WPS4792

POLICY RESEARCH WORKING PAPER 4792

Explaining Enterprise Performance in Developing Countries with Business Climate Survey Data

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Abstract

This paper surveys the recent literature which examines the impact of business climate variables on productivity and growth in developing countries using enterprise surveys. Comparable enterprise surveys today cover some 70,000 firms in over 100 countries around the world. The literature that has analyzed this data provides evidence that a good business climate drives growth by encouraging investment and higher productivity. Various infrastructure, finance, security, competition and regulation variables have been shown to significantly

impact firm performance. Section 1 of this paper outlines the theoretical framework that underpins the investment climate literature. Section 2 describes the available datasets and surveys the key findings of the empirical literature, first macroeconomic and then microeconomic studies. Particular attention is paid to the robustness of the reported results. Section 3 highlights important econometric issues common to this literature and suggests a research agenda and possible improvements in survey design.

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Introduction

This is a survey paper of the literature discussing the impact of the business climate on productivity and growth in developing countries. In recent years, an unprecedented data collection effort has yielded a set of comparable enterprise surveys covering close to 70,000 firms from over 100 countries in all continents. As a result, a number of studies have started to analyze the impact of the business climate variables contained in these surveys on different dimensions of firm performance. The general aim of this literature is to generate policy prescriptions based on the identification of the main constraints facing firms. Although many of these studies identify relevant constraints, contradictory or fragile results are also found, pointing to some weaknesses in the methodology applied in some papers as well as in the original survey questionnaire design itself.

The objectives of this paper are to review the literature, take stock of the lessons learned, highlight strengths and shortcomings, and propose potential improvements. To do so, we start by providing a theoretical framework to think about the impact of the business climate on productivity and growth in developing countries (Section 1). We then survey the existing empirical literature that is based on investment climate survey data. We discuss the empirical macro literature in order to put the firm level investment climate studies into context. The main findings of the micro literature are then outlined, and the robustness of the results considered (Section 2). Finally, we highlight the main econometric issues raised by the current literature, put forward a number of ideas to advance research on the investment climate and suggest possible improvements in survey design (Section 3).

Section 1.   Economic Growth and the Business Climate

This first section describes the general theory of the business climate and outlines a theoretical model linking critical variables with economic performance and growth. A number of structural, institutional, and behavioral variables shape and drive economic growth. The critical variables that collectively define the so-called business or investment climate are, broadly speaking, (1) infrastructure, (2) access to finance, (3) security (absence of corruption and crime) and (4) the regulatory framework, including competition policies and the protection of property rights. The main hypothesis of the investment climate literature is that the business climate affects activity throughout the economy—particularly incentives to invest. An improvement in the business climate increases returns to current lines of activity and so increases investment in these. It also creates new opportunities – for example, through trade or access to new technology. It influences the psychology of entrepreneurs – the Keynesian 'animal spirits – affecting their assessment of whether innovation will pay off. It puts competitive pressure on firms that have enjoyed privileged positions as a result of import or other protection, or special access to government officials. As a result of greater competition, it may cause some firms, perhaps those closer to technological frontiers, to shine—even as others fail.

Given the complexity of effects that changes in the business climate elicit, different firms, industries, and regions will be affected in different ways. Moreover, business climate–fueled growth is not simply a shift toward some technological frontier. Developing countries must overcome or reduce all kinds of obstacles to efficiency, dynamic and otherwise, without any illusions that the economy will soon arrive at a frontier. Indeed, changes in the investment climate may have their most crucial impact far from the technological frontier.

A weak business climate, on the other hand, may not only discourage investment, it can also lead businesses to take costly or counterproductive steps to defend themselves from the consequences of its weaknesses. If social order and control are weak, firms typically have to invest heavily in defensive measures such as private security (as in parts of Latin America or the former Soviet Union). If the power supply is unreliable, firms will invest in their own generating capacity (as in many parts of South Asia). If it is difficult to get goods through or to ports, trade is discouraged (as in many countries in Sub-Saharan Africa) and larger, more costly inventories are held. Many such constraints on development are not quickly or easily reversed.

To formalize the idea of an economy in which the business climate significantly impacts output and productivity – the key hypothesis in the recent literature – it makes sense to present a simple aggregate model that explicitly includes the business climate, using an approach that is standard in endogenous growth theory.[2] It should be noted that aggregate growth models inevitably involve production possibility frontiers, and as discussed, in developing economies crucial economic gains may take place far from some hypothetical technological or efficiency frontier. Moreover, more specific questions may have to appeal to different and more disaggregated models – each with its own insights – rather than shoehorning all interesting phenomena into one particular model. The following aggregate model, however, does provide a broad sense of the main economic relationships investigated by the literature surveyed below. Even microeconomic studies that focus exclusively on firm level variations in productivity and growth implicitly hypothesize a macro relationship of this type in the aggregate.

Suppose that output, Y, is a function of the capital stock, K, labor, L, and the business climate, as measured by a single variable M. We write this function, where t is time, as:

(1) $Y = e^{t \cdot \alpha(M)} F(K, M)$

Note that we implicitly distinguish between the non-infrastructure aggregate capital stock, K, and the infrastructure capital stock K_I, which is a determinant of M.[3] As the output function is written here, the business climate affects both output and productivity levels, through the function F( ), and the rate of change of output, through the function α( ). To keep things simple, we can portray the rate of change of the business climate in the model as being governed by:

(2) $\dot{M} = g(\mu, M(\mu, x), Y)$,

[2] See Aghion and Howitt, 1998. Also Stern, Dethier and Rogers, 2005: 207.
[3] Straub, S. 2008: 6-8

where μ is a vector of policy actions government can take, x is a vector of all other factors determining the investment climate, and g is the function that converts these inputs into the change in M. While policy can cause immediate, discrete changes in M, say if there is a one-off change in the law, it also acts through the rate of change of M. The rate of change of M can depend on both M itself and the level of income in the society (see below). We also assume that:

(3) $\quad \dot{K} = h(sY, M)$

where s is the aggregate savings rate, meaning that the capital stock increases with savings in the economy. Moreover, as Durlauf et al. (2008) have pointed out, the investment climate can also affect physical capital accumulation rates by influencing decisions to invest.

Finally, we model the rate of change in the labor force as a function of population growth n, and the investment climate. Changes in the investment climate as defined here can have profound implications for labor force growth, for instance, if regulations with respect to foreign workers are amended (causing an influx or exodus of foreign labor), or if infrastructure development connects regions with low labor force participation rates with more dynamic ones.

(4) $\quad \dot{L} = i(n, M)$

These four equations describe a dynamic growth model with three state variables, K, L and M.

The growth rate can be increased by policy, captured in the vector μ, which improves the business climate directly, and by shifting the rate of change of M. An increase in M can increase both the growth rate, through α( ), and the level of productivity, directly through F( ). Improvements in the business climate could generate further improvements through political economy mechanisms if they increase the number of people and firms with a stake in a better climate. For example, if trade reforms create an export-oriented sector of the economy, that sector may increase pressure for further reforms to trade policy or trade-related infrastructure. And higher incomes might lead to pressure for an improved business climate in other ways, as people seek rules governing the protection of wealth or capital (hence the presence of Y in function g( ) in equation 2). The model could in principle capture phenomena such as an endogenous business climate and virtuous (or vicious) circles of growth. We could also generalize the notation to cover a vector of capital goods, vintage models, many dimensions of the business climate, and so on.

To the extent that (changes in) the business climate affect different firms differently, the aggregate model, with its reliance on a representative firm, is not adequate. As stressed in Banerjee and Duflo (2005), such a model can hardly account for the behavior of firms in a world where either markets or governments fail, or people face psychological difficulties to take advantage of opportunities. In such a case, the impact of constraints such as infrastructure limitations, lack of access to finance, or political economy issues on individual firm's decisions can be analyzed in non-aggregative models. Relatively simple, distinct, disaggregated models, addressing the relevant constraints of interest, can

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provide a variety of insights. As Section 2 will demonstrate, the empirical studies that exploit data from investment climate surveys, while usually implicitly set in a macro context as the one described by our model, are examples of the added value provided by a disaggregated, microeconomic approach.

Section 2. Survey of Recent Enterprise-Level Business Climate Studies

Firm-level enterprise and business climate data has proved a rich resource for research on the characteristics and constraints of firms in the developing and transitioning world. This section surveys the recent literature with a focus on empirical work that exploits the data to explain firm performance as a function of different aspects of the business climate. Sub-section 1 places the recent micro-level business climate literature into the context of the macro-studies that largely preceded it, thus highlighting the place of the firm-level literature as a whole and the added value it provides. Sub-section 2 discusses the available datasets. Sub-section 3 outlines the most serious econometric challenges encountered throughout the firm-level literature. Sub-section 4 then presents the key results of the literature for the four main sets of business climate variables that have been investigated: (1) Infrastructure, (2) Financial Constraints, (3) Corruption and Crime and (4) Competition and Regulation.

1. Firm Level Analyses in the Context of the Macro-Institutions Literature

The microeconomic business climate literature surveyed here is framed by more macro-oriented analyses. It is useful to briefly contrast the two literatures to put the firm-level studies into context and better understand their specific potential and advantages. The macro-literature has provided some interesting insight, but is characterized by a number of inherent limitations that microeconomic studies can help overcome.

The macroeconomic literature has generally attempted to use cross-country samples to explain GDP-based outcome variables[4] with broad, country-level indicators of institutional quality, the policy environment and infrastructure. The majority of such analyses have found significant effects of these variables on economic performance, even though recent studies have been more cautious in their interpretation of the evidence.

In a review paper for the European Investment Bank, Romp and de Haan (2005) find the consensus view in the macro-literature to be that 'public capital furthers economic growth'.[5] With respect to institutions and the policy environment, Pande and Udry (2005) speak of 'compelling evidence' and a 'persuasive case' that

> 'long run growth is faster in countries that have higher quality contracting institutions, better law enforcement, increased protection of private property rights, improved central government bureaucracy, smoother operating formal

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[4] Typically GDP per capita (e.g. in Acemoglu, Johnson & Robinson, 2001), GDP per worker (e.g. in Hall & Jones, 1999), or the growth rates of these two variables (e.g. in Knack & Keefer, 1995, or Mauro, 1995).
[5] Romp and de Haan, 2005: 52

sector financial markets, increased levels of democracy, and higher levels of trust'[6]

Likewise, Dollar et al. (2005) state that a 'range of empirical studies…find a relationship between long-run growth…and measures of institutional quality'[7]. The World Development Report 2005 underlines that the macro-analyses 'generated useful insights – the most important is that secure property rights and good governance are central to economic growth.'[8]

A recent paper by Durlauf, Kourtellos and Tan (2008) is more cautious. Investigating 'the strength of empirical evidence for various growth theories when there is model uncertainty with respect to the correct growth model'[9], the authors judge that 'previous findings on the direct importance of institutions to growth are fragile'[10]. They do, however, conclude that there is at least 'some evidence that institutions…play a role as determinants of growth rates' even if 'their effect is likely to flow through their influence on physical capital accumulation rates and not via TFP growth directly.'[11] Straub, Vellutini and Warlters (2008) find some evidence for a positive effect of infrastructure on growth, especially in poorer countries, but conclude that in general, the 'results from studies using aggregate data lack robustness'[12]. Romp and de Haan (2005) highlight that recent estimations of infrastructure elasticities are much lower than earlier calculations that did not account for endogeneity effects appropriately.[13] Some econometric problems, such as the failure to account for model uncertainty in cross-section studies[14], persist in the literature. Moreover, Romp and de Haan underline the considerable heterogeneity of the results across economies, arguing that the precise 'channels through which infrastructure affects economic growth'[15] are still not understood very well. The consensus view that a broadly defined 'business climate – institutions, infrastructure and the social environment – significantly affect economic performance is thus qualified by lingering concerns about the robustness and generality of specific results and the precise channels through which the estimated effects occur.

The macroeconomic approach is characterized by a number of *inherent* limitations that suggest that microeconomic, firm-level analyses are required to achieve more robust results and more precise policy recommendations. These inherent limitations of the macro-literature include:

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[6] Pande, R. and C. Udry. 2005: 31.
[7] Dollar, D., M. Hallward-Driemeier and T. Mengistae. 2005: 22.
[8] World Bank. 2004: p.25;
[9] Durlauf, S.N., A. Kourtellos and C.M. Tan. 2008: 329.
[10] *Ibid.*:338.
[11] *Ibid.*: 342.
[12] Straub, S., C. Vellutini and M. Warlters. 2008: 23.
[13] This is primarily because conceptual and econometric problems such as reverse causality or inefficient proxy variables have been at least partly addressed in more modern studies.
[14] Romp, W. and J. de Haan. 2005: 57.
[15] *Ibid.*: 58.

