ABSTRACT

Title of dissertation: REGULATION, INSTITUTIONS, AND PRODUCTIVITY GROWTH

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This dissertation investigates how the investment climate affects firm dynamics, productivity, and macroeconomic performance across countries. The first chapter provides an empirical analysis of the macroeconomic impact of business regulation. It first characterizes the stylized facts on regulation across the world, using a set of newly constructed, comprehensive indicators of regulation in a large number of countries in the 1990s. These indicators are then used to study the effects of regulation on economic growth and macroeconomic volatility employing cross-country regression analysis. The analysis allows for the effects of regulation to vary with the country's level of institutional development, and it also controls for the likely endogeneity of regulation with respect to macroeconomic performance. Results show that a heavier regulatory burden reduces growth and increases volatility, although these effects are smaller the higher the quality of the overall institutional framework.

The second chapter focuses on the mechanism through which regulation impacts on macroeconomic outcomes, and assesses the role of firm entry and exit as channel of transmission of the effects of regulation on productivity growth. We use sector and manufacturing-wide productivity and firm turnover data derived from firm-level information for OECD and Latin American countries to explore the effects of various types of regulations –product-market regulation, labor-market regulation and fiscal regulation– following a two-step approach. The first step examines the impact of regulatory barriers on firm turnover. The second assesses the effects of firm turnover on productivity growth. Results provide partial evidence that regulation, particularly product market regulation, hampers productivity growth by deterring firm entry and exit.

The third chapter investigates the effects of regulation uncertainty on the innovative behavior of firms, and on the efficiency of the Schumpeterian "creative destruction" process. It argues that regulation uncertainty, caused by a poor institutional environment, distorts the selection process of firms and leads to high observed reallocation, but low productivity. Following Hopenhayn (1992), an industry is modeled where firms engage in innovative investment and face an uncertain innovation cost. The analysis centers on the entry and exit decision of firms, their innovative behavior, and the subsequent industry evolution. Simulation results show that, in equilibrium, a more uncertain cost creates distortions in the reallocation process that lead to lower average productivity, size, and innovative investments, having similar effects as an increase in the magnitude of the cost. This indicates that, in addition to the level of regulation, *unpredictability* of regulation is an important source of inefficiency in the reallocation process.

REGULATION, INSTITUTIONS, AND PRODUCTIVITY GROWTH

by

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FOREWORD

Chapters 1 and 2 of the dissertation, entitled "Regulation and Macroeconomic Performance" and "Regulation and Microeconomic Dynamics: A Comparative Assessment for Latin America," represent joint work between Ana Maria Oviedo, and Norman Loayza and Luis Servén, from The World Bank's research department. Ana Maria's examining committee has determined that she has made a substantial contribution to this joint work. This work is included in this thesis with the approval of Prof. John Haltiwanger, the chair of Ana Maria's dissertation committee, and of Prof. John Shea, a member of Ana Maria's committee and the Director of Graduate Studies for the Department of Economics.

To Céline

To Jamele

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Chapter 1

Regulation and Macroeconomic Performance

1.1 Introduction

Regulation of goods and factor markets is purportedly enacted to serve specific social purposes. In reality, however, it obeys a more complex political economy process, where legitimate social goals are mixed with the objectives of particular interest groups concerning the level and distribution of rents. But regulation also has potentially important effects on economic performance that have attracted increasing attention in recent years. According to a commonly held view, excessive regulation is the prime cause of Europe's macroeconomic underperformance over the last decade vis-à-vis the United States (see Blanchard 2004). Likewise, intricate regulation and its arbitrary enforcement are listed by the World Bank (2004) among the key obstacles to growth in developing countries.

The key mechanism through which regulation affects aggregate economic performance is the Schumpeterian process of "creative destruction" at the core of the growth engine in market economies - the continuous restructuring and factor reallocation through which new technologies replace the old (Aghion and Howitt 1992, Caballero and Hammour, 1996). There is ample evidence that the shift of resources away from less productive and toward more efficient production units accounts for much of the observed growth in aggregate productivity.[1] The macroeconomic impact of regulation arises primarily from its effects on the dynamics of restructuring.[2] In particular, regulatory barriers that disrupt the process of resource reallocation tend to cause a deterioration in aggregate economic performance by allowing low-productivity activities to survive too long, and discouraging the adoption of new high-productivity activities (Caballero and Hammour, 1998).

