Big size			0.087** (0.041)			0.075** (0.038)			0.079* (0.041)			0.066* (0.038)
Organizational change				0.054* (0.028)						0.050* (0.028)		
commercialization Change					0.061** (0.030)						0.056* (0.030)	
Labor cost Growth						-0.084** (0.035)						-0.084** (0.035)
Fixed Assets Growth						-0.004 (0.010)						-0.003 (0.010)
Process and Product Innovation							0.136*** (0.053)	0.137*** (0.053)	0.132** (0.053)	0.133** (0.053)	0.132** (0.053)	0.130** (0.053)
Number of firms	2023	2023	2023	2023	2023	2017	2023	2023	2023	2023	2023	2017
Sargan test	1.855	1.314	1.553	1.283	1.211	1.644	1.785	1.222	1.472	1.250	1.229	1.585
P-value	0.603	0.726	0.670	0.733	0.750	0.649	0.618	0.748	0.689	0.741	0.746	0.663
Durbin-Wu-Hausman test	1.506	1.447	1.389	1.270	1.331	1.461	1.809	1.746	1.634	1.564	1.632	1.743
P-value	0.220	0.229	0.239	0.260	0.249	0.227	0.179	0.186	0.201	0.211	0.201	0.187

Robust standard errors are reported in brackets. All regressions include industry dummies. Significance at the *** 1%, **5% and * 10% level.

instruments used are client, innovation intensity interacted with increased market share, increased range and obstacles to innovation
Source: Authors' estimations.

As far as the service industry is concerned, when the theoretical model is estimated through OLS, g_2 has a positive and significant impact, and is larger than in the case of manufacturing firms. *Labor cost growth* and *fixed assets growth* were not available in the data provided for the services estimations. For that reason are not included as control variables. Table 8 shows instrumental variables estimations where the effect of g_2 is slightly larger, and instruments used are *increased range*, *increased market share* and *patent*. Table 9 and 10 compare the effects between skilled and unskilled workers, where instrumental variables estimations do not show a big difference. Additionally, in all the service industry estimations, *process innovation only* has a negative but not significant impact and *organizational changes*, have an impact on unskilled employment growth. Another outcome to highlight is that *organizational changes* have more impact on service firms, and *commercialization changes* affect more frequently industry firms.

Table 7: Service firms. OLS estimations. Dependent Variable: $\ell_i - (g_{1i} - \pi_i)$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Constant	0.250*** (0.023)	0.251*** (0.023)	0.227*** (0.037)	0.213*** (0.032)	0.250*** (0.024)	0.190*** (0.048)	0.190*** (0.043)	0.191*** (0.043)	0.176*** (0.051)	0.178*** (0.045)	0.180*** (0.049)	0.150** (0.061)
Process Innovation Only	-0.035 (0.040)	-0.032 (0.040)	-0.034 (0.039)	-0.041 (0.039)	-0.032 (0.040)	-0.041 (0.039)	-0.029 (0.040)	-0.027 (0.040)	-0.028 (0.040)	-0.033 (0.039)	-0.023 (0.041)	-0.031 (0.040)
Sales growth dt new products	0.993*** (0.084)	0.990*** (0.085)	0.985*** (0.085)	0.970*** (0.088)	0.991*** (0.089)	0.971*** (0.089)	0.958*** (0.082)	0.956*** (0.083)	0.954*** (0.083)	0.949*** (0.085)	0.961*** (0.085)	0.952*** (0.086)
Located in the capital		-0.020 (0.020)	-0.021 (0.020)	-0.019 (0.020)	-0.020 (0.020)	-0.020 (0.020)		-0.019 (0.020)	-0.020 (0.020)	-0.019 (0.020)	-0.018 (0.020)	-0.019 (0.020)
Medium size			0.001 (0.024)			-0.002 (0.025)			-0.002 (0.025)			-0.003 (0.025)
Big size			0.025 (0.028)			0.020 (0.028)			0.018 (0.028)			0.015 (0.028)
Organizational change				0.043 (0.027)		0.046 (0.030)				0.026 (0.029)		0.032 (0.030)
commercialization Change					-0.003 (0.032)	-0.019 (0.035)					-0.028 (0.036)	-0.034 (0.037)
Process and Product Innovation							0.069* (0.037)	0.069* (0.037)	0.066* (0.037)	0.058 (0.039)	0.078* (0.042)	0.065 (0.042)
Number of firms	1371	1371	1371	1371	1371	1371	1371	1371	1371	1371	1371	1371

Robust standard errors are reported in brackets. All regressions include service industry dummies.

Significance at the *** 1%, **5% and * 10% level.

Source: Authors' estimations.

Table 8: Service firms. IV estimations. Dependent Variable: $\ell_i - (g_{1i} - \pi_i)$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Constant	0.230 (0.374)	0.231 (0.374)	0.212 (0.375)	0.214 (0.374)	0.225 (0.375)	0.187 (0.375)	0.192 (0.374)	0.193 (0.374)	0.179 (0.375)	0.184 (0.374)	0.178 (0.374)	0.153 (0.375)
Process Innovation Only	-0.030 (0.044)	-0.028 (0.044)	-0.030 (0.044)	-0.041 (0.045)	-0.026 (0.045)	-0.040 (0.046)	-0.030 (0.044)	-0.028 (0.044)	-0.030 (0.044)	-0.037 (0.045)	-0.022 (0.045)	-0.033 (0.046)
Sales growth dt new products	1.065*** (0.138)	1.064*** (0.138)	1.050*** (0.140)	0.968*** (0.157)	1.086*** (0.152)	0.989*** (0.167)	0.936*** (0.167)	0.937*** (0.167)	0.930*** (0.169)	0.881*** (0.177)	0.980*** (0.174)	0.918*** (0.182)
Located in the capital		-0.018 (0.021)	-0.020 (0.021)	-0.019 (0.021)	-0.018 (0.021)	-0.020 (0.021)		-0.019 (0.021)	-0.020 (0.021)	-0.020 (0.021)	-0.018 (0.021)	-0.019 (0.021)
Medium size			0.000 (0.024)			-0.002 (0.024)			-0.001 (0.024)			-0.003 (0.024)
Big size			0.022 (0.029)			0.019 (0.029)			0.018 (0.029)			0.016 (0.029)
Organizational change				0.043 (0.032)		0.044 (0.032)				0.030 (0.032)		0.033 (0.032)
commercialization Change					-0.013 (0.036)	-0.020 (0.037)					-0.029 (0.036)	-0.033 (0.037)
Process and Product Innovation							0.073* (0.041)	0.071* (0.041)	0.069* (0.041)	0.066 (0.042)	0.076* (0.042)	0.068 (0.042)
Number of firms	1371	1371	1371	1371	1371	1371	1371	1371	1371	1371	1371	1371
Sargan test	1.521	1.552	1.775	1.315	1.622	1.585	1.307	1.342	1.560	1.220	1.416	1.474
P-value	0.468	0.460	0.412	0.518	0.445	0.453	0.520	0.511	0.458	0.543	0.493	0.478
Durbin-Wu-Hausman test	0.342	0.362	0.271	0.000	0.476	0.013	0.020	0.014	0.023	0.172	0.015	0.040
P-value	0.342	0.547	0.602	0.991	0.490	0.909	0.886	0.905	0.880	0.679	0.903	0.841

