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Greasing the wheels of entrepreneurship?: the impact of regulations and corruption on firm entry

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GREASING THE WHEELS OF ENTREPRENEURSHIP? THE IMPACT OF REGULATIONS AND CORRUPTION ON FIRM ENTRY

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GREASING THE WHEELS OF ENTREPRENEURSHIP? THE IMPACT OF REGULATIONS AND CORRUPTION ON FIRM ENTRY

Abstract

The paper investigates whether the impact of regulations on entrepreneurship depends on corruption. We first test whether regulations robustly deter firm entry into the markets. Our results show that some regulations are indeed important determinants of entrepreneurial activity. Specifically, more procedures required to start a business and larger minimum capital requirements are detrimental to entrepreneurship. Second, we test whether corruption reduces the negative impact of regulations on entrepreneurship in highly regulated economies. Our empirical analysis for a maximum of 43 countries over the period 2003-2005 shows that corruption is beneficial in highly regulated economies. At the maximum level of regulation among our sample of countries, corruption significantly increases entrepreneurial activity. Our results thus provide support for the ‘grease the wheels’ hypothesis.

JEL Code: D73, F59, M13, L26.

Keywords: corruption, start-ups, grease the wheels, entrepreneurship, regulation, doing business.

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1. Introduction

The level of entrepreneurship and, especially, the number of firm start-ups are in the focus of most governments around the world. In order to be able to set a policy agenda which is successful in promoting entrepreneurial activity it is necessary to understand the determinants of this phenomenon. While the characteristics that shape the individual decision to become self-employed are already well understood (e.g., Parker 2004, Grilo and Irigoyen 2006) the determinants of the large differences on the country level are yet not fully explored. According to previous surveys of the literature (OECD 1998, Havrylyshyn 2001), greater entrepreneurial activity is fostered by, among others, the availability of credit and venture capital, solid laws and well-defined property rights, good political and economic institutions, and efficient regulation of the economy.

While the impact of strict regulations on entrepreneurial activity has been subject to previous research, hypotheses have mostly been tested in an ad hoc manner – in models lacking potentially relevant control variables, thus likely implying biased results. In depth tests for robustness are lacking. As our first contribution to the literature, we thus develop a robust empirical model of the determinants of entrepreneurial activity. Specifically, we employ two state of the art techniques in order to test whether regulations robustly affect the entry of firms into the market. First, we focus on a cross-section of up to 35 countries employing the Bayesian Averaging of Classical Estimates (BACE) as developed by Sala-i-Martin et al. (2004). We then turn to a panel of 43 countries and employ Extreme Bounds Analysis (EBA) as proposed by Leamer (1983), Levine and Renelt (1992) and Sala-i-Martin (1997).

Clearly, the impact of regulations on entrepreneurial activity is likely to depend on the quality of a country's institutions. As our main contribution to the literature, we therefore analyze whether and to what extent corruption – as one key feature of a country's institutional quality – affects the impact of regulations on entrepreneurship. The question of whether corruption might grease the wheels of an economy has frequently been investigated in the context of economic growth. Routine corruption may well be efficiency enhancing. As Leff (1964: 11) puts it: "If the government has erred in its decision, the course made possible by corruption may well be the better one." Corruption may also 'grease the wheels' in rigid public administrations. As Huntington (1968: 386) notes: "In terms of economic growth, the only thing worse than a society with a rigid, over-centralized, dishonest bureaucracy is one with a rigid, over-centralized, honest bureaucracy." Corruption might be a means to achieve certain benefits which make work in the official economy easier, e.g., winning a contract from a

public authority, getting a licence (e.g. for operating taxes or providing other services or getting the permission to convert land into “construction ready” land, etc.). However, the majority of the literature finds no evidence in favour of the greasing the wheels hypothesis (e.g. Wei 1999).¹ Arguably, while it might be difficult finding corruption, overall, to increase economic growth, focusing on entry of firms instead might change the verdict. In this paper we thus empirically analyze whether corruption affects the impact of strict regulations on entrepreneurial activity. As our measure of corruption we employ two different datasets provided by Transparency International and the World Bank. Data on regulation is taken from the World Bank’s Doing Business Database and the Economic Freedom Index developed by the Fraser Institute.

To anticipate our results, we find that – on average – more procedures required to start a business and larger minimum capital requirements robustly reduce the number of entrepreneurs entering the market. However, corruption seems to reduce the negative impact of regulations on firm entry. That is, we find evidence in favour of the ‘grease the wheels’ hypothesis.

We proceed as follows. The next section reviews the previous cross-country evidence on the determinants of entrepreneurial activity – the variables identified there will be employed in the empirical analysis. Section 3 develops our main hypothesis on the interaction between regulations and corruption, while our data are described in section 4. In section 5, we test whether regulations robustly affect firm entry; section 6 tests our main hypothesis. The final section concludes.

2. The Previous Literature

The empirical literature on the determinants of entrepreneurship focuses on four broad categories of determinants: economic, personal, social/cultural, and institutional. Among the economic variables included in the vast majority of previous empirical specifications, GDP per capita features most prominently. However, whether per capita GDP indeed affects entrepreneurship is still unsettled. According to Ovaska and Sobel (2004), there is no significant impact on the number of new enterprises per 1000 inhabitants. To the contrary, Parker and Robson (2004) and Fisman and Sarria-Allende (2004) show that per capita GDP increases entrepreneurship. Still others report GDP per capita to reduce entrepreneurial

¹ Mauro (1995), for example, investigates the impact of corruption on economic growth for separate samples of high and low red tape countries. His results show no evidence in favour of a beneficial effect of corruption. Méon and Sekkat (2005) find some evidence that corruption even sands the wheels of the system (instead of greasing it). Specifically, Méon and Sekkat show that the negative impact of corruption on economic growth becomes worse when indicators of the quality of governance deteriorate.

activity (van Stel et al. 2003, Nooederhaven et al. 2004, Bjørnskov and Foss 2006, Wennekers et al. 2007). Van Stel et al. (2003), however, find nascent entrepreneurship to be more prevalent with the square of per capita GDP, suggesting a u-shaped relationship. The u-shaped impact of per capita GDP on entrepreneurship is confirmed in Verheul et al. (2004), with an implied turning point of around 26,000 US\$. As potential explanation, development might be accompanied by raising real wages, in turn raising the opportunity costs for self-employment. From a certain level of development, the service sector gains importance, favoring entrepreneurship.

