

# Initial Informality as an Obstacle to Intellectual Capital Acquisitions: Empirical Evidence from Latin America \*

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## Abstract

**Purpose:** Most developing countries are characterized by large informal sectors. A substantial proportion of firms in these countries began operations in the informal sector, eventually becoming formal. This paper studies whether, after formalization, firms that began operations in the informal sector are more or less likely to use intellectual capital in the form of disembodied technology licensing than firms that began operations in the formal sector. The moderating roles of being a downstream firm, age, and the country's per capita income are also analyzed.

**Design/methodology/approach:** The effect of initial informality on the probability of licensing is estimated using firm-level data from the World Bank's Enterprise Survey, conducted in several Latin American countries in 2006–2017.

**Findings:** Formal firms that began informally are less likely to use licensed technology, suggesting the existence of long-run effects of informality. The effect of initial informality is more negative among downstream firms.

**Research limitations/implications:** The analysis uses cross-sectional data. Unobservable firm fixed effects could be controlled for using longitudinal data.

**Practical implications:** Initial informality affecting the innovation strategies of firms should be considered when designing policies that incentivize formality.

**Social implications:** If, in light of the results of this analysis, policies are designed which foster a better allocation of resources, there will be a tangible impact in the lives of many people in developing countries.

**Originality/value:** This is the first paper that analyzes the relationship between initial informality status and technology licensing, a relevant channel for the international diffusion of technology.

**Keywords:** Licensing; Informality; Competition; Latin America.

**Article classification:** Research paper.

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# 1 Introduction

While most scholars, policy makers and businesses leaders agree on the existence of a positive impact of innovation and technological upgrades on productivity and growth, firms in Latin American countries (LAC) still perform poorly in terms of innovation investments. The reasons and determinants remain largely unidentified, and may involve factors that are external to the firm, such as market and institutional conditions, and other internal factors such as organization or management quality. In this paper, we focus on a particular internal characteristic of the firm, namely having begun operations in the informal sector, and how that feature acts as a barrier to the use of disembodied foreign technology. This is a relevant question given the prominent role that licensing plays in the international diffusion of technology (Arora et al., 2004; Gambardella et al., 2007), which ultimately has an impact on total factor productivity and growth (Mendi, 2007). For this reason, technology licensing has been the object of study in many previous contributions (Teece, 1986; Kamien, 1992; Fosfuri, 2006; Kirchberger and Pohl, 2016; Mendi et al., 2016). Hence, from the perspective of the receiving country, understanding which factors affect the process of technology licensing is relevant in order to design economic policies properly, as well as business strategies, and more so in a context of emerging economies, such as those in Latin America.

With this purpose in mind, we analyze firm-level data from the World Bank’s Enterprise Survey, using observations from firms in Latin America, spanning the 2006-2017 period. The questionnaire used in these waves of the Enterprise Survey include a number of questions on innovation activities, and specifically one on whether the firm makes use of technology licensed by a foreign-owned firm.<sup>1</sup> We study whether initial informality status is indeed associated with a higher or lower propensity to purchase disembodied technology, controlling for a number of firms characteristics and contextual factors. We find that initial informality indeed decreases the probability of technology licensing in the context of Latin American countries. We also study whether three specific factors, namely being a downstream firm –that is, selling directly to final consumers-, firm age, and the level of development in the country where the firm operates play

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<sup>1</sup>Specifically, the question is “Does the establishment at present use technology licensed from a foreign-owned company?”

a moderating role on the relationship between initial informality status and licensing.

Informality largely characterizes the economies of developing countries (Webb et al., 2009). Many countries around the world, particularly developing countries have large shadow economies, representing 40% to 60% of the gross domestic product in the case of some developing economies (Schneider and Enste, 2013). Although the impact of informality in the economies and firms operating in the formal sector is sizable, there are relatively few contributions to the literature that discuss the effect of informality on innovation. In this line, Charmes et al. (2018) propose an agenda for measuring innovation in the informal sector in Africa. We believe that it is possible to distinguish between two determinants of the innovation activities of formal firms: first, the fact that informal firms compete with formal firms in the product market; second, the fact that some formal firms began operations as informal firms.

First, informal firms are likely to have a negative effect on the operations of formal firms, thus reducing formal firms' incentives to invest (Mendi and Costamagna, 2017). In fact, the OECD Global Forum on Competition (OECD, 2009) concludes that informal firms, while being less efficient than formal firms, do not comply with economic regulations and tax payments, allowing them to gain market share from formal firms. This introduces a profit dissipation effect, which decreases formal firms' incentives to invest in general and to purchase a license in particular. This effect depends on several factors, especially the magnitude of the competitive pressure exerted by a new player in the downstream market (Arora and Fosfuri, 2003). Hence, we expect informality to be a strong determinant of technology transfer. The fact that informality is a structural problem in LAC justifies the study of informality using an institutional framework (Lau and Bruton, 2008), where institutions set the "rules of the game" (Peng et al., 2009). The institution-based view has grown in response to the long-standing criticisms of industry-based and resource-based lack of attention to contexts (Peng, 2002). We take this view into account in our empirical analysis by controlling for the intensity of competition from informal producers as a contextual factor determining formal firms' decisions to acquire licensed technology.

