

# How Important Are Financing Constraints? The Role of Finance in the Business Environment

*Meghana Ayyagari, Asli Demirgüç-Kunt, and Vojislav Maksimovic*

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What role does the business environment play in promoting or restraining firm growth? Recent literature points to a number of factors as obstacles to growth. Inefficient functioning of financial markets, inadequate security and enforcement of property rights, poor provision of infrastructure, inefficient regulation and taxation, and broader governance features such as corruption and macroeconomic stability are all discussed without any comparative evidence on their ordering. Using firm-level survey data on the relative importance of different features of the business environment, the article finds that although firms report many obstacles to growth, not all the obstacles are equally constraining. Some affect firm growth only indirectly through their influence on other obstacles, or not at all. Analyses using directed acyclic graph methodology and regressions find that only obstacles related to finance, crime, and policy instability directly affect firm growth. The finance result is shown to be the most robust. The results have important implications for the priority of reforms. Maintaining policy stability, keeping crime under control, and undertaking financial sector reforms to relax financing constraints are likely to be the most effective routes to promote firm growth. JEL codes: D21, G30, O12

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Firm growth is at the center of the development process, making it a much researched area in finance and economics. The field has seen resurgence in interest from policymakers and researchers, with a new focus on the broader business environment in which firms operate. Through surveys, researchers have documented that firms report many features of their business environment as obstacles to their growth. Firms report being affected by inadequate security

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and enforcement of property rights, inefficient functioning of financial markets, poor provision of infrastructure services, inefficient regulations and taxation, and broader governance features such as corruption and macroeconomic instability. Many of these perceived obstacles are correlated with low firm performance.

These findings can inform government policies that shape the opportunities and incentives facing firms, by influencing their business environment. But even if firm performance is likely to benefit from improvements in all dimensions of the business environment, addressing all of them at once would be challenging for any government. Thus, understanding how these different obstacles interact and which ones influence firm growth directly is important in prioritizing reform efforts. Further, since the relative influence of obstacles may also vary with the level of development of the country and with firm characteristics such as size, it is important to assess whether the same obstacles affect all subpopulations of firms.

This article identifies the features of the business environment that directly affect firm growth, using evidence from the World Business Environment Survey (WBES), conducted by the World Bank in 1999 and 2000 in 80 developed and developing economies around the world. These data are used to assess whether each feature of the business environment that firms report as an obstacle affects their growth, the relative economic importance of the obstacles found to constrain firm growth, whether an obstacle has a direct effect on firm growth or acts indirectly by reinforcing other obstacles that have a direct effect, and whether these relationships vary with the level of economic development and firm characteristics.

An obstacle is defined as binding if it has a significant impact on firm growth. Of the 10 business environment obstacles that firms report, only 3 emerge from the regressions as binding constraints with a direct association with firm growth: finance, crime, and policy instability. To reduce the dimensionality of the different business environment factors in a systematic structured approach, directed acyclic graph (DAG) methodology is implemented by an algorithm used in artificial intelligence and computer science (Sprites, Glymour, and Scheines 2001). The DAG algorithm also confirms finance, crime, and policy instability as the binding constraints, with other obstacles having an indirect association, if at all, with firm growth through the binding constraints.

Further tests find finance to be the most robust, in that the finance obstacle is binding regardless of which countries and firms are included in the sample. Regression analysis also shows that finance has the largest direct effect on firm growth. These results are not due to influential observations, reverse causality, or perception biases likely to be found in survey responses. Policy instability and crime, the other two binding constraints in the full sample, are driven by the inclusion of transition and African economies where, arguably, they might be the most problematic. Instrumental variable regressions also show finance to be the most robust result.

The relative importance of different factors is found to vary according to firm characteristics. Larger firms are significantly less affected by the finance obstacle, but being larger does not relax the obstacles related to crime or policy instability to the same extent.

Although firms identify many specific financing obstacles such as collateral requirements and lack of access to long-term capital, only the cost of borrowing is directly associated with firm growth. But the cost of borrowing is itself affected by imperfections in financial markets. Firms that face high interest rates also perceive that the banks to which they have access are corrupt, underfunded, and require excessive paperwork. Difficulties with posting collateral and limited access to long-term financing are also correlated with high interest rates. These obstacles are also likely to be aggravated by underdeveloped institutions.<sup>1</sup>

Several studies point to the importance of financing obstacles. Using firm-level data, Demirgüç-Kunt and Maksimovic (1998) and others provide evidence on how the financial system and legal enforcement relax firms' external financing constraints and facilitate their growth. Rajan and Zingales (1998) show that industries that depend on external finance grow faster in countries with better developed financial systems.<sup>2</sup> Although these studies investigate different obstacles to firm growth and their impact, they generally focus on a small subset of broadly characterized obstacles.

The current study is most closely related to Beck, Demirgüç-Kunt, and Maksimovic (2005) but differs significantly from that study in the question being asked, the execution, and the findings. Beck, Demirgüç-Kunt, and Maksimovic examine whether three obstacles (finance, corruption, and legal obstacles) selected on a priori grounds individually influence firm growth rates; they do not compare the obstacles to identify the most binding constraint. This is crucial since, as the current study shows, most obstacles when entered individually are significant in growth regressions. The current study also differs in methodology, since Beck, Demirgüç-Kunt, and Maksimovic do not incorporate country-fixed effects (or the DAG methodology) and have limited discussion of causality.

The current study looks at the full set of business environment obstacles—finance, corruption, infrastructure, taxes and regulations, judicial efficiency, crime, anticompetitive practices, policy instability and uncertainty, inflation,

1. Fleisig (1996) highlights the problem with posting collateral in developing and transition economies with the example of financing available to Uruguayan farmers raising cattle. While cattle are viewed as one of the best forms of loan collateral in the United States, a pledge on cattle is worthless in Uruguay. Uruguayan law requires specific description of the pledged property, in this case, identification of the pledged cows. The need to identify collateral so specifically undermines the secured transaction, since the bank is not allowed to repossess a different group of cows in the event of nonpayment.

2. Here is a parallel literature on financial development and growth at the country level. Specifically, cross-country studies (King and Levine 1993; Beck, Levine, and Loayza 2000; Levine, Loayza, and Beck 2000) show that financial development fosters economic growth. See Levine (2005) for a review of the finance and growth literature.

and exchange rate—and finds finance, crime, and policy instability to be the most binding and financial to be the most robust. Thus this study has implications for the priority of reform efforts, while the study by Beck, Demirgüç-Kunt, and Maksimovic does not.

Several qualifications need to be emphasized. First, as is common in the literature, the current study takes as given the existing population of firms in each country and studies the constraints they face. But, as described by Hausman, Rodrik, and Velasco (2008), it must be noted that in a more general setting the population of firms is itself endogenous. For example, Beck, Demirgüç-Kunt, and Maksimovic (2006) show that firm size distribution adapts to the business environment, and Demirgüç-Kunt, Love, and Maksimovic (2006) show that certain organizational forms are better adapted to specific business environments. Nevertheless, the analysis in this article can be seen as a way of identifying and targeting the most binding constraints for existing firms, conditional on having entered, but not necessarily as a way of identifying the constraints to entry. Second, this article examines cross-country firm-level regressions and therefore does not detail the experience of any single country in depth. But controlling for country-fixed effects provides useful—although not definitive—information from the cross-country set-up on the binding constraints to firm growth. Finally, in the absence of panel data and firm-fixed effects, potential reverse causality concerns are endemic to the growth literature. These issues are addressed in detail using instrumental variables.

The article is organized as follows. Section I describes the methodology. Section II discusses the data and summary statistics. Section III presents the main results. Section IV presents conclusions and policy implications.

## I. METHODOLOGY: IDENTIFICATION OF BINDING CONSTRAINTS

Numerous studies argue that differences in the business environment can explain much of the variation across countries in firms' financial policies and performance. While much of the early work relied on country-level indicators and firms' financial reports, more recent work has relied on surveys of firms, which provide data on a wide range of potential obstacles to growth.<sup>3</sup>

Surveys have identified a large number of potential obstacles to growth, making it difficult to identify the obstacles that are truly constraining. Enterprise managers may identify several operational issues, not all of them constraining. Therefore, it is necessary to identify the extent to which reported obstacles affect the growth rates of firms. An obstacle is to be considered a "constraint" or a "binding constraint" only if it has a significant impact on firm growth. Significant impact requires that the coefficient of the obstacle in

3. See Dollar, Hallward-Driemeier, and Mengistae (2005), Gelb and others (2007), Carlin, Schaffer, and Seabright (2005), and Svejnar and Commander (2007).

the firm growth regression be significant and that the enterprise managers identified the factor as an obstacle.<sup>4</sup>

To the extent that the characteristics of a firm's business environment are correlated, it is likely that many perceived business environment characteristics will be correlated with realized firm growth. It is important to sort these into obstacles that directly affect growth and those that may be correlated with firm growth but affect it only indirectly.