Other economic variables discussed as potential determinants of entrepreneurship comprise inflation, taxes, and foreign direct investment. Ovaska and Sobel (2004), for example, show that inflation significantly reduces nascent entrepreneurship. According to Parker and Robson (2004) self-employment significantly increases with the average income tax rate. Van Stel et al. (2003), however, do not find a significant effect of tax revenue on nascent entrepreneurship. Surprisingly, foreign direct investment does not seem to robustly affect domestic entrepreneurship, and the same has shown to be true for unemployment (van Stel et al. 2003, Ovaska and Sobel 2004, Nooederhaven et al. 2004, Parker and Robson 2004, Wennekers et al. 2007).² Interestingly, high unemployment benefits seem to reduce self-employment as they raise the opportunity costs for self-employment (Wennekers et al. 2007).

Finally, the importance of credit availability for nascent entrepreneurship has been stressed as early as in Schumpeter (1911) and Knight (1921). Empirical evidence is provided in Ovaska and Sobel (2004), and Stephen et al. (2004). Specifically, Stephen et al. show that when lenders give priority to secured creditors in developing countries, nascent entrepreneurship is significantly more prevalent. Ovaska and Sobel find credit availability to robustly increase the number of new enterprises per 1000 capita.

A second strand of the empirical literature investigates the personal characteristics of entrepreneurs. According to Grilo and Thurik (2005), for example, badly educated men are more likely to be self-employed. Perceived administrative barriers reduce the likelihood of being self-employed, while individual risk tolerance and the perceived lack of financial support do not seem to matter. Based on country-level data, Wennekers et al. (2007) show that education and the age structure of the population do not robustly matter for self-employment. Uhlaner and Thurik (2007), to the contrary, find entrepreneurial activity to decline with secondary education, but to increase with tertiary education. The authors' explanation for this finding is that more widespread secondary education reduces the need for

² However, Verheul et al. (2004) report entrepreneurial activity to decline with rising unemployment.

self-employment, while higher levels of tertiary education increase the pool of potential entrepreneurs that favor both the human capital requirement for self-employment as well as non-monetary rewards such as greater autonomy and greater self-fulfillment.

A third group of variables broadly relates to social and cultural characteristics. According to Nooederhaven et al. (2004) and Parker and Robson (2004), the female share in labour significantly reduces the rate of self-employment in a sample of 15 countries over the period 1978-2000.³ This can be explained by the well documented psychological results that women are in general less likely to become self-employed. As Nooederhaven et al. also show, people more satisfied with their lives and those more satisfied with democracy are significantly less likely to be self-employed. However, Uhlaner and Thurik (2007) report the exact opposite. According to their cross-section analysis for 27 countries, life satisfaction significantly increases entrepreneurial activity. Verheul et al. (2004) find life satisfaction not to be among the significant determinants of entrepreneurial activity. Their evidence points to the importance of family values instead. Wennekers et al. (2007) show that a society's tolerance for uncertainty and ambiguity increases the rate of self-employment significantly. According to Freytag and Thurik (2007), the preference for becoming self-employed is higher with shorter life expectancy and less spending on health care.

Finally, parts of the previous literature investigate whether and to what extent sound institutions and the degree of regulation prevents or promotes entrepreneurial activity. The reminder of this section focuses on the impact of institutions on entrepreneurship.

Ovaska and Sobel (2004) and Bjørnskov and Foss (2006) investigate the impact of economic freedom on entrepreneurial activity. Arguably, the degree to which a country's government intervenes in the economy via its consumption, redistributions, and taxation, among others, is likely to set important ground for entrepreneurship. However, Ovaska and Sobel do not find economic freedom to determine the number of new enterprises per 1000 inhabitants in a sample of 10 countries over the period 1995-2000. To the contrary, the cross-sectional analysis in Bjørnskov and Foss (2006) shows that the size of the government significantly reduces entrepreneurial activity, while the provision of sound money increases entrepreneurship. The quality of the legal system, restrictions on international trade, and regulations do not significantly affect entrepreneurial activity. Ovaska and Sobel (2004) also report that import tariffs do not significantly affect nascent entrepreneurship. Employing the

³ Verheul et al. (2004), to the contrary, do not find a significant impact of the female labour share on entrepreneurial activity. According to Wennekers et al. (2007), the significance of the female labour share depends to some extent on how the model is specified.

same data as Bjørnskov and Foss, Freytag and Thurik (2007) show that the degree of regulation significantly diminishes entrepreneurial activity.

Desai et al. (2003) and Stephen et al. (2004) draw on data about regulations at the country level recently provided by the World Bank. The World Bank measures, among others, the number of procedures required to start a company and those required to enforce a contract. According to the results in Stephen et al. and (the overall sample of) Desai et al., entry barriers do not robustly affect nascent entrepreneurship – a result also reported in van Steel et al. (2003). This is contrary to Klapper et al. (2004), also drawing from the World Bank database, and showing the costs of entry (measured as costs, number of procedures and, respectively, cost and time to enter) to reduce the fraction of new firms significantly. While these studies employ different dependent variables – so their results can not directly be compared – the difference in regression outcomes might be due to the methodological refinement in Klapper et al., taking the fraction of new firms entering the US market as proxy for ‘natural entry barriers’ into account. Similarly, and also on the industry level, Fisman and Sarria-Allende (2004) show entry regulation multiplied with US firm turnover to significantly reduce the number (and growth rate) of firms. Splitting their overall sample, Desai et al. (2003) confirm their result for the overall sample when focusing on Eurozone countries only, while – surprisingly – the number of procedures required to start a firm significantly increases entry rates in Central and Eastern European countries. According to Stephen et al. (2004), the number of procedures required to enforce a contract significantly increase market entry rates, while its square significantly prevents entry. Similarly, Ciccone and Papaioannou (2006) show that government entry procedures reduce entry in industries experiencing expansionary global demand and technology shifts.

Desai et al. (2003) consider a range of additional institutional variables as potential determinants of firm entry rates. Their results show that institutional variables are important determinants of entry in Central and Eastern European (CEE) countries, but less so in countries belonging to the Eurozone. Specifically, entry rates in CEE countries rise significantly with less formalism, fewer interference of courts, better protection of property rights, and lower values of an industrial relations labor law index. Only the results regarding interference of courts and industrial labor laws also prevail in the overall sample.

In their firm-level analysis for 9 countries, Scarpetta et al. (2002) confirm the importance of regulations for entrepreneurship. They show entry rates to be significantly lower with stricter administrative regulations and stricter sector specific product market regulations.

Post communist countries have been hypothesized to exhibit significantly smaller levels of entrepreneurship while – at the same time – experiencing greater growth rates, as private economic involvement has been suppressed under communism. Empirical results on the impact of entrepreneurship are, however, inconclusive. Van Stel et al. (2003), Verheul et al. (2004), and Freytag and Thurik (2007) report entrepreneurship to be less prevalent in former communist countries, while Bjørnskov and Foss (2006) do not find a significant impact of former communism on total entrepreneurial activity.