- The explanatory variables at the country level obscure important dimensions of heterogeneity such as variations across different regions *within* a country[16] and/or across different types of firms (by firm size, firm age and so on).
- The limited number of countries restricts the sample size of country-level analyses, especially cross-sectional ones, and thus the robustness of the results.[17]
- Aggregate business climate indicators are often imprecise, rely on *de jure* information, or subjective judgments about the weighting of variable components, and lack direct input about actual conditions as experienced by affected parties such as firms.
- Many country level indicators 'contain little or no variation over time and thus are completely or almost indistinguishable from country-, sector- or region-specific effects that may reflect other features than the business environment.'[18]
- The instruments most often used consist of geographical or historical pre-conditions (latitude, colonial history, settler mortality, etc.), which limits the ability of the empirical models to identify the consequences of institutional change for growth.[19]

Thus Durlauf et al. (2008) state that 'it is most likely the case that the limits to what information can be extracted from aggregate regressions requires more attention to microeconomic and historical studies'[20]. Similarly, Straub (2008) argues that 'the main limitation [of the macroeconomic literature] is …the fact that the interesting questions cannot be addressed with data at that level of aggregation'[21]. Pande and Udry (2005) highlight that 'this [macro] literature has served its purpose and is essentially complete' and argue for the necessity of 'empirical research based on micro-data in development economics' to 'make progress'[22]. The World Development Report 2005 underlines that these 'limits [of macroeconomic analyses] inspired the search for more disaggregated evidence on the quality of a location's business climate and …the impact of that climate on the investment decisions and performance of firms.'[23]

The crucial pre-requisite for finding 'more disaggregated evidence' is the availability of raw disaggregated data. The following section will introduce the main firm-level datasets on which almost the entire micro-literature on business climate is based.

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[16] Dollar, Hallward-Driemeier and Mengistae. 2005: 2.
[17] *Ibid.*
[18] Commander and Svejnar. 2007: 3.
[19] Pande and Udry. 2005: 8.
[20] Durlauf, Kourtellos and Tan. 2008: 344.
[21] Straub, 2008: p.35.
[22] Pande and Udry. 2005: 3 and 31.
[23] World Bank. 2004: 21.

2. Datasets

Overview of Existing Datasets

Before the 1990s, standardized firm-level business surveys spanning multiple countries were practically non-existent. This began to change with an initial series of largely self-contained projects which carried out business surveys for certain sets of countries and with various thematic scopes.

Four key projects of that period were sponsored by the World Bank: First, a first set of Africa-focused surveys carried out from 1992 to 1995 by the Africa Regional Program on Enterprise Development (RPED); second, the first round of the Business Environment and Enterprise Performance Survey (BEEPS) for 22 transition countries in 1999; third, the World Business Environment Surveys (WBES), implemented for 80 countries and the West Bank/Gaza territories from late 1998 to early 2000; fourth, a number of Firm Analysis and Competitiveness Surveys (FACS) in the Development Economics Research Group (DECRG). While these projects yielded unprecedented and highly useful data for the countries and issues they were designed for, they suffered from limited comparability amongst each other due to differing questionnaire designs and priorities.

The key development of the early 2000s was a push for greater standardization in order to build up a single, centralized database of comparable business climate surveys from around the world. For this purpose, a set of core questions was 'pooled and consolidated'[24] from the earlier surveys. This set of core questions became the crucial component of the new, standardized business climate questionnaires known as Productivity and Business climate Surveys (PICS). In a specific country survey, around 50-60% will consist of the core modules (some 80 questions), the rest of nationally specific ones that can be added flexibly to the core instrument depending on each country's data needs. The core instrument was also partly incorporated into the latest rounds of surveys that had started earlier, for instance BEEPS, the second and third round of which contain most of the core PICS questions.

Launched in 2001,[25] the new PICS surveys have been used to acquire detailed firm-level data in 15 to 20 countries a year. The results have been collected in a central database (www.enterprisesurveys.org) along with those of earlier, comparable projects such as BEEPS II and III. All surveys in this database are now commonly referred to as Enterprise Surveys (ES),[26] although the old terminology (PICS, BEEPS etc.) persists to some extent. The database currently holds information from almost 70,000 firms from

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[24] http://iresearch.worldbank.org/InvestmentClimate ['About ICS', 07/22/2008]

[25] Hallward-Driemeier, M. and R. Aterido. 2007. [http://www.businessenvironment.org/dyn/be/docs/158/Hallward-Driemeier.pdf, 07/21/2008]: 5.

[26] Not to be confused with the World Business Environment Surveys (WBES) mentioned above, which were a one-off project in 1999-2000.

over 100 countries in six different regions. Aterido et al. (2007) have outlined key features of the database in a recent paper: [27]

> 'The median sample size is 350 firms, with several large countries having substantially larger samples…The sample of firms in each country is stratified by size, sector and location…The unit of analysis is the "Establishment" in the manufacture and service sectors. Most firms are registered with local authorities, although they may be only in partial compliance with labor and tax authorities.'

The core questions are generally answered by the manager or owner of the establishment in face-to-face interviews. Accounting data may be provided by the establishment's accountant and/or human resource manager. Some countries have attached nationally specific modules answered by workers (for instance the Thailand 2007 PICS survey). Among the earlier surveys, there is still some variation of the core questions, so that comparative analyses of multiple business climate variables may require a focus on a subset of the total database. Aterido et al. suggest a highly comparable subset of around 50,000 firms in 80 countries.[28]

Structure and Content of the Core Business Climate Survey Instrument

The standardized core survey instrument is organized into two distinct parts.[29] The first part provides general information about the firm and the business climate it faces. The second part collects accounting information such as production costs, investment flows, balance sheet information and workforce statistics. The questions about the firm and the business climate in the first part include:

- *General information about the firm:* age, ownership, activities, location.
- *Sales and supplies:* imports and exports, supply and demand conditions, competition.
- *Business climate constraints:* evaluation of general obstacles
- *Infrastructure and services:* power, water, transport, computers, business services
- *Finance:* sources of finance, terms of finance, financial services, auditing, land ownership
- *Labor relations:* worker skills, status and training; skill availability; over-employment; unionization and strikes
- *Business-government relations:* quality of public services, consistency of policy and administration, customs processing, regulatory compliance costs (management time, delays, bribes), informality, capture.
- *Conflict resolution/legal environment:* confidence in legal system, resolution of credit disputes
- *Crime:* security costs, cost of crimes, use and performance of police services
- *Capacity, innovation, learning:* utilization, new products, planning horizon, sources of technology, worker and management education and experience.

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[27] Hallward-Driemeier, M.; and R. Aterido. 2007: 20. See also: Aterido, R., M. Hallward-Driemeier and C. Pagés. 2007: 10-11.

[28] : Aterido, R., M. Hallward-Driemeier and C. Pagés. 2007: 10.

[29] PICS Implementation Manual (Nov. 2003) http://iresearch.worldbank.org/InvestmentClimate/Help/pics_manual.pdf [07/21/2008]

Both subjective perceptions of managers and objective data on various business climate indicators are recorded.

Box 1: Basic infrastructure variables – subjective and objective

With respect to basic infrastructure, there is one key subjective perceptions variable in the core survey. It includes three indicators: electricity, transport and telecommunications.

- Rate whether the following issues are a problem for the operation and growth of your business on a five point scale from 'No Obstacle' up to 'Very Severe Obstacle': (a) Telecommunications, (b) Electricity, (c)Transportation (d) … [14 other non-infrastructure issues incl. customs/trade regulation, labor regulation etc.]

There are also a number of objective indicators:

- During how many days last year did your establishment experience the following service interruptions, how long did they last, and what percent of your total sales value was lost last year due to: (a) power outages or surges from the public grid? (b) insufficient water supply?; (c) unavailable mainline telephone service?
- Does your establishment own or share a generator? If yes, what percentage of your electricity comes from your own or a shared generator?
- What share of your firm's water supply do you get from public sources?
- What percentage of the value of your average cargo consignment is lost while in transit due to breakage, theft or spoilage?
- Does your enterprise regularly use e-mail or a website in its interactions with clients and suppliers
- Based on the experience of your establishment over the last two years, what is the actual delay experienced (from the day you applied to the day you received the service or approval) and was a gift or informal payment asked for or expected to obtain each of the following? (a) A mainline telephone connection, (b) An electrical connection, (c) A water connection; (d)… [three other non-infrastructure issues]

Specific national surveys may add infrastructure questions to augment the core-instrument. Moreover, some changes to the core instrument have been made over time, thus some surveys include additional indicators, in the case of infrastructure for instance:

- What is your average cost of a kilowatt-hour (KwH) of electricity from the public grid?
- If yes [on generator ownership], what was the generator's original cost to your establishment?

There has been considerable debate about possible weaknesses of subjective, perception-based indicators compared to objective, quantitative data. Concerns have been raised whether subjective data may be vulnerable to 'waves of pessimism and euphoria', to inconsistencies across regions and countries because firms compare themselves to different benchmarks (so called "anchoring effects"[30]), or to managers' inability to form accurate subjective estimates.[31] For instance, managers may fail to separate internal weaknesses of the firm (e.g. inability to provide proper documentation) from external business climate constraints (e.g. inefficient bureaucracy. These problems are a specific concern when conducting econometric estimations based on cross-sectional data, and

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[30] See for example Bertrand and Mullainathan, 2001.
[31] Gelb, Ramachandran, Kedia-Shah and Turner. 2007: 2.

addressing them may require the use of panel data to control for individuals' or firms' fixed effects.

Exploring such concerns, Gelb et al. (2007) examine subjective data yielded by the core Enterprise Survey perceptions-question cited in Box 1. They conclude that while 'perceptions of critical business climate constraints may not always correspond fully to "objective" reality', firms 'do not complain indiscriminately' and response 'patterns correlate reasonably well with several other country-level indicators related to the business climate'. Likewise, Aterido et al. (2007) underline that:

> 'subjective rankings are highly correlated with objective measures in 16 of the 17 variables [and] also significantly correlated with external sources, including Doing Business indicators. Pierre and Scarpetta (2004) use 38 countries and confirm that countries with more restrictive labor regulations are associated with higher shares of firms reporting labor regulations as constraining'[32]

However, even if objective and subjective measures are significantly correlated, it is important to remember that the latter remain prone to bias. For example, a study by Olken (2006) compares corruption perceptions among villagers in Indonesia with objective measures of corruption in road construction projects. It shows that although subjective and objective measures are positively correlated, there are also systematic individual-level biases in the latter. Similar issues are very likely to arise in firm-level surveys.

In spite of these problems, subjective indicators can still play a useful role in identifying important constraints through descriptive statistics. For instance, Carlin, Schaffer and Seabright (2006) have highlighted the ease with which a subjective ranking of constraints by firms allows a comparison of the importance of different constraints. This is not readily possible with objective indicators that measure various elements of the business climate in variable-specific units.[33] For instance, it is much easier to directly ask firms to rank the perceived severity of the constraint posed by the power supply relative to corruption, rather than trying to rank it based on two objective measures such as the number of power outages relative to the amount of bribes paid. Carlin et al. also argue that while over-optimism or pessimism may affect estimates of the absolute level of measured constraint severity, there is no reason to think that average *differences* between constraint rankings are likely to be biased. Thus subjective data may be helpful to shed light on the relative importance of different constraints within economies. However, even if they can play an important complementary role, subjective indicators are probably less useful than objective ones in standard econometric analyses.

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[32] Aterido, R., M. Hallward-Driemeier and C. Pagés. 2007: 11-12.
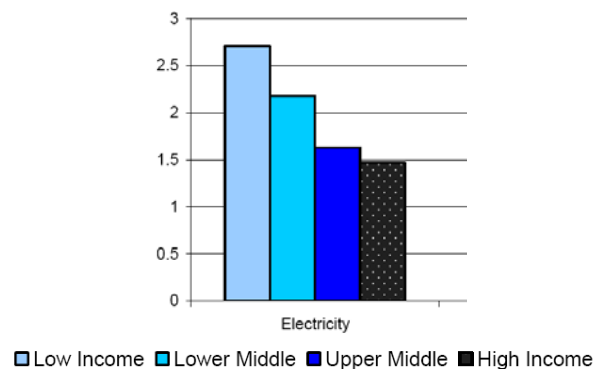[33] Carlin, W., M.E. Schaffer and P. Seabright. 2006: 13.