A recent empirical literature has examined the impact of various kinds of regulation on

[1] See for example Haltiwanger (2000) and Ahn (2001).

[2] For theoretical linkages between regulation and firm dynamics see, for instance, Pakes and McGuire (1994), Hopenhayn (1992), Bergoeing et al., (2004), and Chapter 3 of this thesis. See also Blanchard and Giavazzi (2001) for an insightful model highlighting the macroeconomics of labor and product market regulation.

proximate determinants of GDP growth - productivity, investment and employment- finding for the most part negative effects. In this vein, Nicoletti and Scarpetta (2003) find that product market regulation lowers multifactor productivity growth in OECD countries, while Bassanini and Ernst (2002) report a negative effect of regulation on innovation. Alesina et al. (2002) likewise find that product market regulations have a negative effect on private investment in OECD economies. In turn, Nicoletti et al. (2001a,b) provide empirical evidence that anti-competitive regulation reduces employment in a panel of industrial countries, while CEPR-IFS (2003) find that increased product market competition encouraged by deregulation raises both investment and employment in a panel data set covering OECD countries.[3] Regarding labor regulation Blanchard and Wolfers (2000) and Heckman and Pagés (2000) find that hiring and firing restrictions discourage employment creatiofn in European and Latin American economies, respectively. Moreover, simulations for OECD economies suggest that the effects of output and labor regulation on aggregate investment and employment are quantitatively considerable (Bayoumi, Laxton and Pesenti, 2004).

A few empirical studies tackle the impact of regulation and deregulation on aggregate growth in a cross-country setting. Koedijk and Kremers (1996) find a negative association between measures of product market regulation and GDP growth among 11 European countries. In contrast, they find that labor regulations have no significant association with growth performance. Dutz and Hairy (1999) apply extreme-bounds analysis to estimate the contribution to growth of a variety of (mostly subjective) regulation and competition indicators in a sample of industrial and developing countries. They find significant effects of measures of anti-trust policy and the average age of large firms (taken as proxy for entry and exit barriers). However, Card and Freeman (2002) fail to find any significant association between subjective measures of economic regulation and growth performance in a panel regression covering OECD countries over 1970-99.

In this Chapter, we present a comprehensive empirical assessment of the macroeconomic effects of regulation in a large sample of industrial and developing countries. We focus on two key measures of macroeconomic performance, namely the growth and volatility of real GDP. Our

[3]In contrast, CEPR-IFS (2003) finds that the impact of product market competition on aggregate productivity growth is less robust: the effect is positive only when the cross-country variation is taken into consideration, and negative when the estimates are computed using the within-country variation.

empirical strategy relies on the inclusion of suitable indicators of regulation into simple empirical equations relating these aggregate performance measures to standard control variables taken from the macroeconomics and growth literature. While we do not characterize the specific channel through which the aggregate impact of regulation unfolds, our approach allows us to obtain a summary measure of the magnitude of such impact that combines the action of the various intervening mechanisms factor reallocation, capital accumulation, competition and innovation considered in the literature.

Our analysis extends the literature along four dimensions. First, we provide a broad characterization of business regulation around the world. Drawing from a variety of data sources, we build a set of synthetic indicators capturing the regulations that firms face in the multiple dimensions of their activity entry and exit, trade, taxes, contract enforcement, labor and finance. One novel feature of these indicators is that they go beyond *de jure* regulation and incorporate, to a significant extent, the burden of *de facto* regulation. Using this information, we document the stylized facts of regulation across the world, regarding the extent of regulation in different countries, its relation with per capita income, and the observed relationship between different types of regulation.

Second, unlike the existing literature on the macroeconomic impact of regulation, which has focused almost exclusively on aggregate growth or its proximate determinants, we examine also the effect of regulation on aggregate volatility. This is of independent interest for several reasons. On the one hand, recent literature suggests that excessive regulation can lead to microeconomic inflexibility (Caballero, Engel and Micco 2004). This tends to hamper the economy's ability to absorb shocks requiring microeconomic reallocation, thus amplifying their aggregate impact. On the other hand, certain kinds of product market regulation such as those on entry and exit act as barriers to firm creation and destruction and might have the opposite effect, attenuating cyclical output fluctuations. Hence, the impact of regulation on volatility is a priori ambiguous, and can be established only empirically. To our knowledge, this is the first attempt at addressing this issue.