Where the effect of initial informality on firm behavior is concerned, informal firms have characteristics that are different than those of formal firms (Darbi et al., 2018). For instance, La Porta and Shleifer (2008, 2014) find that sales per worker in formal firms are larger than

those of informal firms of comparable size, suggesting that formal and informal sectors constitute two largely isolated parts in a dual economy. Funkhouser (1996) also finds substantial differences in terms of education of the workforce between formal and informal firms. Hence, informality has important consequences on firms' decisions and on the overall allocation of resources. What we address in this paper is precisely whether these consequences survive an eventual transition to the formal sector. For instance, initial informality may induce firms to adopt a suboptimal organizational design, introducing resistance to change in general and the adoption of new technologies in particular, if, for instance, the status of incumbent workers could be compromised in some way (Atkin et al., 2017). This increases corporate inertia (Tripsas and Gavetti, 2000), and may constitute a barrier to the adoption of productivity-enhancing managerial activities (Bloom et al., 2013). In fact, Mendi and Mudida (2018) find that Kenyan formal firms which began operations in the informal sector and eventually became formal are less likely to introduce innovations than firms that began operations in the formal sector.

We structure the remainder of the paper as follows. First, Section 2 discusses the different hypotheses tested in the empirical section. Section 3 describes the data used in this paper. Section 4 presents the econometric analysis of the data. Section 5 frames the empirical results in the received literature. Finally, Section 6 discusses a number of implications for practitioners and researchers, as well as limitations of the present analysis and suggestions for future research.

## **2 Hypotheses**

This section presents the hypotheses being tested in Section 4, using data discussed in Section 3. We will distinguish between the main direct effect and the effect of different moderators.

### **2.1 Direct effect: initial informality status**

According to McGahan (2012), the managerial implications of informality constitute a relatively unexplored area. Mendi and Costamagna (2017) tried to shed light on the interaction between formal and informal firms and, more precisely, whether the latter affected the innovation activities of the former. However, an interesting and related question is whether informality

status has any long-lasting effects on the way firms operate. That is, are firms that began operations as informal firms different than those that began operations as formal firms? In this line, Mendi and Mudida (2018), using a sample of Kenyan firms that operate formally, find that those that began operations as informal firms are less likely to introduce innovations than those that started up as formal firms.

These long-lasting differences may be driven by the persistence of managers of informal firms who are essentially different from those who managed firms that began formally. We expect informally-started firms to behave differently in relation to their vision, their strategies, and other aspects such as access to qualified labor and to finance, and, for these reasons, to be less likely to engage in licensing activities than those firms that began operations formally. Additionally, the location of the premises of the firm may be an obstacle to the access of information on markets and technology, which may reduce the likelihood of the use of foreign technology, thus conditioning future performance in the formal sector. Firms that began informally are also more likely to have a shorter credit history, which could represent an obstacle to the implementation of licensed technology.

**Hypothesis 1** *Firms that began operations as informal firms are less likely to use licensed technology than firms that began operations as formal firms.*

## 2.2 Moderators

In this subsection, we discuss the role of a number of factors as moderators of the basic relationship between initial informality and licensing. In particular, we focus on the position of the firm in the value chain, on firm age, and on the level of development of the country where the firm is located.

### 2.2.1 Upstream vs downstream firms

Borrowing from Industrial Organization literature (Tirole, 1988), a firm is said to be an upstream firm if it mainly sells its product to other firms, whereas a downstream firm sells mainly to final consumers. We expect initial informality to be less prevalent among upstream firms, since their customers are other firms that, for tax reasons, may have a preference for dealing

with other formal firms. This makes entry for an informal firm into the upstream segment more difficult to begin with. In contrast, starting up informal and eventually transitioning to the formal sector is more likely to occur in the downstream segment. If despite the transition to the formal sector, these firms that began informally retain characteristics that make them less productive (Mendi and Mudida, 2018), then the difference in propensity to engage in innovation relative to comparable formal firms is larger among downstream firms. For this reason, we expect a stronger negative effect on licensing activities of firms that began operations in the informal sector among downstream firms.

**Hypothesis 2** *The effect on licensing of beginning operations as an informal firm will be stronger for downstream firms.*

### 2.2.2 Firm age

There are reasons to believe that the relationship between initial informality and licensing will be stronger or weaker depending on firm age. On the one hand, a number of studies suggest that younger firms are typically more dynamic than older firms, and probably less prone to organizational inefficiencies associated with excessive bureaucratization than their older counterparts and that these characteristics makes them more flexible in dealing with competitors (Huergo and Jaumandreu, 2004; Balasubramanian and Lee, 2008; Czarnitzki and Delanote, 2013; Audretsch et al., 2014; Garcia-Quevedo et al., 2014; Coad et al., 2016). In contrast, older firms are more likely to have easier access to credit, given that they have longer credit histories, and thus they have a reduced possibility for gaps in their financial histories. Access to credit is found to be a crucial factor in innovation in general and licensing in particular, see Aghion et al. (2012). In the context of Latin America, we expect the latter effect to more than offset the former, hence we expect older firms to be less affected by competitive pressure in their licensing decisions. This leads to the following hypothesis:

**Hypothesis 3** *The effect on licensing of beginning operations as an informal firm will be stronger for younger firms.*

### 2.2.3 Economic development

The size of the informal sector in more advanced economies is typically smaller than it is in less developed countries. However, whether the similarity between firms that began informally and firms that began formally is greater in more developed countries remains an unexplored empirical question. It is reasonable to believe that firms that are located in developed countries have easier access to a common stock of knowledge, which makes for level access to external technology. In contrast, firms that began informally and that are located in a less developed country may experience difficulties accessing external knowledge. This may create a divide between formal and informal firms in lower income countries, in line with the argument in La Porta and Shleifer (2014). For this reason, we expected the difference between initially formal and initially informal firms to be larger in countries that have lower levels of GDP per capita.

**Hypothesis 4** *The effect of beginning operations as an informal firm will be stronger in those countries with a lower GDP per capita.*

## 3 The data

In our empirical analysis, we use the World Bank’s Enterprise Survey data. The Enterprise Survey is conducted in a number of different countries, mostly developing and middle-income countries, and beginning in 2002. The methodology used in the Enterprise Survey is homogeneous across countries, and relies on stratified random sampling<sup>2</sup>. Furthermore, individual country data is subject to revision by World Bank staff and merged into a comprehensive database, which is the one used in this paper<sup>3</sup>. Within the comprehensive database, we focus on a sample of Latin American countries for the 2006–2017 period. We believe that focusing on this subsample of countries is meaningful given that the institutional context is comparable across countries in Latin America. Since the survey was not implemented in every country

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<sup>2</sup>The strata for Enterprise Surveys are firm size, business sector, and geographic region within a country.

<sup>3</sup>The Enterprise Survey data is publicly available on the following website: <https://www.enterprisesurveys.org/portal/login.aspx>. Data used in the present study was accessed on August 20, 2018.

every year, Table 1 displays the years for which data are available for every country in the sample. We have excluded a number of countries with available Enterprise Survey data, which are geographically in The Americas but are not Spanish- or Portuguese-speaking countries, such as Guyana, Belize, and some other countries in the Caribbean.<sup>4</sup> Notice that most countries were sampled in 2006 and in 2010, whereas a third wave, including all countries surveyed in 2010 except Chile, Panama, and Venezuela, was launched in 2016–17. In Brazil, the largest economy in Latin America, the survey was conducted only in 2009.

Table 1: Survey years by country

<b>Country</b>	2006	2009	2010	2016	2017
Argentina	✓		✓		✓
Bolivia	✓		✓		✓
Brazil		✓			
Chile	✓		✓		
Colombia	✓		✓		✓
Costa Rica			✓		
Dominican Republic			✓	✓	
Ecuador	✓		✓		✓
El Salvador	✓		✓	✓	
Guatemala	✓		✓		✓
Honduras	✓		✓	✓	
Mexico	✓		✓		
Nicaragua	✓		✓	✓	
Panama	✓		✓		
Paraguay	✓		✓		✓
Peru	✓		✓		✓
Uruguay	✓		✓		✓
Venezuela	✓		✓		

All firms surveyed are formal firms, although some of them began operations in the informal sector. This characteristic of the firms is observed, since it is the object of one of the questions. The questionnaire used in Latin American countries includes a number of questions related to innovation, such as whether the firm introduced any product and/or process innovations in the three years prior to the survey, and whether the firm was using technology licensed by a foreign firm. Additionally, the questionnaire also included questions providing information on up to what degree practices of firms in the informal sector represented an important obstacle

<sup>4</sup>Specifically, Antigua and Barbuda, Bahamas, Barbados, Belize, Dominica, Grenada, Guyana, Jamaica, St. Kitts and Nevis, St. Lucia, St. Vincent and Grenadines, Suriname, and Trinidad and Tobago.



Table 2: Variable definitions

<b>Dependent variables</b>	
LICENSING	Dummy that takes value 1 if the firm used technology licensed by a foreign-owned firm, 0 otherwise
<b>Independent variable</b>	
BEGIN_INFORMAL	Dummy that takes value 1 if the firm began operations as an informal firm, 0 otherwise
<b>Moderators</b>	
DOWNSTREAM	Dummy that takes value 1 if the main buyers for the firm's product are final consumers, 0 otherwise
YOUNG	Dummy that takes value 1 if firm age is larger than the median of the sample, 0 otherwise
TOP5	Dummy that takes value 1 if the firm is located in a country in the sample top 5 in terms of GDP per capita, 0 otherwise
BOTTOM5	Dummy that takes value 1 if the firm is located in a country in the sample bottom 5 in terms of GDP per capita, 0 otherwise
<b>Controls</b>	
GROUP	Dummy that takes value 1 if the firm belongs to a group of firms, 0 otherwise
LNEMPLOYEES	Logarithm of the number of employees
LNAGE	Logarithm of firm age, in years
EXPORTINTEN	Percentage of the firm's sales that are exported
LNMANAGER_EXPER	Log of manager's years of experience
COMPETPRES	Number of competitors that the firm faces
OBST_REGION	Regional average of informal firms as obstacle to firms' operations