3. The Enterprise-Level Literature on Business Climate: Recent Results

This subsection summarizes the most important results of the recent business climate literature which relates firm performance to investment climate indicators. Given that many studies have very specific and limited samples, one must be careful before drawing general conclusions. However, a large variety of samples can be shown to yield essentially similar or complementary results. The subsection is structured by types of constraints, looking in turn at 'Basic Infrastructure' (Electricity, Telecommunications, Transport, Water), 'Financial Constraints', 'Corruption and Crime' and 'Competition and Regulation'. In each case, a summary of relevant descriptive statistics precedes a review of the regression results.

Basic Infrastructure

Carlin, Schaffer and Seabright (2006) have analyzed descriptive statistics based on *subjective* indicators from 55 Enterprise Surveys.[34] As reported in Box 1, the main perceptions question of the ES core instrument asks about three basic infrastructure indicators – electricity, telecommunications and transportation. Among the three, electricity emerges as the most important perceived infrastructure problem.[35] It is viewed as a particularly severe problem in the poorest countries of the sample, including 9 out of 10 African nations[36], 4 out of 5 South Asian countries[37], Kosovo and Albania. Gelb et al. (2007) confirm that electricity constraints decrease in perceived severity as GDP per capita rises.

Perceived Severity of Electricity Constraint (0 to 3 scale) by Country Income Groups [38]

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[34] Carlin, Schaffer and Seabright (2006) calculate a relative and an absolute measure of the importance of particular constraints. The relative measure calculates the importance of each constraint relative to the average perceived constraint severity of the country in question. Each constraint is then ranked by the total number of countries in which it is perceived as more severe than average. The absolute measure ranks constraints by the number of countries for which the constraint is ranked higher than the average perceived severity of all constraints in all countries (2.2).

[35] *Ibid.*: p.15.

[36] The exception is South Africa

[37] The exception is Oman

[38] Carlin, Schaffer and Seabright. 2006: 6. Country income classification is from the World Bank, July 2005, based on GNI. Note that Carlin et al. state that the graph is based on a 0 to 3 scale, however, the actual question in the core survey uses a 0 to 4 scale. It is not clear whether this is an error or whether Carlin et al. amended the original scale.

With the exception of Ireland, transport is rated as an above average constraint only in 'a handful of poor or war torn economies'. Telecommunications does not appear at all in Carlin et al.'s main ranking, possibly indicating the extent to which the rapid spread of mobile phones has reduced the importance of this constraint. It also underlines the need to update the objective survey questions referring to 'mainline' telephone services only.

An analysis of infrastructure statistics based on objective indicators is provided by Lee and Anas (1992) and Lee, Anas and Oh (1996; 1999) for Nigeria, Indonesia and Thailand. Their analyses are *not* based on the standard Enterprise Survey (ES) data, but on three dedicated surveys that were carried out in the late 1980s and early 1990s. The infrastructure information they collected, however, is very similar to the one available in the ES database.[39]

Lee et al. focus on the incidence of public infrastructure deficiencies, the extent of private provision responses to these deficiencies and the costs thereby imposed. They find large variations in the availability and quality of public infrastructure across the three countries, across regions within the countries and across firm sizes. In general, Nigeria tended to have a worse public infrastructure performance and a correspondingly higher incidence of private provision than Thailand and Indonesia. The authors speculate that the comparatively worse problems in Nigeria are related to the country's (then) tighter restrictions on private provision arrangements. Aimed at protecting inefficient public suppliers, these restrictions prevented the emergence of private infrastructure provision regimes more efficient than the simple 'one firm, one generator' model. [40] The authors argue in favor of '[opening] up the markets for power, water and other various infrastructure services' in order to improve service reliability and reduce system congestion.[41] However, Lee et al. do not explore this suggestion in detail and do not discuss possible implications and problems (such as equity-efficiency trade-offs).

A key finding of the study is the disproportionate way in which smaller firms are affected by infrastructure deficiencies. In all three countries, small firms relied far more on the public supply than larger ones and were thus subject to the bulk of the power failure incidents.[42] Lee et al. argue that this was not because the 'burden of poor electricity or water supplies is less per unit of output' for smaller firms, but rather due to economies of scale in private provision of electricity and water, which means it is relatively cheaper for larger firms to avoid the public system and provide their own power and water. This result finds support in the much broader analyses of 80+ Enterprise Surveys by Aterido et al. (2007) who examine the deviation of perceived constraints from the average ranking. They find that small firms report electricity as a greater relative constraint than larger firms.[43] The authors make the intuitive argument that smaller firms are 'more likely to be

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[39] The key descriptive statistics can be calculated in both cases: number of firms that own a generator; number of firms that own a private well; production time and sales value lost due to public infrastructure interruptions *et cetera*. Stratification and sample sizes are also similar in both cases (a couple of hundred enterprises per country and year, stratified by industries, regions/cities and firm size).

[40] Lee, K.S., A. Anas and G. Oh. 1999: 2141.

[41] *Ibid.*: 2149.

[42] *Ibid.*: 2138. See also World Bank (2004): Box 6.10.

[43] Note that Figure 6.4 in the World Development Report 2005 shows that a greater percentage of large than small firms rank infrastructure constraints as 'major' or 'severe'. However, this is not inconsistent with smaller firms

in areas without access to electricity or to be dependent on an unreliable public grid'[44], given that they lack the scale economies to operate a generator efficiently. Lee et al. (1999) suggest that since a very large share of new jobs in developing countries are created by small firms, the negative impact of infrastructure deficiencies on employment creation is potentially huge.[45] Regrettably, the potential links between the disproportional infrastructure problems of small firms and job creation are not followed up by the authors and no tentative cost estimates in terms of jobs are provided.

Lee et al.'s analyses demonstrate the concrete insights that can be gained from descriptive firm-level statistics of infrastructure variables. Their specific results are somewhat dated by now, but the concerns they address remain relevant today. The Enterprise Survey database, which contains similar statistics for more than 100 countries, is an extremely valuable new resource in that respect.

While descriptive statistics are useful to establish basic facts, regression analyses have provided a more detailed view of the relationship between infrastructure and firm performance indicators. Escribano and Guasch (2005) use ES data from Guatemala, Honduras and Nicaragua to calculate ten different measures of firm productivity. The productivity measures are then regressed on a number of controls as well as a broad array of objective business climate variables of which four are infrastructure indicators - the log of average duration of power outages, the log of the number of days to clear customs for imports, the log of shipment losses as fraction of sales as well as a dummy for internet access. The regressions are carried out both for a pooled sample and for each of the three countries separately. The authors find that in all regressions the infrastructure variables always have the expected signs, and the vast majority is significant. The authors are confident enough in their results to interpret the elasticities straightforwardly, noting that for the pooled sample:

> 'a one percent increase in the average duration (hours per day) of power outages decreases productivity between 0.02 and 0.1 percent, depending on the productivity measure used. It mainly affects old plants…a one percent increase in the fraction of shipment losses will decrease productivity between 1.23 and 2.53 percent. This is most important in old and small firms…firms with access to internet are between 11% and 15% more productive [than] those firms without'[46]

Escribano and Guasch go to great length to avoid bias and inconsistency in their analysis. They take care to avoid simultaneity problems, control for country, industry and year effects with dummies and also including at least two firm characteristics as controls (age and share of imported inputs). Regressions are run on all variables at a time to avoid omitted variable bias. Moreover, they use region-industry averages of the IC variables as instruments to alleviate reverse causality. Escribano and Guasch show that infrastructure

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perceiving infrastructure as a greater *relative* constraint. There may be structural reasons – such as larger firms' greater demands on the various elements of the business climate – that on average lead larger firms to report higher absolute constraint rankings in the various categories.

[44] Aterido, R., M. Hallward-Driemeier and C. Pagés. 2007: 15.

[45] Lee, K.S., A. Anas and G. Oh. 1999: 2140.

[46] Escribano, A.; and J. Guasch. 2005: 55.

has a significant impact on productivity, explaining some 9 percent of it in total – the second highest percentage after 'red tape, corruption and crime'[47].

However, a number of points should be noted when interpreting this result. Firstly, the huge impact of internet access on productivity suggests that this dummy functions as a proxy for better equipped, higher-technology firms rather than just representing internet access *per se*.[48] This advises caution when deriving policy interpretations. For instance, if the large productivity improvements captured by the internet dummy are actually related to much broader technological differences between firms, then prioritizing putting internet-connections into every firm could be a misguided step. Secondly, one should be careful not to generalize too much from these results and recall that they are based on only three (lower) middle income countries. The relationships may be considerably different in very poor countries where subjective measures indicate that electricity is a more severe problem.[49]

Hallward-Driemeier, Wallsten and Xu's (2006) study underlines that specific aspects of infrastructure are greater constraints in some countries than in others. They use data from an Enterprise Survey of China to regress different firm performance indicators (TFP, investment rate, sales growth, employment growth) on a number of controls[50] and on objective business climate indicators, including two infrastructure ones: loss of sales due to transportation or power problems, and share of employees that use computers[51]. The authors find 'no evidence that physical infrastructure affects firm performance' but 'the impact of technological infrastructure [on productivity] appears to matter significantly'. Hallward-Driemeier et al. conclude that this 'roughly' conforms to their knowledge of China, which has relatively few bottlenecks in roads and power after the recent build-up of physical infrastructure, but still faces a 'binding constraint' in terms of 'technological infrastructure'.

In a sample of five Eastern European countries (Kyrgyz Republic, Moldova, Poland, Tajikistan, Uzbekistan), Bastos and Nasir (2004) obtain a similar result as Escribano and Guasch. Regressing TFP on three controls (firm age, export status and ownership) and three aggregate business climate indicators ('competition', 'infrastructure' and 'rent predation'[52]), they find that all three IC measures have the expected sign and are significant at the 1% level. 'Infrastructure' accounts for the second largest share of the variation in firm-level productivity, behind 'competition' but before 'rent predation'. What undermines the results of Bastos and Nasir, however, is the fact that their 'two-

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[47] *Ibid.*: 73.

[48] Likewise, the other indicators may also capture some additional variation from unobserved variables. In essence, this means that there may still be some omitted variable bias that distorts the estimated parameters, or alternatively, there may be no (or almost no) bias, but the included variable may only be an instrument/proxy for the actual cause of the productivity effect.

[49] For example, the marginal impact of power outage duration on productivity could be much higher after certain thresholds, which may not be reached in middle-income countries.

[50] Ownership (share of ownership that is domestic private; share of ownership that is foreign), logs of firm age, city population and city GDP per capita

[51] in each case city-industry averages are employed to lessen reverse causality

[52] The authors use principal component analysis to obtain their aggregate indicators. See Annex 2 for the specific indicators on which the aggregate measures are based.

step' estimation is vulnerable to simultaneity bias as pointed out by Escribano and Guasch. Moreover, they do not control for country effects. Thus, while their indicators may capture some genuine cross-country differences in the three business climate categories, they are also vulnerable to bias if other cross-country effects (such as trade policy, political instability etc.) influence productivity and are also correlated with their indicators.

Dollar et al. (2005) use a sample of Enterprise Surveys from Bangladesh, China, India and Pakistan to regress total factor productivity on a number of controls and five objective business climate variables, including the two infrastructure indicators 'log of the cost of power losses as a % of sales' and log 'time required to obtain a phone line'. The authors find that even after controlling for firm characteristics, geography variables and country-level effects, power losses have a significantly negative effect on productivity. This seems to confirm the importance of electricity in poor countries and more generally the significance of infrastructure for explaining variation in productivity. However, the telecommunications variable has a perversely positive and significant coefficient, but this counter-intuitive result 'is not robust across all specifications'.