Robust standard errors are reported in brackets. All regressions include service industry dummies.

Significance at the *** 1%, **5% and * 10% level.

increased range, increase market share and patent.

Source: Authors' estimations.

Table 9: Service firms. OLS estimations by Type of Labor (Skilled and Unskilled). Dependent Variable: $\ell_i - (g_{1i} - \pi_i)$

	Skilled Employment						Unskilled Employment					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0.046*** (0.000)	0.073** (0.033)	0.136** (0.059)	0.255*** (0.045)	0.073** (0.033)	0.302*** (0.058)	0.079*** (0.000)	0.124*** (0.035)	0.039 (0.055)	0.124*** (0.035)	0.124*** (0.035)	0.045 (0.054)
Process Innovation Only	-0.039 (0.058)	-0.036 (0.058)	-0.035 (0.059)	-0.044 (0.060)	-0.034 (0.058)	-0.042 (0.060)	-0.049 (0.069)	-0.043 (0.069)	-0.047 (0.068)	-0.060 (0.068)	-0.041 (0.070)	-0.060 (0.068)
Sales growth dt new products	0.855*** (0.061)	0.851*** (0.062)	0.862*** (0.062)	0.833*** (0.065)	0.856*** (0.063)	0.848*** (0.065)	1.073*** (0.144)	1.064*** (0.145)	1.043*** (0.143)	1.021*** (0.155)	1.069*** (0.149)	1.016*** (0.154)
Located in the capital		-0.027 (0.033)	-0.027 (0.034)	-0.027 (0.033)	-0.027 (0.033)	-0.026 (0.033)		-0.046 (0.035)	-0.052 (0.035)	-0.045 (0.035)	-0.045 (0.035)	-0.049 (0.035)
Medium size			-0.054 (0.042)			-0.057 (0.044)			0.002 (0.034)			-0.003 (0.035)
Big size			-0.062 (0.040)			-0.068 (0.042)			0.091** (0.040)			0.083** (0.039)
Organizational change				0.038 (0.047)		0.055 (0.054)				0.086 (0.060)		0.093 (0.065)
commercialization Change					-0.015 (0.039)	-0.032 (0.046)					-0.015 (0.043)	-0.049 (0.050)
Number of firms	1355	1355	1355	1355	1355	1355	1216	1216	1216	1216	1216	1216

Robust standard errors are reported in brackets. All regressions include service industry dummies.

Significance at the *** 1%, **5% and * 10% level.

Source: Authors' estimations.

Table 10: Service firms. IV estimations by Type of Labor (Skilled and Unskilled). Dependent Variable: $\ell_i - (g_{1i} - \pi_i)$

	Skilled Employment						Unskilled Employment					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0.275 (0.604)	0.276 (0.604)	0.329 (0.605)	0.259 (0.604)	0.265 (0.605)	0.295 (0.606)	0.166 (0.567)	0.165 (0.567)	0.085 (0.567)	0.125 (0.568)	0.161 (0.567)	0.033 (0.569)
Process Innovation Only	-0.036 (0.072)	-0.033 (0.072)	-0.030 (0.072)	-0.045 (0.073)	-0.029 (0.072)	-0.038 (0.074)	-0.055 (0.070)	-0.047 (0.070)	-0.054 (0.071)	-0.083 (0.072)	-0.045 (0.071)	-0.084 (0.073)
Sales growth dt new products	0.901*** (0.222)	0.899*** (0.223)	0.943*** (0.226)	0.809*** (0.253)	0.939*** (0.246)	0.891*** (0.270)	0.984*** (0.235)	0.987*** (0.235)	0.925*** (0.241)	0.712*** (0.269)	1.005*** (0.257)	0.706** (0.286)
Located in the capital		-0.026 (0.034)	-0.026 (0.034)	-0.027 (0.034)	-0.025 (0.034)	-0.025 (0.035)		-0.047 (0.034)	-0.054 (0.034)	-0.051 (0.034)	-0.047 (0.034)	-0.056* (0.034)
Medium size												
Big size			-0.055 (0.039)			-0.058 (0.039)			0.005 (0.039)			0.001 (0.039)
Organizational change			-0.065 (0.047)			-0.069 (0.047)			0.097** (0.047)			0.094** (0.048)
commercialization Change												
Number of firms				0.040 (0.051)		0.052 (0.052)				0.115** (0.052)		0.115** (0.052)
comercializationchange					-0.023 (0.058)	-0.035 (0.059)					-0.009 (0.058)	-0.030 (0.059)
Number of firms	1355	1355	1355	1355	1355	1355	1216	1216	1216	1216	1216	1216
Sargan test	1.434	1.471	1.229	1.379	1.489	1.124	3.208	3.234	4.666	2.750	3.264	4.126
P-value	0.488	0.479	0.541	0.502	0.475	0.570	0.201	0.199	0.097	0.253	0.196	0.127
Durbin-Wu-Hausman test	0.053	0.059	0.160	0.011	0.141	0.030	0.180	0.133	0.301	1.596	0.077	1.397
P-value	0.820	0.807	0.689	0.918	0.707	0.863	0.671	0.715	0.583	0.207	0.782	0.237

Robust standard errors are reported in brackets. All regressions include service industry dummies.
Significance at the *** 1%, **5% and * 10% level.
increased range, increase market share and patent.
Source: Authors' estimations.