to firm activities. Table 2 displays the variable definitions, distinguishing between dependent, independent, moderators, and control variables. The independent variable is LICENSING, a binary variable that indicates whether the firm uses technology licensed by a foreign-owned firm. The independent variable of interest is BEGIN\_INFORMAL, an indicator of whether the firm began operations in the informal sector prior to becoming a formal firm.

The moderators used in the econometric analysis are DOWNSTREAM, YOUNG, TOP5 and BOTTOM5. The main reason for the inclusion of these moderators is to test for the existence of a heterogeneous effect of beginning as an informal firm depending on whether the firm belongs to a group of firms, is a downstream firm, is younger than the median sample, or is located in the top 5 or the bottom 5 countries in the sample in terms of per capita GDP.

In our econometric specifications we include as controls a number of variables that account for observable firm characteristics, such as size, belonging to a group of firms, firm age, or the proportion of the firm's revenues coming from foreign markets. Additionally, in all specification we have included a full set of time, country, and industry dummies, following the classification of firms into the following manufacturing sectors: Food, Beverages, and Tobacco; Textiles and Garments; Wood, Paper, Printing; Chemicals, Plastics, and Pharmaceuticals; Metals; Machinery and Equipment; Transportation Equipment; Other Manufacturing. Given that the role of technological licensing is likely to be different for manufacturing than for services industries, we choose to focus on manufacturing only. In addition to the full set of time, country and industry dummies, we include as control variables LNEMPLOYEES, the logarithm of the number of employees in the firm. The variable LNAGE is firm age, in years. Export intensity is measured by EXPORT\_INTEN, which is the firm's exports as a percentage of its revenues. Manager's ability is measured by LNMANAGER\_EXPER, which is the logarithm of the manager's experience, in years. COMPETPRES is normalized to be between zero and one, with the measure increasing with the number of competitors.<sup>5</sup> The measure of the importance of the presence of informal firms as an obstacle for the firm's normal activities is subjective, and is measured by a 4-point Likert scale, normalized to be between zero and one. Finally, OBST\_REGION is the regional average of the importance of the presence of informal firms as an obstacle to firms'

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<sup>5</sup>Specifically, the variable takes the following values: 1 if there is no competitor, 2 if there is only one competitor, 3 if there are between 2 and 5 competitors, and 4 if there are more than 5 competitors.

operations.

Table 3: Summary Statistics

	Mean	Std. dev.	Min.	Max.
LICENSING	0.144	0.351	0.000	1.000
BEGIN_INFORMAL	0.112	0.316	0.000	1.000
INNOVATIVE	0.712	0.453	0.000	1.000
PRODINN	0.608	0.488	0.000	1.000
PROCINN	0.540	0.498	0.000	1.000
COMPETPRES	0.833	0.247	0.000	1.000
OBST_REGION	1.999	0.318	0.815	2.659
GROUP	0.146	0.353	0.000	1.000
DOWNSTREAM	0.200	0.400	0.000	1.000
LNEMPLOYEES	3.637	1.427	0.000	10.060
LNAGE	2.821	0.997	0.000	7.608
EXPORT_INTEN	0.122	0.255	0.000	1.000
LNMANAGER_EXPER	2.949	0.681	0.000	3.912

Table 3 presents summary statistics of the variables used in the analysis below. Notice that some of the variables are binary. In particular, the dependent variable of interest is binary, which induces us to estimate probit models. Our sample size is 14,945 observations. Out of these, 9,838 are innovative firms, that is firms that introduced either a new product or a new process in the two years prior to the survey. Overall, 14.4% of the firms in the sample use technology licensed by foreign firms, and approximately 17.2% of the innovative firms use licensed technology.<sup>6</sup> Roughly one tenth of the firms in the sample began operations as informal firms. Regarding competitive pressure, approximately 61% of the firms in the sample, operate in industries where there they have to compete with at least five other firms. In contrast, roughly 7% of the firms are either monopolist or duopolists. On average, the firms in our sample are 16.8 years old, with the median age being 18 years. Of the firms in the sample, 14.6% belong to a group of firms, and the exporting intensity of firms in our sample is relatively low, with an average 12.2% of sales. Finally, 20% of the firms in the sample are downstream firms, that is, firms that sell mostly to final consumers, and managers of firms in our sample have an average experience of 19 years.

The first and the second columns of Table 4 report the means of the variables for the firms

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<sup>6</sup>This is a relatively high rate of use of technological licensing. It is indeed higher for instance than that found by Armand and Mendi (2018) among Spanish firms, which was in the neighborhood of 5%.