Results based on firm performance variables other than productivity by and large confirm the significant role variations in infrastructure play in explaining differences in firm success. Reinikka and Svensson (2002) use the 1998 Ugandan Industrial Enterprise Survey for a sophisticated short study of the effects of poor infrastructure and deficient public services on the level of private investment. The authors first construct a model to garner hypotheses for the empirical analysis that follows. The model characterizes two decisions – whether a firm buys private, complementary infrastructure capital, and how much it invests in non-complementary, productive capital in the next period. The first empirical estimation thus runs a probit regression of 'ownership of a generator' on the number of days of power interruptions from the public grid, the firm's employment size, the percentage of foreign ownership, a dummy indicating whether the firm exports part of its output, firm profit and age. The model hypothesis is confirmed as public power outages show a significantly positive relationship with the probability of owning a generator.[53] Moreover, a firm is significantly more likely to own a generator if it is a larger firm, an exporter or has a higher percentage of foreign ownership. With respect to the investment decision, the empirical analysis also confirms the model hypotheses. For firms without a generator, investment is found to be negatively related to the number of days of power interruptions. However, 'an increase in the number of days lost has no statistically significant effect on investment for firms with their own generators'[54]. This comes at a cost, however, for if the public power supply is good (i.e. conditional on few lost days), firms that have installed expensive private electricity infrastructure invest less than firms without a generator. On the whole, Reinikka and Svensson (2002) conclude that their analysis of Ugandan firm level data shows that poor public capital 'significantly reduces productive investment by firms'.[55] They deduce that a poorly functioning public

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[53] In the empirical analysis the actual public power outcomes are taken as a proxy for ex-ante beliefs of firms that invest in complementary private infrastructure capital in the first period.
[54] Reinikka, R. and J. Svensson. 2002: 65.
[55] *Ibid.*: 67.

infrastructure sector is likely to hinder a private supply response to more general macroeconomic reforms.

Aterido et al. (2007) use employment growth as their dependent variable and regress on a large number of controls and objective business climate variables including three infrastructure ones: log of days with power outages, log of % of sales lost due to power outages and log of days without water. Their analysis is based on a sample of at least 80 Enterprise Surveys, considerably more than other papers. With respect to infrastructure, the authors find a significantly negative effect of power outages on employment growth for medium sized firms, and at least the expected sign for small and large firms.

Hallward-Driemeier and Aterido (2007) carry out a similar study with particular focus on Africa which produces interesting results. They regress employment growth on a variety of controls and business climate variables, including losses from power outages (% of sales), frequency of outages and whether a firm owns a generator as infrastructure indicators. They can confirm that a higher incidence of power losses is associated with a negative impact on employment growth. Interestingly, the authors find that African firms seem to have adapted to this problem to some extent so that given the frequency of outages, African employment growth is stronger than expected relative to the rest of the world. This has partly to do with the comparatively high incidence of generator ownership in Africa, which reduces the impact of power shortages from the public grid. However, another reason seems to be that a higher frequency of outages seems to have contributed to a disproportional concentration of African employment growth in very small firms, which are less capital intensive and thus less vulnerable to power outages in terms of employment effects.

Export status – whether or not a firm exports goods abroad – has also been studied as a dependent variable. As trade integration has often been associated with economic growth – both at the firm and country level – authors have been interested to test whether a relationship between business climate and export status can be found. Dollar et al. (2006) draw on a sample of firm level surveys from Bangladesh, Brazil, China, Honduras, India, Nicaragua, Pakistan and Peru to carry out probit estimations of whether the probability that a randomly chosen firm in a particular city exports is connected to business climate indicators (controlling for country and a number of other variables). They include 'losses from power outages' as their infrastructure indicator and find it to have a negative and significant impact on the probability of exporting in all their specifications.

Datta (2008) uses Enterprise Survey data from India to investigate the effects of a highway improvement program on the production efficiency of firms. Datta's paper is particularly interesting for the way he exploits panel data to avoid the reverse causality problem stemming from the fact that better economic performance may attract more infrastructure, rather than more infrastructure causing firms' efficiency to improve. Datta argues that if

> 'the precise route of the highway was not manipulated to include some intermediate areas (counties, districts, cities) and exclude others based on factors correlated with the outcomes of interest, then the highway construction can be

> treated as exogenous *to the areas that the highway runs through*…This allows for a difference-in-difference estimation strategy, where changes in relevant outcomes for affected firms are compared to the corresponding outcomes for firms whose location precluded their directly benefiting from the highway program'[56]

Datta argues that since the highway improvement program in question used the most direct routes between its destinations, and because no 'opting out' was possible and no realignments carried out, the areas *in between* the destinations can indeed be viewed as a quasi-random selection of locations with existing highways to which the upgrade 'treatment' was applied. Datta finds that firms that profited from the upgrade held significantly lower inventories, became less likely to report transportation as a major or severe problem, and showed a greater propensity to change suppliers between the two years (suggesting they found more suitable ones). This is interpreted as evidence that 'improved highways facilitated productive choices', 'eased the extent to…which transportation infrastructure constrains firms' and allowed them to 'produce more efficiently'[57].

Papers that find no significant effects of infrastructure indicators on firm performance are in the minority, and generally have very specific samples or clear methodological limitations. For instance, Commander and Svejnar (2007) use a sample of BEEPS surveys (round II and III) to regress firm revenues on a number of controls and *subjective* business climate variables, including a composite 'infrastructure' one based on the perceptions question reproduced in Box 1. They do find that perceived infrastructure constraints have a negative and significant effect on firm revenue – but only without controls for country fixed effects. The authors conclude quite generally that only country effects (due partly to differences in infrastructure, partly to other unobserved heterogeneities) have an impact, while within-country differences in infrastructure do not. However, this seems like a premature conclusion given the significant within-country effects found in many other studies, that the sample is limited to Eastern Europe and Central Asia and only subjective indicators were used.

Fisman and Svensson (2005) use an Ugandan dataset to test whether firm sales growth is explained by corruption and taxation, controlling for a number of variables including an composite index of 'public services' (electricity, water, telephone, waste disposal, paved roads). Although this index has the expected positive sign (a higher index number standing for better infrastructure), it is not individually significant.

Competition and Regulation

The view that competition and entry should promote efficiency and prosperity 'has now become…common wisdom worldwide.'[58] Generally speaking, this view would lead us to expect a positive effect of competition on firm performance, and a negative effect of (excessive) regulation. Studies based on business climate survey data have predominantly
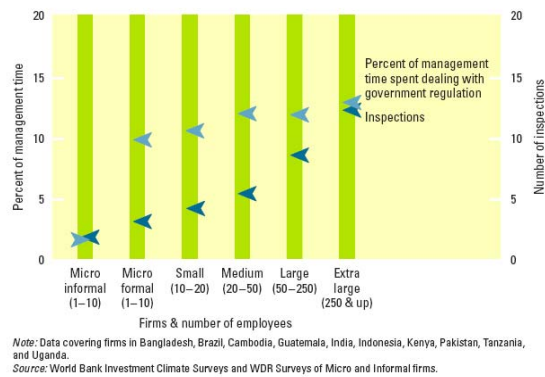
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[56] Datta, S. 2008: 2-3. [Italics are the author's]
[57] *Ibid.*: 4 and 15.
[58] Aghion and Griffith. 2005: 1.

focused on using existing local or cross-country differences in regulatory outcomes to explain firm performance. There is still a lack of panel analyses which could estimate the impact of changes (i.e. reforms) in the same regulatory framework(s) over time. This is partly due to the still small number of Enterprise Survey rounds, which restricts the size of available panel datasets..

Carlin et al.'s (2006) examination of descriptive statistics based on subjective Enterprise Survey variables from some 60 countries shows that anti-competitive practices are ranked as of greater than average importance in all of their country groups. Alan Gelb et al. (2007) look at two types of (subjective) indicators of regulation – tax administration and labor regulations. The results yielded by their subjective Enterprise Survey data are quite intuitive. Like corruption and crime, tax administration is perceived as a problem primarily in developing countries in the middle income range.[59] As one moves further up in the income level, labor regulations are more often perceived as severe constraint. Gelb et al. argue that policies 'become more serious determinants of the business climate at this stage, largely because the state has stronger capacity to implement them.'[60] The World Development Report 2005 cites some evidence that larger firms spend more time dealing with officials and are inspected more often[61]:

Note: Data covering firms in Bangladesh, Brazil, Cambodia, Guatemala, India, Indonesia, Kenya, Pakistan, Tanzania, and Uganda.
Source: World Bank Investment Climate Surveys and WDR Surveys of Micro and Informal firms.

Bastos and Nasir's (2004) analysis of BEEPS data regresses productivity on an aggregate 'competition' variable based on four subjective and one objective indicator[62]. They find a strongly positive and significant impact of competition on productivity. Indeed, competition is shown to explain a far larger part of the variation in firm performance than their 'rent predation' and 'infrastructure' variables. They conclude that this

> 'finding suggests that the relatively quick steps governments can take to increase competition will have a big payoff in firm performance – even as the slow, expensive process of upgrading infrastructure takes place. It also

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[59] Gelb, A., V. Ramachandran, M. Kedia-Shah and G. Turner. 2007: 13-14.
[60] *Ibid.*: 15.
[61] World Bank. 2004: 100.
[62] i) & ii) Importance of domestic competition for decisions to: a. introduce new products, b. reduce costs; iii) & iv) Importance of foreign competition for decisions to a. introduce new products, b. to reduce costs; v) Number of competitors in main product line;

indicates that high levels of fixed investment…will not be enough to spur growth'[63]

As stated above, however, their conclusions must be qualified by possible problems due to simultaneity bias and the failure to check for robustness of their results with country dummies.

Commander and Svejnar (2007) include an objective measure of competition – 'more than 3 competitors' – in their regressions on otherwise subjective business climate indicators, which are not significant once country effects are controlled for. However, the competition variable is shown to have a very robust positive and significant impact on firm revenue even if country effects are controlled for.

Escribano and Guasch (2005) do not have a real competition variable, but do check for an impact of regulation on productivity with the variable: 'Number of days spent in Inspection and regulation related work'. It is shown to impact productivity negatively in a significant way in almost all specifications. The authors ascribe some 12% of the variation in productivity to their combined 'Red tape, corruption and crime' variables, making it the most important set of variables. Beck, Demirgüç-Kunt and Maksimovic's (2005) analysis of 54 WBES surveys includes a subjective 'degree of legal obstacles' variable, which is found to be negative and significant. Hallward-Driemeier, Wallsten and Xu's (2006) examination of China includes the regressor 'city-industry mean of the share of senior managers' time in dealing with regulatory requirements', which has a negative and significant impact on sales and employment growth, but is not a significant explanatory variable for firm productivity.

Hallward-Driemeier and Aterido (2007) highlight that the impact of the regulatory environment is not necessarily only negative. Regulations can have positive sides as well, especially if they are consistently enforced. Hallward-Driemeier and Aterido find that consistent enforcement of regulations has a clear positive association with employment growth in most of the developing world, though it is insignificant for Africa. The variable indicating management's time spent dealing with the authorities has an ambiguous impact. In the full sample, it is positive in general but less so in Africa. The authors argue that while there seem to be some benefits associated with accessing public services, at 'about 15 percent of management time, the marginal impact of additional interactions with the government is negative'[64]. On the other hand, pure red tape such as unnecessary delays in customs have significantly negative effects.

Aterido et al. (2007) use the same two indicators representing the regulatory framework: the relatively objective '% of management's time dealing with government regulations' and the subjective ranking of the statement 'officials interpretation of regulations is consistent'.[65] The authors find that consistency of enforcement has a positive and significant effect in general, which is particularly marked for small firms. The authors

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[63] Bastos, F. and J. Nasir. 2004: 24.
[64] Hallward-Driemeier, M., S. Wallsten and L.C. Xu. 2006: 9.
[65] See Tables 6,7, 8 and 9.

also obtain a generally positive effect of managements' time spent dealing with authorities, which they interpret as representing the benefit from obtaining public goods. As before, a quadratic version of the indicator suggests that the benefits are offset as the overall time mangers spend with officials rises beyond a certain point.[66] There is also some evidence that large firms profit less from management time spent dealing with authorities[67], which may partly be due to the fact that the average time large enterprises spend dealing with officials is longer than for small firms.

Financial Constraints

Examining subjective indicators, Carlin et al. (2006) find the cost of finance ranked above average in severity in all of their country groups[68]. In particular, the cost of finance is the highest ranked constraint in the African country group[69]. Alan Gelb et al.'s (2007) study of subjective perceptions data shows that the perceived severity of 'access to finance' constraint declines with country income level.[70] The World Development Report 2005 includes the following graph, based on a similar sample, which also indicates a higher reported severity of the financial constraint in poorer countries[71]:
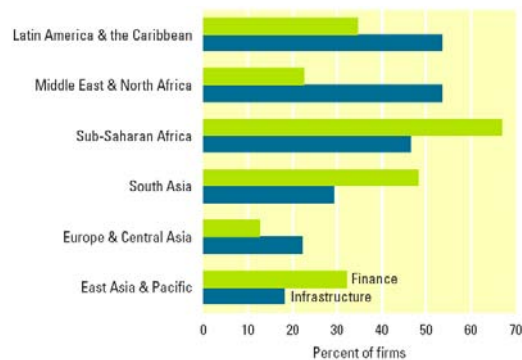
Note: Figure shows the share of firms that report access to finance, and any of electricity, telecommunications, or transportation as "major" or "severe" obstacles to the operation and growth of their business.
Source: World Bank Investment Climate Surveys.