Since there is no theoretical basis for classifying the obstacles, empirical measures are required. The DAG methodology is used to reduce dimensionality in a structured way. The DAG algorithm begins with a set of potentially related variables and uses the conditional correlations between them to rule out possible relations among them. The final output of the algorithm is a pattern of graphs listing potential relations among the variables that have not been ruled out, which shows variables that have direct effects on the dependent variable or other variables, variables that have only indirect effects on the dependent variable through other variables, and variables that lack a consistent statistical relation with the other variables. If DAG identifies an obstacle as having a direct effect on firm growth, that obstacle would also have a significant coefficient in all ordinary least squares regressions regardless of which subset of other obstacles is entered as control variables in the regression equation. Ayyagari, Demirgüç-Kunt, and Maksimovic (2005) further illustrate the use of this methodology.<sup>5</sup>

Regression analysis is also used for further robustness tests, such as testing for possible endogeneity bias using instrumental variable methods and controlling for additional variables at the firm and country level, growth opportunities, influential observations, and potential perception biases in survey responses.

While the obstacles a firm faces depend on the institutions in each country, the obstacles are not likely to be the same for each firm in each country. Thus, the unit of analysis is the firm. As described in what follows, the regressions have country-level fixed effects.

4. In the survey, managers indicate that an obstacle is a problem by assigning it a value of 1 to 4. The significance of the coefficient in the growth regression is usually sufficient to determine whether an obstacle is binding since the mean value of all obstacles exceeds 1. But in determining the relative impact, it is important to take into account the level of the obstacles.

5. DAG analysis is related to the use of different analytical methods to identify the most reliable predictors of economic growth such as the extreme bounds analysis (EBA) used in Kormendi and Meguire (1985), Barro (1991), and Levine and Renelt (1992), and the technique in Sala-i-Martin (1997). DAG analysis has several advantages over these methods. While these methods start from an equation specified by the researcher that embodies a causal ordering that is then tested, DAG can endogenously discover the causal ordering. Moreover, whereas EBA treats one relation at a time, the graphs produced by DAG show robust relations among all the variables being analyzed, taking into account the implications of robust relations elsewhere in the system on the ordering in a specific relation.

## II. DATA AND SUMMARY STATISTICS

As the main purpose of the WBES is to identify obstacles to firm performance and growth around the world, it contains many questions on the nature and severity of different obstacles. Specifically, firms are asked to rate the extent to which finance, corruption, infrastructure, taxes and regulations, judicial efficiency, crime,<sup>6</sup> anticompetitive practices, policy instability and uncertainty, and macro issues such as inflation and exchange rate constitute obstacles to their growth.

In addition to the detail on obstacles to growth, one of the great values of this survey is its wide coverage of smaller firms. The survey is size-stratified, with 40 percent on observations on small firms (defined as employing 5–50 employees), 40 percent on medium-size firms (51–500 employees), and the remainder from large firms (more than 500 employees).

The firm-level obstacles are reported in table 1. The WBES asked enterprise managers to rate each factor as an obstacle to the operation and growth of their business on a scale of 1–4, with 1 denoting no obstacle; 2, a minor obstacle; 3, a moderate obstacle; and 4, a major obstacle. Firms in high-income countries tend to face lower obstacles in all areas (panel A of table 1). In the sample of developing economies, regional analysis indicates that African firms report corruption and infrastructure as the highest obstacles, Latin American firms report crime and judicial efficiency as the highest obstacles, and Asian countries report financing as the lowest obstacle (panel B). Smaller firms face higher obstacles than larger firms in all areas except in those related to judicial efficiency and infrastructure, where the ranking is reversed (panel C).

Firm sales growth over the past three years is used as a measure of firm performance. Sales growth is used rather than productivity because productivity measures are noisier and available for a much smaller sample of firms. Information on other performance measures such as profits was not available. Appendix table A-1 reports firm growth and the obstacles firms report, averaged over all sampled firms in each country. Average firm growth across countries shows a wide dispersion, from negative rates of 20 percent for Armenia and Azerbaijan to 64 percent for Malawi and Uzbekistan. Firms report taxes and regulations to be their greatest obstacles. Inflation, policy instability, and financing obstacles are also reported to be highly constraining. In contrast, factors associated with judicial efficiency and infrastructure are ranked as the lowest obstacles faced by entrepreneurs.

The correlations among the obstacles reported by firms are significant but fairly low, with few above 0.5 (correlation matrix not shown). As expected, the two macro obstacles, inflation and exchange rate, are highly correlated, at

6. The survey includes two obstacles on crime, one capturing street crime and the other organized crime. Since the correlation between the two obstacles is higher than 70 percent, only street crime, which is more strongly correlated with firm growth, is used in the analysis.

TABLE 1. Economic Indicators and General Obstacles

Classification	GDP per capita	Firm growth	General obstacles									
			Financing	Policy instability	Inflation	Exchange rate	Judicial efficiency	Street crime	Corruption	Taxes and regulation	Anticompetitive behavior	Infrastructure
<i>A: Averaged across country income groups<sup>a</sup></i>												
High (N = 11)	21,376.34	0.19	2.19	2.2	2.04	1.93	1.81	1.71	1.59	2.67	2	1.72
Upper middle (N = 18)	4,131.817	0.19	2.75	2.62	2.54	2.27	2.13	2.38	2.29	2.93	2.18	1.99
Lower middle (N = 26)	1,984.852	0.11	3	3.14	3.1	2.94	2.31	2.72	2.73	3.24	2.59	2.31
Low income (N = 25)	435.3	0.14	2.85	2.84	3.02	2.61	2.15	2.78	2.98	2.73	2.53	2.7
<i>B: Averaged across geographic regions</i>												
Europe and North America (N = 9)	22,863.72	0.19	2.2	2.22	2.06	1.89	1.79	1.78	1.63	2.77	1.98	1.76
Latin America (N = 20)	3,022.2	0.09	2.83	3.02	2.84	2.8	2.39	2.95	2.74	3.01	2.43	2.4
Asia (N = 10)	2,772.52	0.05	2.59	2.82	2.74	2.66	1.99	2.62	2.71	2.51	2.44	2.43
Transition (N = 23)	2,417.02	0.19	3.05	2.99	3.06	2.7	2.17	2.39	2.5	3.28	2.44	2.09
Africa (N = 18)	1,115.81	0.23	2.77	2.43	2.75	2.21		2.64	2.80	2.32		2.75
<i>C: Averaged across firm size groups</i>												
Small	3,759.33	0.13	2.89	2.84	2.90	2.59	2.13	2.64	2.62	2.94	2.43	2.24
Medium	4,377.98	0.16	2.86	2.87	2.84	2.60	2.18	2.46	2.53	3.00	2.41	2.26
Large	4,365.68	0.17	2.54	2.75	2.65	2.55	2.19	2.49	2.43	2.70	2.23	2.36

Note: The variables are described as follows: GDP per capita is real GDP per capita in U.S. dollars averaged over 1995–99. Firm growth is the percentage change in firm sales over the past three years (1996–99). Financing, policy instability, inflation, exchange rate, judicial efficiency, street crime, corruption, taxes and regulation, anticompetitive behavior, and infrastructure are general obstacles as indicated in the firm questionnaire. They take values of 1–4, where 1 indicates no obstacle and 4 indicates a major obstacle. In panels A, B, and C, firm variables are averaged over all firms in the specified group.

<sup>a</sup>Income groups are defined according to World Bank (2005).

Source: Authors' analysis based on WBES data described in text.



0.58. The correlations of corruption with crime and judicial efficiency are also relatively high, at 0.55 each, indicating that in environments where corruption and crime are widespread, judicial efficiency is adversely affected. The correlation between the financing obstacle and all other obstacles is among the lowest, indicating that the financing obstacle may capture different effects than those captured by other reported obstacles. All obstacles are negatively and significantly correlated with firm growth. These relations are explored further in the next section.

### III. FIRM GROWTH AND REPORTED OBSTACLES

This section explores the link between the obstacles that firms report and firm growth rates using country-fixed effect regressions and DAG analysis. It finds that finance, crime, and policy instability are most significantly associated with firm growth, suggesting that these are the binding constraints. The results are robust to a number of checks, including variation across different firm sizes and country income levels, endogeneity concerns, removal of outliers, and perception biases. Of the individual financing obstacles, high interest rates are found to be most significantly associated with firm growth.

#### *Obtaining the Binding Constraints*

Firm growth rates are regressed on the different obstacles firms report. All regressions are estimated with firm-level data using country-level fixed effects.<sup>7</sup> The standard errors are adjusted for clustering at the country level. Specifically, the regression equations take the form:

$$\text{Firm growth} = \alpha + \beta_1 \times \text{obstacle} + \beta_2 \times \text{firm size} + \text{country-fixed effects} + \varepsilon. \quad (1)$$

The hypothesis that a reported obstacle is a binding constraint (has a significant impact on firm growth) is tested by determining whether  $\beta_1$  is significantly different from 0. Significant impact also requires that the obstacle has a value higher than 1, which is true for all obstacles.

When individual obstacles are analyzed separately, all but corruption, exchange rate, anticompetitive behavior, and infrastructure are significantly related to firm growth (table 2). The regressions explain up to 7.4 percent of the variation in firm growth across countries. The coefficients of the significant obstacles range from 0.021 for the judicial efficiency obstacle to 0.032 for the

7. In unreported regressions, the robustness of the results was also checked by including additional control variables in the regression. Specifically, adding variables at the firm level to capture a firm's industry, number of competitors, organizational structure, and whether it is government or foreign owned, an exporter, or a subsidy receiver reduces country coverage from 80 to 56 but does not significantly affect the results for individual obstacles. Of the three binding constraints identified earlier, only the policy instability obstacle loses significance. Results are similar with country random effects controlling for GDP per capita and inflation at the country level.