5 Robustness Checks

Tables 11 and 12 present additional instrumental variable estimations using other instruments different to those mentioned before. In table 11, estimations are conducted using only *innovation intensity* as an instrument. In table 12, three instruments are shown, namely *client*, *increased market share interacted with innovation intensity*, and *increased range*. In both cases, results showed to be robust when using different instruments. In all cases, g_2 is always positive and statistically significant. The only difference is that in table 16 -where *innovation intensity* is the instrument- the effect of g_2 is a bit larger: it goes up to 0.34, while in the other cases it is of 0.30.

Additional estimations are carried out dividing the different samples according to the firm size. These results might be seen in the tables 13, 14 and 15 where g_2 has the higher impact in large-sized firms, and a lower impact in medium-sized firms. *Process innovation only* is negative in medium and large firms but is not significant. Besides that, commercialization changes have a positive result on employment growth in small firms. Small and large firms are affected by *fixed assets growth* in a negative way, and medium firms are affected by *labor costs growth which have a negative and significant effect*.

Table 11: Manufacturing firms. IV estimations with other instruments. Dependent Variable: $\ell_i - (g_{1i} - \pi_i)$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Constant	0.398	0.397	0.398	0.398	0.402	0.395	0.404	0.401	0.396	0.389	0.388	0.388	0.390	0.396	0.387	0.395	0.392	0.388
	(0.522)	(0.522)	(0.522)	(0.522)	(0.522)	(0.522)	(0.521)	(0.522)	(0.522)	(0.522)	(0.522)	(0.522)	(0.522)	(0.522)	(0.522)	(0.521)	(0.521)	(0.522)
Process Innovation Only	-0.050**	-0.049*	-0.049**	-0.050**	-0.048*	-0.050**	-0.048*	-0.048*	-0.049*	-0.041*	-0.040	-0.039	-0.042*	-0.037	-0.040	-0.040	-0.040	-0.039
	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)
Sales growth dt new products	0.343***	0.342***	0.339***	0.344***	0.342***	0.341***	0.344***	0.344***	0.341***	0.338***	0.337***	0.333***	0.339***	0.338***	0.336***	0.340***	0.340***	0.337***
	(0.121)	(0.121)	(0.121)	(0.121)	(0.121)	(0.121)	(0.121)	(0.121)	(0.121)	(0.122)	(0.122)	(0.122)	(0.122)	(0.122)	(0.122)	(0.122)	(0.122)	(0.122)
Located in the capital		0.014	0.013	0.016	0.014	0.014	0.019	0.019	0.017		0.015	0.015	0.017	0.015	0.015	0.020	0.021	0.019
		(0.024)	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)		(0.024)	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)
Foreign Owned		0.002	0.008	-0.028	0.003	0.002	-0.030	-0.030	0.001		0.002	0.009	-0.027	0.002	0.002	-0.029	-0.029	0.000
		(0.036)	(0.038)	(0.038)	(0.036)	(0.036)	(0.038)	(0.038)	(0.036)		(0.036)	(0.038)	(0.038)	(0.036)	(0.036)	(0.038)	(0.038)	(0.036)
Exports dummy			-0.013										-0.017					
			(0.025)										(0.025)					
Medium size				0.004			0.000	0.001					0.002			-0.001	-0.000	
				(0.026)			(0.026)	(0.026)					(0.026)			(0.026)	(0.026)	
Big size				0.082**			0.080**	0.081**					0.078**			0.076**	0.077**	
				(0.032)			(0.032)	(0.032)					(0.032)			(0.032)	(0.032)	
Organizational change					-0.006									-0.010				
					(0.024)									(0.025)				
Commercialization Change						0.007			0.010						0.004			0.006
						(0.027)			(0.027)						(0.027)			(0.027)
Labor cost Growth							-0.142***	-0.143***	-0.144***							-0.142***	-0.143***	-0.144***
							(0.036)	(0.036)	(0.036)							(0.036)	(0.036)	(0.036)
Fixed Assets Growth								0.006	0.006									0.006
								(0.007)	(0.007)									(0.007)
Process and Product Innovation										0.075	0.076	0.080	0.065	0.078	0.076	0.065	0.067	0.077
										(0.051)	(0.051)	(0.051)	(0.051)	(0.051)	(0.051)	(0.051)	(0.051)	(0.051)
Number of firms	4256	4256	4256	4256	4256	4256	4254	4242	4242	4256	4256	4256	4256	4256	4256	4254	4242	4242
Sargan test	1.109	1.083	1.037	1.100	1.099	1.069	1.104	1.132	1.096	1.157	1.129	1.066	1.136	1.159	1.124	1.140	1.167	1.157
P-value	0.292	0.298	0.308	0.294	0.294	0.301	0.294	0.288	0.295	0.282	0.288	0.302	0.287	0.282	0.289	0.286	0.280	0.282
Durbin-Wu-Hausman test	1.115	1.090	1.044	1.107	1.106	1.076	1.111	1.140	1.104	1.164	1.136	1.073	1.144	1.166	1.131	1.148	1.175	1.165
P-value	0.291	0.296	0.307	0.293	0.293	0.300	0.292	0.286	0.293	0.281	0.287	0.300	0.285	0.280	0.288	0.284	0.278	0.280

Robust standard errors are reported in brackets. All regressions include industry dummies.

Significance at the *** 1%, **5% and * 10% level.

instrument used is innovation intensity

Source: Authors' estimations.