Within countries, descriptive statistics of subjective data indicate that access to finance is particularly problematic for less productive firms.[72] Size also seems to influence the ability of obtaining credit from banks. Using 54 datasets from the World Business Environment Surveys (WBES), Beck, Demirgüç-Kunt and Maksimovic (2005) regress a subjective firm level indicator of financial access[73] on firm size and a number of specific country-level institutional effects. It is found that even after controlling for a country's

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[66] Aterido, R., M. Hallward-Driemeier and C. Pagés. 2007: 21.

[67] *Ibid.*: 38. Table 6, Column 1.

[68] Africa (10), South Asia (5), East Asia (7), Latin America and the Caribbean (7), OECD Europe (6), Central and Eastern Europe (8), South Eastern Europe (8) and the CIS (11)

[69] South Africa is an exception; the constraints ranked most highly there are labor regulation, skill shortages, macroeconomic stability and crime

[70] Gelb, A., V. Ramachandran, V., M. Kedia-Shah and G. Turner. 2007: 13.

[71] World Bank. 2004: 115.

[72] Carlin, W., M.E. Schaffer and P. Seabright. 2006: 6 (Figure 1b).

[73] 'How problematic is financing for the operation and growth of your business: no obstacle (1), a minor obstacle (2), a moderate obstacle (3), or a major obstacle (4);

institutions, smaller firms report significantly higher financial obstacles than large firms.[74] Likewise, Aterido et al (2007) find, based on objective Enterprise Survey data, that smaller firms have significantly less access to different forms of finance even when controlling for age, export status, ownership and industry.[75] In line with this, the business climate survey data indicates that small firms tend to finance a much smaller share of their investments with formal credits.[76] Bigsten et al. (2003) confirm that in their sample of African countries, close to two-thirds of micro firms are credit constrained, but only 10 percent of large firms. The authors also find that regressions controlling for other important factors such as expected profitability and indebtedness, 'the likelihood of a successful loan application varies with firm size' in the same way.[77]

Most of the studies employing regression analysis to examine the relationship between firm performance and the business climate include indicators representing measures of financial access. The most pertinent results will be outlined below, keeping in mind the general methodological criticisms of key papers already mentioned in the context of infrastructure indicators.

Beck, Demirgüç-Kunt and Maksimovic (2005) regress firm sales growth on a number of controls as well as one summary[78] and 11 specific[79] subjective indicators of financial obstacles. Entered alongside the legal and corruption summary variables, the financial obstacles main indicator is found to have a negative and significant effect on firm growth. The authors also find 6 of the 11 specific financial constraints indicators having a negative and significant impact, however, because each is entered individually, it is likely that omitted variable bias distorts these results. It should also be noted that Beck et al. do not calculate location-industry averages, rendering their estimates vulnerable to reverse causality at the firm level, as does their reliance on subjective indicators.

Aterido et al.'s (2007) main objective financial constraint indicator is 'percentage of investments financed externally' and they take greater care than Beck et al. (2005) to reduce endogeneity at the firm level.[80] Attempting to explain employment growth, they find that in general, a higher share of investments financed externally is associated with greater employment growth. Hallward-Driemeier and Aterido (2007) also find a significantly positive impact of their financial access variable 'share of investment financed externally' on firms of all sizes:

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[74] Beck, T., A. Demirgüç-Kunt and V. Maksimovic. 2005: 150.

[75] Aterido, R., M. Hallward-Driemeier and C. Pagés. 2007: 36 (Table 4) and 8.

[76] World Bank. 2004: 116.

[77] Bigsten, A. and M. Söderbom. 2005: 11.

[78] 'How problematic is financing for the operation and growth of your business: no obstacle (1), a minor obstacle (2), a moderate obstacle (3), or a major obstacle (4);

[79] i) 'Are collateral requirements of bans/financial institutions no obstacle (1), a minor obstacle (2), a moderate obstacle (3), or a major obstacle (4)?'; ii) 'Is bank paperwork/bureaucracy no obstacle….?'; iii) 'Are high interest rates no obstacle…?'; iv) 'Is the need of special connections with banks/financial institutions no obstacle…?'; v) 'Is banks' lack of money to lend no obstacle…?'; vi) 'Is the access to foreign banks no obstacle…?'; vii) 'Is the access to nonbank equity/investors/partners no obstacle…?'; viii) 'Is the access to specialized export finance no obstacle…?'; ix) 'Is the access to ease finance for equipment no obstacle…?'; x) 'Is inadequate credit/financial information no obstacle…?'; xi) 'Is the access to long term finance no obstacle…?';

[80] Aterido, R., M. Hallward-Driemeier and C. Pagés. 2007: 20.

'A 10 percent increase in the share of investments financed through bank loans (equivalent to doubling the average share) is associated with a 3 percent increase in employment growth. This result is robust to alternative measures of finance, including formal bank financing of investment to trade credit among firms.'[81]

By contrast, Commander and Svejnar (2007) cannot find a significant effect of their subjective 'cost of finance' variable on firm revenue in their dataset from Eastern Europe and Central Asia.[82] Dollar et al. (2005) find no significant effect of their financial indicator 'access to overdraft facility' on productivity of firms in the garment industry, but in an expanded sample they do find a significant and strongly positive impact of the variable on annual sales growth. Dollar et al. (2006) find a relatively robust positive relationship between 'access to overdraft' and the probability that a firm is an exporter.[83] Hallward-Driemeir, Wallsten and Xu's (2006) study of the Chinese business climate yields no significant link between a variety of firm performance indicators and bank access. As pointed out above, this result may largely be due to the peculiar nature of the Chinese state owned banking sector which tends to be relatively inefficient and subsidizes unsuccessful enterprises for political reasons. Thus, it is not particularly surprising that access to finance has no systematic impact on variations in firm performance in China.[84]

Escribano and Guasch (2005) do not include a variable indicating availability of credit to the firm in their equations. However, they do include one dummy indicating whether the firm is a publicly listed company, and another dummy that represents whether the firm is externally audited or not. Both indicators are significantly positively related to firm productivity (between 11.5 and 17 percent).

In a large cross country sample, Carlin et al. (2006) find the coefficient of their subjective indicator of 'cost of finance' to be negative in both between and within-country regressions, and also significant in the latter. However, they argue that this result is not primarily due to financial constraints impacting productivity, but rather the fact that inherently less productive firms are rationally denied credit by financial managers (and complain about it). This reasoning makes intuitive sense, but Carlin et al.'s actual results are undermined by weaknesses in their methodology. For instance, if the above endogeneity bias is suspected as a problem, the authors should also have tested the relationship between firm productivity and the average cost of finance in the firms' location and industry (rather than for the firm itself), thus alleviating the firm-level endogeneity. Moreover, the endogeneity mechanism they highlight seems more likely to impact subjective data and seems less relevant for objective data on which much of the significant relationships found in the literature are based. Finally, their method of regression on one indicator at a time is also sub-optimal because it is likely to cause omitted variable bias. While the finance-endogeneity effect they highlight is interesting and should be kept in mind when interpreting results of financial indicators, their

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[81] Aterido, R., M. Hallward-Driemeier and C. Pagés. 2007: 8.
[82] Except when the variable is entered separately from the other IC variables, which renders it vulnerable to omitted variable bias
[83] Dollar, D., M. Hallward-Driemeier and T. Mengistae. 2005. 1507.
[84] Hallward-Driemeier, M., S. Wallsten and L.C. Xu. 2006: 645.

particular econometric results to not by themselves undermine the significant relationships between financial availability and firm performance found in other papers, which are more pro-active in countering endogeneity problems.

Corruption and Crime

Carlin et al.'s summary of subjective indicators from a large number of enterprise surveys identifies crime and corruption as problems reported primarily in less developed countries. Of the two, corruption is more commonly perceived as problematic:

> 'Crime and/or corruption show up as important constraints in all groups of countries except the OECD: crime in only one-quarter of countries and corruption in 70%.'

The analysis of subjective firm level data by Gelb et al. (2007) shows that concern about corruption and crime tends to peak in the middle of developing countries' income range. The authors interpret this as showing that once economies overcome utmost poverty and the most basic limitations related to infrastructure, finance and macroeconomic stability, problems of low administrative and bureaucratic capacity come to the forefront of firms' concerns.

Recent studies that examine the relationship between firm performance and business climate indicators generally find significant effects for corruption and crime indicators. Fisman and Svensson (2005) use their Ugandan firm-level dataset for a study focused on corruption and its effect on growth. Their OLS and IV regressions of sales growth on a corruption indicator and a variety of controls show a

> 'strong, robust, and negative relationship between bribery rates and the short-run growth rates of Ugandan firms, and […] the effect is much larger than the retarding effect of taxation.'

Escribano and Guasch's (2005) study of productivity in Guatemala, Honduras and Nicaragua includes the explanatory variables 'payments to deal with bureaucracy faster as % of sales' and 'number of criminal attempts suffered'. The coefficient for the number of crimes suffered shows the expected negative sign and is significant. However, the size of bribe payments has a robust positive relation with productivity. This may mean that firms that can afford paying (more) bribes will tend to be more productive in the first place and/or reap productivity advantages from their payments. However, in terms of policy implications it certainly does not imply that the incidence of corruption in the three countries should be seen as positive for productivity in general. Rather, the authors argue, 'it is clear that there is room for improvement in the administrative procedures followed in the three countries…so that no more arbitrary administrative gains in productivity [arise] from bribes of firms.'[85] Still, the difference in the direction of the sign of the corruption variable in the two studies is somewhat puzzling, and further research would be required to reveal the source of the difference (which could be genuine cross-country

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[85] Escribano, A. and J. Guasch. 2005: 54.

variation in the mechanisms of corruption, or related to the somewhat different regression specifications).

An interesting result with respect to the sign of the coefficient of corruption indicators is provided by Aterido et al.'s (2007) analysis of employment growth in a very large sample of some 80 Enterprise Surveys. They find a significantly negative effect of their bribe dummy, as well as alternative corruption indicators, on the growth of small, medium and large firms. However, the coefficient is positive for micro-firms.[86] This probably indicates that micro-firms find it easier to escape the attention of corrupt officials and therefore tend to grow faster relative to larger firms if the industry-location averages of corruption are higher. In their study of the Chinese business climate, Hallward-Driemeier, Wallsten and Xu find that objectively measured corruption[87] matters 'a great deal' for sales growth. Reducing 'the mean score of corruption by one standard deviation…has a positive effect on sales growth by…6 percentage points'.[88] However, no significant effect of corruption can be shown for other firm performance indicators such as productivity and employment growth. In Beck, Demirgüç-Kunt and Maksimovic's (2005) main regression of sales growth on a number of controls and three summary subjective business climate indicators, corruption obstacles, unlike financing and legal ones, are not significant, although the coefficient does have the expected negative sign. The authors suspect this to be due to multicolinearity, in the sense that the 'impact of corruption on firm growth is captured by the financial and legal obstacles.'[89] In an Eastern European and Central Asian sample, Bastos and Nasir (2004) also find a significantly negative effect of their 'rent predation' aggregate variable, which measures a combination of corruption and regulation. However, the rent predation variable explains less variation of productivity than the infrastructure and competition measures.

Section 3.   Lessons and Ways Forward

In the previous section, we have reviewed the results of firm-level studies that relate enterprise performance to various objective and subjective business climate indicators, along with a series of controls for variables such as firm characteristics, industry and country effects.

As has been seen, these studies have provided new evidence for one of the central assertions of the 2005 World Development Report, namely, that a good business climate 'drives growth by encouraging investment and higher productivity'[90] At least four elements of the investment climate – infrastructure, finance, corruption and crime, and competition and regulation – have been shown to significantly impact firm performance.