Turning to our institutional variable of primary interest – corruption – Desai et al. (2003) show that firm entry rates are not significantly affected by corruption in their overall sample and the Eurozone, while corruption significantly reduces entry in Central and Eastern European countries. Ovaska and Sobel (2004) find corruption to significantly reduce the number of new enterprises (per 1000 capita).

To summarize, the previous literature stresses the importance of a country's economic, social/cultural, and institutional peculiarities, as well as personal characteristics of (potential) entrepreneurs. Most important given the focus of this paper, the literature points to the importance of institutional quality and regulations for the degree of entrepreneurial activity. Whether and to what extent the variables proposed in the previous literature robustly affect entrepreneurship in our sample of countries will be investigated further below.

3. The Hypothesis

According to public choice theory, special interest groups benefit from particular government actions – at the cost, however, of overall efficiency and well-being (Stigler 1971). As the benefits for each individual of a small lobbying special interest group are huge, whereas the costs to the average member of society are rather small, government sizes become larger and larger as politicians maximize their re-election probabilities. According to classical economic theory, to the contrary, the state remedies market failures by producing important public goods (Musgrave 1959), levying Pigouvian taxes (Pigou 1928), and providing institutional frameworks without which the markets would not work efficiently or not function at all (Blankart 2003). While according to the Public Choice view, therefore, regulation is acquired by industries and designed in their benefit, the Public Interest perspective implies that regulation is required to reduce inefficiencies and achieve socially optimal outcomes.

Arguably, depending on which view about regulation holds when confronted with reality, regulations are either beneficial or harmful and, consequently, ways to overcome those regulations would be welcome, or not. Clearly, one way to circumvent regulation is by bribing

officials. In corrupt countries, officials can easily be bribed to issue permits, potentially facilitating entrepreneurial activity and – in particular – firm entry into the market. Corruption might be considered as the ‘speed of money’ which considerably reduces the slow-moving queues in public offices. The grease the wheels hypothesis features prominently in the early economics literature on the effects of corruption (e.g. Leff 1964, Leys 1965, Huntington 1968). Beck and Mahler (1986) and Lien (1986) proposed corruption to increase efficiency. This is because inefficient regulations constitute an impediment to investment that can be overcome by bribing bureaucrats.

Méon and Sekkat (2005) summarize the arguments brought forward in favour of the ‘grease the wheels’ hypothesis. First, corruption can increase the speed with which bureaucrats issue permits. Bribes thus serve the function to give incentives to bureaucrats to speed up the process (Leys 1964, Lui 1985). Méon and Sekkat quote Huntington (1968) arguing corruption to speed up railroad, utility, and industrial corporation construction, resulting in higher growth.

Second, corruption might improve the quality of civil servants (Leys 1965, Bailey 1966). This is because inefficiently low wages are supplemented by graft, increasing the attractiveness of jobs in the administration, in turn increasing the quality of civil servants.⁴

Third, licenses might be allocated more efficiently when the most efficient firm can pay the highest bribe (Leff 1964, Beck and Mahler 1986, Lien 1986).

In summary, graft may be a hedge against bad public policy – in particular when institutions are biased against entrepreneurship (Méon and Sekkat 2005).

Clearly, the empirical literature on corruption has established a negative impact of corruption on economic growth (e.g. Dreher and Herzfeld 2005, Méon and Sekkat 2005).⁵ This seems to be inconsistent with the grease the wheels hypothesis. However, as Méon and Sekkat (2005) point out, the negative impact of corruption on growth per se is not inconsistent with the hypothesis. According to the grease the wheels hypothesis, corruption is not on average beneficial, but only when regulation is excessive. Moreover, corruption might affect growth via various channels. For example, corrupt officials might create distortions to preserve their illegal income (Kurer 1993). Firms may be able to pay the highest bribe, and thus get some contract, just because it compromises on the quality of the product (Rose-

⁴ Focusing on the Ukraine, Gorodnichenko and Sabirianova Peter (2007) find that although public sector employees receive approximately 30% lower wages as compared to those in the private sector their level of consumer expenditures and asset holdings is essentially identical.

⁵ There are, however, exceptions. As Glaeser and Saks (2006) show for the US, the negative relationship between corruption and economic growth of states disappears once state characteristics are accounted for.

Ackerman 1997). Corruption might increase uncertainty, thereby increasing risks (Campos et al. 1999). Economic growth would consequently deteriorate. Even if, overall, the negative effect of corruption prevails, the true test is whether corruption helps circumventing strict regulations. Even if the overall impact of corruption on growth is negative, it may still increase, for example, entrepreneurial activity that is suppressed by rigid regulations.

The ‘grease the wheels’ hypothesis has previously found support in empirical research. According to Meón and Weill (2006), corruption reduces aggregate efficiency in countries where institutions are effective, but increases efficiency when institutions are ineffective.⁶ Moreover, the cross-industry analysis of Klapper et al. (2004) provides preliminary evidence that regulatory barriers to firm entry do not adversely affect entry in corrupt countries, while they do in less corrupt ones.

We therefore hypothesize:

Hypothesis: Corruption increases firm entry rates in the presence of administrative barriers to entry.

4. Data

Our definition of entrepreneurship follows Wennekers and Thurik (1999: 46-47), defining entrepreneurship as “the manifest ability and willingness of individuals” to perceive new economic opportunities and seizing these opportunities into the market in the face of uncertainty. We use data provided by the Global Entrepreneurship Monitor (GEM). The GEM dataset contains survey-based annual data on early-stage entrepreneurial activity for 43 countries since 2001.⁷ The surveys in the different countries are generally conducted by local university institutes. Representative samples of at least 2,000 individuals are annually drawn for each country. The detailed list of partner institutions and the number of people interviewed as well as more details on these interviews is available in Minniti et al. (2005, p. 4-8 and p. 57, respectively). We focus on nascent entrepreneurial activity defined as the percent of the adult population who are nascent entrepreneurs. “Nascent entrepreneurs are those individuals, between the ages of 18 and 64 years, who have taken some action toward creating a new

⁶ The efficiency-enhancing view of corruption has, however, also been criticized (see, e.g. Tanzi 1998, Rose-Ackerman 1999, Kaufmann and Wei 2000, Dal Bó and Rossi 2006). Kaufman and Wei (2000) report that multinational firms paying more bribes also spend more time negotiating with foreign country officials, contradicting the grease the wheels hypothesis. Using firm-level data, Dal Bó and Rossi (2006) show that electricity distribution firms in Latin America are more inefficient in countries with high levels of corruption.

⁷ The EIM Public Knowledge Web on SMEs and Entrepreneurship provides the dataset at <http://data.ondernemerschap.nl/webintegraal/userif.aspx>.

business in the past year.⁸ To qualify for this category, individuals must also expect to own a share of the business they are starting and the business must not have paid any wages or salaries for more than three months” (Minniti et al., 2005, p.16).