Table 4: Tests of differences in means, by initial informality status

	FORMAL	INFORMAL	t-stat.	Obs.
LICENSING	0.150	0.095	6.079***	14945
PRODINN	0.613	0.572	3.123**	13815
PROCINN	0.544	0.508	2.721**	13815
COMPETPRES	0.833	0.836	-0.553	14369
OBST_REGION	1.994	2.037	-5.151***	14760
GROUP	0.152	0.095	6.236***	14945
DOWNSTREAM	0.185	0.332	-8.720***	6018
LNEMPLOYEES	3.703	3.116	16.048***	14945
LNAGE	2.803	2.963	-6.221***	14945
EXPORT_INTEN	0.126	0.090	5.501***	14945
LNMANAGER_EXPER	2.944	2.981	-2.073*	14945

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

that began formally and informally, respectively. The third column of the table presents the value of the t-statistic of the difference in means between the two groups, with stars indicating statistical significance as explained at the bottom of the table. All of the t-tests turn out to be statistically significant at the 5% level, revealing the existence of differences between firms that began in the formal and in the informal sectors for all the variables except COMPETPRES and LNMANAGER\_EXPER, which is significant only at the 10% level. In particular, firms that began activities in the formal sector are more likely to use licensed technology, as well as to introduce new products and processes. In our econometric analysis we will verify whether this difference exists after controlling for firm characteristics and contextual factors. Firms that began in the formal sector are also more likely to belong to a group of firms, to have more employees and export a larger proportion of their production. In contrast, firms that began operations in the informal sector are more affected by competition from firms in the informal sector in their regions, as measured by OBST\_REGION. Firms that started up as informal firms are also more likely to be downstream firms, and also older and employ managers that have a longer accumulated experience in the industry, suggesting the existence of a low turnover in their management teams.

## 4 Empirical analysis

The empirical analysis makes use of the World Bank’s Enterprise Survey data, which was implemented in a number of Latin American countries in the period 2006–2017. Although in this paper we focus on Latin America, the Enterprise Survey implemented in some African countries also included a question on the use of licensing. Since the dependent variable in our analysis, LICENSING, is binary, that is, it only takes values zero or one, we estimate Probit models in all cases. In all cases, the tables report average marginal effects of the variables, not estimated coefficients. A probit model is non-linear in the variables, implying that the coefficients cannot be interpreted as marginal effects as in the case of a linear probability model. In the case of continuous variables, the marginal effects are to be interpreted as the derivatives of the probability of licensing with respect to the variable of interest. In the case of binary variables, it is the effect on the probability of licensing of changing the value of the independent variable from zero to one. The following two subsections discuss the empirical findings regarding the effect of competitive pressure, and of variables that are believed to act as moderators of the relationship between competitive pressure and licensing, respectively.

### 4.1 Main effects

Table 5 reports estimated marginal effects for different specifications where the dependent variable is, in all cases, the indicator of the firm purchasing a technology licensed by a foreign firm. The specification estimated in the first column includes BEGIN\_INFORMAL and the set of controls (which includes country and industry dummies to account for country- or industry-specific effects). The estimated marginal effect of BEGIN\_INFORMAL is negative and statistically significant at the 5% level, suggesting that indeed firms that began operations in the informal sector are less likely to make use of licensed technology. This result is robust (column 2) to the inclusion of COMPETPRES and this variable squared, which is a measure of the effect of the number of competitors. Columns 3 and 4 of Table 5 include in the specification, in addition to competitive pressure, the influence of informal producers, as measured by OBST\_REGION. This variable captures the influence of informality as a contextual factor affecting the operations of formal firms. The size of the marginal effect of BEGIN\_INFORMAL is robust to the

inclusion of these additional controls, being similar to that in the previous columns, and also being statistically significant at the 5% level.

Regarding the effects of the different controls, these are in line with previous findings on the determinants of the innovation strategies of firms. In particular, firms that belong to a group of firms are more likely to use licensed external knowledge, most likely from other firms in the group (Mendi, 2005). Larger firms are more likely to use licensed technology, which confirms the influence of size on innovative activities. Indeed, some authors argue that large firms are more efficient innovators because they possess advantages in terms of scale, access to financing and private appropriation of rents, among others (Cockburn and Henderson, 2001), whereas other researchers support the view that small firms are better innovators because of flexibility in the organizational structure (Koberg et al., 2003). Exporting is also positively associated with licensing. This could be due to a joint selection into exporting and using foreign technology, or by learning about foreign technology by exporting. Firm age and the experience of managers are negatively associated with licensing. One potential explanation is that different cohorts simply have different strategies regarding the use of foreign technology. Another explanation is that older firms, which are more likely to employ more experienced managers, may base their competitive advantages not on innovation activities, but on corporate political activities. However, our data does not allow us to distinguish between these two potential explanations.

#### **4.1.1 Innovative firms**

The analysis in the previous table suggested that beginning informal reduces the probability of the firm purchasing licensed technology by roughly two percentage points. This is quite a substantial decrease, since on average, 14% of the firms in our sample use licensed technology. What we now proceed to do is to check whether the effect is present for relevant subsamples. In particular, we focus on firms with similar innovative outcomes. For this reason, we analyze whether the effect appears if we focus on the subsamples of innovative firms, product innovators, and process innovators.