TABLE 2. Impact of Obstacles on Firm Growth

Variable	1	2	3	4	5	6	7	8	9	10	11	12
Constant	0.205*** (0.028)	0.165*** (0.036)	0.193*** (0.034)	0.170*** (0.029)	0.180*** (0.040)	0.140*** (0.026)	0.152*** (0.032)	0.117*** (0.029)	0.111*** (0.028)	0.126*** (0.033)	0.332*** (0.059)	0.297*** (0.047)
Size	0.003 (0.002)	0.005** (0.003)	0.004 (0.002)	0.004 (0.002)	0.005* (0.003)	0.005* (0.003)	0.005* (0.003)	0.003 (0.002)	0.005* (0.003)	0.005 (0.003)	0.004 (0.003)	0.004 (0.002)
Financing	-0.032*** (0.008)										-0.034*** (0.009)	-0.028*** (0.008)
Policy instability		-0.024*** (0.010)									-0.022* (0.013)	-0.014 (0.009)
Street crime			-0.030*** (0.013)								-0.033** (0.015)	-0.025* (0.014)
Inflation				-0.020** (0.009)							-0.002 (0.011)	
Taxes and regulation					-0.027** (0.012)						0.001 (0.013)	
Judicial efficiency						-0.021** (0.010)					-0.003 (0.009)	
Corruption							-0.017 (0.011)				0.011 (0.012)	
Exchange rates								-0.000 (0.009)				
Anticompetitive behavior									-0.004 (0.007)			
Infrastructure										-0.009 (0.008)		

(Continued)

TABLE 2. Continued

Variable	1	2	3	4	5	6	7	8	9	10	11	12
Number of firms	6,235	6,133	5,964	6,175	6,343	5,142	5,620	6,068	5,091	6,205	4,551	5,778
Number of countries	79	79	79	79	79	61	78	79	60	79	59	78
Adjusted $R^2$	0.07	0.073	0.07	0.068	0.069	0.07	0.072	0.069	0.069	0.068	0.074	0.072

\*Significant at the 10 percent level; \*\*significant at the 5 percent level; \*\*\*significant at the 1 percent level.

*Note:* Numbers in parentheses are standard errors clustered at the country level. The regression equation estimated is  $\text{firm growth} = \alpha + \beta_1 \times \text{size} + \beta_2 \times \text{financing} + \beta_3 \times \text{policy instability} + \beta_4 \times \text{inflation} + \beta_5 \times \text{exchange rates} + \beta_6 \times \text{judicial efficiency} + \beta_7 \times \text{street crime} + \beta_8 \times \text{corruption} + \beta_9 \times \text{taxes and regulation} + \beta_{10} \times \text{anticompetitive behavior} + \beta_{11} \times \text{infrastructure} + \beta_{12} \times \text{country-fixed effects} + \varepsilon$ . The variables are described as follows: firm growth is the percentage increase in firm sales over the past three years. Firm size is the log of firm sales. Financing, policy instability, inflation, exchange rate, judicial efficiency, street crime, corruption, taxes and regulation, anticompetitive behavior, and infrastructure are general obstacles as indicated in the firm questionnaire. They take values of 1–4, where 1 indicates no obstacle and 4 indicates a major obstacle. In specifications 1–10, each of the obstacle variables is included individually. Specification 11 includes all the obstacles that were significant in specifications 1–10; specification 12 includes only financing, policy instability and street crime obstacles. All regressions in specifications 1–12 are estimated using country-fixed effects with clustered standard errors.

*Source:* Authors' analysis based on WBES data described in text.

finance obstacle. Thus, for instance firms that say financing is a minor obstacle grow 3.2 percent slower than those that say finance is not an obstacle. Alternatively, a one-standard deviation increase in the financing obstacle decreases the firm growth rate by 3.6 percent.

Column 11 of table 2 includes all the significant obstacles in the regression equation. In this specification, only the finance, policy instability, and crime obstacles have a significant constraining effect on growth. Dropping the remaining obstacles from the regression (which are jointly insignificant as well), as in specification 12, shows only finance and crime as having a constraining effect on growth. The economic impact of the finance obstacle is higher than that of crime, but the difference is not statistically significant.

It is also possible to do such impact evaluation at the regional, country, or firm level, instead of at the sample mean. Looking at the mean obstacles for individual countries reported in the appendix table A-1, it is clear that the binding obstacles are not equally important in every country. For example, in Singapore, where the mean value of the binding obstacles is all close to one, the economic impact of the obstacles is much smaller than in Nigeria, where the mean value of all three obstacles is more than 3, indicating severe constraints. Thus, it is possible to use these cross-country results to do growth diagnostics at the country level as discussed in Hausmann, Rodrik, and Velasco (2008). Looking more closely at the firm level, there may be some firms in Nigeria for which the constraints are not binding (depending on the value of the obstacles they report) and some in Singapore for which they are. In fact, average values of obstacles by firm size, as shown in table 1, suggest that the three obstacles will always be more binding for smaller firms than for larger firms.

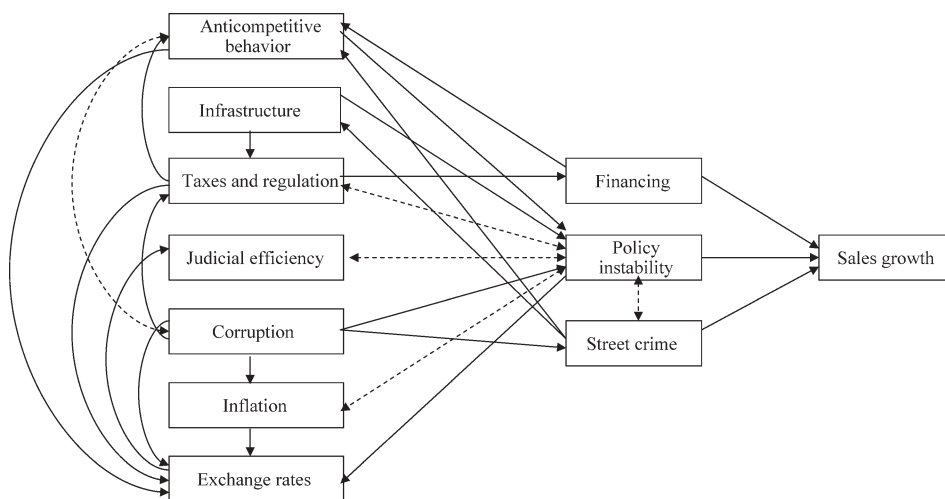
Overall, these results suggest that the three obstacles—finance, crime, and policy instability—are the only true constraints, in that they are the only obstacles that affect firm growth directly at the margin. The other obstacles may also affect firm growth through their impact on each other and on the three binding constraints, but they have no direct effect on firm growth.

#### *Have the Key Constraints Been Identified? Robustness Checks*

The DAG methodology is used to check the robustness of the regression findings since DAG is useful in simplifying the set of independent variables in a systematic way, as described in Ayyagari, Demirgüç-Kunt, and Maksimovic (2005).

The DAG analysis is implemented using the software program TETRAD III (Scheines and others 1994). In keeping with common practice, the business environment obstacles are assumed to cause firm growth, not the other way around, and the model is assumed to contain all common causes of the variables in the model. To be consistent with the fixed effects specification in table 2, demeaned values of the business environment obstacles are used,

FIGURE 1. DAG Analysis of the General Obstacles to Firm Growth



Source: Authors' analysis based on WBES data described in text.

where the country average of each obstacle is subtracted from the corresponding obstacle.

Figure 1 illustrates the application of this algorithm to the full sample. The input to the algorithm is the correlation matrix between firm growth and the 10 demeaned business environment obstacles from the sample of 4,197 firms.<sup>8</sup>

Figure 1 shows that the only business environment obstacles that have a direct effect on firm growth are financing, crime, and policy instability. Financing in turn is directly affected by the taxes and regulation obstacle, which include factors such as taxes and tax administration, and regulations in the areas of business licensing, labor, foreign exchange, environment, fire, and safety. Crime is directly affected by the corruption obstacle, and policy instability is affected by corruption, infrastructure, and anticompetitive behavior.<sup>9</sup> The

8. In addition, the significance level was selected for the tests of conditional independence performed by TETRAD. Because the algorithm performs a complex sequence of statistical tests, each at the given significance level, the significance level is not an indication of error probabilities of the entire procedure. Spirtes, Glymour, and Scheines (2001, p. 116), after exploring several versions of the algorithm on simulated data, conclude that "in order for the method to converge to correct decisions with probability 1, the significance level used in making decisions should decrease as the sample size increases, and the use of higher significance levels may improve performance at small sample sizes." For the results in this article obtained from samples ranging from 2,659–4,197 observations, a significance level of 0.10 was used. At the 5 percent significance level, finance, crime, and policy instability have a direct effect on firm growth, whereas at the 1 percent level only finance and crime have a direct effect on growth.

9. The DAG analysis and the set of causal structures determined by the algorithm are useful for an objective selection of variables, with the heuristic interpretation that if DAG analysis shows that obstacle  $X$  causes obstacle  $Y$ , then firms' reports of  $X$  as an obstacle are also likely to affect the probability that they report  $Y$  as an obstacle. For details refer to formal definitions.

dashed double-headed arrows between policy instability and crime, inflation, taxes and regulation, and judicial efficiency indicate that the direction of orientation between policy instability and these variables changes between patterns.

