



This article appeared in a journal published by Elsevier. The attached copy is furnished to the author for internal non-commercial research and education use, including for instruction at the authors institution and sharing with colleagues.

Other uses, including reproduction and distribution, or selling or licensing copies, or posting to personal, institutional or third party websites are prohibited.

In most cases authors are permitted to post their version of the article (e.g. in Word or Tex form) to their personal website or institutional repository. Authors requiring further information regarding Elsevier's archiving and manuscript policies are encouraged to visit:

<http://www.elsevier.com/copyright>



Contents lists available at ScienceDirect

Journal of Development Economics

journal homepage: www.elsevier.com/locate/devec

Does it pay firms to register for taxes? The impact of formality on firm profitability

David McKenzie^{a,b,c,*}, Yaye Seynabou Sakho^a^a World Bank, United States^b BREAD, United States^c IZA, Germany

ARTICLE INFO

Article history:

Received 20 August 2007

Received in revised form 13 February 2009

Accepted 13 February 2009

JEL classification:

O17

O12

D21

Keywords:

Informal sector

Entrepreneurial ability

Tax registration

ABSTRACT

This paper estimates the impact of registering for taxes on firm profits in Bolivia, the country with the highest levels of informality in Latin America. A new survey of micro and small firms enables us to control for a rich set of measures of owner ability and business motivations that can affect both profits and the decision to formalize. We identify the impact of tax registration on business profitability using the distance of a firm from the tax office where registration occurs, conditional on the distance to the city center, as an instrument for registration. Proximity to the tax office provides firms with more information about registration, but is argued to not directly affect profits. We find tax registration leads to significantly higher profits for the firms that the instrument affects. However, we also find some evidence of heterogeneous effects of tax formality on profits. Tax registration appears to increase profits for the mid-sized firms in our sample, but to lower profits for both the marginal smaller and larger firms, in contrast to the standard view that formality increases profits. We show that owners of large firms who have managed to stay informal are of higher entrepreneurial ability than formal firm owners, in contrast to the standard view (correct among smaller firms) that informal firm owners are low ability.

© 2009 Elsevier B.V. All rights reserved.

1. Introduction

Informality is pervasive amongst firms in developing countries, yet simple comparisons of formal and informal firms usually reveal that formal firms are more productive and profitable. A series of high-profile sector studies by the McKinsey Global Institute around the world comparing the operation of formal and informal firms concluded that informality has a very negative impact on productivity, even going so far as to conclude that “in Portugal and Turkey, for instance, informality accounts for nearly 50% of the overall productivity gap with the United States” (Farrell, 2004). However, such estimates ignore the fact that formality is a choice of firms – the lower productivity of informal firms may therefore just reflect less productive firms choosing to remain informal rather than be the consequence of informality.

This paper seeks to provide more credible evidence of the impact of being formal on business profits, using new survey data on firms in urban Bolivia, the country with the highest levels of informality in Latin America (World Bank, 2007). We control for a rich set of owner

characteristics, which provide a more comprehensive set of measures of owner ability, background, and motivations for entering business than existing studies of formality. We then identify the impact of registering for a tax identification number on firm profits by using the GPS-measured distance of a firm from the tax office where registration for taxes occurs as an instrument for whether or not a firm is registered for taxes. After controlling for the distance of the firm to the city center and other locational characteristics, we argue that this distance affects the information a firm has about registration, but does not independently affect profits. We show our results are robust to several potential threats to this identification assumption.

We find that registering to pay taxes leads to significantly higher profits for the firms that the instrument affects. Nevertheless, we also provide some suggestive evidence of heterogeneous effects of formality on profitability. In particular, we find that although registering for taxes appears to increase profits for firms in the middle size group in our sample (2 to 5 workers and the middle tercile of capital stock), registering for taxes is associated with lower profits for firms smaller than this, and for firms larger than this. The main benefit of registering for taxes appears to be an increase in the customer base through the ability to issue tax receipts – we find no evidence of increased access to finance. Very small firms are too small to benefit from issuing tax receipts, while owners of large informal firms have high ability and can achieve a large customer base through their own business skills.

This research adds to a nascent literature on the micro-level impacts of informality on firms. Despite increasing research concerning

* Corresponding author. World Bank, United States.

E-mail address: dmckenzie@worldbank.org (D. McKenzie).

¹ We thank the editor, an anonymous referee, Bill Maloney, Pablo Fajnzylber and various seminar participants for helpful comments. The survey used in this paper was financed by a World Bank ESW on policies to increase the formality and productivity of firms. All views expressed in the paper are those of the authors, and not of the World Bank, its executive directors, or the countries which they represent.

the nature of informality, its determinants, and its macro effects (e.g. Loayza (1996), Schneider and Enste (2000), Maloney (2004, 2006), Perry et al. (2007)), there are currently few studies which attempt to provide rigorous estimates of the impact of formality on firms themselves. In a recent study, Fajnzylber, Maloney, and Rojas (2006a) use propensity-score matching methods and control function approaches to estimate the impact of paying taxes and belonging to business associations on the performance of Mexican micro enterprises. They find relatively large impacts, with paying taxes estimated to increase business profits by at least 20%, and belonging to business associations estimated to increase business profits by at least 10%. However, their identification relies on assumptions about the formality status of firms being determined either on the basis of a set of observable variables or through a specific functional form in the estimation equation. If firms select into formality on the basis of unobserved owner ability or firm productivity, these may overestimate the impact of becoming formal.

A second set of recent studies have looked at the short-term impacts of increases in formality induced by business simplification procedures. Monteiro and Assunção (2006) and Fajnzylber, Maloney, and Rojas (2006b) use difference-in-differences and regression discontinuity designs respectively to obtain non-experimental estimates of the impact of the SIMPLES program in Brazil. They find higher revenues for firms that operate with a license, but do not examine whether these revenues are offset by higher expenses (such as taxes), or whether these higher revenues are also accompanied by higher profits. Two recent studies of a business simplification

program in Mexico (Kaplan et al., 2006; Bruhn, 2006) did not find much impact of reforms on registration amongst existing micro-enterprises. This is consistent with the view that firms weigh the costs and benefits of becoming formal, with small firms seeing few benefits.

Our research builds on these existing studies in several important ways. The instrumental variables approach we use here provides a source of identification driven by differences in information across firms, which together with the rich set of owner characteristics as controls, provides a new, and perhaps more credible, approach to identifying the impact of formality. Secondly, this study is the first we are aware of to empirically examine the heterogeneity of impacts by firm size, with our finding of negative impacts on larger firms in particular a new one. Finally, we also examine some of the channels through which tax registration affects profits, which can aid in designing policies intended to make registration more attractive for firms.

The remainder of the paper is structured as follows. Section 2 describes the new survey data used; Section 3 describes the registration process in Bolivia and the measure of formality we choose to focus on; Section 4 provides a simple model of a firm's formalization decision and uses this to motivate our identification strategy; Section 5 provides the main empirical results; and Section 6 concludes.

2. Data

The data come from the Bolivian *Encuesta de Productividad de Empresas*, a survey of micro- and small enterprises designed by the

Table 1
Summary statistics.