The three columns of Table 6 report estimated marginal effects using the same specification as in the previous table, but using observations from the subsample of innovators, product

Table 5: Effect of beginning informal on licensing

	(1)	(2)	(3)	(4)
BEGIN_INFORMAL	-0.017** (0.008)	-0.018** (0.008)	-0.020** (0.008)	-0.018** (0.008)
GROUP	0.045*** (0.009)	0.045*** (0.010)	0.043*** (0.010)	0.045*** (0.010)
LNEMPLOYEES	0.055*** (0.003)	0.055*** (0.003)	0.055*** (0.003)	0.055*** (0.003)
LNAGE	-0.008*** (0.003)	-0.008*** (0.003)	-0.009*** (0.003)	-0.008*** (0.003)
EXPORT_INTEN	0.038** (0.016)	0.035** (0.016)	0.035** (0.016)	0.035** (0.016)
LNMANAGER_EXPER	-0.009** (0.004)	-0.010** (0.004)	-0.010** (0.004)	-0.010** (0.004)
Number of observations	14945	14369	14193	14369
Country dummies	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Intensity of competition	No	Yes	Yes	Yes
Competition informal	No	No	Yes	Yes

Standard errors in parenthesis are clustered at the regional level.

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

innovators, an process innovators, respectively. In all cases, in addition to time, industry and country dummies, we will include in our specification the level and the square of our measure of competition, COMPETPRES, as well as the level and the square of our measure of intensity of competition from informal producers, OBST\_REGION. In the first column of the table, we report estimated marginal effects using the subsample of innovative firms, that is, those firms that introduced either a product or a process innovation in the two years prior to the survey. The marginal effect is negative and statistically significant at the 10% level, and slightly larger in absolute value than that reported in the previous table.

In a similar way, the estimated marginal effects using the subsample of product innovators (column 2) and process innovators (column 3) are also negative and statistically significant at the 10% level. Regarding the effect of the rest of the regressors, size and belonging to a group of firms are positively associated with licensing. Furthermore, exporting seems to be positively associated with licensing among product innovators. In light of these results, it is striking to note that, even restricting ourselves to firms that introduced new products and/or processes in the two years prior to the survey, there is a difference in licensing behavior between firms that began informally and firms that began formally.

## 4.2 Moderators

This subsection inquires into whether the effect of BEGIN\_INFORMAL is modulated by other variables. In particular, we will consider the fact that a firm is a downstream firm, whether the firms is younger than the average, and whether it is located in a high- or a low-income country. This is done by including in the econometric specifications an interaction term between BEGIN\_INFORMAL and the indicator variables of these moderating factors, specifically DOWNSTREAM, YOUNG, TOP5, and BOTTOM5.

Table 7 considers the moderating role of the variables referred to in the previous paragraph. Specifically, the first column of the table includes the interaction of BEGIN\_INFORMAL with DOWNSTREAM. The latter variable is only available for the 2006 wave, which reduces the number of observations in the first column. For this same reason, the inclusion of time dummies is not needed in this case. In a similar way, the specifications whose marginal effects are



Table 6: Effect of beginning informal on licensing, subsample of innovators

	Innovative (1)	Product (2)	Process (3)
BEGIN_INFORMAL	-0.022* (0.011)	-0.023* (0.013)	-0.022* (0.011)
GROUP	0.045*** (0.014)	0.048*** (0.016)	0.043*** (0.015)
LNEMPLOYEES	0.059*** (0.004)	0.061*** (0.005)	0.060*** (0.005)
LNAGE	-0.003 (0.004)	-0.003 (0.004)	0.004 (0.005)
EXPORT_INTEN	0.037* (0.019)	0.051** (0.022)	0.036* (0.020)
LNMANAGER_EXPER	-0.015** (0.006)	-0.014** (0.007)	-0.014* (0.007)
Number of observations	9360	7997	7150
Country dummies	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes
Intensity of competition	Yes	Yes	Yes
Competition informal	Yes	Yes	Yes

Standard errors in parenthesis are clustered at the regional level.

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

Table 7: The moderating role of downstream, age, and per capita income

	(1)	(2)	(3)	(4)
BEGIN_INFORMAL	-0.024* (0.012)	-0.022*** (0.008)	-0.019** (0.008)	-0.017** (0.009)
DOWNSTREAM	-0.028** (0.013)			
YOUNG		0.007 (0.008)		
TOP5			-0.034 (0.024)	
BOTTOM5				-0.050 (0.046)
GROUP	0.035*** (0.014)	0.043*** (0.010)	0.043*** (0.010)	0.043*** (0.010)
LNEMPLOYEES	0.056*** (0.004)	0.055*** (0.003)	0.055*** (0.003)	0.055*** (0.003)
LNAGE	-0.010*** (0.004)	-0.006 (0.005)	-0.009*** (0.003)	-0.009*** (0.003)
EXPORT_INTEN	0.032 (0.022)	0.034** (0.016)	0.035** (0.016)	0.035** (0.016)
LNMANAGER_EXPER	0.002 (0.007)	-0.010** (0.004)	-0.011** (0.004)	-0.010** (0.004)
Number of observations	5935	14193	14193	14193
Country dummies	Yes	Yes	Yes	Yes
Time dummies	No	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Intensity of competition	Yes	Yes	Yes	Yes
Competition informal	Yes	Yes	Yes	Yes

Standard errors in parenthesis are clustered at the regional level.