Table 12: Manufacturing firms. IV estimations with other instruments. Dependent Variable: $\ell_i - (g_{1i} - \pi_i)$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Constant	0.389 (0.454)	0.388 (0.454)	0.388 (0.455)	0.387 (0.454)	0.384 (0.455)	0.381 (0.455)	0.392 (0.454)	0.387 (0.454)	0.380 (0.454)	0.372 (0.454)	0.371 (0.454)	0.371 (0.454)	0.372 (0.454)	0.370 (0.455)	0.366 (0.454)	0.376 (0.453)	0.372 (0.454)	0.365 (0.454)
Process Innovation Only	-0.041* (0.023)	-0.039* (0.023)	-0.039* (0.023)	-0.039* (0.023)	-0.040* (0.023)	-0.041* (0.023)	-0.037 (0.023)	-0.038* (0.023)	-0.041* (0.023)	-0.024 (0.023)	-0.023 (0.023)	-0.023 (0.023)	-0.023 (0.023)	-0.023 (0.023)	-0.024 (0.023)	-0.022 (0.023)	-0.022 (0.023)	-0.023 (0.023)
Sales growth dt new products	0.297*** (0.101)	0.295*** (0.101)	0.296*** (0.101)	0.299*** (0.101)	0.295*** (0.101)	0.293*** (0.101)	0.300*** (0.101)	0.300*** (0.101)	0.293*** (0.101)	0.296*** (0.101)	0.294*** (0.101)	0.294*** (0.101)	0.298*** (0.101)	0.294*** (0.101)	0.293*** (0.101)	0.300*** (0.101)	0.299*** (0.101)	0.294*** (0.101)
Located in the capital		0.021 (0.022)	0.021 (0.022)	0.023 (0.022)	0.021 (0.022)	0.021 (0.022)	0.025 (0.022)	0.025 (0.022)	0.022 (0.022)		0.023 (0.022)	0.023 (0.022)	0.024 (0.022)	0.023 (0.022)	0.022 (0.022)	0.026 (0.022)	0.026 (0.022)	0.024 (0.022)
Foreign Owned		0.006 (0.033)	0.003 (0.035)	-0.017 (0.035)	0.005 (0.033)	0.005 (0.033)	-0.019 (0.035)	-0.018 (0.035)	0.004 (0.033)		0.005 (0.033)	0.005 (0.035)	-0.015 (0.035)	0.005 (0.033)	0.005 (0.033)	-0.017 (0.035)	-0.016 (0.035)	0.004 (0.033)
Exports dummy			0.005 (0.023)									0.001 (0.023)						
Medium size				0.005 (0.024)			0.002 (0.024)	0.002 (0.024)					0.003 (0.024)			-0.000 (0.024)	-0.000 (0.024)	
Big size				0.061** (0.029)			0.060** (0.029)	0.060** (0.029)					0.055* (0.030)			0.054* (0.029)	0.053* (0.030)	
Organizational change					0.004 (0.022)									0.001 (0.022)				
Commercialization Change						0.017 (0.024)			0.019 (0.024)						0.014 (0.024)			0.016 (0.024)
Labor cost Growth							-0.120*** (0.032)	-0.122*** (0.032)	-0.122*** (0.032)							-0.120*** (0.032)	-0.122*** (0.032)	-0.122*** (0.032)
Fixed Assets Growth								0.009 (0.007)	0.010 (0.007)								0.010 (0.007)	0.010 (0.007)
Process and Product Innovation										0.103** (0.044)	0.105** (0.044)	0.105** (0.045)	0.097** (0.045)	0.105** (0.045)	0.104** (0.045)	0.097** (0.045)	0.099** (0.045)	0.105** (0.045)
Number of firms	3812	3812	3812	3812	3812	3812	3810	3802	3802	3812	3812	3812	3812	3812	3812	3810	3802	3802
Sargan test	0.448	0.370	0.346	0.159	0.355	0.225	0.160	0.162	0.210	0.305	0.246	0.245	0.110	0.244	0.164	0.115	0.113	0.157
P-value	0.799	0.831	0.841	0.923	0.837	0.894	0.923	0.922	0.901	0.859	0.884	0.885	0.947	0.885	0.921	0.944	0.945	0.924
Durbin-Wu-Hausman test	0.799	0.763	0.779	0.819	0.760	0.727	0.840	0.835	0.737	0.995	0.957	0.958	1.007	0.962	0.933	1.033	1.032	0.952
P-value	0.371	0.382	0.378	0.366	0.383	0.394	0.359	0.361	0.391	0.318	0.328	0.328	0.316	0.327	0.334	0.309	0.310	0.329

Robust standard errors are reported in brackets. All regressions include industry dummies.

Significance at the *** 1%, **5% and * 10% level.

instruments used are client, increase market share interacted with innovation intensity and increased range

Source: Authors' estimations.

Table 13: Small-sized Manufacturing firms. OLS estimations. Dependent Variable: $\ell_i - (g_{1i} - \pi_i)$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Constant	0.263 (0.586)	0.273 (0.583)	0.239 (0.590)	0.235 (0.540)	0.760* (0.440)	0.257 (0.586)	0.267 (0.584)	0.245 (0.589)	0.234 (0.545)	0.757* (0.440)
Process Innovation Only	0.086 (0.122)	0.076 (0.109)	0.060 (0.096)	0.046 (0.098)	0.023 (0.075)	0.091 (0.124)	0.081 (0.110)	0.070 (0.099)	0.054 (0.100)	0.026 (0.075)
Sales growth dt new products	0.374*** (0.138)	0.377*** (0.140)	0.377*** (0.140)	0.377*** (0.140)	0.331*** (0.108)	0.358*** (0.131)	0.361*** (0.134)	0.361*** (0.134)	0.362*** (0.134)	0.323*** (0.107)
Located in the capital		-0.109 (0.160)	-0.109 (0.160)	-0.113 (0.161)	0.021 (0.061)		-0.108 (0.160)	-0.108 (0.160)	-0.112 (0.161)	0.021 (0.061)
Foreign Owned		0.074 (0.139)	0.072 (0.138)	0.070 (0.138)	0.078 (0.167)		0.072 (0.139)	0.072 (0.138)	0.069 (0.138)	0.078 (0.167)
organizationalchange			0.049 (0.058)					0.033 (0.055)		
commercialization Change				0.133** (0.067)					0.121* (0.064)	
Labor cost Growth					0.082 (0.185)					0.080 (0.186)
Fixed Assets Growth					-0.799*** (0.106)					-0.799*** (0.106)
Process and Product Innovation						0.254** (0.105)	0.250** (0.100)	0.240*** (0.093)	0.227** (0.093)	0.120 (0.074)
Number of firms	4202	4202	4202	4202	4183	4202	4202	4202	4202	4183

Robust standard errors are reported in brackets. All regressions include industry dummies.
Significance at the *** 1%, **5% and * 10% level.
Source: Authors' estimations.