	# obs	Mean	S.D.	25th	50th	75th
Female	469	0.50				
Age of Owner	465	42.0	12.1	32	42	50
Married	469	0.68				
Spoke indigenous language as child	469	0.30				
Years of education	469	10.5	4.5	6.5	12	14
Mother had no education	469	0.36				
Mother had 9 or more years education	469	0.16				
Entrepreneurial self-efficacy	469	0.00	1.94	-1.55	0.02	1.59
Went into self-employment to care for family	469	0.62				
Went into self-employment for flexible hours	469	0.57				
Went into self-employment for business growth	469	0.68				
Childhood poverty index	469	0.00	1.44	-1.42	0.34	1.43
Father was a business owner	469	0.34				
Distance to the tax office (km)	469	3.09	1.97	1.58	2.79	4.29
Distance to the city center (km)	469	3.25	1.98	1.61	3.00	4.44
Distance to the municipal office (km)	469	3.30	1.75	1.95	3.38	4.28
Average tax inspection rate in city*industry	469	0.34	0.17	0.16	0.39	0.43
Tax inspection rate in 1 km radius of firm	459	0.36	0.25	0.17	0.33	0.50
Firm has a municipal license	469	0.57				
Firm has a tax identification number (NIT)	469	0.29				
Age of the firm (years)	466	12.0	13.0	3	9	17
Firm is 3 years or less in business	469	0.27				
Number of workers	469	3.20	3.11	1	2	5
Number of paid workers	466	2.30	3.00	0	1	4
Zero paid workers	469	0.35				
One to four paid workers	469	0.45				
Five to ten paid workers	469	0.17				
Eleven or more paid workers	469	0.03				
Log capital stock (excluding land and buildings)	418	8.90	2.15	7.65	9.24	10.50
Monthly profits (Bolivianos)	416	1628	2104	500	843	2000
Log monthly profits	416	6.81	1.09	6.21	6.74	7.60
Pay taxes	467	0.33		0.00	0.00	1.00
Taxes as share of profits	416	0.05		0.00	0.00	0.01
Log sales in February 2007	343	8.08	1.50	7.09	8.01	9.16
Issue tax receipts	469	0.12		0.00	0.00	0.00
Use trade credit	469	0.18		0.00	0.00	0.00
Receive working capital from customers/suppliers	469	0.19		0.00	0.00	0.00
Received a bank loan in 2005 or 2006	469	0.32		0.00	0.00	1.00
Corruption is an obstacle to business growth	448	0.56		0.00	0.00	1.00

Source: World Bank Bolivian Encuesta de Productividad de Empresas 2007.

authors and carried out during March 2007.² The survey covered the four largest cities in Bolivia – La Paz, El Alto, Santa Cruz and Cochabamba – with additional surveying conducted in several rural areas. We restrict our analysis to urban areas in this paper, and in particular, to firms within a 10 km radius of the city center and city's tax office.³ The resulting sample consists of 469 firms.

2.1. Sampling design

Six industries were chosen for the survey: grocery stores, restaurants and food sales, manufacturing of clothing from wool and cloth, transportation of passengers and cargo, manufacturing of clothing from camelid wool (from llamas and alpacas), and manufacturing of furniture from wood. The industries were chosen to represent a large portion of the self-employed and small employers, and to encompass a diversity of sectors. According to the 2005 MECOVI (Bolivian Living Standards Measurement Survey), the industries chosen include four of the top five industries⁴ for urban small and medium enterprises and cover approximately 40% of all self-employed and employers.

The sample frame consisted of a geographic information database maintained by the survey firm. This database is based on a census of all economic establishments in these cities carried out in August 2005, and includes enterprises operating within households. This was supplemented with data for the transportation sector on all firms that have registered their cars. This provided a reasonably comprehensive sampling frame for urban areas.⁵ The sample was stratified across cities and firm size, in order to include a mix of micro firms (with less than five workers), and small firms with 5–20 workers. The sample used here is almost equally divided across the four cities. Groceries, Food, and Transportation each constitute about 20% of the sample, Clothing from wool and cloth and manufacturing from wood each constitute 15% of the sample, and clothing from camelids the remaining 10%.

2.2. Sample characteristics

Table 1 provides summary statistics for the 469 firms used in this paper. The median firm has been in business for 9 years, although 27% have been in business 3 years or less. The median firm in the sample has 2 paid workers, with only 20% of the sample having five or more paid workers. Mean monthly profits are 1628 Bolivianos (\$US211).⁶ Profits were measured through a direct question, following the recommendations made in De Mel, McKenzie and Woodruff (2008). Half the firm owners are female. Average education levels for owners are quite high, but there is substantial variation. The median owner has 12 years of education, but 20% of firm owners have less than 6 years education, and 31% have more than 12 years.

² The survey was conducted by the Bolivian survey firm *Encuestas y Estudios*.

³ The total sample including rural areas is 629 firms. We also dropped the few firms surveyed which were not owned by the person interviewed (in order that we can control for owner characteristics), and a few firms in transportation with above 20 workers. Our main results are robust to also including the rural firms. However, since these firms are a median distance of 220km away from the city center, and only 7 of the 92 firms have an NIT, we do not believe they are comparable to the firms in the urban areas.

⁴ The only one of the top five industries not covered is construction, where it was felt there was little overlap between formal and informal firms, and where the broad industry grouping is very heterogeneous, covering skilled engineers and architects along with less skilled workers.

⁵ A sample frame was not available for rural areas, and therefore snowball sampling methods were used to survey camelid and wood firms in rural areas. The lack of a representative sampling frame provides a further reason for excluding rural areas in this study.

⁶ During March 2007, 1USD was approximately 7.7 Bolivianos.

2.3. Measuring owner ability and background

A main concern for our empirical work is that there are characteristics of firm owners which affect both profitability and the decision of whether or not to formally register the business. One such factor could be owner ability, which may determine the size of the gain in profits from becoming formal. Other such factors could be family background and wealth, which might affect the ability of the firm to meet the costs of formalizing, and the utility associated with being formal. Our instrumental variables strategy aims to overcome such concerns, but we also attempt to directly measure and control for these variables much more than is possible with variables such as gender, own education, age, marital status and ethnicity found in standard firm surveys.

We use three different measures of owner ability and motivation. The first is mother's education, consisting of dummy variables for mother having no education (36% of firm owners), and for mother having 9 or more years education (16%). The second measure is entrepreneurial self-efficacy. Self-efficacy is the first principal component of ten questions intended to measure the self-assessed ability to perform certain tasks. Owners were asked on a four point scale how confident they are that they could do ten business tasks. Examples include their ability to estimate accurately the costs of a new project; to resolve a difficult dispute with a client or supplier in another city; to hire good employees to expand their business; to sell a product to a new client; and to price their business correctly if they wish to sell it. Such a measure is more closely tied to business skills than years of education, and has a correlation of only 0.11 with years of education. The third measure consists of three dummy variables capturing motivations for going into business. Owners who entered self-employment for the chance of business growth may be more likely to become formal than those who entered self-employment in order to have flexibility to care for family or carry out household tasks.

Additional measures of family background are whether or not their father was a business owner (34% say yes), and a childhood poverty index, intended to capture family wealth well before the time of business entry. The childhood poverty index is a principal component based on mother's education, questions about the type of floor their house had as a child (60% had a dirt floor, 15% cement, while others had mosaic, tile, or wood); and the frequency with which they didn't have enough to eat as a child (31% say they never went hungry, 54% said sometimes, and 15% say almost always or always). This index has a correlation of -0.48 with own education, 0.41 with speaking an indigenous language as a child, and -0.15 with log capital stock, suggesting it is measuring family wealth to some extent.