The output also shows that the relations between the obstacles themselves are quite complex and that there are multiple relations in the DAG among the business environment obstacles.<sup>10</sup> Since the main focus of this article is to identify the business environment obstacles with a direct effect on growth, the interactions among the different variables are left for future work. Hence, rather than focusing on the farthest variables in the figure, which are indirectly related to firm growth and are thus likely to have a very diluted impact on firm growth, we focus on the variables with direct effects, which are likely to have the biggest impact on growth. Most important, the DAG analysis also identifies financing, crime, and policy stability as the only variables having direct effects on firm growth, as suggested by specification 11 of table 2. As discussed in section II, the analysis identifies direct effects after conditioning on all subsets of the other variables. This suggests that in regression analysis, financing, crime, and policy instability will always have significant coefficients irrespective of the subsets of other obstacles included in the regression. Thus, these are binding constraints, and policies that relax these constraints can be expected to directly increase firm growth.

#### *Binding Constraints and Firm Size and Level of Development*

This section explores whether these relationships are different for firms of different sizes and at different levels of development. The first three columns of table 3 include specifications that interact the three obstacles with firm size, given by the logarithm of sales. The interaction term with the financing obstacle is positive and significant at the 1 percent level, suggesting that larger firms are less financially constrained, confirming the findings of Beck, Demirgüç-Kunt, and Maksimovic (2005). The interaction terms with policy instability and crime are also positive but not significant. When all the interactions are entered together in specification 4, only the interaction term with the financing obstacle is significant. Thus, although there is also some indication that large firms are also affected less by crime and policy instability, this evidence is much weaker.

The three obstacles are also interacted with dummy variables for country income—upper middle income, lower middle income, and low income. The excluded category is high income. The results indicate that all three obstacles tend to be more constraining for middle-income countries. This finding suggests that middle-income countries, having overcome country-specific

10. In addition to the directed arrows and bidirectional arrows, figure 1 also shows that in some cases common latent causes drive associations between some variables (such as financing and corruption) and that in other cases the direction of orientation is inconsistent: some statistical tests indicate that an edge should be oriented as  $x_1 \rightarrow x_2$ , and other statistical tests indicate that it should be oriented as  $x_1 \leftarrow x_2$ .

TABLE 3. Firm Growth Interaction Effects

Variable	Interaction with firm size				Interaction with country income dummy variables			
	1	2	3	4	1	2	3	4
Constant	0.278*** (0.050)	0.218*** (0.061)	0.225*** (0.058)	0.421*** (0.089)	0.207*** (0.029)	0.177*** (0.039)	0.184*** (0.030)	0.299*** (0.046)
Firm size	-0.004 (0.004)	-0.000 (0.004)	-0.000 (0.004)	-0.009 (0.006)	0.004 (0.002)	0.005* (0.003)	0.004 (0.002)	0.004 (0.002)
Financing	-0.058*** (0.016)			-0.053*** (0.015)	-0.002 (0.013)			-0.004 (0.015)
Financing × Size	0.003*** (0.001)			0.003*** (0.001)				
Financing × Upper middle					-0.041* (0.023)			-0.034 (0.022)
Financing × Lower middle					-0.041** (0.019)			-0.027 (0.019)
Financing × Low income					-0.016 (0.019)			-0.019 (0.022)
Policy instability		-0.042** (0.020)		-0.024 (0.019)		0.008 (0.012)		0.014 (0.012)
Policy instability × Size		0.002 (0.001)		0.001 (0.001)				
Policy instability × Upper middle						-0.056*** (0.021)		-0.045** (0.018)
Policy instability × Lower middle						-0.055** (0.024)		-0.043* (0.025)
Policy instability × Low income						0.005 (0.019)		-0.008 (0.017)

Street crime			-0.042*	-0.034 (0.025)			-0.010	-0.014
			(0.024)				(0.014)	(0.014)
Street crime × Size			0.001 (0.001)	0.001 (0.002)				
Street crime ×							-0.021	-0.010
Upper middle							(0.026)	(0.025)
Street crime ×							-0.052**	-0.039
Lower middle							(0.025)	(0.027)
Street crime ×							0.039*	0.044**
Low income							(0.021)	(0.020)
Number of firms	6,235	6,133	5,964	5,778	6,235	6,133	5,964	5,778
Number of countries	79	79	79	78	79	79	79	78
Adjusted R <sup>2</sup>	0.071	0.074	0.071	0.074	0.070	0.075	0.073	0.075
F-test of interactions				0.0503	0.1184	0.0088	0.0039	0.0022

\*Significant at the 10 percent level; \*\*significant at the 5 percent level; \*\*\*significant at the 1 percent level.

*Note:* Numbers in parentheses are standard errors clustered at the country level. The regression equation estimated is  $\text{firm growth} = \alpha + \beta_1 \times \text{size} + \beta_2 \times \text{financing} + \beta_3 \times \text{policy instability} + \beta_4 \times \text{street crime} + \beta_5 \times \text{financing} \times \text{income dummy variables} + \beta_6 \times \text{financing} \times \text{size} + \beta_7 \times \text{policy instability} \times \text{income dummy variables} + \beta_8 \times \text{policy instability} \times \text{size} + \beta_9 \times \text{street crime} \times \text{income dummy variables} + \beta_{10} \times \text{street crime} \times \text{size}$ . The variables are described as follows: firm growth is the percentage increase in firm sales over the past three years. Firm size is the log of sales. Financing, policy instability, and street crime are general obstacles as indicated in the firm questionnaire. They take values 1–4, where 1 indicates no obstacle and 4 indicates a major obstacle. Income dummy variables are country dummy variables based on the income level of the country. High-income dummy variable takes the value of 1 for countries belonging to the high-income group and 0 otherwise, upper middle-income dummy variable takes the value of 1 for countries belonging to the upper middle-income group and 0 otherwise, lower middle-income dummy variable takes the value of 1 for countries belonging to the lower middle-income group and 0 otherwise, low-income dummy variable takes the value of 1 for low-income group countries and 0 otherwise. In specifications 1–3 in each panel, the obstacle variables and its interactions are included individually. Specification 4 in both panels includes the full model. All regressions are estimated using country-fixed effects with clustered standard errors. Each specification also reports the  $p$ -value of the joint significance test of the interaction terms.

*Source:* Authors' analysis based on WBES data described in text.



institutional obstacles, are now more constrained by a common set of obstacles pertaining to finance, crime, and policy instability. This is consistent with Gelb and others (2007), who find that firms' levels of complaints about different obstacles vary with the income level of the countries. The *F*-tests for the hypotheses that all the entered interactions are jointly equal to 0 are rejected at the 1 percent level of significance for the crime and policy instability obstacles but not for the financing obstacle. This suggests that firms in countries in all income groups are similarly affected by the financing obstacle.

### *Checking for Reverse Causality*

While financing, crime, and policy instability have been identified as first-order constraints, significantly affecting firm growth, it is possible that the relations observed may also be due to reverse causality, with inefficient, slow growing firms blaming the environment for their performance. But while reverse causality is potentially a concern, it does not explain why poorly performing firms would systematically complain most about financing, crime, and policy instability and not about the other obstacles. While there might be a causal relation between poor performance and availability of financing, examined in what follows using instrumental variables, it is harder to posit a causal relation between poor performance and crime and policy instability.

The approach recommended by Carlin, Schaffer, and Seabright (2005) is used to check for reverse causality for the street crime and policy instability obstacles. They compare the coefficients of the fixed effects "within-estimator" and "between-estimator" and test for sign changes, arguing that since reverse causality is more likely to be significant at the firm level, it will cause the within-estimator and the between-estimator to change signs.<sup>11</sup> When the fixed effects model is run using the within-estimator, the obstacle coefficients are negative when entered individually. None of the coefficients are perversely positive, which might have suggested reverse causality. The between-estimator also shows the obstacle coefficients to be negative.

Furthermore, as seen in table 1, some factors such as taxes and regulation are rated as very high obstacles compared with others but do not appear as binding constraints, whereas street crime is not rated very highly (except in Latin America) yet still emerges as a binding constraint. This suggests that firms may complain about many factors when surveyed but controls are needed for country differences and firm heterogeneity to identify the obstacles with the largest association with firm growth.

To assess the robustness of the results, instrumental variable regressions (limited information maximum likelihood estimators) are used to extract the exogenous component of the three obstacles. Two sets of instruments are used

11. Carlin, Schaffer, and Seabright (2005) argue that only in the case of the financing constraint, reverse causality makes the within-coefficient more negative than the true value, thus making this method inapplicable.

for financing, crime, and policy instability. The first is the average value of the obstacles for the industry groups in each country. While it is likely that individual firms may blame the obstacles for their poor performance, it is less likely that all firms in a given country-industry group will engage in such blame shifting. Instrumenting the obstacles with the average obstacle for each industry group in the country isolates the exogenous part of the possibly endogenous obstacle the firm reports, which can be used to predict growth. When the obstacles are considered at the country-industry level of aggregation, causality is likely to run from the average obstacles to individual firms, not vice versa. In addition, country-industry averages also help with potential measurement errors that are largely idiosyncratic to the firm and hence uncorrelated with the average values of the obstacles.<sup>12</sup> The second set of instruments is firm responses to the survey question: Does your firm use international accounting standards? A firm's adoption of international accounting standards is likely to influence its business environment constraints, in particular the financing constraint, but is not necessarily independently linked to firm growth rates.