Table 14: Medium-sized manufacturing firms. OLS estimations. Dependent Variable:

$$\ell_i - (g_{1i} - \pi_i)$$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Constant	-0.453 (0.575)	-0.438 (0.580)	-0.441 (0.581)	-0.421 (0.585)	-0.474 (0.578)	-0.455 (0.575)	-0.440 (0.580)	-0.440 (0.582)	-0.420 (0.586)	-0.476 (0.578)
Process Innovation Only	-0.043 (0.034)	-0.046 (0.035)	-0.048 (0.031)	-0.034 (0.031)	-0.042 (0.035)	-0.036 (0.033)	-0.039 (0.035)	-0.038 (0.031)	-0.024 (0.031)	-0.035 (0.035)
Sales growth dt new products	0.235** (0.115)	0.235** (0.115)	0.235** (0.115)	0.236** (0.116)	0.238** (0.116)	0.228** (0.111)	0.227** (0.111)	0.227** (0.111)	0.227** (0.111)	0.231** (0.111)
Located in the capital		-0.013 (0.029)	-0.012 (0.030)	-0.013 (0.029)	-0.005 (0.029)		-0.011 (0.029)	-0.011 (0.030)	-0.011 (0.029)	-0.004 (0.029)
Foreign Owned		-0.031 (0.032)	-0.030 (0.032)	-0.032 (0.032)	-0.023 (0.033)		-0.031 (0.032)	-0.031 (0.032)	-0.032 (0.032)	-0.023 (0.033)
organizationalchange			0.009 (0.037)					-0.001 (0.037)		
commercialization Change				-0.051 (0.047)					-0.063 (0.048)	
Labor cost Growth					-0.493*** (0.151)					-0.493*** (0.150)
Fixed Assets Growth					0.026 (0.031)					0.026 (0.031)
Process and Product Innovation						0.128** (0.059)	0.127** (0.059)	0.128** (0.061)	0.142** (0.061)	0.125** (0.060)
Number of firms	2818	2818	2818	2818	2816	2818	2818	2818	2818	2816

Robust standard errors are reported in brackets. All regressions include industry dummies.
Significance at the *** 1%, **5% and * 10% level.
Source: Authors' estimations.

Table 15: Large-sized manufacturing firms. OLS estimations. Depent Variable: $\ell_i - (g_{1i} - \pi_i)$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Constant	-0.170*** (0.004)	-0.170*** (0.004)	-0.164*** (0.015)	-0.170*** (0.004)	-0.159*** (0.017)	-0.170*** (0.004)	-0.170*** (0.004)	-0.167*** (0.014)	-0.170*** (0.004)	-0.159*** (0.017)
Process Innovation Only	-0.037 (0.033)	-0.040 (0.034)	-0.036 (0.031)	-0.042 (0.031)	-0.037 (0.033)	-0.041 (0.035)	-0.044 (0.037)	-0.042 (0.034)	-0.048 (0.034)	-0.041 (0.036)
Sales growth dt new products	0.499*** (0.143)	0.496*** (0.142)	0.498*** (0.141)	0.495*** (0.141)	0.489*** (0.144)	0.512*** (0.142)	0.512*** (0.141)	0.512*** (0.141)	0.511*** (0.140)	0.504*** (0.142)
Located in the capital		-0.038 (0.033)	-0.038 (0.033)	-0.037 (0.033)	-0.033 (0.032)		-0.039 (0.034)	-0.039 (0.034)	-0.039 (0.034)	-0.035 (0.033)
Foreign Owned		-0.022 (0.023)	-0.022 (0.023)	-0.022 (0.023)	-0.026 (0.024)		-0.023 (0.023)	-0.023 (0.023)	-0.023 (0.024)	-0.027 (0.024)
organizationalchange			-0.010 (0.025)					-0.005 (0.024)		
commercialization Change				0.008 (0.027)					0.013 (0.026)	
Labor cost Growth					-0.064 (0.063)					-0.063 (0.063)
Fixed Assets Growth					-0.013** (0.006)					-0.014** (0.006)
Process and Product Innovation						-0.036 (0.037)	-0.043 (0.040)	-0.042 (0.038)	-0.047 (0.039)	-0.042 (0.041)
Number of firms	1246	1246	1246	1246	1241	1246	1246	1246	1246	1241

Robust standard errors are reported in brackets. All regressions include industry dummies.
Significance at the *** 1%, **5% and * 10% level.
Source: Authors' estimations.

6 Concluding Remarks

Mainstream economic theories consider innovation as a fundamental cause of economic growth. In the same line of argumentation, several studies shed light on the relationship between GDP growth and investment in R & D, suggesting a positive and significant impact on the former. Most innovations are undertaken by firms in developed countries. Firms undertake innovations looking for profits: they create new products and gain a larger market share. Different empirical studies have tried to identify the impact and the effects of innovation on employment. The direction and magnitude of these effects are related to the type of innovations and the way they are measured.

Colombian firms are still in high proportion non-innovators. Even firms that have innovated have decreased, when the two waves of the innovation surveys are compared. This could be explained by the fact that the Colombian economy lacks of significant sophisticated sectors, high value-added activities and firms performing in these areas. Companies need to invest a larger amount in Science & Technology activities, and those who are investing should not just increase the share, but also use these resources in a more efficient manner, reevaluate and change processes, introduce more commercialization and undertake organizational changes.

The proportion of new innovations destined to international markets is extremely low in Colombia. In this setting, firms who export not necessarily generate more jobs through the effects of innovation, and this may perpetuate the export structure of Colombia based on primary activities and low value-added products.

Our empirical analysis shows that *sales growth due to new products* affects positively employment growth, and the effects remain regardless of the firm size, the type of labor, the innovation intensity, and the economic sector. However, the magnitude of the effect is different according to the features of employees and firms. This means that the results are robust to different specifications and the inclusion of different control variables. On the other hand, in most of the cases the effect of process innovation is negative, but the displacement effect is not significant. This might vary depending on features associated to the firms e.g., innovation intensity, firm size, industry or service sector– and type of employment under analysis.