3. The registration process in Bolivia in theory and practice

In order to be fully formal, a firm in Bolivia must register with three different Government agencies, while those with employees are required to register their employees with three additional agencies. The three main steps to formalization are

- 1) registering with the municipal government (*Alcaldia*) to obtain a municipal business license,
- 2) registering with the tax authorities (*Servicios de Impuestos Nacional (SIN)*) to get a tax identification number (NIT), and
- 3) registering in the registry of commerce (*Fundempresa*).

Firms with employees must take the further steps of registering them for health benefits with the National health system (CNS), for social security with the Pension fund (AFP), and registering them with the Labor Ministry.

However, out of our sample of 469 firms, only 13 have completed the three steps listed here, and only 5 also have workers registered with the three additional agencies. In practice then, almost all micro

and small enterprises are informal to some extent. The creation of *Fundempresa* in 2002 does not seem well-known to firms in 2007. Only 10% of firms in our sample say they know what *Fundempresa* is and what its purpose is, and only 18 firms are registered with it.

Therefore for most firms in our sample, formality consists of first registering for a municipal license, and then registering for a tax identification number (NIT). 57% of firms in our sample have a municipal license, and 29% a NIT. Only 14 of the 134 firms with a NIT do not have a municipal license. Recent years have seen improvements in the time taken to obtain municipal licenses in some municipalities. Coupled with greater interaction with municipal officials, our focus group surveys revealed that most firms seemed aware of the process necessary to get a municipal license and felt enforcement was stronger at the municipal level. In contrast, no such efforts have been made to simplify the process of obtaining a tax identification number, and, as we will show, many firms do not have good knowledge of this process. As a result, we believe that most firms failing to have a municipal license do not have one as a result of informed choice, whereas some firms without tax identification numbers do not have one as a result of imperfect information. The result is that we will be able to identify the impact of a tax identification number, but not that of a municipal license.

Our survey firm conducted 12 focus group interviews of firms across different sectors and size groups (Encuestas y Estudios, 2007). Firms in the focus groups were asked what they themselves understood formality to be. For the majority of members of our focus groups, formality means *dar facturas* or providing formal receipts, for which a NIT is required. Others mentioned being registered at the municipal level and paying municipal fees. The measures of formality this paper focuses on are therefore the one firms themselves see as defining what it means to be formal.

We asked firms in our focus groups and in the main survey what they saw as the main benefit of having a NIT. One-quarter of surveyed firms with a NIT said the main benefit was to increase their customer base, through being able to issue tax receipts. Clients can use these tax receipts for claims or tax refunds. The other main benefits according to firms are avoiding fines (19% say this), and to be obeying the law (43% say this). The benefit of obeying the law may also reflect less uncertainty about fines or other punishments, or reflect some psychic benefit associated with obeying the rules of society.

4. Modeling the choice of firms to become formal and our identification strategy

4.1. The choice of formality

Profit-maximizing firms will choose whether or not to register for taxes if the expected present discounted value of the net benefits from doing so outweighs the upfront costs. That is, a firm will choose to get a tax identification number if and only if:

$$\sum_{t=1}^T \delta^t E(\pi_{F,t} - \pi_{U,t}) + \theta_{\text{law-abiding}} > C_{\text{Money}} + C_{\text{Time}} + C_{\text{Information}} \quad (1)$$

where $\pi_{F,t}$ denotes the firm's profits if it is formally registered at time t , and $\pi_{U,t}$ denotes the firm's profits if it is not formally registered at time t . $\theta_{\text{law-abiding}}$ denotes the utility benefit to firm owners from obeying the law and feeling they are contributing to national welfare through paying taxes. C_{Money} , C_{Time} , and $C_{\text{Information}}$ denote the monetary, time, and information costs from registering. The monetary costs also implicitly include the shadow value of capital for liquidity-constrained firms. For simplicity of exposition we assume here that the value of being formal at time t does not depend on formality status in previous periods. If it does, the problem can be written as a dynamic optimization problem with a value function, and the same intuition as exposited here will still apply.

Eq. (1) shows the key challenge of identifying the impact of formality on firm profitability. The choice to register for taxes or become formal will itself depend on the impact of formality on business profits ($\pi_{F,t} - \pi_{U,t}$). As a result, if there are no costs to registering and no non-monetary benefits from doing so, all firms for which it is profitable to be registered will have done so, and only firms for which informality does not pay will remain informal. If there are homogeneous treatment effects, everyone will either be formal or everyone informal. If there are heterogeneous effects, those who are informal will not be appropriate controls for those who are formal.

However, Eq. (1) also shows that some firms for which it is profitable to become formal will not do so if the initial costs of registering are too high. In the Bolivian case, the monetary costs of registering for a NIT are very low (zero for the registration itself, with only the costs of photocopying and obtaining accompanying documents needed). However, the time and information costs will depend on how closely located the firm is to the office where they have to register, and on how much general information is available about the registration process. This provides a potential source of identification: comparing two firms with the same potential net change in profits (and same psychic benefits) from obtaining a tax identification number, but with different time and information costs will enable estimation of the increase in profits resulting from formalization.

4.2. Identification

Our basic identification strategy is therefore to use the geographic location of the firm relative to that of the tax office as a source of variation on the information and time costs of registering, assuming that after other locational controls are added, that distance to the tax office has no independent impact on profits.

The latitude and longitude of each firm was obtained using GPS receivers. In La Paz there is a single regional office and a single national office where firm owners can register for a NIT, while in each of the other cities there is a single location of the tax office. We also obtained the coordinates of these tax offices, and of the city centers. We then calculate the straight-line distance from the firm to the nearest tax office and to the city center. Since the sample is contained in dense urban neighborhoods, straight-line distances will be good approximations for actual travel distances (Gibson and McKenzie, 2007). We have restricted the sample to firms within a 10 km radius of the tax office: the mean firm is 3.1 km away. The assumption is that for two

Table 2
Do unregistered firms closer to the tax office have better knowledge?

	Doesn't know where tax office is		Doesn't know where tax office is or is more than 3 km off in guess		Firm was been visited by a tax inspector in 2006	
	(1)	(2)	(3)	(4)	(7)	(8)
Log distance to tax office	0.0279 (0.037)	0.0932 (0.063)	0.0683** (0.034)	0.1047* (0.053)	-0.0682** (0.027)	0.0374 (0.036)
Firm owner controls	No	Yes	No	Yes	No	Yes
Firm characteristics	No	Yes	No	Yes	No	Yes
City dummies	No	Yes	No	Yes	No	Yes
Industry dummies	No	Yes	No	Yes	No	Yes
Observations	335	325	335	325	335	325

Marginal coefficient from Probit estimation.
Notes: robust standard errors in parentheses. *, **, and *** denote significance at the 10%, 5% and 1% levels.
Firm owner controls are age, gender, marital status, indigenous language use, education, mother's education, childhood poverty, reasons for going into business, and entrepreneurial self-efficacy.
Firm characteristics are a dummy for firm age of 3 years or less, log distance to city center, and average tax enforcement rates for the city*industry and for a 1 km radius around the firm.

firms of equal distance from the city center, the one that is closer to the tax office has better knowledge of the registration process.

Our survey indeed reveals limited knowledge about the process of getting a tax number. 39% of firms without a NIT say they don't know what a tax number is. Only 44% of unregistered firms say they know where the nearest tax office is, and only 31% are able to give its location to within 3 km. Table 2 uses the sample of unregistered firms to examine whether there is a relationship between distance to the tax office and knowledge of where the tax office is. Column 2 shows a large, but not significant effect on whether the firm owner says they know where the office is. Since some firm owners may claim to know where it is, but not actually know, we also asked them to tell us the distance to the office. Columns 3 and 4 show that there is a large and significant effect of distance to the tax office on this measure of ignorance.