Third, we take into account the fact that the effects of regulation are likely to depend not only

on the quantity of regulation, but also on its quality. There are good reasons for this. On analytical grounds, certain types of regulation such as those designed to enhance competition in goods or financial markets should be expected to exert beneficial effects on economic performance, rather than adverse ones.[4] More generally, countries with better institutions tend to create regulatory environments genuinely aimed to improve business conditions rather than privilege a few interest groups. They are also more likely to enforce regulation in a transparent and even-handed manner, limiting the regulator's margin for arbitrariness and corruption that can place many firms at a disadvantage, sometimes forcing them to operate in the informal sector.[5] All these arguments suggest that the quality of regulation is likely to be closely related to overall governance quality, and thus in our experiments we use standard governance indicators to capture regulatory quality.

Fourth, our empirical approach also allows for the possibility that aggregate performance may itself be one of the factors weighing on policy makers' decision to adopt regulatory measures. Low growth or excessive macroeconomic volatility may make it more likely for the authorities to introduce or tighten regulation e.g., adopting strict labor regulations or raising firm exit barriers in the hope of containing job and output losses in downswings. Thus, any observed association between regulation and macroeconomic performance could reflect causality from the latter to the former rather than (or in addition to) the reverse. To ensure that our results reflect the causal effect of regulations on growth and volatility, we also report empirical results from instrumental variable estimations.

Before proceeding, we should note one important caveat of our analysis. Our objective is limited to studying the macroeconomic consequences of regulation. It is not our purpose to evaluate the success of specific regulations at meeting their stated objectives, nor do we pretend to judge the impact of regulation on social welfare dimensions beyond the influence of economic growth and volatility.

The rest of the Chapter is organized as follows. Section 2 describes the synthetic regulation indicators and presents some stylized facts concerning the patterns of regulation across industrial

[4]For instance, Klapper et al. (2004) find that certain regulations, such as entry and exit barriers, have negative effects on firm entry, whereas others, like investors' rights regulations, have positive effects.

[5]See for instance De Soto (1989).

and developing countries. Section 3 reports estimates of the impact of regulation on growth and aggregate volatility. Section 4 offers some concluding remarks.

1.2 Business regulation around the world

We now turn to the description of the nature and extent of business regulation around the world. In this section, we first give an account of the areas of economic activity under regulation on which we focus and describe how we measure regulation in each of them. Next, we discuss differences in regulation intensity across regions of the world and give a preview of the relationship between regulation and macroeconomic variables.

1.2.1 A typology of regulation

Our departure point is the assumption that the macroeconomic impact of business regulation arises from its effects on firm dynamics. Therefore, we select the relevant areas of business regulation by looking for them at the three stages of the life of a firm: entry, growth, and exit. In most countries, all three are regulated to some degree; for instance, in virtually all countries entrepreneurs need to follow a number of procedures to start a firm, although the burden of the administrative process varies widely across countries.[6] Once a firm is legally registered and allowed to operate, its decisions are conditioned by regulations on hiring and firing workers, taxes, safety standards, environmental regulations, interest rate controls, trade barriers, legal procedures, etc.[7] Finally, a firm going out of business must again follow a sometimes costly and lengthy procedure.

1.2.2 How does regulation alter firm dynamics?

Regulation certainly affects firms' decisions, but does it improve the conditions for their activities or, on the contrary, does it impose unnecessary restrictions that increase costs and reduce productivity? Although we do not rule out the first option, we should recognize the potentially distortive effects of regulation on firms' decisions and ultimately on macro performance. We

[6] See Djankov et al. (2002).

[7] Some regulations have also "indirect" effects on firm dynamics, for instance, Berkowitz and White (2002) find that personal bankruptcy laws play an important role in small firms' access to credit in the U.S.