The analysis is also conducted at the country level, averaging the obstacle variables and firm growth rates across countries and controlling for log GDP per capita rather than for any of the firm-level variables. The instruments for financing and policy instability obstacles are a "Common law" dummy variable, which takes a value of 1 if the country follows common law tradition, and three religion variables, Protestant, Muslim, and Catholic, which represent the percentages of the population that are Protestant, Muslim, or Catholic in each country. The instrument for street crime is the common law dummy variable and the "latitude" of a country's capital city. An extensive literature has identified these institutional variables as good instruments for institutional development, and hence they are not used as explanatory variables in the short-term growth regressions in the second stage.

When country-industry averages of the obstacles are used as instruments, only the financing obstacle is negative and significant (table 4, columns 1–3). The first stage *F*-statistic is large, indicating that the country-industry average of the financing obstacle is a good instrument.<sup>13</sup> While the country-industry averages pass the instruments test for policy instability and street crime, these obstacles are now insignificant in the regression. In addition, when all three obstacles are implemented together, financing is again the only significant constraint (column 4). This reinforces the finding that financing is the most robust of the three binding constraints.

When firms' adoption of international accounting standards is used as an instrument, all three obstacles have a significant negative impact on firm

12. Use of group averages as instruments is a common technique, as used in Fisman and Svensson (2007) and described in Krueger and Angrist (2001).

13. This is further confirmed by the weak identification test statistic (Kleibergen-Paap Wald statistic), which is much larger than the critical value of 16.38

TABLE 4. Robustness Test—Instrumental Variables, Firm-level Regressions

Instrument	Country-industry average of the obstacle variable				Does the firm follow international accounting standards?		
	1	2	3	4	5	6	7
Size	0.002 (0.002)	0.006*** (0.002)	0.004* (0.002)	0.003 (0.002)	-0.004 (0.004)	0.011* (0.006)	-0.005 (0.005)
Financing	-0.066*** (0.025)			-0.067** (0.028)	-0.285*** (0.101)		
Policy instability		-0.045 (0.029)		-0.041 (0.031)		-0.897* (0.499)	
Street crime			-0.011 (0.029)	0.014 (0.032)			-0.529** (0.232)
Number of firms	6,235	6,133	5,964	5,778	5,846	5,747	5,592
<i>First-stage test of excluded instruments</i>							
F-statistic (financing)	382.32 (0.000)			112.13 (0.000)	36.48 (0.000)		
F-statistic (policy instability)		334.57 (0.000)		106.44 (0.000)		4.66 (0.031)	
F-statistic (crime)			351.30 (0.000)	110.22 (0.000)			11.11 (0.001)
Underidentification test—Kleibergen-Paap rk Wald statistic	549.12 (0.000)	405.91 (0.000)	453.67 (0.000)	366.18 (0.000)	35.90 (0.000)	4.54 (0.033)	11.20 (0.001)
Weak instrument robust inference—Anderson Rubin Wald test	7.06 (0.008)	2.41 (0.121)	0.14 (0.704)	3.55 (0.014)	9.43 (0.002)	9.82 (0.002)	9.18 (0.002)

\*Significant at the 10 percent level; \*\*significant at the 5 percent level; \*\*\*significant at the 1 percent level.

*Note:* Two-stage instrumental variable regressions are used. Numbers in parentheses are standard errors clustered at the country level. The first-stage regression equation estimated is financing (or policy instability or street crime) =  $\alpha + \gamma_1 \times \text{country-fixed effects} + \gamma_2 \times \text{firm size} + \gamma_3 \times \text{instrument}$ . The second-stage regression equation estimated is firm growth =  $\alpha + \beta_1 \times \text{country-fixed effects} + \beta_2 \times \text{firm size} + \beta_3 \times \text{financing (predicted value from first stage)} + \beta_4 \times \text{policy instability (predicted value from first stage)} + \beta_5 \times \text{street crime (predicted value from first stage)}$ . In specifications 1–4, the instrument used is the average value of the obstacle across each industry in each country. In specifications 5–7, the instrument used is firm response to the variable, “Does the firm adopt international accounting standards?” The variables are described as follows: firm growth is the percentage increase in firm sales over the past three years. Firm size is the log of sales. Financing, policy instability, and street crime are general obstacles as indicated in the firm questionnaire. They take values 1–4, where 1 indicates no obstacle and 4 indicates a major obstacle.

*Source:* Authors’ analysis based on WBES data described in text.

growth. While the first-stage  $F$ -statistic is significant in each case, it is greater than 10 only for the financing and crime obstacles (Stock and Watson 2003 rule of thumb for good instruments). But the Anderson Rubin Wald test, which is the preferred test for robust inference in the weak instrument case, is rejected in all three cases, suggesting that all three obstacles are individually important in affecting firm growth. Over-identification tests are not reported since the equation is just identified in each case.

Cross-country regressions are also run using historical institutional variables as instruments (table 5). All three obstacle variables are negative and significantly associated with firm growth. While the first-stage  $F$ -tests are significant at least at the 5 percent level in each case, the  $F$ -statistic is less than 10, suggesting that the instruments may be weak. Hence, tests for robust inference under weak identification are considered. The Anderson Rubin Wald test of the null hypothesis that the obstacle coefficient is 0 is rejected in all cases. Confidence intervals for these coefficients are also computed. Following Moreira and Poi (2001) and Mikusheva and Poi (2006), critical values of the likelihood ratio tests are obtained, which yield correct rejection probabilities even when the instruments are weak. The confidence region and the  $p$ -value for the coefficient on the obstacle variable based on the conditional likelihood show that the estimated coefficients belong to the confidence region. The underidentification test (Kleibergen-Paap rk Wald statistic) is rejected in each case, indicating that the equation is identified and that instruments pass the test of instrument relevance. The Hansen  $J$ -statistic of overidentification is never rejected, suggesting that the instruments are valid. After controlling for a number of other country-level variables, including growth rates, inflation, property rights protection, level of financial development, and level of institutional development, the (unreported) results are unchanged.

Overall, with different sets of instruments at the firm and country level, the results suggest that there are exogenous components of the financing, crime, and policy instability obstacles that predict firm growth and that the results are not due to reverse causality. The instrumental variable estimations also show that finance is the most robust of the binding obstacles. It must be noted, however, that it is difficult to find perfect instruments at the level of the firm in cross-country regressions and hence that some caveats regarding the instruments are in order. The country-industry averages of the instruments could potentially be correlated with the error term, so there could be systematic differences in growth rates and firm complaints across country-industry groups that raise reverse causality concerns. On the use of international accounting standards as an instrument, it should be noted that firm-fixed effects could not be used in the absence of panel data, so there is always the risk that a firm's adoption of accounting standards might be correlated with unobservables that affect firm growth. Finally, while the instruments in the country-averages regressions can be considered exogenous since historical institutional variables

TABLE 5. Robustness Test—Instrumental Variables, Firm-Level Regressions, Cross-country Regressions

Instrument	1 Common law dummy variable, three religion dummy variables	2 Common law dummy variable, three religion dummy variables	3 Common law dummy variable, latitude
Constant	2.385** (1.013)	1.122*** (0.344)	1.206*** (0.465)
GDP per capita	-0.091** (0.043)	-0.031* (0.016)	-0.052* (0.029)
Financing	-0.556** (0.255)		
Policy instability		-0.270*** (0.093)	
Street crime			-0.264*** (0.102)
Number of countries	79	79	80
F-statistic	2.71 (0.037)	6.44 (0.000)	6.95 (0.002)
Underidentification test—Kleibergen-Paap rk Wald statistic	11.74 (0.019)	27.86 (0.000)	14.63 (0.001)
Weak instruments robust inference— Anderson Rubin Wald test	3.30 (0.015)	3.30 (0.015)	6.69 (0.002)
Moreira and Poi Conditional Likelihood Ratio test	(-2.264, -0.213) (0.986)	(-0.569, -0.115) (0.921)	(-0.726, -0.085) (0.983)
Overidentification test of all instruments— Hansen J-statistic	0.966 (0.809)	1.227 (0.747)	0.562 (0.453)

\*Significant at the 10 percent level; \*\*significant at the 5 percent level; \*\*\*significant at the 1 percent level.

*Note:* Two-stage instrumental variable regressions are used. Numbers in parentheses are robust standard errors. The first-stage regression equation estimated is financing (or policy instability or street crime) averaged across countries =  $\alpha + \gamma_1 \times$  common law dummy variable +  $\gamma_2 \times$  latitude +  $\gamma_3 \times$  Protestant +  $\gamma_4 \times$  Catholic +  $\gamma_5 \times$  Muslim +  $\gamma_6 \times$  GDP per capita +  $\varepsilon$ . The second-stage regression equation estimated is firm growth =  $\alpha + \beta_1 \times$  GDP per capita +  $\beta_2 \times$  financing (predicted value from first stage) +  $\beta_3 \times$  policy instability (predicted value from first stage) +  $\beta_4 \times$  street crime (predicted value from first stage). The variables are described as follows: firm growth is the percentage increase in firm sales over the past three years. GDP per capita is the log of real GDP per capita in U.S. dollars. Financing, policy instability, and street crime are general obstacles as indicated in the firm questionnaire. They take values 1–4, where 1 indicates no obstacle and 4 indicates a major obstacle. English Common law is a dummy variable that takes the value of 1 for common law countries. Latitude is the absolute value of the latitude of the country scaled between 0 and 1. Protestant, Catholic, and Muslim variables are the percentage of Protestant, Catholic, and Muslim religions in each country from La Porta and others (1997). “Does the firm adopt international accounting standards?” is a dummy variable that takes the value of 1 if the firm adopts international accounting standards and 0 otherwise.