Turning to the explanatory variables used in the empirical analysis below, one central set of variables refers to regulation. As we focus in particular on the regulations of starting a business, we incorporate the following four variables in our empirical analysis (taken from the Doing Business Dataset provided by the World Bank):⁹ the number of procedures required to start a new business, the number of days required to start a new business, the costs of starting a new business and the minimum capital required to start a new business. The data are available for 175 countries from 2003 onwards. The data focus on start-ups of limited liability companies owned by five local nationals and operating in the respective country’s largest city. Procedures are defined as any interaction between the founders and external parties necessary to complete the start-up process. The number of required procedures ranges between 2 and 19. The days required to start a business capture the median duration that incorporation lawyers indicate to be necessary to complete the founding process. This measure ranges from 2 to 168. The costs of a business start-up are measured as a percentage of the country’s income per capita. Only official costs are recorded which guarantees that there is no direct relation to our corruption measures. The data range for this variable is 0 to 147. The minimum capital required to start a business is the amount that the entrepreneur needs to deposit in a bank before registration starts. It is also measured in percent of the country’s income per capita, ranging between 0-947.

In addition to these four indices we employ the subindex on regulations included in the Economic Freedom Index developed by Gwartney and Lawson (2006). The index ranges from 0-10, with 10 showing higher values of economic freedom on the original scale. We reverse the index in order to ensure that our regulation measures all point into the same direction: higher numbers indicate stricter regulations. The index covers credit market regulations, labour market regulations, and business regulations, employing a wide range of variables (including some of the measures of regulations we use here).

To measure corruption, we employ two well-known and widely used indices. The first indicator is provided by Transparency International (TI), ranging from 0 to 10. The second index is from the World Bank’s ‘governance matters’ database (Kaufmann et al. 2006) with

⁸ The exact question the respondent has to answer is: “Over the past twelve months have you done anything to help start this new business, such as looking for equipment or a location, organizing a start-up team, working on a business plan, beginning to save money, or any other activity that would help launch a business?” (<http://www.gemconsortium.org/download.asp?fid=410>).

⁹ The data is available at <http://www.doingbusiness.org/>.

values between -2.51 and 1.71. We rescaled the two indices, so that higher values represent more corruption.

Our selection of control variables follows the literature review of section 2. All variables with their sources are presented in Appendix 2, while Appendix 3 shows the countries included in our sample. Note that not all variables previously used in the literature could be incorporated in our panel set-up due to missing observations.

5. Do regulations prevent entry?

Before we turn to testing whether corruption affects the impact of regulations on firm entry, we analyze whether regulations robustly affect firm entry in the first place. We pursue two strategies. First, we use the BACE approach proposed by Sala-i-Martin et al. (2004) for two cross-sections covering the years 2004 and 2005.¹⁰ This approach builds on Bayes' rule describing an update of probabilities enabled by additional information. In the context of regression analysis this is done employing the relevant goodness of fit statistics. If a particular model is supported by the data then its posterior probability will be higher than the prior probability. We use the simplest prior possible for our approach: all variables have a priori the same probability of being included in the model. This has the advantage that we do not need to a priori specify the functional form of the model. The only variable we have to choose is the number of variables we expect to be included in the model a priori. Looking at the existing literature, 5 variables seem to be a reasonable choice. As the BACE approach in principle allows testing the probability of models with just one variable as well as models including all possible variables at once an enormous set of different combinations arises. The results are based on approximately 13 million regressions. We report the results for all our measures of regulation in Table 1. Additionally we include the control variables that are most commonly used in the literature: GDP per capita and its square and a dummy variable for countries with communist history. The criterion for a variable to be considered as robust is a posterior inclusion probability higher than the prior probability. The prior probability is given by the number of parameters considered to be in the model (in our case 5) divided by the total number of variables to be tested. This critical value is included in the table.

As can be seen, not one of the variables typically used in previous cross-section analyses passes the test for both cross-sections. Focusing on the 2004 data, lagged GDP per capita and its square, as well as minimum capital required to start a business robustly affect

¹⁰ Note, that we can not report results for the year 2003 as there are not enough observations available for the BACE procedure.

entrepreneurship. Using data for the year 2005, however, shows that the dummy for communist history is the only robust determinant. We conclude that the small number of observations included in the two cross-sections makes drawing reliable inferences almost impossible. To increase the number of observation, employing panel data for the analysis of entrepreneurship is inevitable.

Table 1: BACE results

	2004		2005	
	Posterior Inclusion probability	Posterior mean	Posterior Inclusion probability	Posterior mean
Lagged GDP per capita	0.464	-0.0003	0.206	-3.51E-05
Lagged GDP per capita squared	0.464	5.77E-09	0.206	4.27E-10
Dummy for communist history	0.108	0.0982	0.939	-5.5052
Procedures required to start a business	0.169	-0.0425	0.116	-0.0134
Days required to start a business	0.162	-0.0045	0.085	-0.0003
Costs of starting a business	0.151	0.0058	0.089	0.0031
Minimum capital required to start a business	0.558	-0.0183	0.137	-0.0005
Economic Freedom regulation subindex	0.098	-0.0250	0.266	-0.2555
Countries	31		35	
Total number of variables	15		16	
Critical prior probability	0.333		0.313	

Notes: Posterior Inclusion probability measures the probability that a given variable belongs in the model using a goodness of fit measure similar the Schwartz Information criterion. The Posterior mean gives the average coefficient of the approximately 13 million regressions conditional on the inclusion of the respective variable. The critical prior probability is 5 (the number of coefficients believed to belong in the model) divided by the total number of tested variables.

As one major drawback of BACE, however, a balanced data sample is needed. Since not all variables proposed in the previous literature are available for all years and countries, our panel data are unbalanced. Still, we also want to test the robustness of the impact of regulations on firm entry exploiting the time-series variation in the existing data. This dimension has completely been neglected in the previous literature, even though the panel structure of the data allows a substantial increase in the number of degrees of freedom. While it seems that the

small number of observations included in the cross-section makes reliable statistical analysis infeasible, we can still test whether a robust model emerges when panel data are used.