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[86] Aterido, R., M. Hallward-Driemeier and C. Pagés. 2007: 22.
[87] Their variable is the city-industry share of the corruption score, which is constructed as the principal component of two variables: the ratio of bribes to sales plus the share of contract value used as bribe to get a business contract
[88] Hallward-Driemeier, M., S. Wallsten and L.C. Xu. 2006: 644.
[89] Beck, T., A. Demirgüç-Kunt and V. Maksimovic. 2005: 151-153.
[90] World Bank. 2004: 2 and 8.

Even as problems remain, the firm-level studies have already improved on the macro-literature in a number of respects. Numerous firm-level papers have now shown that important within-country heterogeneity exists. Variation in local business climate does indeed matter for explaining differences in firm performance. Much the same point is made by single-country, regional business climate studies such as the one on China by Hallward-Driemeier et al. (2006). Moreover, the much larger sample sizes made possible by going to this disaggregated level allow for more robust results than in the macro-studies. The information obtained from the business climate surveys is also much more detailed and practical than aggregate indicators, allowing, for instance, insights about the variation of business climate effects across regions and different types of firms.

Building on this, a rich research program becomes possible. Below, we start by outlining the econometric issues and limitations of the current literature, and summarize the lessons derived from them. We then highlight what in our view are the most promising areas for future research. Finally, we open the debate on potential improvements in the design of existing survey questions.

1. *Econometric Lessons from the Current Literature*

The standard approach in the current literature based on enterprise survey data has been to use regression analysis to identify which – if any – business climate indicators determine firm performance and to what extent. Almost universally, the basic specification of these regressions has been:

$$\text{Firm Performance} = \beta_1 + \beta_2(\text{IC Indicators}) + \beta_3(\text{Firm Characteristics}) + \beta_4(\text{Additional Controls}) + \varepsilon$$

When interpreting results from these regressions, it is important to keep some basic characteristics and limitations of the approach in mind. Significant coefficients of the explanatory variables are only obtained if there is variation in these variables. Thus, the results presented above efficiently pinpoint existing bottlenecks that explain observed variations in firm performance, but they are less useful for identifying universal problems. For instance, Hallward-Driemeier, Wallsten and Xu (2006) find that access to banking services is not a significant determinant of firm performance in China. However, this does not mean that increasing the availability and efficiency of financial services is unimportant for improving Chinese productivity. As the authors point out, 'it only means that the state-owned banking sector has not contributed significantly to regional firm growth'[91]. In other words, the fact that Chinese state-owned banking has not had a systematic impact on firm performance means that it does not show up as a determinant of actual *variation* therein. But the common lack of efficient banking services may still be responsible for sub-optimal levels of firm performance throughout China. This methodological issue is particularly relevant for studies with small samples, because expanding the number of observations will tend to introduce more variation and thus allow more general statements.

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[91] Hallward-Driemeier, M., S. Wallsten and L.C. Xu. 2006: 645.

A related issue is that of 'camels and hippos' raised by Hausmann and Velasco (2005) and discussed in Gelb et al. (2007) and others. All results are necessarily based on the answers of existing firms that were interviewed. However, if one only interviews those present ('camels in the desert'), one may miss the crucial constraint ('water') of those who have not entered ('no hippos in the desert'). In other words, a self-selected sample may imply a lack of variation in the explanatory variables that prevents us from noticing a critical constraint. However, in their study of perceptions data, Gelb, Ramachandran, Shah and Turner (2007) argue that such self-selection is hardly ever complete (e.g. hippos can be expected to live in a water hole at the edge of the desert), and that firms that choose to enter in spite of serious constraints (which may force them into costly evasive actions), will perceive them as particularly serious and thus introduce econometrically significant variation.[92] Still, as it stands it is important to recognize that the econometric model above only informs us about the effect of constraints on the sample of existing firms. It is sometimes argued that the more interesting issue is rather the underlying industrial structure (e.g. the camel/hippo ratio in the desert) which should give away the most important constraint (i.e. the absence of hippos indicates that the main constraint is the lack of water). This, however, could only be addressed with completely different models such as "entry" models.

Another general methodological problem is that of multicolinearity. If regressors are correlated with each other, estimates will be inefficient and, as Bastos and Nasir (2004) point out, it may be impossible to 'know the importance of any one particular indicator since it may be serving as a proxy for other, more relevant variables'[93]. This is a particular problem with the business climate data, as many indicators are closely related. For instance, the prevalence of e-mail usage may largely move with the quality of electricity supply. This counsels caution when interpreting very specific indicators, and emphasizes the importance of choosing a good regression specification. To some extent, variables such as 'prevalence of e-mail' should be seen as proxies for broader infrastructure factors. Bastos and Nasir's (2004) solution is to explicitly aggregate a number of specific indicators into broader measures ('infrastructure, 'competition' etc.), in order to get clearer results at the loss of some (presumably misleading) detail.

Endogeneity – the correlation between the explanatory variables and the error term – is even more serious than multicolinearity, because it causes not only inefficiency and interpretative difficulties, but bias and inconsistency of the estimates. The presence of endogeneity undermines the validity of estimated relationships between business climate indicators and firm performance.

It is unrealistic to assume that firm level business climate indicators are exogenous for a number of reasons. First, a major endogeneity problem arises if relevant explanatory variables are mistakenly omitted from the regression equation and also correlated with relevant included regressors. If this is the case, the estimated parameters of the included regressors will pick up some of the impact on the dependent variable of the omitted variables with which they are correlated. This will distort the estimates of the parameters

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[92] Gelb, A., V. Ramachandran, M. Kedia-Shah and G. Turner. 2007: 27-29.
[93] Bastos, F. and J. Nasir. 2004: 10.

of the included regressors, because they will now capture both their own effect and part of that of the correlated omitted variables.

Second, better subjective and objective investment climate indicators may be associated with better performing firms not because they cause such firms to be more productive, but on the contrary, because 'an inherently more efficient firm can work within the exogenously given environment to reduce inspections, power losses or days for customs clearance or phone lines.'[94] Similarly, not only may better suited business environments cause firms to be more efficient, but inherently more efficient firms may also be more likely to have the necessary resources to identify and (re-)locate to better suited environments. At the aggregate level, inherently more prosperous regions may have greater political clout to obtain infrastructure and other business climate improvements from government. If one cannot fully control for these reverse causality factors, estimates of the effect of the investment climate on firm performance will be biased.

To limit the endogeneity bias problem, the current firm level business climate literature suggests the following measures:

o Regressions on single business climate indicators are very likely to produce biased and inconsistent parameter estimates due to omitted variables. A sufficiently broad array of indicators and controls should therefore be used in regression equations. The selection of regressors should go from general to specific.[95]

o Objective indicators are generally preferable to subjective ones as explanatory variables, because they are less vulnerable to measurement error and reverse causality.[96]

o Using location-industry or industry averages instead of (or as instruments for) the firm-level objective indicators can help alleviate endogeneity due to reverse causality.[97] The idea is that while better region-industry investment climate indicators should explain variation in firm performance, individual firm performance has virtually no impact on the average-indicator. This alleviates direct reverse causality.

o Country-level effects should be controlled for, either with country dummies or more specific country-effects variables, to avoid a contamination of the IC coefficients with correlated but unobserved country level effects on firm performance.

o A simple two-step estimation procedure that estimates TFP as the residual of a production function and then attempts to explain TFP with IC indicators is potentially vulnerable to simultaneity bias. The problem is that in most cases the inputs of the production function will be correlated with the investment climate indicators, because

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[94] Dollar, D., M. Hallward-Driemeier and T. Mengistae. 2005: 9.
[95] Carlin, W., M.E. Schaffer and P. Seabright. 2006: 36.
[96] Bertrand, M.; and S. Mullainathan. 2001: 71. Also: Aterido, R., M. Hallward-Driemeier and C. Pagés. 2007: 12.
[97] See for instance: Hallward-Driemeier, Wallsten and Xu, 2006. Dollar, Hallward-Driemeier and Mengistae, 2006. Escribano and Guasch, 2005. Commander and Svejnar, 2007. These authors use location-industry averages that exclude the respective firm.

the investment climate influences not only productivity *per se*, but also input choices of firms. This means that in the production function regression, the error term (i.e. TFP) is likely to be correlated with the regressors (labor, capital etc.) via the investment climate, leading to bias. If possible, this approach should thus be avoided. Escribano and Guasch (2005) suggest alternative procedures.

o In the absence of panel data, an approach similar to Miguel, Gertler and Levine (2005) might be useful to alleviate some endogeneity problems. They try to explain industrialization (measured as the growth in manufacturing employment) at the district level in Indonesia over a 10 years period with social capital indicators at the beginning of the period (but find no effect!). A similar approach could be taken with indicators from ICA surveys.

Finally, note that a complete assessment of the results in the literature we have surveyed so far would also require that we look more closely at the issue of the quality and relevance of the performance proxies used as dependent variables (productivity or profit, or sales growth etc.). While entering into the details of the literature on this topic would take us beyond the scope of this paper, let us note that in general measures of firm-level productivity are much more likely to run into problems and generate biases, as the very construction process of these variables make them likely to be correlated with policy shocks and managerial decisions (Katayama, Lu and Tybout, 2006). This is not to say that alternative proxies (e.g. profit, sales or employment growth) are completely free of these problems (see Del Mel, McKenzie and Woodruff, forthcoming) but in many cases they appear to be preferable.

2. *The Research Agenda*

There remain a number of areas in which additional research could bring interesting results. At the theoretical level, we need to develop a better understanding of the link between firms' choices and the business climate, especially in developing countries. That means modeling decisions about investment, R&D, employment and so on, which hinge on the type of constraints revealed by the existing surveys (things like credit constraints, infrastructure bottlenecks, level of competition in goods and labor markets, volatility of macroeconomic conditions, entry costs, commitment and enforcement problems or information issues).

The type of modeling used in the literature on firms' choices of formality might be useful here.[98] Together with tools from industrial organization and contract theory, this approach should provide a good basis to formalize insights on market behavior in developing countries. Additionally, results could then be used to understand the very different shapes of firms' distributions we see across countries, for example in terms of size, productivity or exporting behavior, and guide the empirical applications.

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[98] For instance: Rauch 1991; Straub 2005; De Paula and Sheinkman 2008.

At the empirical level, some of the most interesting insights in the firm-level business climate literature have come from recent studies that look at interactions of business climate indicators with firm characteristics or with each other. For instance, Hallward-Driemeier and Aterido (2007) interact IC measures with firm sizes to obtain more detailed results on the impact of the business environment on the performance of different types of firms. Honorati and Mengistae (2007) examine the interplay of regulation, infrastructure, financial constraints and corruption. They obtain some interesting results, for instance that all three aspects have significant influence on Indian industrial growth, yet their effect depends on the incidence of corruption. Most existing firm level studies have not considered these types of interactions, and more work in this direction could deliver interesting outcomes that lay the groundwork for more precisely targeted policy recommendations.

A key research goal highlighted by a number of authors is that once more surveys rounds become available, proper panel data regressions could test for the impact of *changes* in the business climate on productivity, factor returns, and growth.[99] For instance, whereas current microeconomic studies predominantly aim to assess the variation in firm performance due to local and cross-country variations in existing constraints, panel data could allow an assessment of the impact of changes (reforms) in the shape of different constraints on firm performance. However, with only 3 survey rounds available at most, it is still relatively early for these types of studies.

Even the standard methodological approaches have not yet made full use of the large Enterprise Survey database. For instance, no best-practice study (properly accounting for endogeneity) of the relationship between firm productivity and the business climate has been carried out for the full, up-to-date Enterprise Survey database.[100] Likewise, 'little analysis is available on the impact of infrastructure on manufacturing firm productivity' in Africa.[101] More specifically still, there is a lot of scope to carry out detailed country studies such as that of China by Hallward-Driemeier, Wallsten and Xu (2006) or that of India by Honorati and Mengistae (2007) and Amin (2007). It is generally easier to correctly interpret econometric results in single-country studies, because outcomes are easier to connect to real-life circumstances and complementary data.

As noted above, a recent paper by Durlauf et al. (2008) argued that the effect of institutions is 'likely to be through their influence on proximate growth determinants (factor accumulation, in this case) rather than through their effects on technological innovation.' It would be interesting to explore this question further in a micro-context. So far, only a few papers have used measures of capital (or human capital) accumulation as dependent variable and there has been no systematic comparison to the results for total factor productivity.

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[99] See for instance: Dollar, D., M. Hallward-Driemeier and T. Mengistae. 2005: 30.
[100] This has only been done with employment growth as dependent variable. See: Aterido, R., M.Hallward-Driemeier and C. Pagés, 2007.
[101] Bigsten, A. and M. Söderbom. 2005: 15. However, there has been at least one paper on the relationship between employment growth and the investment climate in Africa.