*Source:* Authors’ analysis based on WBES data described in text.

are being used, there is the possibility of omitted-variable bias in the absence of country-fixed effects.

#### *Other Robustness Checks*

This section describes several robustness checks of the main findings. First is an investigation of whether the results are driven by a few countries or firms. Chandra and others (2001) suggest that firms in African countries may exhibit different responses than the other firms in the sample. A report by the United States General Accounting Office (2004) analyzes several firm-level surveys on Africa, including the WBES, and concludes that perceptions of corruption levels vary greatly for African countries, presenting a challenge for broad-based U.S. anticorruption programs. Ayyagari, Demirgüç-Kunt, and Maksimovic (2008) argue that transition economies are fundamentally different from others in their perceptions of protection of property rights.

The first four columns of table 6 present the results for preferred specification on different samples after eliminating transition and African economies. While financing and crime remain binding constraints, policy instability loses significance when these countries are dropped from the sample. These results suggest that the type of policy instability present in transition and African economies is particularly damaging to firm expansion.

High inflation rates may be responsible for the very high firm growth rates observed in some countries, particularly in Bosnia and Herzegovina, Estonia, and Uzbekistan. Constructing real firm growth rates and replicating all the analyses in this article do not change the main results, however.

To check whether the results are driven by specific outlier firms, firms with very high growth rates (higher than 100 percent) are eliminated. Firms reporting very high growth rates are typically from transition and African economies, where political connections could be behind the high growth rates and firms thus may not be affected by business environment obstacles. The experience of these firms may therefore differ from that of the typical firm. In the reduced sample, financing remains the most binding constraint to firm growth, confirming that the results are not driven by the fastest growing firms in the sample. The impact of crime on firm growth is less robust to eliminating high growth rate firms, however.

It is also possible that young firms are affected differently by business environment obstacles. Excluding all firms younger than five years old from the sample leaves the financing result unchanged, while crime and policy instability are not significant in the regressions (results not reported). This suggests that ensuring policy stability and controlling crime are particularly important to the growth of younger firms. Financing is still the main binding constraint to growth when robust regression analysis or quintile regressions are used to control for the presence of possible influential outliers.

Several other robustness checks of the main findings were also conducted (results are available on request). First, the variation at the firm level and the

TABLE 6. Robustness Test—Varying Samples

Variable	High-growth firms included, countries excluded				High-growth firms excluded, countries excluded				
	Transition economies	African economies	African and transition economies	Uzbekistan, Bosnia and Herzegovina, Estonia	None	Transition economies	African economies	African and transition economies	Uzbekistan, Bosnia and Herzegovina, Estonia
	1	2	3	4	5	6	7	8	9
Constant	0.227*** (0.045)	0.307*** (0.045)	0.233*** (0.045)	0.226*** (0.041)	0.172*** (0.028)	0.225*** (0.039)	0.175*** (0.029)	0.236*** (0.042)	0.165*** (0.028)
Firm size	-0.000 (0.002)	0.005 (0.003)	0.000 (0.002)	0.004 (0.003)	0.003 (0.002)	0.001 (0.002)	0.003 (0.002)	0.000 (0.002)	0.003 (0.002)
Financing	-0.012* (0.006)	-0.033*** (0.008)	-0.020*** (0.007)	-0.019*** (0.007)	-0.018*** (0.005)	-0.017*** (0.006)	-0.020*** (0.005)	-0.022*** (0.006)	-0.016*** (0.005)
Policy instability	-0.007 (0.008)	-0.015* (0.009)	-0.010 (0.008)	-0.008 (0.008)	-0.015*** (0.005)	-0.011 (0.007)	-0.015** (0.006)	-0.010 (0.008)	-0.014*** (0.005)
Street crime	-0.016** (0.007)	-0.027*** (0.008)	-0.020*** (0.007)	-0.021*** (0.007)	-0.007 (0.005)	-0.018*** (0.006)	-0.008 (0.005)	-0.020*** (0.007)	-0.009* (0.005)
Number of firms	3,224	5,236	2,682	5,534	5,631	3,202	5,107	2,678	5,421
Number of countries	54	62	38	75	78	54	62	38	75
Adjusted R <sup>2</sup>	0.073	0.072	0.056	0.053	0.086	0.074	0.082	0.068	0.084

\*Significant at the 10 percent level; \*\*significant at the 5 percent level; \*\*\*significant at the 1 percent level.

*Note:* Numbers in parentheses are standard errors clustered at the country level. The regression equation estimated is firm growth =  $\alpha + \beta_1 \times$  GDP per capita +  $\beta_2 \times$  size +  $\beta_3 \times$  financing +  $\beta_4 \times$  policy instability +  $\beta_5 \times$  street crime. The variables are described as follows: firm growth is the percentage increase in firm sales over the past three years. GDP per capita is the log of real GDP per capita in U.S. dollars. Firm size is the log of firm sales. Financing, policy instability, and street crime are general obstacles as indicated in the firm questionnaire. They take values 1–4, where 1 indicates no obstacle and 4 indicates a major obstacle. Specifications 1–4 exclude certain countries from the full sample of firms, while specifications 5–9 exclude the countries from a reduced sample that does not include firms reporting very high (or very low) growth rates ( $> \pm 100$  percent). All regressions are estimated using country-fixed effects with clustered standard errors.

*Source:* Authors' analysis based on WBES data described in text.



variation at the country level were separated—that is, both the individual firm-level effect of the obstacle (the demeaned value of the obstacle, or obstacle minus the country average of the obstacle) and the cross-country effect (the country average of the obstacle) are included. Once again, in the full specification with the firm-level and country-level effects of all the 10 business environment obstacles included, the only individual firm-level obstacles that are binding constraints to growth are financing, policy instability, and crime.

Next, various tests were performed to detect outliers and influential points. DFBETA statistics were computed for each obstacle variable. The DFBETAs for regressor  $i$  measure the distance that this regression coefficient shifts when the  $j$ th observation is included or excluded from the regression, scaled by the estimated standard errors of the coefficient. None of the obstacles in the regressions have  $|DFBETA| > 1$  or the even the stricter cutoff of  $|DFBETA| > 2\sqrt{(N)}$ , as suggested by Besley, Kuh, and Welsch (1980). This implies that the results are not driven by influential observations. Financing and crime have a significant negative effect on firm growth, while policy instability is insignificant.<sup>14</sup>

The observed association between obstacles and firm growth might occur because firms that face higher obstacles are also those that face limited growth opportunities. After controlling for growth opportunities using average industry growth or firm-level dependence on external finance, the results remain unchanged using either measure of growth opportunities. Financing, policy instability, and street crime are significant when entered individually, and only financing and street crime are significant when entered together.

Also investigated is whether firm ownership drives the results. The sample includes 203 firms with government ownership. Excluding these firms leaves the financing and crime results unchanged. The sample also includes 1,340 firms with more than 50 percent foreign ownership. When these foreign firms are excluded from the analysis, only the financing obstacle remains significant. This suggests that foreign-owned firms are particularly sensitive to policy instability and crime. Including dummy variables to control for government and foreign ownership also leads to similar results, in that only financing and crime are significant.

Finally, the results are checked for robustness subject to controlling for perception biases. Following Kaufmann and Wei (1999), two kvetch variables were constructed, Kvetch1 and Kvetch2, which are deviations of each firm's response from the mean country response to two general survey questions.

14. The DFITS statistic of Welsch and Kuh (1977), which identifies the influence of each observation on the fitted model, was also computed (unreported results). Besley, Kuh, and Welsch (1980) suggest that a cutoff of  $|DFITS_j| > 2\sqrt{(k/N)}$  indicates influential observations, where  $k$  is the number of estimated coefficients and  $N$  is the number of observations. There are 145 observations in the current sample with  $|DFITS|$  greater than the cutoff value. When these influential observations are dropped, the financing, policy instability, and crime obstacles are all negative and significant.

Kvetch1 uses the responses to the question: How helpful do you find the central government today towards businesses like yours? Kvetch2 is constructed using the responses to the question: How predictable are changes in economic and financial policies? Since higher values correspond to unfavorable responses, positive deviations from the country mean indicate pessimism, and negative deviations indicate optimism. Controlling for differences in perceptions using the kvetch variables leaves only financing and crime results unchanged. Policy instability remains insignificant.

### *Individual Financing Obstacles*

The results indicate that financing is one of the most important obstacles that directly constrain firm growth. To get a better understanding of what type of financing obstacles are constraining firm growth, entrepreneurs were asked to rate the extent to which the following financing factors represent an obstacle to their growth: collateral requirements, paperwork and bureaucracy, high interest rates, need for special connections, banks lacking money to lend, access to foreign banks, access to nonbank equity, access to export finance, access to financing for leasing equipment, inadequate credit and financial information on customers, and access to long-term loans. The ratings are again on a scale of 1 to 4, increasing with the severity of obstacles.