Since employing the BACE method for our panel data is infeasible, we use Extreme Bounds Analysis (EBA) instead as our second strategy to test whether regulations robustly affect entrepreneurship. The EBA has been proposed by Leamer (1983) and Levine and Renelt (1992) and enables us to examine which explanatory variables are robustly related to our entrepreneurial measure. EBA has been widely used in the economic growth literature. The central difficulty in this research – which also applies to the research topic of the present paper – is that several different models may all seem reasonable given the data but yield different conclusions about the parameters of interest. The EBA can be exemplified as follows. Equations of the following general form are estimated:

$$Y = \beta_M M + \beta_F F + \beta_Z Z + \nu \quad (1)$$

where Y is the dependent variable, M is a vector of commonly accepted explanatory variables and F is a vector containing the variables of interest. The vector Z contains up to three possible additional explanatory variables (as in Levine and Renelt 1992) which, according to the previous literature, are related to the dependent variable. The error term is ν . The EBA test for a variable in F states that if the lower extreme bound for β_F – i.e., the lowest value for β_F minus two standard deviations – is negative, while the upper extreme bound for β_F – i.e., the highest value for β_F plus two standard deviations – is positive, the variable F is *not* robustly related to Y .

As argued by Temple (2000), it is rare in empirical research that we can say with certainty that one model dominates all other possibilities in all dimensions. In these circumstances, it makes sense to provide information about how sensitive the findings are to alternative modelling choices. The EBA provides a relatively simple means of doing exactly this. Still, the EBA has been criticized in the literature. Sala-i-Martin (1997) argues that the test applied in the Extreme Bounds Analysis poses too rigid a threshold in most cases. If the distribution of β has some positive and some negative support, then one is bound to find at least one regression for which the estimated coefficient changes sign if enough regressions are run. We will therefore not only report the extreme bounds, but also the percentage of the regressions in which the coefficient of the variable F is significantly different from zero at the 5 percent level. Moreover, instead of analyzing just the extreme bounds of the estimates of the coefficient of a particular variable, we follow Sala-i-Martin's (1997) suggestion to analyze the entire distribution. Following this suggestion, we not only report the unweighted parameter estimate of β and its standard deviation but also the unweighted cumulative distribution

function (CDF-U), i.e. the fraction of the cumulative distribution function lying on one side of zero. We will base our conclusions on the Sala-i-Martin variant of the EBA. In line with Sala-i-Martin a variable is considered to be robustly related to nascent entrepreneurship if the CDF-U value is greater or equal to 0.9.

Another potential objection to the EBA is that the initial partition of variables in the M and in the Z vector is likely to be arbitrary. However, as pointed out by Temple (2000), there is no reason why standard model selection procedures cannot be used in advance to identify variables that are particularly relevant.

Arguably, some variables are included in the large majority of previous empirical studies and are by now common in this branch of the literature. The most commonly used variables are per capita GDP and its square, and a dummy that is one for post-communist countries. These variables did each also pass the critical threshold in one of the robustness tests reported above.

In addition to these three variables our EBA includes the regulation measures introduced above one at the time. The remaining variables, as described in Appendix 1 (and motivated in section 2) enter in combinations of up to three variables. We estimate the regressions using OLS with errors corrected for panel-level heteroskedasticity (panel-correct standard errors, see Beck and Katz, 1996). We also correct for first-order autocorrelation AR(1) of the error term within panels, while the coefficient of the AR(1) process is common to all the panels as suggested by Beck and Katz (1995). We use the Prais-Winsten transformation as this enables us to preserve the first observation for each panel. As Beck and Katz (1995) argue, OLS with corrected standard errors as described above is generally preferable to Feasible Generalized Least Squares.

Table 2 shows the results. The first three lines report the result for the base variables included in the M -vector of the EBA together with the number of procedures required in the F -vector, based on 4691 regressions. As can be seen, GDP per capita and its square easily pass Sala-i-Martin's robustness criterion. The implied turning point of the u-shaped relationship between income and entrepreneurial activity is approximately 27,000 US\$ per capita. This finding is in line with Verheul et al. (2004), reporting the turning point to be around 26,000 US\$.

Table 2: Extreme Bounds Analysis results

Variable	Avg. beta	Avg. S.E.	%Sig	CDF-U
Lagged GDP per capita	-0.0007	0.0003	72.32	0.93
Lagged GDP per capita squared	1.37E-08	5.83E-09	73.23	0.94
Dummy for communist history	-5.45	2.06	71.68	0.97
Procedures required to start a business	-0.35	0.17	65.19	0.90
Minimum capital required to start a business	-0.03	0.01	87.56	0.97
Days required to start a business	-0.01	0.02	42.64	0.77
Costs of starting a business	-0.08	0.07	60.08	0.68
Economic Freedom regulation subindex	-0.81	0.46	55.90	0.87

Notes: The results are based on 4691 regressions. ‘Avg. beta’ reports the average coefficient while ‘Avg S.E’ indicates the average standard error of all regressions. ‘%Sig’ shows the percentage of regressions in which the coefficient is statistically different from zero at the 5 percent level at least. ‘CDF-U’ shows the (unweighted) mass of the larger part of the distribution of the estimated coefficients (i.e. the value is always greater or equal 0.5). The criterion for a variable to be considered as robust is a value of 0.9 or above. The lower and upper bound columns report the smallest and largest coefficient minus/plus two standard deviations, respectively. The estimation technique applied is OLS with heteroskedastic panels corrected standard errors and an AR(1) error term that is common across panels.

Our results also confirm the relevance of communist heritage. Countries with a communist background robustly have lower levels of entrepreneurship.

Turning to our variables of primary interest, the results show that some regulations seems to be a robust determinant of entrepreneurship.¹¹ Specifically, the number of procedures required to start a new business robustly reduces entrepreneurial activity and thus constitutes a barrier to entry. Minimum capital required to start a business also robustly reduces the level of entrepreneurship. The days and, respectively, the costs to start a business, however, do not pass the critical threshold and can thus not be considered to be robust determinants of entrepreneurial activity. The same is true for the Economic Freedom subindex focusing on regulations.

As we pointed out earlier, however, the level of regulation is only part of the story. Even if regulations do not prevent firm entry on average, this might be due to people employing bribes to circumvent the regulations. In the absence of corruption, regulations might still harm, even if on average they do not. This is what we turn to in the next section.

6. Does Corruption Grease the Wheels of entrepreneurship?

Table 3 presents first evidence on the ‘grease the wheels’ hypothesis. Due to the high correlation between the various measures of regulation, we include them in the base

¹¹ The EBA includes our measures of regulation one at the time to avoid multicollinearity.

regression introduced above one at the time. The Transparency International index of corruption enters the robust baseline regression described in the previous section separately and as interaction with the respective measure of regulation.