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Annex

Table 16: Variable Definitions and Sources

Variable	Definition
Employment Growth	Annual growth rate of the firms number of employees
Sales Growth	Annual growth rate of the firms sales
Sales Growth dt new products	Ratio of total new sales to past sales old
Sales Growth dt old products	Ratio of current sales old minus past sales old to past sales old
Price Growth	Annual price Growth, is available for each firm.
Labour Cost Growth	Annual growth rate of the firms labour costs (measured as total remuneration plus social benefits and fiscal contributions per employee)
Non-innovator	Dummy which takes the value of 1 if the firm did not introduce any process or product innovation during the period
Process Innovation	Dummy which takes the value of 1 if the firm Introduced new or significantly improved methods of service delivery, production, distribution, or logistics.
Product Innovation	Dummy which takes the value of 1 if the firm Introduced at least one new product.
Process Innovation Only	Dummy which takes the value of 1 if Product innovation=0 and Process innovation=1
Process and Product Innovation	Dummy which takes the value of 1 if Product innovation=1 and Process innovation=1
Organizational Change	Dummy which takes the value of 1 if the firm Introduced new organizational methods
commercialization Change	Dummy which takes the value of 1 if the firm Introduced new marketing techniques
Client	Dummy which takes the value of 1 if Clients ha been a source of innovation
increase market share	Dummy which takes the value of 1 if innovation has allowed to mantain or increase market share
increased range	Dummy which takes the value of 1 if innovation has allowed increasing quality or range of goods and services
obstacles to innovate	3 different type of obstacles to innovation averaged across firms located in the same metropolitan area
R&D intensity	Ratio of total R&D expenditure to sales
Innovation intensity	Ratio of total innovation expenditure to sales
Patent	Dummy which takes the value of 1 if the firm applied for a patent during the years of analysis
Located in the Capital	Dummy which takes the value of 1 if the firm is located in Bogot, the capital of Colombia
Foreign Owned	Dummy which takes the value of 1 if the firm has 10% or more foreign capital participation
Fixed Assets Growth	Annual growth rate of the firms fixed assets

Source: All the information was provided by National Statistics Department of Colombia DANE

Table 17: Descriptive Statistics

	Manufacturing Firms 2007-2010		Service Firms 2010-2011	
Small		50.8%		35.3%
Medium		34.1%		36.7%
large		15.1%		28.0%
Non-innovators		65.5%		65.6%
Process only		23.2%		5.7%
Product innovators		11.3%		28.7%
Process and Product Innovators		3.7%		10.7%
Located in the Capital		42.5%		51.35%
Foreign Owned		9.3%		-
	Mean	Standard Deviation	Mean	Standard Deviation
Employment Growth	3.0%	0.3751	6.0%	0.258
Sales Growth	14.0%	3.8723	8.6%	0.363
Sales Growth dt new products	4.3%	0.3103	5.9%	0.170
Sales Growth dt old products	9.6%	3.8670	2.7%	0.383
Unskilled Labor Growth	3.8%	0.5117	2.3%	0.505
Skilled Labor Growth	11.7%	1.1219	14.3%	0.530
Full-employment Growth	12.2%	1.8710	-	-
Part-time employment Growth	46.7%	5.9708	-	-
Female employment Growth	9.6%	0.7500	-	-
Male employment Growth	5.6%	0.5324	-	-
Total Labor Cost Growth	8.1%	0.2783	-	-
R&D intensity	0.3%	0.0219	8.5%	1.117
Innovation intensity	6.2%	0.1717	15.5%	1.369
Prices Growth	2.0%	0.4319	3.5%	0.026

Source: Authors' estimations.

Table 18: Innovation by Industry

Manufacturing Firms	Total		Non-Innovator		Process Only		Product Only		Process and Product	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Food products and beverages	1565	18.93	1007	12.18	428	5.18	78	0.94	52	0.63
tobacco products	4	0.05	-	-	3	0.04	0	0	0	0
textiles	371	4.49	263	3.18	82	0.99	20	0.24	6	0.07
wearing apparel	711	8.6	486	5.88	111	1.34	88	1.06	26	0.31
Tanning and dressing of leather	325	3.93	250	3.02	53	0.64	19	0.23	3	0.04
Wood and of products of wood and cork	160	1.94	112	1.35	26	0.31	16	0.19	6	0.07
Paper and paper products	215	2.6	111	1.34	73	0.88	23	0.28	8	0.1
Printing and reproduction of recorded media	531	6.42	328	3.97	101	1.22	66	0.8	36	0.44
Coke, refined petroleum products and nuclear fuel	35	0.42	24	0.29	8	0.1	-	-	-	-
Chemicals and chemical products	787	9.52	495	5.99	221	2.67	43	0.52	28	0.34
Rubber and plastics products	760	9.19	493	5.96	177	2.14	58	0.7	32	0.39
Other non-metallic mineral products	444	5.37	293	3.54	105	1.27	28	0.34	18	0.22
Basic metals	175	2.12	104	1.26	42	0.51	19	0.23	10	0.12
fabricated metal products	571	6.91	391	4.73	123	1.49	39	0.47	18	0.22
Machinery and equipment n.e.c.	532	6.44	352	4.26	113	1.37	49	0.59	18	0.22
Office, accounting and computing machinery	-	-	0	0	-	-	0	0	0	0
Electrical machinery and apparatus n.e.c.	199	2.41	122	1.48	63	0.76	7	0.08	7	0.08
Communication equipment and apparatus	22	0.27	15	0.18	5	0.06	-	-	0	0
Medical, precision and optical instruments	64	0.77	47	0.57	9	0.11	6	0.07	-	-
Motor vehicles, trailers and semi-trailers	215	2.6	143	1.73	49	0.59	16	0.19	7	0.08
Other transport equipment	46	0.56	32	0.39	8	0.1	-	-	4	0.05
Furniture; manufacturing n.e.c.	532	6.44	345	4.17	117	1.42	48	0.58	22	0.27

A dash represents reserved information.
Source: Authors' estimations.