Future studies should make sure to extensively test the robustness of their results and if possible improve on the methodology in a more fundamental way. This is because even the current 'best-practice' precautions against endogeneity – such as using location-industry averages as instruments of the firm-level indicators, regressing on multiple IC indicators at a time and controlling for the current country, region and industry effects – leave regressions vulnerable to inconsistency and bias, as Carlin et al. (2006) and others point out. For instance, as highlighted above, location-industry averages are used as instruments to alleviate endogeneity stemming from reverse causality. Yet, such endogeneity effects can persist at a more aggregate level as well, because of policy endogeneity and endogenous placement decisions of firms. For instance, using industry-location averages one may find a strong relationship between the performance of firms and the average quality of telecom services of a specific industry and region. However, as Carlin et al. (2006) point out, regions 'that are prosperous for a variety of other reasons for which it is not realistically possible to control econometrically also happen to have higher levels of telecom services.' To counter this effect, a recent paper by Hallward-Driemeier, Wallsten and Xu (2006) has included additional city information and sector dummies to at least help 'control for those more macro issues that affect both the IC variable and the firm'.[102] Nevertheless, the inability to sufficiently control for all factors implies that the endogeneity problem is likely to persist to some extent. In light of this, it is clear that the need arises for more creative instrumental strategies. Again some examples can be found in the literature, for example in Duflo and Pande (2007), who use geographical data to instrument for the endogenous placement of infrastructure, or Datta (2008) and Gibson and Rozelle (2003) who take advantage of the seemingly exogenous placement of road works in specific contexts to assess their impact.

Finally, it should be noted that the underlying assumption of most of the firm-level literature is that changes in the business climate which improve firm performance will translate into broad social benefits. Regression results based on data provided by firm-managers are thus often straightforwardly translated into policy advice, e.g. to increase competition and lower regulation. In order to reduce the risk of any negative impacts, it may be worthwhile to consider possible competing interests when deducing policy recommendations. For instance, regulations may impact firm productivity negatively but provide benefits to non-managerial social groups.

3. Improving Questionnaire Design

At a fundamental level, it may also be worthwhile to re-think some of the Enterprise Survey questions which determine the raw data on which all analyses are based. For instance, in the era of mobile phones – which are particularly important in many developing countries – the focus on mainline telephone services is anachronistic and misleading. With regard to infrastructure indicators, Straub (2008) makes a number of suggestions for more detailed questions such as firms' access to alternative transport modes (railways, airports, roads etc.) or the ownership of vehicles.[103]

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[102] Hallward-Driemeier, M., S. Wallsten and L.C. Xu, 2006: 640.
[103] Straub, S. 2008: 39.

There appear to be many holes in the information provided. In electricity for example, most information is on quality (outages and cost thereof) but basic information on cost and availability of service would be needed: average cost of a kilowatt-hour (KwH) of electricity from the public grid / cost of generators. Similarly, in water, information is sought on the sources of provision, but it should be complemented with the respective average unit costs.

In transport, data on the possibility to access different types of services (roads, railroads, etc.), together with an assessment of their unit cost and quality, and the ownership of different types of vehicles, would make it possible to assess the significance of the transport mix chosen by firms. In the case of telecommunications, as mentioned above, mobile telephony is completely absent from existing surveys. Here again, data on access, unit cost and quality of service would be necessary. One could also wonder why questions geared at the use of internet are restricted to the sub-sample of service firms.[104]

Finally, in all cases, a few key dimensions need to be added. First, information on the institutional nature of service providers and regulatory arrangements would be crucial from a policy perspective. Moreover, in a context where the geographical dimension is increasingly recognized to be important,[105] data need to be spatially referenced. Obviously, the practical task of gathering this type of data (including in particular several hours spent with directors and managers of firms, who often have imperfect knowledge about the things they are asked to report) implies a trade-off between being exhaustive and the quality of the data collected. However, the fact that such exercises are bound to aim at second best results should not impede that we try to address the most obvious shortcomings of current surveys.

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[104] Similarly, questions on innovation are restricted to manufacturing firms.
[105] See Straub, 2008. Also, Gibson and McKenzie, 2007.

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Annex: Selection of Papers Analyzing the Relationship between Firm Performance and the Business climate

Paper	Dataset	Type of Analysis	Dependent Variable(s)	Independent Variables	Results / Criticism
Bastos and Nasir (2004): 'Productivity and Business climate: What matters most'	BEEPS II Extended (Kyrgyz Republic, Moldova, Poland, Tajikistan, Uzbekistan)	1. Estimation of TFP and subsequent regression of TFP on three broad business climate measures – rent predation, infrastructure and competition – which were constructed from individual survey indicators using principal component analysis 2. Determination of the relative importance of the three business climate regressors using the Kruskal (1987) methodology.	- ln(TFP)	*Business climate Variables:* -Rent predation variable, based on: * Amount of unofficial payments to public officials as % of sales * % of senior management time spent in dealing with red tape * Days last year spent on inspections - Infrastructure variable, based on: * Days of interrupted phone serv. * Days of interrupted water serv. * Days of interrupted power serv. - Competition variable, based on subjective estimates of importance of domestic / foreign competition to introduce new products / reduce costs. *Control Variables:* Firm Age, Exports (% of sales), Foreign Ownership	Results: The business climate variables have the expected signs and are jointly significant. Using Kruskal's methodology, competition is found to explain far more variation in firm-level productivity than infrastructure, which in turn explains more variation than rent predation. Criticism: Authors do not include country dummies (see criticism of Commander and Svejnar, 2007). Two step estimation procedure vulnerable to simultaneous equation bias as outlined by Escribano and Guasch, 2005).
Beck, Demirgüç-Kunt, Maksimovic (2005): 'Financial and Legal Constraints to Growth: Does Firm Size Matter'	54 datasets from the World Business Environment Surveys (WBES)	1. To find out whether firm size determines perceptions on financing, legal and corruption constraints to doing business, the authors carry out OLS regressions of firm-level financing, legal and corruption indicators on firm size, controlling for country level financing, legal and corruption constraints. 2. To see whether variations in perceived obstacles can	- 32 mostly subjective business climate variables in the categories 'financial', 'legal' and 'corruption'. - Firm growth (percentage change in firm sales over the past 3 years)	*Business climate variables (subjective on a 1 to 4 scale):* - Summary financing obstacle - Summary legal obstacle - Summary corruption obstacle - 29 subjective and 3 objective IC indicators for more specific constraints within the three summary categories. *Controls:* Ownership (government/foreign); Exporter status; number of competitors; industry dummies;	Results: 1. 'Firms' perception of the financing and corruption obstacles they face relates to firm size, with smaller firms reporting significantly higher obstacles than large firms. In contrast, smaller firms report lower legal obstacles than do larger firms, but these differences are not significant.' 2. When entered individually, all [three summary] obstacles have a negative and significant effect on firm growth…[entered at the same time] financing and legal obstacles are

		explain firm sales growth, the authors carry out OLS regressions of firm growth on IC indicators (each in turn, not all together), controlling with industry dummies, firm characteristics and country random effects. 3. To explore how the effects of IC indicators differ by firm size, a series of size controls are added as explanatory variables.		country specific dummies (inflation; GDP; GDP per capita; GDP growth);	both significant and negative, but corruption loses its significance…'. Entering the 32 individual obstacles each in turn, some of the financing and corruption variables, but none of the legal ones are significant. Two of the only three quasi-objective indicators are significant. 3. The authors find evidence that financial obstacles have a much greater impact on the operation and growth of small firms than on that of large firms. Criticism: Very few objective business climate indicators (only three quasi-objective ones out of 35). Also, the results on the 32 specific IC variables are based on regressions of firm growth on each of the variables in turn → Likely omitted variable bias! Authors do not
Dollar, Hallward-Driemeier, Mengistae (2005): 'Business climate and Firm Performance in Developing Economies'	Four datasets from the World Bank Enterprise Surveys Main Database: Bangladesh, China, India and Pakistan	1. GLS and Levinsohn/Petrin production function estimation of TFP in the garments industries of all countries. TFP is then regressed on the logs of a set of IC variables and controls. 2. Regression of factor rewards in garments industries on the same variables plus firm characteristics. The hypothesis is that factor rewards will be higher were IC is better. 3. Regression of sales growth, growth in fixed assets and growth in employment in all industries (pooled dataset) on IC variables and controls. All regressions carried out for the full sample, and a sub-sample of small firms.	For garments industry only: - TFP - Average wage - Average profit For pooled data (all industries): - Sales growth - Annual growth rate of fixed assets - Annual growth rate of employment	*Business climate variables:* - log(custom days export) - log(custom days import) - log (power loss) - log (days to get phone) - log (overdraft facility) Instrumented by city-sector averages. *Control variables (not all in every regression):* log of…distance from market; distance from port; population; lagged annual sales; lagged age of firm; fixed assets at start of year; last year's employment; also country, year and industry dummies.	Results: 'Business climate matters for the level of productivity, wages, profit rates, and the growth rates of output, employment and capital stock at the firm level – in garments and similar sectors…' → IC explanatory variables show consistent joint significance and often individual significance as well. Results robust to inclusion of country dummies which shows that local business climate important! Criticism: Regressions with total factor productivity potentially vulnerable to simultaneity bias. However, results largely confirmed with alternative firm performance dependent variable.

Escribano and Guasch (2005): 'Assessing the Impact of the Business climate on Productivity Using Firm Level Data: Methodology and the Cases of Guatemala, Honduras and Nicaragua'	'Data collected for ICAs in… Guatemala, Honduras and Nicaragua' *– presumably in World Bank Enterprise Surveys Main Database*	The paper aims to develop 'an appropriate and consistent econometric methodology to be used as a benchmark for evaluating the impact of IC variables on productivity at the firm level'. The discussed econometric methods are then applied in the cases of Guatemala, Honduras and Nicaragua. The econometric analysis consists of a variety of regressions of productivity measures on business climate indicators and a set of controls. Results are also analyzed by country, age and size of firms.	- 10 different estimations of firm productivity	*Business climate Variables:* - Red Tape, Corruption and Crime: • No. of days spent in Inspection and Regulation related work • Fraction of sales undeclared to tax authorities • Payments to deal with bureaucracy faster (% of sales) • No. of criminal attempts suffered -Infrastructure: • Average duration of power outages (log) • Days to clear customs for imports (log) • Shipment losses (% of sales) • Dummy for internet access -Quality, Innovation & Labor Skills • Fraction of computer controlled machinery • Fraction of total staff engaged in R & D • Dummy for ISO quality certification • Fraction of total staff with secondary or higher • Dummy for Training beyond 'on the job' training -Finance & Corporate Governance • Dummy for incorporated Company • Dummy for external audit Instrumented by region-industry averages. *Controls:* Age of the firm (log); Share of imported inputs (fraction); country; firm size;	Results: In the theoretical part of the paper, the authors highlight that analyses that use a simple two-step procedure to first estimate firm productivity, and then regress this measure on IC variables are likely to suffer from simultaneity bias. They propose three different methods to estimate productivity. In the empirical part of the paper, the authors identify four 'important categories of business climate (IC) variables…for the case of Guatemala, Honduras and Nicaragua: (a) red tape, corruption and crime; (b) infrastructure; (c) quality, innovation and labor skills; and (d) finance and corporate governance….The estimates show consistently the high impact of business climate on productivity. Overall, it accounts for over 30 percent of productivity. The two most impacting categories are "red tape, corruption and crime" and "infrastructure".'