Another reason that distance to the tax office could determine whether or not a firm registers is that the chance of receiving a visit from a tax inspector may be greater the closer a firm is to the tax office. Column 7 of Table 2 shows that this is indeed the case when we don't condition on firm and location characteristics. However, in all of our regressions we will include controls for city, industry, the average tax enforcement rate in each city*industry pair, and the average tax enforcement rate in a 1 km radius around the firm.⁷ Column 8 shows that after including these controls, there is no effect of distance to the tax office on enforcement.

We thus believe that after the inclusion of firm, owner, and locational controls, distance to the tax office is determining the information a firm has about registration, but is not having an independent effect on its profits. We examine possible threats to this exclusion restriction in the robustness section below.

4.3. First-stage: does distance to the tax office predict formality?

Table 3 then examines whether log distance to the tax office predicts whether or not a firm has a tax identification number, after controlling for firm owner, firm, and location characteristics. We show marginal results from estimation of a probit equation where having a NIT is the dependent variable. Column 1 does not control for firm size, and shows a strong and significant effect of log distance to the tax office on having a NIT. The marginal effect shows that being 3.1 km away from the tax office (the mean) is associated with a 10 percentage point reduction in the likelihood of having a NIT. Since only 29% of firms have a NIT, this is a sizeable effect. Column 2 shows this result also holds after conditioning on firm size, as measured by log of capital stock, and dummy variables for the number of paid workers being in different categories. As one would expect, larger firms are more likely to be formal. Finally, column 3 shows that log distance to the tax office continues to be a significant predictor of having a NIT, even after controlling for the number of firms within 100 m of the firm that also have a NIT. We discuss this more in the robustness section.

Column 1 also highlights the role of owner ability in the formality decision. Owners with more education, higher entrepreneurial self-efficacy, and who went into self-employment for business growth reasons are more likely to have a NIT. After controlling for owner ability, there is no significant effect of gender on the formality decision. Secondly, column 1 shows that firms are more likely to have a NIT when enforcement is higher: both the inspection rate within their city*industry pair and within a 1 km radius of the firm are positively and significantly associated with having a NIT.

In columns 4 and 5 of Table 3, we then examine whether a similar strategy can be used to estimate the impact of a municipal license. Municipal licenses are obtained at the municipal office (*Alcaldia*). However, while there is a weak negative correlation between log distance to the municipal office and having a municipal license

Table 3
First-stage – does distance predict formality?

	NIT			Municipal license	
	(1)	(2)	(3)	(4)	(5)
Female	-0.0950 (0.059)	0.0310 (0.063)	0.0176 (0.067)	-0.0769 (0.071)	0.00275 (0.082)
Age of owner	0.00303 (0.0021)	0.00452** (0.0023)	0.00398* (0.0023)	0.00130 (0.0026)	0.00128 (0.0029)
Owner is married	0.0380 (0.048)	0.00788 (0.051)	0.00142 (0.053)	0.0608 (0.059)	0.0786 (0.064)
Owner speaks indigenous language	0.0135 (0.057)	-0.0302 (0.055)	-0.0606 (0.056)	0.00726 (0.067)	-0.0404 (0.073)
Years of education	0.0185*** (0.0066)	0.0138** (0.0067)	0.0132* (0.0070)	-0.00255 (0.0078)	-0.00589 (0.0085)
Mother had no education	0.0103 (0.065)	0.0820 (0.069)	0.140* (0.076)	0.00486 (0.073)	0.0529 (0.080)
Mother had 9 or more years education	0.0244 (0.069)	0.0467 (0.075)	0.0361 (0.077)	-0.0331 (0.082)	-0.00365 (0.090)
Entrepreneurial self-efficacy	0.0248** (0.012)	0.0186 (0.013)	0.0227* (0.014)	0.0171 (0.015)	0.0147 (0.016)
Went into self-employment to care for family	-0.0735 (0.051)	-0.0189 (0.054)	-0.00656 (0.056)	-0.0698 (0.059)	-0.0905 (0.066)
Went into self-employment for flexible hours	-0.00354 (0.048)	-0.0325 (0.052)	-0.0275 (0.054)	0.0336 (0.057)	0.0598 (0.063)
Went into self-employment for business growth	0.0848* (0.047)	0.0220 (0.050)	0.0120 (0.053)	-0.0283 (0.058)	-0.0696 (0.063)
Childhood poverty index	0.00333 (0.022)	-0.00261 (0.022)	-0.0101 (0.023)	-0.0186 (0.026)	-0.0182 (0.029)
Father owned a business	0.0327 (0.049)	-0.0175 (0.050)	-0.00516 (0.054)	0.0730 (0.057)	0.0643 (0.062)
Log distance to the tax office	-0.122*** (0.035)	-0.118*** (0.038)	-0.0841** (0.042)		
Log distance to the city center	0.0555 (0.041)	0.0753 (0.046)	0.0774 (0.048)	-0.0629 (0.046)	-0.0543 (0.052)
Average tax inspection rate in city*industry	1.029*** (0.36)	0.966*** (0.35)	0.944** (0.37)	0.245 (0.40)	-0.0700 (0.43)
Tax inspection rate in 1 km radius of firm	0.279*** (0.10)	0.235** (0.11)	0.179 (0.11)	0.399*** (0.13)	0.457*** (0.14)
Firm is 3 years or less in age	-0.0941* (0.048)	-0.0441 (0.050)	-0.0385 (0.053)	-0.171*** (0.060)	-0.160** (0.065)
Firm has one to four paid workers		0.245*** (0.063)	0.241*** (0.066)		0.170** (0.067)
Firm has five to ten paid workers		0.521*** (0.10)	0.540*** (0.10)		0.235*** (0.083)
Firm has eleven or more paid workers		0.707*** (0.14)	0.691*** (0.15)		0.326*** (0.11)
Log capital stock (excluding land and buildings)		0.0610*** (0.017)	0.0580*** (0.017)		0.0525*** (0.019)
Number of formal firms in 100 m radius of firm			0.00649*** (0.0022)		
Log distance to municipal authorities				-0.00250 (0.045)	0.0635 (0.053)
Number of firms	455	406	406	455	406

Marginal effects from probit regression for having a Tax identification number (NIT) (columns 1–3) and for having a municipal licence (columns 4 and 5).

Notes: robust standard errors in parentheses.

*, **, and *** denote significance at the 10%, 5% and 1% levels.

Probit also contains industry and city dummies.

(-0.10), this correlation disappears after controlling for firm, owner, and locational characteristics. This is consistent with the view that firms have reasonable knowledge about how and where to get a municipal license, so that distance does not provide sufficient variation in information access to enable identification in this case.

5. The impact of registering for taxes on profits

We now turn to estimation of the impact of a NIT on firm profits. We focus on profits as the dependent variable for two reasons. First,

⁷ In both cases we do not include the firm's own tax enforcement in calculating the average of firms around it.