Table 3: Nascent entrepreneurship and Corruption (Transparency International), 2003-2005

	(1)	(2)	(3)	(4)	(5)
Lagged GDP per capita	-0.0007 (3.20)***	-0.0008 (3.18)***	-0.0007 (3.71)***	-0.0007 (3.46)***	-0.0007 (3.62)***
Lagged GDP per capita squared	1.28E-08 (2.99)***	1.63E-08 (3.29)***	1.21E-08 (3.32)***	1.42E-08 (3.28)***	1.20E-08 (3.08)***
dummy for communist history	-5.6715 (3.50)***	-5.5242 (3.82)***	-5.3483 (4.27)***	-6.3076 (3.45)***	-6.2299 (4.18)***
Transparency International corruption	-0.3095 (0.91)	-0.1119 (0.32)	-0.7443 (2.19)**	-0.7679 (1.41)	-1.1236 (1.69)*
Costs of starting a business	-0.1804 (2.99)***				
Corruption * costs	0.0345 (2.80)***				
Minimum capital required to start a business		-0.0753 (4.39)***			
Corruption * capital required		0.0106 (4.20)***			
Days required to start a business			-0.1149 (4.91)***		
Corruption * days			0.0246 (4.56)***		
Procedures required to start a business				-0.8919 (4.98)***	
Corruption * procedures				0.1441 (2.99)***	
Economic Freedom regulation subindex					-1.5721 (2.80)***
Corruption * regulation					0.2773 (1.65)*
Constant	13.6393 (4.55)***	14.4107 (4.09)***	14.8595 (5.90)***	17.7612 (6.86)***	18.7425 (6.89)***
Observations	93	91	93	93	122
Countries	43	42	43	43	42
Joint significance (p-value)	0.025	0.000	0.000	0.000	0.011
R-squared	0.55	0.52	0.58	0.56	0.50

Notes: Corruption is measured on a scale between 0-10, with higher values indicating more corruption. Higher values of all regulation variables indicate stricter regulation. Estimation is with heteroskedastic panels corrected standard errors OLS and common AR(1) error term across panels. Joint significance refers to corruption, the respective measure of regulation, and their interaction.

Absolute z-statistics are given in parentheses.

* significant at 10%; ** significant at 5%; *** significant at 1%

In all five regressions reported in Table 3, entrepreneurial activity decreases with (lagged) GDP per capita and increases with its square, at the one percent level of significance. Also at the one percent level, entrepreneurial activity is lower in countries with a communist history. The non-linear relationship between per capita GDP and nascent entrepreneurship implies the following: An increase of per capita GDP by 1000 US\$ reduces the number of new entrepreneurs relative to the adult population by about 0.8 percentage points at the minimum (261 US\$). At the mean of 18,000 US\$ the reduction is 0.3 percent, while at the maximum value of 39,000 US\$, start up activity is increased by 0.3 percent. Post-communist countries have between 5.3-6.3 percentage points fewer new entrepreneurs.

Column 1 tests whether the costs of starting a new business affect entrepreneurship. As can be seen, the level of corruption itself does not significantly affect entrepreneurship (in the absence of regulation). However, entrepreneurial activity is significantly more pronounced with lower costs to start a business, while the interaction term shows the expected positive coefficient. The two latter coefficients are individually significant at the one percent level, while the three coefficients of interest are jointly significant at the five percent level. However, the marginal effect of corruption and its level of significance have to be interpreted conditional on the interaction with the costs to start a business (see Friedrich, 1982). The marginal effects as well as the corresponding minimum and maximum values are shown in Appendix 4. At zero costs of starting a business, an increase in the index of corruption by one point reduces entrepreneurship by 0.31 percentage points.¹² At the maximum level of 131.3, a corresponding increase in corruption increases entrepreneurship by 4.2 percentage points. While the conditional effect is not significant at the minimum level of regulation, the effect is significant at the one percent level at maximum regulation, lending strong support to the ‘grease the wheels’ hypothesis.

Column 2 focuses on the minimum capital required to start a business instead. The regression shows a similar picture. At the one percent level of significance, stricter capital requirements reduces entrepreneurial activity, while the effect of corruption becomes more positive the higher the minimum capital requirements. Again, the marginal effect is significant for the highest value of capital required (946.7), but not when capital requirement is zero. An increase in the index of corruption by one point does not affect entrepreneurship in

¹² Note that the index of corruption is to some extent ordinal rather than cardinal. It is thus not obvious that an increase from 1 to 2, e.g., corresponds to an increase from 4 to 5. However, the index of corruption is usually treated to be cardinal, assuming a linear scale of the ordinal index. See, Mauro (1995), Treisman (2000), Méon and Sekkat (2005), Méon and Weill (2006), among many others.

the absence of regulations but increases entrepreneurship by almost 10 percentage points at maximum regulation.

Table 4: Nascent entrepreneurship and Corruption (World Bank), 2003-2005

	(1)	(2)	(3)	(4)	(5)
Lagged GDP per capita	-0.0006 (2.65)***	-0.0007 (2.71)**	-0.0006 (3.35)***	-0.0006 (2.92)***	-0.0007 (4.18)***
Lagged GDP per capita squared	1.08E-08 (2.50)**	1.42E-08 (2.83)***	1.13E-08 (3.04)***	1.16E-08 (2.75)***	1.30E-08 (3.72)***
dummy for communist history	-5.5527 (3.55)***	-5.5479 (4.06)***	-5.3752 (4.30)***	-6.1670 (3.59)***	-6.6376 (4.19)***
World Bank Control of Corruption	-0.1391 (0.17)	0.4267 (0.46)	-1.3242 (1.60)	-1.3416 (1.05)	-2.8858 (1.69)*
Costs of starting a business	0.0129 (0.53)				
Corruption * costs	0.0753 (2.69)***				
Minimum capital required to start a business		-0.0176 (4.70)***			
Corruption * capital required		0.0219 (4.97)***			
Days required to start a business			0.0286 (1.22)		
Corruption * days			0.0504 (4.13)***		
Procedures required to start a business				-0.0527 (0.24)	
Corruption * procedures				0.3323 (3.22)***	
Economic Freedom regulation subindex					0.0687 (0.09)
Corruption * regulation					0.8120 (1.88)*
Constant	11.5167 (4.87)***	13.6233 (5.53)***	10.4437 (6.67)***	12.7767 (2.94)***	12.1049 (2.63)***
Observations	93	91	93	93	96
Countries	43	42	43	43	42
Joint significance (p-value)	0.038	0.000	0.000	0.000	0.001
R-squared	0.55	0.54	0.58	0.56	0.50

Notes:

Corruption is measured on a scale between -2.51 and, 1.71 with higher values indicating more corruption. Higher values of all regulation variables indicate stricter regulation. Estimation is with heteroskedastic panels corrected standard errors OLS and common AR(1) error term across panels. Joint significance refers to corruption, the respective measure of regulation, and their interaction.

Absolute z-statistics are given in parentheses.

* significant at 10%; ** significant at 5%; *** significant at 1%

Turning to the number of days and, respectively, procedures required to start a business, the results are again similar. With a minimum of two days required, an increase in corruption by one point reduces entrepreneurship by 0.7 percentage points (at the five percent level of significance); at the maximum of 152 days, the increase in entrepreneurship amounts to 3 percentage points (column 3). The corresponding increase at the maximum number of procedures (17) is 1.7 percentage points.