Fisman and Svensson (2005): 'Are Corruption and Taxation Really Harmful to Growth? Firm Level Evidence'	Uganda Industrial Enterprise Survey – *presumably in World Bank Enterprise Surveys Main Database*	Regression analysis to test for a significant impact of corruption and taxes on firm sales growth, controlling for other factors.	- Sales growth: [log(sales1997-log(sales1995)]/2	*Business climate variables:* - Reported bribe as share of sales - Reported tax as share of sales Instrumented by location-industry avg. - Index (0-5) of availability of public services (elect., water, telephone, waste disposal, paved roads) -Index of regulation (log of 1+ percentage of senior management's time spent dealing with regulation) *Control Variables*: ownership (foreign >50%); log of firm age; (log of) sales in 1995; trade (firm exports and/or imports);	Results: Both taxation and bribes are found to have a robust, significantly negative impact on short-run sales growth; the retarding effect of bribes is thereby stronger than that of taxes. Foreign ownership has a positive impact on sales growth, as does 'trade status' at least in one specification.
Dollar, Hallward-Driemeier and Mengistae (2006): 'Business climate and International Integration'	Eight datasets from the World Bank Enterprise Surveys Main Database: Bangladesh, Brazil, China, Honduras, India, Nicaragua, Pakistan and Peru.	Probit regression of export status on business climate indicators and control variables (geographic, sector, firm characteristics). The aim is to relate business climate to the probability that a randomly chosen firm in a particular city exports. Country dummies are used in some specifications to obtain analysis of within-country variation.	- Indicator variable of whether firm exports or not - Indicator variable of whether firm has foreign ownership or not	*Business climate variables:* - Three objective IC indicators: days to clear customs; access to overdraft; losses from power outages. - One subjective IC indicator: whether managers thought government services inefficient. The authors use location averages to instrument the variables. *Control variables:* distance to international market; distance to port; population; population squared; country dummies; sector dummies; firm size (employment).	Results: The authors 'find that a sound business climate – as reflected in low customs clearance times, reliable infrastructure, and good financial services – makes it more likely that domestic firms will export, enabling the more productive firms to expand their scale and scope.' The empirical link is largely robust to the inclusion of country dummies (at least joint significance and some individual significance remains), showing that local factors matter for the IC.

Carlin, Schaffer and Seabright (2006): 'Where are the Real Bottlenecks? A Lagrangian Approach to Identifying Constraints on Growth from Subjective Survey Data'	~60 World Bank Enterprise Surveys Main Database (BEEPS 2002, 2004 and 2005 and PICS from 2000-2005)	1. Overview of descriptive statistics of subjective IC indicators 2. Development of model of the firm to predict relationship between reported constraints and the characteristics of firms 3. Regression of TFP on	- TFP (defined for manufacturing firms using TFP residuals, or the firms' self-reported technological level)	*Business climate variables:* 17 subjective indicators of the severity of different business climate constraints on a four/five point scale (see Box 1) *Control variables:* Country dummies; ownership (foreign owned/state owned/new and private owned); big city;	Results: 1. The descriptive statistics show that physical infrastructure rarely rates highly as a constraint, problems with licensing and customs affect relatively few countries (esp. CIS), crime and/or corruption show up as important constraints in all groups of countries except the OECD, seven dimensions of the business environment that are ranked as of greater than average importance in all country groups: anti-competitive practices, tax rates and tax administration, access to and cost of finance, and policy uncertainty and macroeconomic stability. 2. Regressions yield results largely in line with model predictions. Between-country regressions show negative and significant effects of Telecom, Electricity, Transport, Customs regulation, Mafia, Land Title and Land Access indicators. Once country effects are controlled for, however, customs regulations, transport and legal system indicators have perverse positive signs. Authors argue that this is due to endogeneity bias. Finance has significant negative impact, as predicted because it does not have public good characteristics but instead inherently unproductive firms are rationally denied credit (and complain about this). Criticism: Firstly, instead of objective indicators, the authors use subjective ones which are particularly vulnerable to the endogeneity effects they allege. Secondly, their regressions only use one business climate indicator at a time, exposing them to omitted variable bias. Thirdly, the posited relationship between firm performance and perceived indicator severity can only be shown for customs regulation and finance but not for any of the other disaggregated indicators. When avoiding these problems, other authors do find non-perverse, significant effects even when employing country dummies. Fourthly, Carlin et al. do not seem to use industry-location averages of their regressors, which could at least lessen firm-level endogeneity biases.

Hallward-Driemeier, Wallsten, Xu (2006): 'Ownership, business climate and firm performance'	China PIC Survey 2000 (part of World Bank Enterprise Surveys Main Database)	Regression of four different firm performance variables on largely objective business climate indicators (measured as city-industry averages) and controls.	-Sales growth -Investment rate -Productivity -Employment growth	*Business climate variables:* -mean loss of sales due to transport/power outages -mean share of labor that uses computers -mean share of R&D staff in labor -mean regulatory burden -mean corruption -mean share of non-permanent labor -mean bank access *Control variables:* ownership (domestic private/foreign); logs of firm age+1 and firm age+1 squared; log lagged sales; log lagged employment; log city population and GDP per capita; city and industry dummies;	<u>Results:</u> - ownership significant, foreign ownership more so than private domestic - no evidence that physical infrastructure matters significantly, but technological infrastructure does (expected given that hard infrastructure such as road and power good in China) - labor market flexibility weakly significant - No evidence that average access to finance in a region and industry affects performance (expected given inefficiency of Chinese bank sector) -Government regulatory burden and corruption strongly significant As expected, ownership has strong effects on firm performance. Relative to state ownership, domestic private ownership is associated with a higher sales growth rate and investment rate'. Effect of foreign ownership even larger. There 'is no evidence that physical infrastructure affects firm performance' but 'the impact of technological infrastructure appears to matter significantly…Labor market flexibility matters weakly…We do not find <u>Criticism:</u> The two-step TFP regression is vulnerable to Escribano and Guasch simultaneity bias criticism. However, the authors also use other firm performance measures which produce at least approximately similar results.
Aterido, Hallward-Driemeier and Pagés (2007): 'Business climate and Employment Growth: The impact of Access to Finance, Corruption and Regulations Across Firms'	World Bank Enterprise Surveys Main Database	1. A descriptive overview of firm-level employment growth and business climate data from over 100 countries, focusing in particular on differences by firm size. 2. Regression of employment growth on IC constraints controlling for a variety of firm characteristics (esp. size) and other factors.	- Firm Employment Growth [change in the enterprise's permanent employment during the period t and three years before, divided by the firm's simple average of	*Business climate variables:* - Finance: • Firm has overdraft facility • % of sales sold on credit • % of working capital financed externally • % of investments financed externally -Regulations: • Log of days to get an operating license last 2 years • % of management's time dealing	Results: 'The results indicate significant differences across size categories of firms – both in terms of differences in objective conditions faced by firms and in terms of non-linearities in the impact of these conditions. Low access to finance, corruption, poorly developed business regulations and infrastructure bottlenecks shift downward the size distribution of employment. Low access to finance and ineffective business regulations reduce the growth of all firms, especially micro and small firms. Corruption and poor infrastructure create growth bottlenecks for medium and large firms. The

| | | | permanent workers during the same period. The measure is symmetric and bounded by +/-2] | with gov't regulation
• log of days spent on inspections last year
• log of average days to obtain imports…last year
• log of average days to get exports thru custom last year
• log of total days spent on labor inspections last year

-Corruption
• Firms in comparable activities bribe to get things done (yes/no)
• % of sales on bribes to get things done by similar firms
• Similar firms give gifts to officials (yes/no)
• % of government contracts on bribes by comparable firms

-Infrastructure
• Power outages during the last year (log days)
• % of sales lost due to power outages last year
• Log days of no water last year

Authors use country-city-sector-size averages of these variables.

Controls: Firm size (micro/small /medium/large); firm age (young/ mature/old); location (large and small cities); ownership (foreign/government); exporter; industry; country; | results also reinforce the importance of differentiating the impact across size classes of firms that allow for the micro firms (less than 10 employees) to be different from 'small' firms'

'our estimates suggest that a weak business climate reduces overall employment in the business sector…firms may be confined to industries with limited innovation and growth opportunities. In addition, a larger share of firms may remain informal or semi-informal, reducing the capacity of the state of collecting taxes and paying for fundamental inputs for development such as education.' |
| Hallward-Driemeir and Aterido (2007):

'Impact of Access to Finance, Corruption and Infrastructure on Employment Growth: Putting Africa in Context' | World Bank Enterprise Surveys Main Database, with a focus on the African datasets contained therein | 1. Descriptive overview of how the African employment growth rate compares to the rest of the world, and how specific business climate constraints differ across regions and different types of firms.

2. For both a sample of African countries and one of | - Employment Growth

-Capital Intensity

-Change in Capital Intensity | *Business climate variables:*

-share of investments financed with bank loans
-days without power
-management time with officials
-frequency of bribes to 'get things done'

Alternative specifications include: days to clear import customs; consistency of enforcement of regulations; share of sales | Results: 'Firms in Africa do face greater obstacles in terms of finance, infrastructure, public services and governance. ….[However,] the more challenging business environment conditions [do not translate into lower average growth compared to other developing countries, but they] are associated with shifting down the [firm] size distribution, lowering the relative growth of larger firms, or in some cases expanding micro-firms' |

		other developing countries, the authors regress employment growth and other outcome variables on a set of business climate indicators and controls.		on credit; *Control variables (not all in every regression):* firm size, firm age, export status, foreign ownership, sector controls; survey dummies, country controls;	This may be because there are incentives to remain small e.g. because bad transport infrastructure creates demand-pockets for small suppliers, being small and informal minimizes contact with corrupt state etc.
Commander and Svejnar (2007): 'Do Institutions, Ownership, Exporting and Competition Explain Firm Performance? Evidence from 26 Transition Countries'	BEEPS II and BEEPS III First cross sectional analyses, but authors also construct panel subset with approx. 1300 firms	1. Authors regress log of firm sales revenues on subjective business climate indicators and a set of controls (OLS and IV) 2. Using a constructed panel of 1300 firms, the authors regress the change of revenues between 2002 and 2005 on the 2002-05 rate of change of labor and capital and on the initial 2002 levels of the business environment constraints and structural variables (OLS)	1. Log of Firm sales revenues 2. Log of Change in firm sales revenues	*Firm level IC variables from BEEPS (subjective perceptions of managers on 1-4 scale):* - cost of financing - tax rates - custom/foreign trade regulations - business licencing&permit - macroeconomic instability - functioning of the judiciary - corruption - street crime theft & disorder - anti-competitive practices - infrastructure *Country level IC variables (in separate regressions):* - 12 Doing Business variables - 10 Heritage Foundation indices of economic freedom *Control variables (not all in every regression):* levels of capital and labor inputs; categories of ownership (privatized; new private; foreign), export orientation of firm; log of exports/sales. Note that main controls are replaced by Instrumental Variables.	Results: - 'Overall [the authors] show that country effects…matter for firm performance but that differences in the business environment constraints observed across firms within countries do not.' -Foreign ownership found to have positive effect on firm performance, but domestic private ownership not -Export orientation found to have positive effect only in simple specification, not if authors control for ownership Criticism: The authors use only subjective, perception based business climate indicators. This may be sub-optimal. Objective business climate indicators, such as the time required to clear customs, have been found to be significant even with the inclusion of country dummies (see for instance Dollar, Hallward-Driemeier, Mengistae, 2005). Subjective business climate indicators may be sub-optimal because systematic variations in *perceptions* in the cross-country dataset are largely a function of broad business confidence related to macro factors such as political and macroeconomic stability or the financial system. Such country level effects are largely captured by country dummies. Once firm characteristics (such as size, age etc.) are also controlled for, the remaining variation in perception based indicators of specific business climate constraints may be largely due to quasi-random factors such as the managers' personality. This could explain why these subjective indicators do not show up as significant, although concrete objective measures of the business climate may do.

| Honorati and Mengistae (2007):

'Corruption, the Business Environment, and Small Business Growth in India' | Indian Firm Analysis and Competitiveness Survey, 2002 and 2005 | 1. Descriptive analysis of objective and subjective data.

2. Regressions analysis to examine the effects of corruption, labor regulation, access to finance and the quality of power supply on the growth of manufacturing businesses in India. | Annual sales growth | *Business climate variables:*

- lagged profitability (finance proxy)
- lagged indebtedness (finance proxy)
- indicators of corruption, labor regulation and power shortages

Controls: industry, state and year dummies; initial size; | Results:

1. The authors find a pattern whereby 'the better performing states are also better in every important aspect of their business environment…low-income, low-growth states have the worst indicators of all institutional variables except for labor regulation'

2. Regression results show that 'average business growth rate is lower where labor regulation is greater, power shortages are more severe, and financial constraints stronger…[moreover] each of the three factors on business growth depends on the incidence of corruption….sales growth is constrained by cash-flow only in businesses that are not affected by labor regulation, power shortages or corruption.' The authors interpret this 'as indication that corruption is a proxy for something more fundamental than the payments of bribes, namely, the quality of property rights institutions in the sense of Acemoglu and Johnson (2005)'. Their results are consistent 'with the…view that the quality of property rights institutions exerts more abiding influence on economic outcomes than the quality of contracting institutions…' |