Table 4
Treatment effect of a tax identification number on profits.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS	OLS	OLS	OLS	2SLS	2SLS	MLE	MLE
Tax identification number (NIT)	0.533*** (0.12)	0.0835 (0.13)	0.431*** (0.12)	0.0119 (0.12)	1.473** (0.69)	1.376** (0.66)	1.042** (0.46)	0.881*** (0.28)
Female	-0.449*** (0.15)	-0.154 (0.14)	-0.346** (0.15)	-0.0974 (0.14)	-0.255 (0.17)	-0.102 (0.16)	-0.293** (0.14)	-0.100 (0.14)
Age of owner	-0.0127** (0.0050)	-0.00787 (0.0050)	-0.0113** (0.0049)	-0.00757 (0.0047)	-0.0147** (0.0057)	-0.0119** (0.0057)	-0.0133*** (0.0051)	-0.0104** (0.0048)
Owner is married	0.0750 (0.11)	0.111 (0.10)	0.137 (0.11)	0.159 (0.10)	0.0595 (0.13)	0.0681 (0.13)	0.0913 (0.12)	0.101 (0.11)
Owner speaks indigenous language	-0.0142 (0.14)	-0.0368 (0.14)	0.0931 (0.13)	0.0716 (0.13)	0.0475 (0.15)	0.0861 (0.15)	0.0663 (0.13)	0.0808 (0.12)
Years of education	0.000771 (0.015)	-0.0101 (0.014)	-0.00201 (0.016)	-0.00778 (0.014)	-0.0222 (0.021)	-0.0260 (0.019)	-0.0139 (0.017)	-0.0194 (0.015)
Log distance to the city center	0.0457 (0.093)	0.0578 (0.094)	0.0226 (0.086)	0.0255 (0.089)	0.0220 (0.090)	0.0341 (0.094)	0.0223 (0.088)	0.0310 (0.086)
Average tax inspection rate in city*industry	-1.710** (0.77)	-1.978*** (0.71)	-1.235* (0.72)	-1.438** (0.66)	-2.246** (0.98)	-2.462*** (0.86)	-1.829** (0.87)	-2.090*** (0.75)
Tax inspection rate in 1 km radius of firm	0.360 (0.25)	0.199 (0.23)	0.199 (0.25)	0.0553 (0.24)	-0.0676 (0.31)	-0.254 (0.29)	0.0426 (0.27)	-0.142 (0.24)
Firm is 3 years or less in age	-0.263** (0.13)	-0.104 (0.12)	-0.248** (0.12)	-0.109 (0.11)	-0.166 (0.13)	-0.0474 (0.13)	-0.200* (0.12)	-0.0696 (0.11)
Firm has one to four paid workers		0.160 (0.13)		0.209 (0.13)		-0.0306 (0.17)		0.0566 (0.12)
Firm has five to ten paid workers		0.683*** (0.18)		0.664*** (0.17)		0.220 (0.29)		0.381** (0.19)
Firm has eleven or more paid workers		1.104*** (0.26)		1.054*** (0.25)		0.321 (0.49)		0.587* (0.36)
Log capital stock (excluding land and buildings)		0.178*** (0.034)		0.166*** (0.033)		0.105** (0.042)		0.127*** (0.032)
Mother had no education			0.0940 (0.13)	0.0999 (0.13)	0.0924 (0.14)	0.0538 (0.15)	0.0931 (0.14)	0.0706 (0.13)
Mother had 9 or more years education			0.301* (0.18)	0.218 (0.15)	0.302 (0.18)	0.200 (0.17)	0.302* (0.16)	0.206 (0.15)
Entrepreneurial self-efficacy			0.115*** (0.029)	0.107*** (0.026)	0.0823** (0.038)	0.0824*** (0.031)	0.0957*** (0.031)	0.0913*** (0.027)
Went into self-employment to care for family			-0.205* (0.11)	-0.150 (0.11)	-0.157 (0.12)	-0.140 (0.12)	-0.177 (0.11)	-0.143 (0.11)
Went into self-employment for flexible hours			-0.0352 (0.11)	-0.0133 (0.10)	-0.0555 (0.11)	-0.0424 (0.11)	-0.0471 (0.11)	-0.0318 (0.11)
Went into self-employment for business growth			0.0887 (0.11)	0.0282 (0.10)	0.00799 (0.13)	-0.0283 (0.12)	0.0413 (0.12)	-0.00780 (0.11)
Childhood poverty index			-0.0794* (0.048)	-0.0708 (0.045)	-0.0789 (0.053)	-0.0690 (0.054)	-0.0791 (0.049)	-0.0696 (0.048)
Father owned a business			-0.203* (0.11)	-0.297*** (0.10)	-0.198* (0.11)	-0.246** (0.12)	-0.200* (0.11)	-0.265** (0.11)
Constant	8.020*** (0.58)	6.122*** (0.65)	7.794*** (0.55)	6.060*** (0.62)	8.389*** (0.70)	7.367*** (0.86)	8.144*** (0.61)	6.892*** (0.66)
Observations	404	369	404	369	404	369	404	369
R ²	0.21	0.35	0.29	0.42				
First-stage F-statistic					10.77	12.77		

Dependent variable: log monthly profits.

Notes: robust standard errors in parentheses.

*, **, and *** denote significance at the 10%, 5% and 1% levels.

Log distance to the tax office is used as the instrument in columns 5–8.

All columns also include city and industry dummies.

from the point of view of a firm deciding on whether or not to register, the impact on profits is a key determinant. Secondly, whilst from a social welfare point of view one would also like to know whether formality improves productivity, estimation of firm productivity is much more complicated than profitability, and relies heavily on assumptions that are unlikely to be credible with the types of firms surveyed here (see the critique in *Katayama, Lu, and Tybout, 2006*).

The basic estimation equation of interest is, for firm *i*:

$$\ln(\text{profits})_i = \alpha + \beta \text{NIT}_i + \delta' X_i + \gamma' Z_i + \theta' L_i + \varepsilon_i \quad (2)$$

where NIT_i is a dummy variable taking value one if firm *i* has a tax identification number, X_i , Z_i , and L_i are owner, firm, and locational characteristics respectively. We begin with OLS estimation of (2).

However, the concern is that there are unobserved characteristics of the firm which are correlated with profits and also influence the decision to get a NIT. We therefore instrument the tax identification number using log distance to the tax office. We employ two methods of using this instrument in estimating (2). The first is two-stage least squares, which has the advantage of not imposing distributional assumptions on the error term. The second method is maximum-likelihood estimation (MLE) of a treatment effects model, which takes account of the fact that NIT is a binary variable, and jointly estimates a probit equation for NIT along with Eq. (2).⁸ In all cases we estimate the equation with and without controls for firm size.

⁸ This was carried out using the *treatreg* command in STATA.

Table 5
Robustness.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Tax identification number (NIT)	0.881*** (0.28)	0.828*** (0.28)	0.880*** (0.27)	0.887*** (0.28)	0.795*** (0.29)	0.847*** (0.29)	0.700* (0.36)
Log distance to Alcadia office			0.0326 (0.090)	0.0288 (0.090)	0.000143 (0.090)	0.0357 (0.090)	0.0315 (0.091)
Number of firms within 100 m				−0.000326 (0.00041)			
Number of formal firms within 100 m					−0.00265 (0.0025)		
Number of firms within 500 m						0.0000863 (0.00011)	
Number of formal firms within 500 m							0.000482 (0.0013)
Observations	369	369	369	369	369	369	369

Dependent variable: Log monthly profits.

Notes: column (1) replicates column (8) of Table 4.

Column (2) drops mother's education, self-efficacy, reasons for going into self-employment, childhood poverty, and father's business background.