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

reported in the second, third, and fourth columns include YOUNG, TOP5, BOTTOM5, and the interactions of these variables with BEGIN\_INFORMAL, respectively. The marginal effects of each variable are reported in Table 7. Notice that the effect of DOWNSTREAM is negative and statistically significant at the 5% level, whereas the effects of the other moderating variables (columns 2, 3 and 4) are statistically insignificant.

However, our purpose is to test hypotheses 2, 3 and 4, which suggest the existence of differential effects of initial informality for downstream firms, young firms, and firms located in relatively poor countries. We are using a probit model, which is non-linear, and in the specifications whose coefficients are reported on Table 7, we include interactions between the variables. Now, while marginal effects of interactions in a probit model do not exist, Figure 1 is to be interpreted as an approximation to the interaction effect between beginning informal and selected moderators. For instance, in the first case, downstream, it is to be interpreted as the difference in the average marginal effect of beginning informal on licensing between upstream and downstream firms. In this case, the effect is negative, and the whole 95% confidence interval is below zero, which means that the average marginal effect of beginning informal is negative and larger in absolute value for downstream firms than for upstream firms. Similar interpretations apply to the cases of YOUNG, TOP5 and BOTTOM5.

As may be seen in Figure 1, the incremental effects of DOWSNTREAM and YOUNG are negative and the whole 95% confidence intervals are below zero. This means that the effect of beginning informal is stronger among downstream firms and younger firms. Regarding the effect of per capita GDP, the incremental effects of TOP5 and BOTTOM5 are consistent with the effect of initial informality being stronger in poorer countries, since we obtain a positive incremental effect for TOP5 and a negative incremental effect for BOTTOM5. However, the effects are not statistically significant at the 5% level, a fact that does not allow us to confirm Hypothesis 4.

## 5 Discussion of the results

Our empirical results point at the existence of a strong, negative effect of beginning informal on the likelihood of a firm engaging in licensing-in of disembodied technology developed elsewhere. These results have been drawn from cross-sectional data, and for this reason they must be taken with caution.

With these caveats in mind, the picture that arises is one where initial informality is indeed a constraint to a firms' access to disembodied knowledge. This suggests the adoption of policies that discourage firms from entering the informal sector in the first place. For instance,

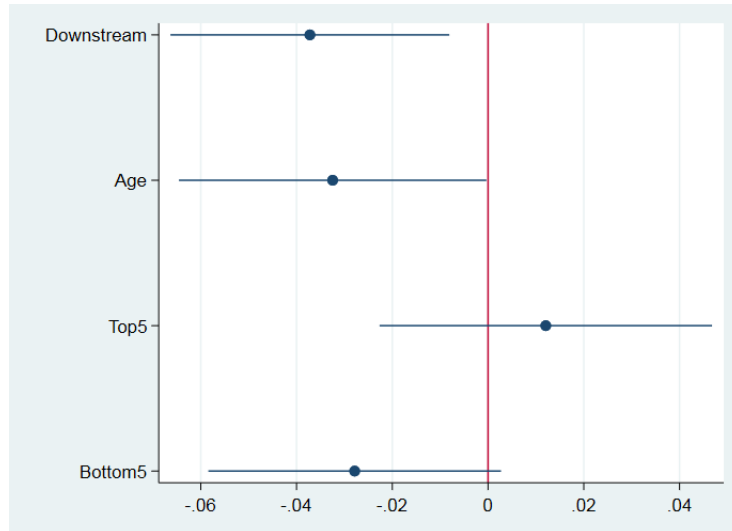


Figure 1: Differential marginal effects of beginning informal on licensing, computed from a probit model with interaction terms

simplifying registration and making it a less expensive option may have a positive effect on the productivity of firms by virtue of their access to superior technology. Another policy option would be to target innovation subsidies precisely to those firms most in need, namely firms that began operations in the informal sector.

Regarding the geographical scope of our study, and observing the effect of initial informality among Latin American firms, two main questions arise: (i) Are governments permissive regarding informality?; and, if so, (ii) how should firms deal with informality as a given variable. We can assume that innovative formal firms would benefit from government policies aimed at reducing informality. For example, higher property rights enforcement decreases the financial incentives to engage in imitation because imitated firms can take action against imitators (Helpman, 1993). However, governments may encounter strong constraints in dealing with informality because of the demand for informal goods. In a rational economic actor model of consumption, the consumer is willing to acquire goods and services in the informal economy simply to save money (Allingham and Sandmo, 1972). In a related contribution, Williams and Martinez-Perez (2014) show that countries with a lower than average level of GDP per capita have greater levels of inequality and higher perceived levels of public sector corruption, and thereby changing the cost/benefit ratio is more likely to be effective in this type of country. However, in emerging countries the informal economy may constitute a short-run boost to the

overall economy. Indeed, governments may incentivize the development of informal firms as employers for labor and consumption that have low probability for survival in the formal economy. Thus, governments in LACs should keep in mind this trade-off between short-run and long-run allocation of resources.