Table 19: Manufacturing firms. OLS estimations by Type of Labor (Full-time and Part-time).
Dependent Variable: $\ell_i - (g_{1i} - \pi_i)$

	Full-time Employment						Part-time Employment					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
Constant	-0.225 (0.588)	-0.217 (0.588)	-0.192 (0.587)	0.044 (0.218)	0.144 (0.233)	0.136 (0.231)	0.420 (0.603)	0.428 (0.605)	0.484 (0.608)	0.495 (0.610)	-0.071 (0.353)	0.315 (0.224)
Process Innovation Only	0.057 (0.072)	0.049 (0.065)	0.023 (0.059)	0.020 (0.056)	0.030 (0.056)	0.037 (0.053)	0.079 (0.151)	0.070 (0.158)	0.014 (0.168)	0.004 (0.175)	0.001 (0.176)	0.019 (0.140)
Sales growth dt new products	0.323*** (0.067)	0.324*** (0.067)	0.323*** (0.066)	0.331*** (0.070)	0.326*** (0.065)	0.325*** (0.065)	0.259* (0.155)	0.255 (0.155)	0.253* (0.151)	0.239 (0.154)	0.238 (0.154)	0.237 (0.152)
Located in the capital		-0.076 (0.100)	-0.071 (0.097)	-0.091 (0.099)	-0.003 (0.050)	-0.007 (0.050)		-0.118 (0.123)	-0.128 (0.124)	-0.103 (0.128)	-0.103 (0.128)	-0.099 (0.128)
Foreign Owned		0.019 (0.059)	-0.052 (0.063)	-0.046 (0.059)	-0.165** (0.074)	-0.118** (0.051)		-0.163* (0.089)	-0.212 (0.131)	-0.363** (0.183)	-0.368** (0.185)	-0.233** (0.093)
Exports dummy			-0.003 (0.081)						-0.423* (0.232)			
Medium size			0.116 (0.084)	0.116 (0.096)	-0.022 (0.046)			0.315** (0.126)	0.159 (0.105)	0.155 (0.104)		
Big size			0.198* (0.114)	0.223* (0.136)	0.153 (0.131)			0.717 (0.495)	0.444 (0.409)	0.445 (0.410)		
Commercialization Change						0.020 (0.055)						0.130 (0.200)
Labor cost Growth				-0.317*** (0.094)	-0.110 (0.193)	-0.109 (0.192)				0.001 (0.001)	0.001 (0.001)	0.001 (0.001)
Fixed Assets Growth					-0.769*** (0.125)	-0.769*** (0.125)					-0.020 (0.016)	-0.021 (0.015)
Number of firms	7800	7800	7800	7469	7454	7454	6549	6549	6549	6254	6237	6237

Robust standard errors are reported in brackets. All regressions include industry dummies.
Significance at the *** 1%, **5% and * 10% level.
Source: Authors' estimations.

Table 20: Manufacturing firms. IV estimations by Type of Labor (Full-time and Part-time).
Dependent Variable: $\ell_i - (g_{1i} - \pi_i)$

	Full-time Employment						Part-time Employment					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
Constant	-0.168 (0.948)	-0.174 (0.948)	-0.171 (0.948)	0.109 (0.558)	0.074 (0.559)	0.327 (0.354)	0.366 (2.840)	0.216 (2.866)	0.206 (2.869)	-0.075 (2.857)	-0.073 (2.861)	-0.302 (2.345)
Process Innovation Only	-0.001 (0.049)	0.006 (0.049)	0.003 (0.049)	0.001 (0.041)	-0.000 (0.041)	0.003 (0.041)	0.132 (0.447)	0.283 (0.480)	0.293 (0.476)	0.570 (0.487)	0.570 (0.486)	0.560 (0.494)
Sales growth dt new products	0.227 (0.211)	0.265 (0.210)	0.254 (0.210)	0.292* (0.173)	0.291* (0.173)	0.293* (0.173)	0.039 (4.753)	1.696 (5.100)	1.918 (5.052)	3.951 (5.071)	3.957 (5.057)	3.944 (5.155)
Located in the capital		0.058 (0.047)	0.057 (0.047)	0.067* (0.039)	0.065* (0.039)	0.065* (0.039)		0.063 (0.162)	0.071 (0.161)	0.087 (0.164)	0.088 (0.164)	0.078 (0.165)
Foreign Owned		-0.015 (0.070)	-0.005 (0.075)	-0.023 (0.061)	-0.020 (0.061)	-0.007 (0.058)		-0.189 (0.224)	-0.121 (0.233)	-0.158 (0.227)	-0.159 (0.228)	-0.094 (0.227)
Exports dummy			-0.084 (0.052)						-0.464*** (0.167)			
Medium size			0.024 (0.053)	-0.008 (0.043)	-0.009 (0.043)			0.334* (0.180)	0.265 (0.183)	0.265 (0.184)		
Big size			0.069 (0.067)	0.033 (0.052)	0.031 (0.052)			0.417* (0.217)	0.270 (0.203)	0.272 (0.203)		
Commercialization Change						-0.034 (0.042)						0.136 (0.160)
Labor cost Growth				-0.217*** (0.033)	-0.226*** (0.034)	-0.227*** (0.034)				0.744*** (0.037)	0.744*** (0.037)	0.740*** (0.037)
Fixed Assets Growth					0.023* (0.013)	0.023* (0.013)					-0.004 (0.061)	-0.003 (0.061)
Number of firms	3643	3643	3643	3538	3531	3531	3299	3299	3299	3176	3171	3171
Sargan test	4.667	9.580	9.269	1.486	1.547	1.448	2.069	3.415	3.144	3.054	2.905	3.335
P-value	0.198	0.023	0.026	0.686	0.672	0.694	0.558	0.332	0.370	0.383	0.407	0.343
Durbin-Wu-Hausman test	0.087	0.011	0.028	0.001	0.000	0.001	0.299	0.388	0.398	0.398	0.374	0.314
P-value	0.768	0.916	0.866	0.981	0.987	0.970	0.585	0.533	0.528	0.528	0.541	0.575

Robust standard errors are reported in brackets. All regressions include industry dummies.
Significance at the *** 1%, **5% and * 10% level.
instruments used are client, innovation effort interacted with increased market share, increased range and obstacles to innovation
Source: Authors' estimations.