Apart from dropping these ability and background variables in column (2), all columns include the same controls as column (8) of Table 4.

*, **, and *** denote significance at the 10%, 5% and 1% levels.

Estimates are MLE using log distance to the tax office as an instrument for NIT.

5.1. OLS results

Columns 1 to 4 of Table 4 provide OLS estimates of the impact of having a NIT on log profits. Column 1 begins with a basic specification which contains some standard characteristics of the owner, such as years of education, age, sex, and marital status, and some standard characteristics of the firm, such as location, firm age, and industry. Having a NIT is associated with 53% higher profits, conditional on these characteristics. Column 2 then controls for firm size. Firm size is statistically significant, and as larger firms are more profitable and also more likely to be registered for taxes, controlling for firm size lowers the coefficient on having a NIT, and the positive association between a NIT and profits is no longer significant.

However, the typical concern in estimating Eq. (2) by OLS is that there are unobservable firm or owner characteristics which are correlated with the decision to become formal and which also affect profits. Two of the most common such factors would be owner ability and anticipated positive productivity shocks. In both cases, we would expect the omission of these factors to lead to an upward bias in the OLS estimate of the impact of having a NIT. If this is the case, we should expect adding more controls for owner ability should lower the OLS estimates. Columns 3 and 4 test this hypothesis by adding additional owner characteristic controls, including mother's education, entrepreneurial self-efficacy, reason for going into business, and childhood poverty (a measure of wealth). Adding these controls does indeed lower the OLS estimates – from 53 to 43% when firm size is not controlled for, and from 8 to 1.2% when firm size is controlled for. Hence after controlling for owner characteristics more comprehensively, there is almost zero association between profits and tax registration status once firm size is accounted for.

5.2. IV results

Columns 5 and 6 of Table 4 provide the 2SLS estimates and columns 7 and 8 the MLE estimates. These estimates show very large, and highly significant, increases in profits from registering for a tax identification number. The MLE estimate in column 8 suggests that firms which obtain a tax identification number have 88% higher profits. The 2SLS estimates are larger, but not significantly so. The MLE estimates are significant at the 1% level, and the 2SLS estimates at the 5% level. Thus according to these estimates, firms earn much larger profits after registering.

Several other variables are also notable in Table 4. First, after conditioning on size and other characteristics, male and female owners don't have significantly different profitability. Secondly, there is a strong and significant effect of entrepreneurial self-efficacy on profits – more

able owners earn higher profits. Third, profits are lower when the tax inspection rate is higher, which is consistent with higher taxes reducing profits. Fourth, profits are higher for larger firms. Finally, note the point estimate on log capital stock (which excludes land and buildings), suggests a 10 to 12% per month return on capital for the mean firm in the sample. This return to capital is comparable to that obtained by McKenzie and Woodruff (2006) for microenterprises in Mexico.

5.3. Robustness

In Table 5 we examine the robustness of our results to potential challenges to the identification strategy. Column 1 of Table 5 repeats the MLE estimate from column 8 of Table 4: an 88% increase in profits from having a NIT. The first potential threat to our exclusion restriction is that more able entrepreneurs may choose to locate their businesses in locations which are closer to the tax office. The fact that so few unregistered firms know where the tax office is also leads us to believe it extremely unlikely that firms are choosing their business location to be closer to or further from the tax office. If they are, unobserved owner ability will not be orthogonal to distance.

Assuming that observed and unobserved ability have similar correlations with distance, in column 2, we examine the sensitivity of our results to dropping our measures of ability and owner background. The point estimate drops from 0.88 to 0.83, with the difference not significant. Therefore the inclusion of ability measures does not significantly affect the estimated treatment effect, which provides support for the view that more able entrepreneurs are not choosing locations closer to the tax office. Instead, micro and small entrepreneurs typically operate at, or near, their homes, making the location decision of the firm a function of where the owner happens to live.

A second potential threat to the exclusion restriction is that despite controlling for the distance to the city center, distance to the tax office may be correlated with other interactions with the government, which could also affect profitability. To examine the robustness of our results to this possibility, in column 3 we add the distance to the municipal office when municipal licenses are issued as a further control. The mean distance from the municipal office to the tax office is only 1.4 km. We see this variable has no effect on firm profitability, and leads to no significant change in the estimated effect of a NIT. This adds further support to our claim that the distance to the tax office is picking up the specific information and time costs of obtaining a NIT, and not something else to do with other interactions with the government.

A third potential threat to our identification strategy is the possibility of agglomeration effects and information externalities. Firms may be highly clustered in certain parts of the cities and firms

Table 6
Heterogeneity of treatment effects.

	All firms		By firm size		
	Without size controls	With size controls	0–1 workers bottom tercile K	2–5 workers middle tercile K	6+ workers Top tercile K
Propensity score matching results					
NIT	0.484	0.209	–0.616	0.408	–0.546
S.E.	0.124	0.130	0.597	0.274	0.257
p-value	0.000	0.110	0.302	0.136	0.033
Sample size	404	369	67	60	41
2SLS results on sub-samples					
First stage F-statistic	10.77	12.77	0.60	4.77	0.84
Second stage: coefficient on NIT	1.473	1.376		1.492	
Second stage: p-value	0.033	0.037		0.056	
Proportion of firms with NIT	0.270	0.266	0.066	0.246	0.721
Mean self-efficacy of firms with NIT	0.55	–0.14	0.92	0.64	0.74
Mean self-efficacy of firms without NIT	–0.15	0.52	–0.94	–0.06	1.72

which are surrounded by many other firms may be more profitable due to agglomeration effects. The presence of other registered firms around it may then provide a firm with more information about the registration process, directly affecting the likelihood that the firm has a NIT. A related threat is that the Government may choose to locate its tax offices near clusters of highly profitable formal firms.

However, as noted there are only two tax offices in La Paz, and only one in each other city. These offices have been in place for some time, and given the large number of firms spread throughout the city, it seems unlikely that government placement of the office could be driving the results. The firms in our sample are not just from one or two industrial clusters, but are spread throughout the city. To assess the robustness of our results to possible agglomeration effects, we need to measure the number of firms and number of firms with a NIT in the vicinity of the firms in our sample. To do this we conducted a census of all firms in blocks around the firms in our sample, taking the GPS coordinates of each, and noting whether or not they displayed a tax registration number.⁹ This involved collecting the coordinates for 20,469 firms. With these coordinates, we then calculate the number of firms within a 100 m radius of each firm in our sample, and the number of firms within a 100 m radius which have a NIT. We also construct the same measures for a radius of 500 m, to allow for larger-sized neighborhood effects. The mean (median) number of firms within 100 m is 62(10), while the mean (median) number of firms with a NIT within 100 m is 6(0).

Columns 4 through 7 of Table 5 then show that our main results are robust to adding these different controls for clustering and agglomeration. The impact of a NIT on profits is still positive and statistically significant, with a 70 to 87% increase in profits from having a NIT. Although having formal firms in the vicinity does help predict whether a given firm has a NIT (Table 3, column 3), neither the total number of firms nor the number of formal firms around a firm is correlated with log profits, suggesting little agglomeration effects are present. Overall the evidence in Table 5 supports our identification assumption, and suggests that these threats to identification are not having a large impact in practice.