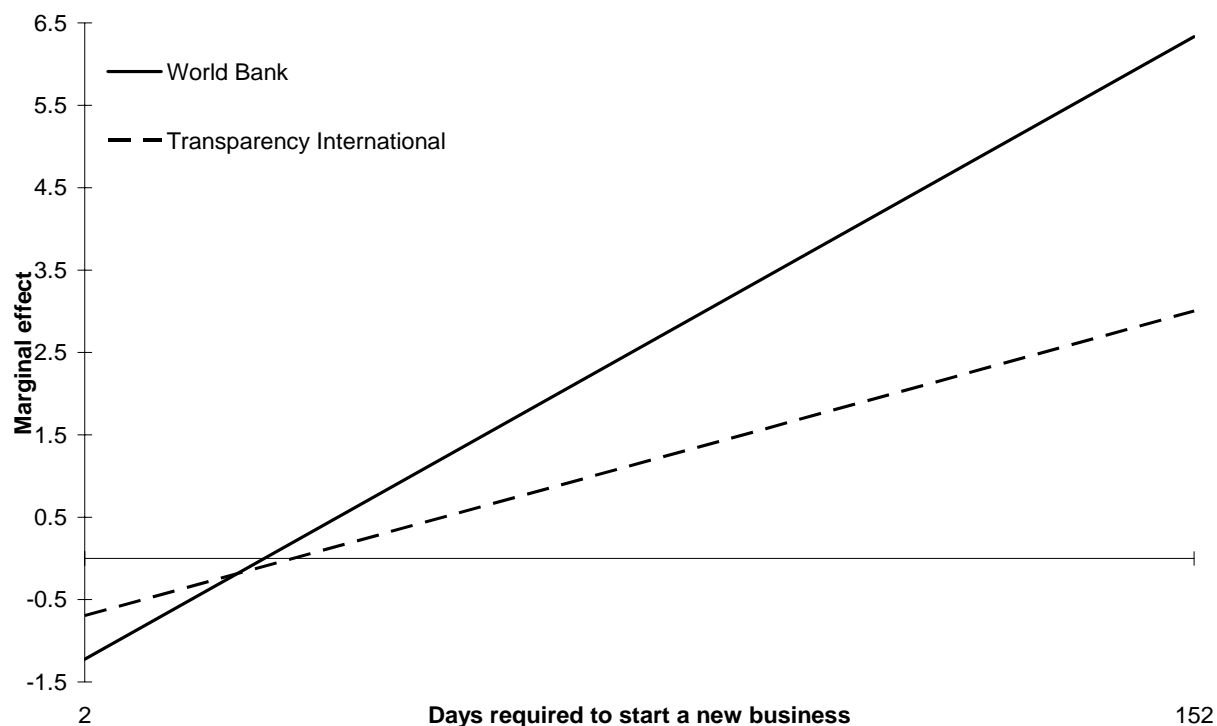
Column 5 reports the results for the Economic Freedom subindex on regulations. At the ten percent level of significance, corruption reduces entrepreneurship at the minimum of the index (1.5). Regulations significantly reduce entrepreneurship, while corruption seems to function as ‘efficient grease’, significantly alleviating this impact.

Table 4 replicates the analysis with Kaufmann et al.’s (2006) index of corruption. As can be seen, the previous results are confirmed. In all regressions, the interaction term is significant at the ten percent level at least, with the expected positive coefficient. The marginal effects at maximum regulation are significant at the one percent level in all but the final specification. The results show that an increase in the index of corruption by one point increases entrepreneurship by 9.8 percentage points at the maximum costs to start a business and 21 percentage points for maximal capital requirements. The corresponding values for the other measures of regulation are 6.3 percentage points (days required to start a business) and 4.3 percentage points (procedures required to start a business).¹³

Figure 1 visualizes the marginal effects of the two corruption measures conditional on the number of procedures required to start a new business. The lines illustrate the increasingly beneficial effect of corruption on entrepreneurship with rising regulations. While we do not report graphs for the other measures of regulation, the general pattern is similar for all of them.

¹³ Potentially, strict regulations might drive entrepreneurs from the official sector to the shadow economy. When corruption is a substitute for the shadow economy, our results might be driven by the underground economy rather than reflecting the impact of corruption per se. However, according to Schneider (2007) there is no obvious relation between corruption and the shadow economy in a sample of developed and developing countries. When we include a variable measuring the size of a country’s shadow economy (Schneider and Enste, 2000; Schneider 2005a, Schneider 2005b) to our regressions, the results are not affected. The coefficient of the shadow economy itself is completely insignificant in all specifications.

Figure 1: Marginal effect of corruption on nascent entrepreneurship



Notes: The figure visualizes the marginal effects of corruption conditional on the number of days required to start a business. The results are based on column (3) of tables 4 and 5. Each line represents the result for one corruption index.

As a test for robustness, we replicate our analysis replacing the dependent variable. As an alternative we use the total entrepreneurial activity index as our left hand side variable. In addition to nascent entrepreneurs this variable also includes newly founded enterprises, i.e. firms that exist longer than three month but less than 42. Again the percentage of entrepreneurs relative to the adult population is measured. Using this new explanatory variable we re-run the regressions presented in Tables 3 and 4. The results are extremely robust and yield almost identical implications. If anything, the relationship between entrepreneurship, corruption and regulation becomes even stronger. Overall, our central findings prevail: The interaction between regulations and corruption remains significant even when looking at the unconditional effect. All our findings with respect to the conditional effects and their significances as described above prevail without exception.¹⁴

¹⁴ As a further test for robustness we also replicated our results using the ICRG index of corruption. We do not report the results, as this index captures political risk involved in corruption rather than corruption per se. The general results are very similar to those reported above.

To summarize, we find strong evidence in favor of the ‘grease the wheels’ hypothesis. While corruption hardly affects entrepreneurship when the economy is not heavily regulated, corruption increases entrepreneurial activity when regulations abound. We also find some evidence that – while strict regulations reduce entrepreneurial activity in the absence of corruption – this negative impact becomes less pronounced with increasing corruption.

7. Conclusion

The paper provides two contributions to the existing literature. First, we test whether regulations robustly deter firm entry into the markets. Our results for two cross sections employing Bayesian Averaging of Classical Estimates (BACE) show no clear pattern, pointing to problems with the small number of observations included and raising some doubts about the stability of results reported in the previous literature. Turning to panel data and employing Extreme Bounds Analysis instead shows that some regulations indeed matter for entrepreneurship. Specifically, we find that more procedures required to start a business and larger minimal capital requirements are – on average – detrimental to entrepreneurship.