Table 21: Manufacturing firms. OLS estimations by Type of Labor (Female and Male).
Dependent Variable: $\ell_i - (g_{1i} - \pi_i)$

	Female Employment						Male Employment					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0.805 (0.940)	0.815 (0.940)	0.839 (0.939)	-0.005 (0.189)	1.381 (0.982)	1.494 (0.989)	0.028 (0.103)	0.055 (0.112)	-0.063 (0.128)	-0.065 (0.118)	1.326 (0.941)	1.413 (0.947)
Process Innovation Only	0.026 (0.062)	0.017 (0.054)	-0.007 (0.043)	-0.004 (0.044)	-0.001 (0.044)	-0.018 (0.042)	0.043 (0.061)	0.034 (0.052)	0.011 (0.041)	0.014 (0.042)	0.016 (0.040)	0.009 (0.039)
Sales growth dt new products	0.296*** (0.096)	0.297*** (0.096)	0.295*** (0.096)	0.295*** (0.096)	0.285*** (0.091)	0.283*** (0.090)	0.309*** (0.093)	0.309*** (0.093)	0.308*** (0.093)	0.307*** (0.092)	0.295*** (0.087)	0.294*** (0.087)
Located in the capital		-0.087 (0.089)	-0.083 (0.087)	-0.081 (0.088)	-0.002 (0.041)	-0.004 (0.040)		-0.080 (0.088)	-0.076 (0.086)	-0.074 (0.087)	0.006 (0.038)	0.004 (0.038)
Foreign Owned		0.034 (0.055)	-0.038 (0.035)	-0.031 (0.040)	-0.154** (0.060)	-0.119** (0.052)		0.040 (0.051)	-0.025 (0.026)	-0.019 (0.031)	-0.141*** (0.054)	-0.111** (0.047)
Exports dummy			0.022 (0.065)						0.018 (0.062)			
Medium size			0.099 (0.073)	0.102 (0.083)	-0.021 (0.036)				0.118* (0.071)	0.119 (0.082)	-0.001 (0.034)	
Big size			0.167*** (0.064)	0.176** (0.077)	0.116* (0.069)				0.149*** (0.051)	0.155** (0.070)	0.096 (0.060)	
Commercialization Change						0.107** (0.050)						0.063 (0.043)
Labor cost Growth				-0.154* (0.081)	-0.012 (0.095)	-0.015 (0.096)				-0.175** (0.075)	-0.033 (0.089)	-0.035 (0.089)
Fixed Assets Growth					-0.766*** (0.127)	-0.766*** (0.127)					-0.768*** (0.125)	-0.768*** (0.125)
Number of firms	8201	8201	8201	8199	8175	8175	8245	8245	8245	8243	8219	8219

Robust standard errors are reported in brackets. All regressions include industry dummies.
Significance at the *** 1%, **5% and * 10% level.
Source: Authors' estimations.

Table 22: Manufacturing firms. IV estimations by Type of Labor (Female and Male).
Dependent Variable: $\ell_i - (g_{1i} - \pi_i)$

	Female Employment						Male Employment					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0.873 (0.605)	0.871 (0.605)	0.871 (0.605)	0.876 (0.604)	0.857 (0.604)	0.836 (0.604)	0.286 (0.556)	0.287 (0.556)	0.287 (0.556)	0.290 (0.556)	0.289 (0.556)	0.288 (0.556)
Process Innovation Only	-0.041 (0.030)	-0.040 (0.030)	-0.039 (0.030)	-0.037 (0.030)	-0.039 (0.030)	-0.045 (0.031)	-0.035 (0.028)	-0.036 (0.028)	-0.036 (0.028)	-0.034 (0.028)	-0.035 (0.028)	-0.035 (0.028)
Sales growth dt new products	0.265** (0.130)	0.275** (0.130)	0.277** (0.130)	0.277** (0.130)	0.274** (0.130)	0.267** (0.129)	0.313** (0.123)	0.314** (0.123)	0.310** (0.123)	0.315** (0.123)	0.314** (0.123)	0.314** (0.123)
Located in the capital		0.015 (0.029)	0.015 (0.029)	0.017 (0.029)	0.016 (0.029)	0.015 (0.029)		-0.007 (0.027)	-0.008 (0.027)	-0.006 (0.027)	-0.006 (0.027)	-0.005 (0.027)
Foreign Owned		-0.004 (0.044)	-0.021 (0.047)	-0.022 (0.046)	-0.016 (0.046)	-0.001 (0.044)		-0.010 (0.041)	-0.012 (0.043)	-0.021 (0.043)	-0.021 (0.043)	-0.012 (0.041)
Exports dummy			0.004 (0.032)						-0.029 (0.030)			
Medium size			-0.029 (0.033)	-0.031 (0.032)	-0.030 (0.032)				-0.014 (0.030)	-0.023 (0.029)	-0.024 (0.029)	
Big size			0.035 (0.042)	0.036 (0.039)	0.035 (0.039)				0.033 (0.039)	0.019 (0.036)	0.018 (0.036)	
Commercialization Change						0.056* (0.031)						0.002 (0.029)
Labor cost Growth				-0.127*** (0.043)	-0.134*** (0.043)	-0.134*** (0.043)				-0.105*** (0.039)	-0.105*** (0.039)	-0.104*** (0.039)
Fixed Assets Growth					0.037*** (0.010)	0.037*** (0.010)					0.004 (0.009)	0.004 (0.009)
Number of firms	3786	3786	3786	3784	3776	3776	3806	3806	3806	3804	3796	3796
R-sq	0.018	0.018	0.018	0.021	0.025	0.025	0.017	0.017	0.018	0.019	0.019	0.019
adj. R-sq	0.012	0.011	0.011	0.013	0.017	0.018	0.011	0.011	0.011	0.012	0.012	0.012
Sargan test	2.069	3.415	3.144	3.054	2.905	3.335	0.592	0.536	0.556	0.438	0.469	0.521
P-value	0.558	0.332	0.370	0.383	0.407	0.343	0.898	0.911	0.907	0.932	0.926	0.914
Durbin-Wu-Hausman test	0.299	0.388	0.398	0.398	0.374	0.314	0.861	0.875	0.801	0.881	0.877	0.884
P-value	0.585	0.533	0.528	0.528	0.541	0.575	0.353	0.350	0.371	0.348	0.349	0.347

Robust standard errors are reported in brackets. All regressions include industry dummies.
Significance at the *** 1%, **5% and * 10% level.
instruments used are client, innovation effort interacted with increased market share, increased range and obstacles to innovation
Source: Authors' estimations.