5.4. Treatment effect heterogeneity and the difference from OLS

The MLE and 2SLS estimates therefore show a large positive effect from formalizing, whereas the OLS estimates show no effect after

⁹ The possibility of agglomeration effects was noted by a referee. The census of firms in blocks around our firms was carried out in August 2008 in response to this critique being raised. We believe the number of firms in the neighborhood of the firms in our sample in August 2008 is a good proxy for the number which were there at the time of the original survey, in March 2007.

controlling for firm size and owner characteristics. Our initial hypothesis was that omitted firm level and owner characteristics would cause an upward bias in the OLS estimates, and so it is clear that this form of bias cannot explain the difference between the OLS and MLE/2SLS estimates. However, OLS will also provide a different estimate than the MLE/2SLS estimates if there are heterogeneous treatment effects, so that the impact of obtaining a tax identification number differs across firms.

If selection into formality status occurs only in terms of the observable variables included in Eq. (2), and columns 3 and 4 of Table 4, OLS will estimate the average treatment effect. In contrast, 2SLS and MLE will estimate local average treatment effects (Imbens and Angrist, 1994). Specifically, they will estimate the impact of registering for taxes on firms for which distance to the tax office influences their formality status. These are firms for which distance makes a difference to whether they know how to register, or which are close enough to the margin of registering that a small change in the travel costs of registering will influence their registration decision.

There are good reasons to believe that the reasons for being informal vary with firm size, since many of the costs and benefits of becoming formal will vary with firm size. To explore the possibility of different effects of a NIT, we use propensity-score matching to estimate the impact of having a NIT for different firm size groupings.¹⁰ The same set of variables as were used in the OLS regressions are used for matching purposes. Nearest neighbor matching was used to estimate average treatment effects matching firms to their three nearest neighbors¹¹.

Table 6 reports the results of propensity score matching. The first two columns report the results of matching, with and without controls for firm size. After controlling for firm size, the average treatment effect of a NIT is a 20.9% increase in profits – larger than the OLS coefficient (1.2% increase in profits), but smaller than the MLE/2SLS coefficients (88–147% increase). Again, with heterogeneous treatment effects the propensity-score matching treatment effect will differ from the average treatment effect estimated by OLS and the local average treatment effect estimated by MLE and 2SLS. We then split firms into three size groupings, based on terciles of capital stock and groupings of 0 to 1, 2 to 5, and 6 and above workers.¹² Although

¹⁰ An alternative approach would be to interact group dummies with the NIT effect in the OLS regression. The propensity-score matching is more general than this, not imposing the same linear relationship between other variables and profits as OLS does. Moreover, it assures that only firms which are observationally similar are being compared.

¹¹ Matching was carried out using the `nmatch` command in STATA. See Abadie, Drukker, Herr and Imbens (2004).

¹² We use the middle diagonals of the 3*3 matrix formed by the three capital stock terciles and three number of worker groupings. These middle diagonals are the groups with most observations for analysis, and naturally correspond to three size groupings of increasing size.

Table 7
How does formality affect profits?

	Pay taxes	Taxes as share of profits	Log sales in February	Issue tax receipts	Use of trade credit	Working capital from customers or suppliers	Bank loan in 2005 or 2006	Corruption is an obstacle to growth
Having a NIT	0.844*** (0.191)	0.121 (0.169)	0.796* (0.418)	0.439*** (0.056)	0.132 (0.138)	−0.136 (0.136)	0.011 (0.155)	−0.312 (0.205)
Sample Size	405	406	301	406	406	406	406	406
Mean of dependent variable	0.323	0.051	8.03	0.116	0.163	0.195	0.303	0.571

Treatment effects regressions.

Notes: robust standard errors in parentheses. *, **, and *** denote significance at the 10%, 5% and 1% levels.

The same control variables as Table 4 are used, and log distance to the tax office is used as an instrument.

the smaller sample sizes when we split the sample this way lead to some statistically insignificant results, the point estimates are suggestive of heterogeneity of treatment effects. Having a NIT is estimated to *lower* profits for very small firms by 61.6%, increase profits for slightly larger firms by 40.8%, but then *lower* profits for firms with 6 or more workers in the top tercile of capital stock, by 54.6%.

We also try using our instrumental variable on these subgroups. MLE had trouble converging in these small samples with many controls, so we report 2SLS results. Table 6 shows that the first-stage instrument relevance condition only holds for the subgroup of mid-sized firms. The first-stage *F*-statistic is only 0.60 for the smaller group and 0.84 for the larger group. For the mid-sized firms, where the instrument is relevant, the 2SLS estimate is 1.49 (with a *p*-value of 0.056), approximately equal in magnitude to the 2SLS estimate for the full sample. Thus the 2SLS appears to only be picking up the treatment effect for mid-sized firms.

What explains this possible nonlinear relationship between formality and profitability? The explanation for very small firms is clear. These firms are too small to immediately benefit from formalization. Registering for taxes immediately involves more costs in the form of tax payments, but these firms are too small to benefit from increased customer base or better access to credit. However, if these firms plan on growing over time, the current cost of formalizing may be justified in terms of the anticipated future benefits. Consistent with this, we find the firm owners who are formal at this small size to be of much higher ability. Firms who are formal in the middle size group (2 to 5 workers and the middle tercile of capital stock) are big enough to enjoy some of the benefits of formalizing, and tax registration increases profits for this group. The mid-sized formal firm owners are still of higher ability than those who remain informal. Nevertheless, it is for this subgroup where distance to the tax office appears to influence the decision to register, and thus where the 2SLS/MLE estimates pick up the effect.

A new insight from this work concerns the somewhat larger firms – those with 6 or more workers and in the top tercile of capital stock. The propensity score matching estimate shows a large and statistically significant *negative* effect of tax formality on profits for this group of firms. The firm owners who have managed to get to this size and remain informal have higher entrepreneurial self-efficacy than firm owners of this size with registered firms. These firms have likely figured out ways to avoid inspections and access many of the potential benefits of formality, without having to pay taxes.¹³ Only 25% of these larger informal firms received a visit by tax inspectors in 2006, compared to 77% of formal firms of the same size.

Our finding that the owners of larger informal firms have higher entrepreneurial ability than owners of larger formal firms is in contrast to the prediction of Rauch (1991), that smaller and informal businesses are more likely to be run by less-talented entrepreneurs. In

his model, enforcement only occurs for larger firms, and more talented entrepreneurs are endogenously allocated to bigger firms, where they are compensated for the costs of regulation. However, in practice, the talent of an entrepreneur may also affect his or her ability to evade enforcement. In this case, more talented entrepreneurs may have more incentive to stay informal – consistent with what we see here.

This heterogeneity in the effect of tax registration seems a likely explanation for the differences in the effect of a NIT over the different methods. OLS averages the effect of a NIT over all firm sizes: the smaller and larger firms who have negative effects, and the middle-sized group of firms who have positive effects. As a result, the average over all these groups is close to zero. Propensity-score matching places more weight on the firms in the middle size group, since these firms are more likely to have similar propensity scores. The MLE and 2SLS estimates will estimate the effect for firms at the margin of becoming formal, for whom information and travel costs make a difference. These are unlikely to be the very small or largest firms (as evidenced by the lack of first-stage relevance when considering only these subsamples), but rather a subset of the middle-sized group, for whom the gains to formality are very high indeed.

5.5. How does having a NIT change profits?

Our treatment effects regression has found effects of a NIT on profits for some firms. In Table 7 we explore several avenues through which a NIT may change profits. Maximum-likelihood treatment effects regressions using log distance to the tax office as an instrument for a NIT are used, with our standard set of control variables, including firm size.