As our main contribution, we tested whether corruption can be an efficient grease, reducing the negative impact of regulations on entrepreneurship in highly regulated economies. Arguably, this is a more effective way of testing the ‘grease the wheels’ hypothesis than using economic growth rates, as has been done elsewhere. Clearly, the impact of circumventing regulations on economic growth can only be an indirect one, so it is not surprising that the studies focusing on growth did not find evidence in favor of a beneficial impact of corruption. We employ a more direct test and focus on the variable that regulations are most likely to affect directly: the number of new entrepreneurs (in percent of the total adult population). Our empirical analysis for a maximum of 43 countries over the period 2003-2005 shows that corruption can indeed be beneficial. At the maximum level of regulation among our sample of countries, corruption significantly increases entrepreneurial activity. As such, corruption might be viewed as being beneficial rather than harmful. This conclusion, however, warrants some caution. First, higher numbers of entrepreneurs entering the market are not necessarily beneficial to society. If regulations effectively prevent those firms from entering the market that are most likely to soon become bankrupt or providing goods or services the government does officially want to prevent from being offered, increases in entrepreneurial activity might be harmful. We can not test this with our data.

Second, our analysis neglects potential long-term feedbacks from corruption to regulations. While it seems reasonable to assume that corruption and regulations are both

exogenous to the entrepreneur's decision to enter the market in the short run, this might no longer be true in the longer term. There is some evidence that frictions are introduced to allow corrupt officials extracting rents in the first place. According to Myrdal (1986), corrupt officials cause delays to get the opportunity to ask for bribes. Edwards (1999), DeLong and Eichengreen (2002), and El-Shagi (2005) all argue that controls may breed corruption. Shleifer and Vishny (1993) emphasize that the imposition of capital controls, e.g., eases collecting bribes. Dreher and Siemers (2005) show that higher corruption is associated with more restrictions on the capital account. Djankov et al. (2002) find that regulation of firm entry is associated with higher corruption, but not higher quality of public or private goods.

When regulations are introduced by corrupt officials to allow the extraction of bribes, the level of regulation in a country will in the long-run rise as a consequence of corruption. As regulations prevent firms from entering the market and corruption can be used to alleviate this impact, we can not know which effect prevails. Studying the longer-term consequences of regulation and corruption would require endogenizing a country's level of corruption. We leave this for future research.

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Appendix 1: Sources and Descriptive Statistics for the key variables

Variable	Source	Mean	Std. Dev.	Min	Max
Nascent entrepreneurship	Global Entrepreneurship Monitor	5.285	3.967	0.5	31.4
GDP per capita (constant 2000\$)	World Bank (2006)	13091.7	11136.1	219.6	39004.9
Dummy for communist history		0.131	0.337	0	1
Procedures required to start a business	Doing Business	8.647	3.905	2	19
Days required to start a business	Doing Business	38.649	34.040	2	168
Costs of starting a business	Doing Business	18.982	25.843	0	146.5
Minimum capital required to start a business	Doing Business	47.632	103.105	0	946.7
Economic Freedom regulation subindex	Gwartney and Lawson (2006)	4.089	0.934	1.4	7.3
Transparency International corruption	Transparency International	5.100	2.431	0	9.6
World Bank corruption	Kaufmann et al. (2006)	-0.205	1.094	-2.51	1.71

Appendix 2: Control variables included in the Extreme Bounds Analysis

Variable	Source
Average income tax (combined central and sub-central government taxes)	OECD (2007)
Average of Net Replacement Rates over 60 months of unemployment, with social assistance	OECD (2007)
Average of Net Replacement Rates over 60 months of unemployment, without social assistance	OECD (2007)
Bank nonperforming loans to total (%)	World Bank (2006)
Credit rights index (measuring the degree to which collateral and bankruptcy laws facilitate lending)	Doing Business
Domestic credit to private sector (% of GDP)	World Bank (2006)
Employer social security contributions	OECD (2007)
Employment in services (% of total employment)	World Bank (2006)
Female employment share (females employed/total females, both 15-64)	OECD (2007)
Female participation rate (female labour force/female population, both 15-64)	OECD (2007)
Foreign direct investment, inflows (% of GDP)	World Bank (2006)
GDP per capita growth (annual %)	World Bank (2006)
Gross replacement rate	OECD (2007)
Health expenditure, total (% of GDP)	World Bank (2006)
Industry, value added (annual % growth)	World Bank (2006)
Inflation, consumer prices (annual %)	World Bank (2006)
Internet users (per 1,000 people)	World Bank (2006)
Labour force, female (% of total)	World Bank (2006)
Life expectancy at birth, total (years)	World Bank (2006)
Long term interest rate	OECD (2007)
Population density (people per sq. km)	World Bank (2006)
Research and development expenditure (% of GDP)	World Bank (2006)
School enrollment, secondary (% gross)	World Bank (2006)
School enrollment, tertiary (% gross)	World Bank (2006)
Services, etc., value added (% of GDP)	World Bank (2006)
Share of 25-39 year olds in group of 25-64	OECD (2007)
Social contributions (% of revenue)	World Bank (2006)
Statutory corporate income tax rates (top marginal rate if applicable)	OECD (2007)
Tax revenue (% of GDP)	World Bank (2006)
Taxes on income, profits and capital gains (% of revenue)	World Bank (2006)
Taxes on international trade (% of revenue)	World Bank (2006)
Unemployment, total (% of total labour force)	World Bank (2006)

Appendix 3: List of countries included

Argentina, Australia, Austria, Belgium, Brazil, Canada, Chile, China, Croatia, Denmark, Ecuador, Finland, France, Germany, Greece, Hong Kong, Hungary, Iceland, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Latvia, Mexico, New Zealand, Norway, Peru, Poland, Portugal, Singapore, Slovenia, South Africa, Spain, Sweden, Switzerland, Thailand, The Netherlands, Uganda, United Kingdom, USA, Venezuela

Appendix 4: Conditional marginal effects of corruption on nascent entrepreneurship

	Costs		Capital requirement		Days	
	min (0)	max (131.3)	min (0)	max (946.7)	min (2)	max (152)
Transparency International	-0.31	4.22***	-0.11	9.94***	-0.70**	3.00***
World Bank	-0.14	9.75***	0.43	21.17***	-1.22	6.33***

	Procedures		Regulation	
	min (2)	max (17)	min (1.5)	max (5.7)
Transparency International	-0.48	1.68***	-0.71*	0.46
World Bank	-0.68	4.31***	-1.67	1.66

Notes: The table includes the marginal effects of corruption conditional on the different regulation measures. We calculated the marginal effects for the minimum and maximum values in the estimation sample. Both values are given in the table.

* significant at 10%; ** significant at 5%; *** significant at 1%

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