## 6 Conclusions

The purpose of this paper is to shed light on whether the fact that a firm began operations in the informal sector has an effect on its innovation activities, specifically licensing, even after the firm becomes formal. In order to do so, we analyze a number of waves of the World Bank Enterprise Survey, implemented in Latin American countries, spanning the 2006–17 period. The particularity of this cross-section is the fact that the questionnaire includes some questions on firms' innovation activities. We find strong evidence that firms that began operations informally are less likely to engage in licensing than those firms that began in the formal sector. We also find that this effect is stronger among downstream and younger firms. Regarding the role of per capita GDP of the country where the firm is located, the estimated effects suggest that the impact of initial informality is stronger in relatively poorer countries, although the effect is not statistically significant at the 5% level. Having summarized the main findings of the paper, we now proceed to discuss a number of implications for practitioners and researchers, as well as limitations and suggestions for future research.

### 6.1 Theoretical and practical implications

Given that licensing is a relevant channel for the diffusion of disembodied technology, both domestically and internationally, informality may be an additional constraint that LAC are facing in accessing the international pool of technology. We believe that the results presented in this paper should therefore be taken into consideration when designing policies to foster innovation in developing countries.

At the same time this opens different roads for practitioners and researchers to follow. Managers should carefully take into account how different types of knowledge –human, social,

and organizational– affect the ways in which a firm decides to generate its own knowledge and/or adapt externally developed knowledge (Dost et al., 2016). Managers should explore inside the organization the stock of available and potential knowledge –including knowledge sharing (Sáenz et al., 2009)– and how this relates with the core of the business and market trends. Perhaps the lack of stimulus toward innovation in LAC is rooted in the market culture, the business environment, and economic instability, but the effort to improve business performance is in any case necessary.

For the specific case of managers leading the transition of the firm from the informal to the formal sector, it is important to pay attention to the cost (opportunity and otherwise) they will be facing for falling behind in the innovation dimension, once they have entered the formal sector, and not accessing disembodied technology needed in order to develop capabilities and competitive advantages. Along the same lines managers also need to be aware as McGahan (2012) suggests that informal transactions (using technology without the corresponding license) may impinge profitability or make almost impossible to enforce governance rights “over transactions, contracts, and relationships that give rise to capabilities” (p.14).

In sight of the recent interest in the relationship between intellectual capital and innovation performance (St-Pierre and Audet, 2011; Agostini and Nosella, 2017), the results from this research should compel researchers to try to identify the deep cultural mechanisms at the organizational and country level that induce firms transitioning towards formality to avoid using licensed technology. This is important, given that the relationship between beginning informal, the propensity to purchase disembodied technology, and intellectual capital has not been previously explored. In particular, considering that Hypothesis 4, GDP being a moderator of the relationship, was not confirmed, researchers should go further down the economical rationale not to engage in licensing and explore cultural elements that reinforce such behaviors. While human capital development might be one of those elements, certainly uncertainty avoidance and power distance might appear as strong factors impacting the relationship.

## 6.2 Limitations and future research

As pointed out in Section 3, we have used firm-level data from the World Bank's Enterprise Survey, comprising the 2006-17 period. Even though different cross-sections have been used, and in some cases the same firms have been surveyed, we have not exploited the panel structure of our data due to the short time dimension of the panel. Furthermore, we have used data from different and sometimes distant cross-sections of the data, dating back to 2006, although we have used time fixed effect to mitigate this problem. Now, using cross-sectional data, unobserved firm characteristics may be positively correlated with both the outcome variable and the independent variable of interest. In this case, our independent variable of interest is the fact that the firm began operations in the informal sector, and eventually transitioned towards the formal sector. In this line, unobserved characteristics of the manager may be driving the probability of transition to the formal sector and the firm's absorptive capacity, which determines its propensity to license-in. Notice that if this were the case, we would have expected a positive relationship between initial informality status and licensing. In contrast, another unobserved factor that may be driving the results is the physical location of the firm. If this location increases the cost of access to the relevant market, then the incentives to engage in innovation-related investments such as licensing are reduced.

These considerations should lead us to consider the results drawn from the present analysis with caution. While we try to control for unobserved factors, such as the qualification of the manager of the firm, or the average intensity of competition from informal producers in the region where the firm is located, there are a number of factors that remain unobserved. The introduction of firm fixed effects, which is made possible by the use of data with a panel structure, is a way to control for time-invariant firm-specific factors. However, it is likely that there are still some time-varying factors that give rise to endogeneity.

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