Table 7 reports regressions that parallel those in table 2, but focusing on specific financing obstacles. A residual is also included for the component of the general financing obstacle not explained by the individual obstacles. The results indicate that not all financing obstacles reported by firms are constraining. Only the coefficients of collateral, paperwork, high interest rates, special connections, banks' lack of money to lend, lease finance, and the residual are significant when entered individually. High interest rates have the highest economic impact—a one-standard deviation increase in the obstacle results in a 3.3 percent decrease in firm growth.

Unlike the obstacles examined previously, specific financing obstacles are highly correlated with each other. Specification 13 includes all obstacles that are significant when entered individually. Only the high interest rates coefficient is significant and only at the 10 percent level. If the residual is also included, as in specification 14, only the residual remains significant. The residual is likely to summarize how different firms are affected differently by the structure and ownership of the financial system, the level of competition, and other factors that are not fully captured by the specific financial obstacles, thus proxying for general access to credit.<sup>15</sup>

Looking at the correlations among obstacles using DAG analysis shows that high interest rates are the only financial obstacle directly constraining firm growth. (It may be noted that while the direction of causation is restricted to go

15. The residual remains significant if all the general obstacles are included in addition to the residual and the significant individual financing obstacles.

TABLE 7. Impact of Individual Financing Obstacles on Firm Growth

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Constant	0.180*** (0.031)	0.172*** (0.029)	0.211*** (0.033)	0.132*** (0.030)	0.166*** (0.034)	0.158*** (0.028)	0.129*** (0.040)	0.129*** (0.039)	0.106*** (0.034)	0.122*** (0.036)	0.121*** (0.039)	0.094*** (0.032)	0.264*** (0.040)	0.212*** (0.048)
Firm size	0.003 (0.003)	0.004 (0.002)	0.004 (0.003)	0.005 (0.003)	0.004 (0.003)	0.004 (0.003)	0.004 (0.003)	0.005 (0.003)	0.005* (0.003)	0.004 (0.003)	0.005* (0.003)	0.006* (0.003)	0.002 (0.003)	0.005 (0.003)
Collateral	-0.023*** (0.007)												-0.006 (0.010)	-0.008 (0.011)
Paperwork		-0.025*** (0.009)											-0.010 (0.010)	-0.015 (0.011)
High interest rates			-0.032*** (0.010)										-0.020* (0.011)	-0.011 (0.012)
Special connections				-0.015** (0.007)									-0.001 (0.010)	-0.002 (0.014)
Lack money to lend					-0.024*** (0.008)								-0.011 (0.009)	-0.007 (0.012)
Lease finance						-0.015 (0.009)								
Access to foreign banks							-0.002 (0.007)							
Access to nonbank equity								-0.005 (0.008)						
Export finance									0.004 (0.009)					
Credit										0.003 (0.007)				
Long-term loans											-0.008 (0.008)			
Financing residual												-0.022** (0.011)		-0.023** (0.011)

(Continued)

TABLE 7. Continued

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Number of firms	6,024	6,133	6,298	6,002	5,808	5,076	5,093	5,037	4,440	5,332	5,030	2,988	5,317	2,988
Number of countries	79	79	79	79	79	78	78	78	78	78	60	58	79	58
Adjusted $R^2$	0.070	0.069	0.070	0.064	0.074	0.070	0.065	0.070	0.071	0.072	0.068	0.006	0.071	0.065

\*Significant at the 10 percent level; \*\*significant at the 5 percent level; \*\*\*significant at the 1 percent level.

*Note:* Numbers in parentheses are standard errors clustered at the country level. The regression equation estimated is firm growth =  $\alpha + \beta_1 \times \text{size} + \beta_2 \times \text{collateral} + \beta_3 \times \text{paperwork} + \beta_4 \times \text{high interest rates} + \beta_5 \times \text{special connections} + \beta_6 \times \text{lack money to lend} + \beta_7 \times \text{access to foreign banks} + \beta_8 \times \text{access to nonbank equity} + \beta_9 \times \text{export finance} + \beta_{10} \times \text{lease finance} + \beta_{11} \times \text{credit} + \beta_{12} \times \text{long-term loans} + \beta_{13}$  (residual). The variables are described as follows: firm growth is the percentage increase in firm sales over the past three years. Firm size is the log of sales. Collateral, paperwork, high interest rates, special connections, lack money to lend, access to foreign banks, access to nonbank equity, export finance, lease finance, credit, and long-term loans are individual financing obstacles as indicated in the firm questionnaire. They take values of 1–4, where 1 indicates no obstacle and 4 indicates a major obstacle. In specifications 1–11, each of the obstacle variables is included individually. Residual is the residual from a regression of the general financing obstacle on all the individual financing obstacles. Specification 13 includes collateral, paperwork, high interest rates, special connections, lack of money to lend, and lease finance. Specifications 12–14 include the financing residual. All regressions are estimated using country-fixed effects with clustered standard errors.

*Source:* Authors' analysis based on WBES data described in text.

from the financing obstacles to growth, no ordering is imposed among the individual financing obstacles.) That finding is not surprising since the high interest rate obstacle captures the cost of financing and is itself an endogenous variable that depends on the ability of the financial system to satisfy the demand for capital. It can be expected to constrain all firms in all countries. Collectively, specific financing obstacles still do not capture everything measured by the general financing obstacle, as illustrated by the effect of the residual. This also suggests that the general access to credit is an important constraint for firms.

The DAG analysis also suggests that perceptions of high collateral requirements and paperwork influence the perceptions of high interest rates. High interest rates also influence perceptions of lack of access to lease finance, banks lacking money to lend, and the need for special connections in banking. Regressions of the high interest rate obstacle on individual financing obstacles found specific financing obstacles all to be individually correlated with high interest rates. When all financing obstacles are considered together, only collateral, paperwork, special connections, lack of money to lend, and access to long-term loans are correlated with high interest rates, as in the DAG analysis.

#### IV. CONCLUSION AND POLICY IMPLICATIONS

Although firms report many obstacles to their growth, not all of them are equally constraining. Some may affect firm growth only indirectly, through their influence on other factors, or not at all. Analyses using regressions and DAG methodology found only finance, crime, and policy instability to be binding constraints, with a direct association with the growth rate of firms. Thus, while the other obstacles studied in this article are also associated with firm growth through their impact on each other and on the direct obstacles, maintaining policy stability, keeping crime under control, and undertaking financial sector reforms to relax financing constraints are likely to be the most effective means of promoting firm growth. The financing obstacle's impact on growth is robust to varying samples of countries, while the policy instability and crime results are less robust to the exclusion of transition and African economies, where they might be the most problematic for business growth. The results were subject to a battery of robustness tests, including changing the sample and controlling for reverse causality, growth opportunities, and potential perception biases in survey responses. The financing obstacle was the most robust to all these tests. This was further confirmed through instrumental variable regressions. This suggests that financial sector reform should be a priority for governments contemplating reform of their business environments.<sup>16</sup>

Further investigation of the financing obstacles revealed the importance of high interest rates in constraining firm growth. This result highlights the

16. An implicit assumption with the use of any survey data is that firm managers are knowledgeable about the different obstacles and understand the true workings of the financial and legal systems.

importance of macroeconomic policies in influencing growth at the firm level, as indicated by the correlation between high interest rates and banks' lack of money to lend. High interest rates are also correlated with high collateral and paperwork requirements, the need for special connections with banks, and the unavailability of long-term loans. These results suggest that bureaucracy and corruption in banking, greater collateral requirements, and lack of long-term loans are common in high-interest-rate environments. In addition to the cost of financing, general access to credit is an important constraint to firm growth. Country- and firm-level determinants of financing obstacles would benefit from further investigation.

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APPENDIX

TABLE A-1. General Obstacles

Country	Firm growth	Number of firms	General obstacles									
			Financing	Policy instability	Inflation	Exchange rate	Judicial efficiency	Street crime	Corruption	Taxes and regulation	Anticompetitive behavior	Infrastructure
Albania	0.22	103	3.04	3.48	2.75	2.61	2.69	3.42	3.34	3.15	2.72	3
Argentina	0.08	82	3.01	3.07	1.77	1.73	2.27	2.39	2.58	3.34	2.41	1.93
Armenia	-0.2	96	2.45	2.87	2.73	2.69	1.5	1.85	1.96	3.39	1.9	1.77
Azerbaijan	-0.2	70	3.11	2.55	2.9	2.61	2.59	2.39	3	3.17	2.96	2.43
Bangladesh	0.13	34	2.6	3.08	2.86	3.09	2.38	3.07	3.61	3.03	2.4	
Belarus	0.1	97	3.33	2.95	3.63	3.16	1.55	2.17	1.88	3.34	1.99	1.7
Belize	0.12	26	2.81	2.38	2.04	1.73	1.56	2.12	1.96	2.77	1.96	2.19
Bolivia	0.04	80	3.03	3.1	2.58	2.46	2.78	2.76	3.56	3.15	2.71	2.63
Bosnia and Herzegovina	0.63	76	3.09	3.19	1.33	1.25	2.54	1.86	2.56	3.16	2.58	2.65
Botswana	0.32	72	2.24	1.55	1.93	1.33		1.88	1.65	1.89		2.16
Brazil	0.03	148	2.67	3.53	2.8	2.94	2.56	2.83	2.53	3.66	2.49	2.18
Bulgaria	0.15	101	3.16	3.03	2.76	2.37	2.26	2.64	2.64	3.1	2.34	2.23
Cambodia	0.07	298	2.04	2.9	2.61	2.32	2	3.29		2.23	2.21	2.33
Cameroon	0.12	44	3.14	2.03	2.03	2.28		2.94	3.36	2.7		3.44
Canada	0.17	74	2.1	2.18	2.15	2.16	1.47	1.32	1.4	2.59	1.62	1.41
Chile	0.09	81	2.36	2.58	2.16	2.59	1.97	2.4	1.86	2.36	1.91	1.86
China	0.05	70	3.36	2.1	2.23	1.83	1.5	1.83	1.94	2.03	2.13	1.89
Colombia	0.06	83	2.67	3.49	3.01	3.34	2.4	3.37	2.87	3.17	2.33	2.46
Costa Rica	0.25	81	2.62	2.67	2.93	2.75	2.2	2.89	2.52	2.8	2.44	2.63
Cote d'Ivoire	0.05	47	2.78	2.85	2.37	1.97		3.29	3.24	2.49		2.29
Croatia	0.1	97	3.26	3.11	2.47	2.86	2.74	2.09	2.59	3.34	2.04	1.94