First and foremost, the main cost of registering for taxes is that we would expect firms with a NIT to be more likely to be paying taxes. The first column of Table 7 shows this to be the case. Firms with a NIT are much more likely to pay taxes. However, column 2 shows that they are not significantly more likely to be paying a larger share of their profits as taxes, which may reflect the noisiness in reporting of taxes and profits, or differences among firms in the share of profits they report to tax authorities.

The main benefit of a NIT according to the firms themselves is the ability to attract more customers by issuing tax receipts. Columns 3 and 4 of Table 7 provide evidence for this positive effect. Having a NIT results in higher sales, and a greater likelihood of issuing tax receipts. This increase in customers is not coming through more contracting with the government, multinationals, or large firms: 97% of our firms make no sales to any of these entities. Further suggestive evidence of more customers is seen through industry-specific questions asked to firms in grocery sales and transportation. Grocery firms with a tax number are 19 percentage points less likely to have many periods during the day without customers than firms without a tax number, controlling for firm size and firm and owner characteristics. Transport firms with a tax number spend a larger share of each day with customers and less time idle.

Another often-discussed potential benefit of formality is better access to credit (e.g. Straub (2005)). However, Table 7 shows no significant

¹³ It is possible that the owners of these larger firms also have better political connections. Our data does not allow us to explore this possibility.

effect of a NIT on the use of trade credit, the provision of working capital from suppliers or customers, and on the likelihood of having a bank loan. There are two likely reasons for this lack of effect. The first is that only a minority of firms use the financial system. Access to credit for many firms is a significant issue, with 56% of firms saying the procedures for accessing credit are a medium or very severe obstacle to their growth, and 67% saying the cost of credit is a medium or very severe obstacle to their growth. Secondly, our focus groups and country discussions suggest that when Banks do decide to grant credit, they are not concerned with the tax status of a firm, and if anything, are just concerned with whether or not they have a municipal license.

A final way in which being registered may increase profits is by lowering the costs of corruption. Only 2% of firms give this as the major benefit of having a NIT. Nevertheless, the last column of Table 7 shows a sizeable, although not quite significant ($p = 0.128$), effect of having a NIT on whether a firm believes corruption is a constraint to their business growth. There is therefore some suggestive evidence for this channel operating.

6. Conclusions

Profit-maximizing firms will choose whether or not to formalize according to whether or not doing so increases their profitability. This provides a challenge for identifying the impact of formality on profits, since firms self-select into formality status. However, similar firms which have different access to information about formalizing may end up with different formality status, even though they have the same net benefits from formalizing. As a result, we can estimate the impact of registering for taxes on firms for whom the choice to formalize is affected by their distance to the tax office. We find large effects of registering for taxes on the profits of these firms, with the effects appearing to come mainly through increases in their customer base.

However, we also find some suggestive evidence that the effect of formalizing differs across firms. While there is a group of firms which can benefit from formalizing, formality lowers profits for very small firms – who are too small to benefit – and for the larger firms in our sample. Firm owners with enough ability to grow their firm to a size of six workers or more and achieve a reasonably large capital stock would have lower profits from formalizing – they would pay more taxes, but are already able to reach a large customer base without formalizing.

The irony then is that registering for taxes would seem to benefit most the informal firms who don't know how to formalize. Conceptually, those who are informal by choice will expect lower profits from formalizing otherwise they would be formal, whereas those who are informal due to ignorance of the procedures needed to formalize stand to benefit from learning how to. Consequently, the results of this study highlight the need for better information

provision by Governments to induce firms at the margin to formalize. They also suggest the need for policies which target the high ability owners of larger informal firms, through providing more benefits of formality and tighter enforcement.

References

- Abadie, Alberto, Drukker, David, Herr, Jane, Imbens, Guido, 2004. Implementing matching estimators for average treatment effects in stata. *Stata Journal* 4 (3), 290–311.
- Bruhn, Miriam. 2006. "License to sell: the effect of business registration reform on entrepreneurial activity in Mexico." Mimeo. Cambridge, Mass.: MIT.
- De Mel, Suresh, McKenzie, David and Woodruff, Christopher, 2008. "Measuring Micro-enterprise Profits: Don't ask how the sausage is made", *Journal of Development Economics*, forthcoming.
- Encuestas y Estudios, 2007. Informe Estudio Cualitativo: Informalidad y Productividad. (Qualitative Study Report: Informality and Productivity), Report submitted to the World Bank, February 2007.
- Farrell, Diana, 2004. The hidden dangers of the informal economy. *The McKinsey Quarterly* (Number 3). http://www.mckinseyquarterly.com/article_page.aspx?ar=1448&l2=7&l3=10&srId=6&gp=1.
- Fajnzylber, Pablo, Maloney, William, Rojas, Gabriel Montes, 2006a. Releasing constraints to growth or pushing on a string? The impact of credit, training, business associations and taxes on the performance of Mexican micro-firms. World Bank Policy Research Working Paper No. 3807. Washington, D.C.
- Fajnzylber, Pablo, Maloney, William, Rojas, Gabriel Montes, 2006b. Does formality improve micro-firm performance? Quasi-Experimental Evidence from the Brazilian SIMPLES program.
- Gibson, John, McKenzie, David, 2007. Using the Global Positioning System (GPS) for better economics and better policy. *World Bank Research Observer* 22 (2), 217–241.
- Imbens, Guido, Angrist, Joshua, 1994. Identification and estimation of local average treatment effects. *Econometrica* 62 (2), 467–475.
- Kaplan, David, Piedra, Eduardo, and Seira, Enrique, 2006. "Are Burdensome Registration Procedures an Important Barrier on Firm Creation? Evidence from Mexico." Mimeo. Washington, D.C.: World Bank.
- Katayama, Hajime, Lu, Shihua and Tybout, James, 2006. "Firm-level productivity studies: Illusions and a Solution", Mimeo. Pennsylvania State University.
- Loayza, Norman, 1996. The economics of the informal sector: a simple model and some evidence from Latin America. *Carnegie-Rochester Conference Series on Public Policy* 45, 129–162.
- Maloney, William, 2004. Informality revisited. *World Development* 32 (7), 1159–1178.
- Maloney, William 2006. "Informality Deconstructed", Mimeo. World Bank.
- McKenzie, David, Woodruff, Christopher, 2006. Do entry costs provide an empirical basis for poverty traps? Evidence from Mexican microenterprises. *Economic Development and Cultural Change* 55 (1), 3–42.
- Monteiro, Joana and Assunção, Juliano, 2006. "Outgoing the shadows: estimating the impact of bureaucracy simplification and tax cut on formality and investment." Mimeo. PUC Rio.
- Perry, Guillermo, Maloney, William, Arias, Omar, Fajnzylber, Pablo, Mason, Andrew, Saavedra, Jaime, 2007. Informality: Exit and Exclusion. *World Bank Latin America and Caribbean Studies*. World Bank, Washington D.C.
- Rauch, James, 1991. Modeling the informal sector formally. *Journal of Development Economics* 35 (1), 33–47.
- Schneider, Friedrich, Enste, Dominik, 2000. Shadow economies: size, causes and consequences. *Journal of Economic Literature* 38 (1), 77–114.
- Straub, Stéphane, 2005. Informal sector: the credit market channel. *Journal of Development Economics* 78 (2), 299–321.
- World Bank (2007) Setting Bolivia's Course on the Road to Formality, Mimeo. The World Bank.