(Continued)



TABLE A-1. Continued

Country	Firm growth	Number of firms	General obstacles									
			Financing	Policy instability	Inflation	Exchange rate	Judicial efficiency	Street crime	Corruption	Taxes and regulation	Anticompetitive behavior	Infrastructure
Czech Republic	0.1	80	3.18	2.95	3	2.46	2.18	2.09	2.1	3.44	2.16	2.5
Dominican Republic	0.21	95	2.63	3.02	2.85	2.88	2.43	3.22	3	3.96	2.75	2.63
Ecuador	-0.06	74	3.27	3.6	3.76	3.78	3.04	3.49	3.53	3.07	2.55	2.67
Egypt, Arab Republic	0.16	44	2.91	3.14	2.68	2.9		2.24	3.14	3.43		3.23
El Salvador	-0.02	73	2.93	2.97	3.16	2.55	2.65	3.67	3.06	2.93	2.36	2.52
Estonia	0.63	109	2.47	2.62	2.41	1.89	1.72	2.09	1.88	2.67	1.85	1.64
Ethiopia	0.26	70	3.02	2.38	2.26	2.47		1.51	2.46	2.33		3.04
France	0.2	62	2.61	2.2	2.03	1.82	1.79	1.77	1.62	3.13	2.02	1.81
Georgia	0.14	78	3.29	2.84	3.29	2.94	1.86	2.32	3.04	3.22	2.18	2.14
Germany	0.11	60	2.59	1.63	1.87	1.64	2.12	1.56	1.88	3.17	2.3	1.71
Ghana	0.19	58	3.1	2.37	3.43	2.58		2.37	2.78	2.83		2.74
Guatemala	0.18	84	2.99	3.16	3.32	3.6	2.5	3.22	2.7	2.75	2.28	2.52
Haiti	0	62	3.28	3.18	2.92	2.9	2.35	3.81	3.08	2.73	3.1	3.89
Honduras	0.1	65	2.97	2.53	3.41	3.3	2.41	3.23	2.9	2.83	2.79	2.56
Hungary	0.28	98	2.6	2.61	2.59	1.6	1.32	1.76	1.95	3.01	2.14	1.53
India	0.15	152	2.59	2.81	2.77	2.42	2.02	1.98	2.8	2.43		2.8
Indonesia	-0.05	70	2.83	3.14	3.21	3.4	2.26	2.69	2.69	2.59	2.96	2.37
Italy	0.16	64	1.97	2.97	2.23	1.83	2.22	2.22	1.76	3.25	2.19	2.24
Kazakhstan	0.1	89	3.29	2.88	3.62	3.48	2.08	2.6	2.7	3.37	2.55	2.1
Kenya	0.03	70	2.76	3.03	2.8	1.75		3.27	3.56	2.53		3.64
Kyrgyz Republic	0	68	3.47	3.23	3.78	3.48	2.13	3.26	3.19	3.59	3	1.98
Lithuania	0.08	68	3.03	2.27	2.3	1.91	2.25	2.52	2.44	3.26	2.31	1.82
Madagascar	0.16	67	3.08	2.67	3.32	2.3		2.79	3.44	2.75		3.03

Malawi	0.64	30	2.81	2.2	3.56	2.54		3.08	2.65	2.37		3.76
Malaysia	0.01	37	2.57	2.14	2.44	1.94	1.63	1.78	2	2.03	1.91	1.92
Mexico	0.24	71	3.24	3.27	3.48	3.13	2.77	3.37	3.31	3.21	2.75	2.23
Moldova	-0.15	84	3.42	3.6	3.86	3.51	2.51	3.11	2.93	3.58	2.93	2.64
Namibia	0.3	52	2	1.66	2.08	2.08		1.96	1.71	1.98		1.63
Nicaragua	0.21	76	3.05	2.91	3.39	3.07	2.33	2.8	2.88	2.96	2.42	2.71
Nigeria	0.26	63	3.11	3.43	3.21	2.92		3.3	3.37	3.1		3.68
Pakistan	0.05	61	3.28	3.64	3.21	2.87	2.56	3.03	3.54	3.2	2.67	3.08
Panama	0.09	81	2.06	2.72	2.04	1.42	2.4	2.98	2.8	2.38	2.44	2.19
Peru	-0.02	83	3.09	3.21	2.85	2.99	2.55	2.81	2.83	3.35	2.68	2.27
Philippines	0.07	84	2.69	2.85	3.36	3.43	2.24	2.8	3.13	3.08	2.9	2.88
Poland	0.33	175	2.47	2.75	2.58	2.27	2.3	2.37	2.27	3.08	2.23	1.67
Portugal	0.12	52	1.8	2.08	2.1	1.74	1.88	1.64	1.73	2.15	2.18	1.75
Romania	0.07	96	3.26	3.44	3.75	3.19	2.59	2.45	2.88	3.57	2.52	2.44
Russian Federation	0.29	384	3.2	3.49	3.53	3.15	2.17	2.65	2.62	3.58	2.67	2.12
Senegal	0.15	38	3	2.21	2.56	2		2.61	3.04	2.97		2.88
Singapore	0.12	74	1.97	1.5	1.61	1.88	1.32	1.22	1.28	1.55	1.58	1.42
Slovak Republic	0.14	91	3.34	1.53	3.13	2.43	2.13	2.49	2.47	3.25	2.26	1.98
Slovenia	0.29	101	2.3	2.6	2.23	2.21	2.29	1.68	1.64	2.91	2.43	1.74
South Africa	0.26	87	2.34	1.97	2.45	2.39		3.58	2.58	2.64		1.83
Spain	0.25	66	2.21	2.17	2.27	1.93	1.97	1.92	2.08	2.65	2.25	1.94
Sweden	0.23	73	1.83	2.46	1.66	1.78	1.46	1.54	1.18	2.67	1.97	1.52
Tanzania	0.25	40	2.85	2.48	2.65	2.07		1.96	2.88	2.7		3.21
Thailand	-0.02	337	3.1	3.49	3.4	3.62	2.13	3.48	3.47	3.54	3.6	2.76
Trinidad and Tobago	0.18	80	3.03	1.81	2.49	2.41	1.45	2.18	1.68	2.78	1.79	2.1
Tunisia	0.14	41	1.79	1.94	1.7	1.94		1.55	2.11	2.12		2.1
Turkey	0.1	115	3.12	3.55	3.61	2.83	2.3	2.09	2.89	3.16	2.79	2.22
Uganda	0.18	67	3.17	2.47	2.68	1.78		2.27	2.93	2.48		2.81
Ukraine	0.03	170	3.45	3.22	3.43	3.05	2.16	2.49	2.51	3.7	2.86	2.22

(Continued)

TABLE A-1. Continued

Country	Firm growth	Number of firms	General obstacles									
			Financing	Policy instability	Inflation	Exchange rate	Judicial efficiency	Street crime	Corruption	Taxes and regulation	Anticompetitive behavior	Infrastructure
United Kingdom	0.27	62	2.33	2.19	2.16	2.28	1.5	1.95	1.24	2.87	1.72	1.69
United States	0.16	66	2.38	2.05	2.12	1.71	1.84	2.14	1.88	2.39	1.7	1.83
Uruguay	0	72	2.73	2.61	2.03	2.39	1.91	2.07	2	3.21	1.71	1.9
Uzbekistan	0.64	94	2.77	2.03	3.04	2.6	1.68	1.77	2.22	2.66	2.28	1.95
Venezuela	-0.02	78	2.62	3.64	3.48	3.12	2.65	3.18	3	3.1	2.63	2.31
Zambia	0.18	46	2.95	2.57	3.45	1.88		3.18	2.78	2.39		3.07
Zimbabwe	0.47	91	3.05	2.73	3.83	2.93		2.57	2.87	2.87		2.53
Average	0.15	86.73	2.8	2.72	2.76	2.49	2.15	2.51	2.56	2.9	2.37	2.34

*Note:* The variables are described as follows: firm growth is the percentage change in firm sales over the past three years (1996–99). Financing, policy instability, inflation, exchange rate, judicial efficiency, street crime, corruption, taxes and regulation, anticompetitive behavior, and infrastructure are general obstacles as indicated in the firm questionnaire. They take values 1–4, where 1 indicates no obstacle and 4 indicates a major obstacle. Firm obstacles are averaged over all firms in each country. The number of firms reported is the number of firms with nonmissing firm growth rates.

*Source:* Authors' analysis based on WBES data described in text.

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