consider seven main areas of a firm's activity subject to regulation: entry, exit, labor markets, fiscal burden, international trade, financial markets, and contract enforcement; for each area, we construct an index of the severity of regulation. Rather than restricting our measures of regulation strictly to legal directives, we want to account for the practical restrictions and complications brought about by certain rules. The regulation of entry index aims at capturing the actual difficulty that an entrepreneur faces to start a business, from a legal perspective as well as in practice. The index of bankruptcy regulation should reflect the speed and efficiency of the bankruptcy process; in particular how well the justice system establishes priorities for creditors and enforces compensation. With the labor market regulation index, we want to measure how difficult it is for a firm to adjust its labor force. The measure should also include information about the wage setting system of the country, and the power of organized labor. The index of fiscal burden aims at measuring the burden to firms imposed by taxation and fiscal spending, an element that determines in many cases a firm's choice of location. With the trade regulation index we look at how much countries protect domestic producers; specifically we are interested in measuring the cost for the entire economy of protecting a selected group of producers. The financial markets regulation index should capture how easy a firm's access to capital markets is. For instance, special credit conditions for some industries, or interest rate controls can reduce the availability of credit to more deserving firms and distort incentives for investment. Finally, the contract enforcement index is a general measure of how easily firms can turn to the justice system to resolve legal disputes.

1.2.3 Measuring regulation

We use six data sources for the construction of our indices: Doing Business (The World Bank Group), Index of Economic Freedom (The Heritage Foundation), Economic Freedom of the World (The Fraser Institute), Labor Market Indicators Database (M. Rama and R. Artecona, 2000), The Corporate Tax Rates Survey (KPMG), and International Country Risk Guide (The PRS Group). These sources cover the largest number of countries and areas under regulation, and their measures use a clear methodology and are straightforward. Except for the Labor Market

Indicators Database, all sources are public. Our sample covers 76 countries.[8] In most cases, data are based on surveys conducted in a single year (in the late 1990's) in a large group of countries; for components with observations for more than one year, we use average values over the period. Therefore, our indices should be interpreted as average regulation levels in the late 1990's. We should note, however, that regulation tends to stay constant over long periods of time.[9]

Each index measures the intensity of the regulatory system on a scale from 0 to 1 (1 representing the heaviest regulation). In order to be able to combine all components, we apply the following standardization formula to each one of them:

$$\frac{X_i - X_{min}}{X_{max} - X_{min}}$$

if higher values of X indicate heavier regulation and

$$\frac{X_{max} - X_i}{X_{max} - X_{min}}$$

if lower values of X indicate heavier regulation.

We then obtain an index of regulation for each area of business activity outlined above by matching each component to one activity, and taking the simple average of the components within each activity.

The *entry* regulation index combines the number of legal steps required to register a new business with an indicator of the overall legal burden of registration and willingness of the government to facilitate the process and intervene minimally. The index of *labor* regulation combines the percentage of workers that belong to a union, the minimum mandatory working conditions, and the degree of hiring and firing flexibility granted by the law. The index of *fiscal burden* measures direct taxation -that is, the maximum tax rate applied to individuals and businesses- and fiscal spending. The index of *trade barriers* combines an indicator of average tariffs with one that mea-

[8] We do not consider here the heterogeneity of regulation within countries. This can be important in some cases, such as the added burden of local taxation in federal systems. At present, however, very few data sources provide information on regulation at the regional level. One of these sources is the Investment Climate Survey of The World Bank, which records data on investment climate and activities of over 14,000 firms in about 30 countries.

[9] See, for instance, Bolaky and Freund (2004).

sures the existence of hidden import barriers, and an indicator of the additional cost of importing generated by mandatory administrative procedures (tariff costs, fees for obtaining licenses, bank fees, etc.). The index of *financial markets* regulation measures the degree of government intervention in the financial market, interest rate controls, ownership of banks, entry barriers, restrictions in securities markets, and competition between domestic and foreign banks. The index of *lack of contract enforcement* combines the number of legal procedures for disputes that are taken to court, with a measure of the stability of the bureaucracy and its sensitivity to political changes in the government. Finally, the index of *bankruptcy* regulation measures the efficiency of the bankruptcy process by combining the time and cost of insolvency, the enforcement of priority of claims, the extent to which the efficient outcome is achieved, and the degree of court involvement in the process. Rather than just summarize *de jure* regulation, our measures capture to a large extent its actual burden on economic agents. However, a caveat is necessary: our indices, as well as their components, do not provide full information about the quality of regulation; in particular, they do not reflect completely either the extent to which regulation corrects for market failures or the political and social context in which regulation is implemented. These distinctions are important because, as already noted, the economic impact of regulation may be dependent on institutional country characteristics.[10] We attempt to account for this issue in the econometric section of this Chapter.

1.2.4 Regulation around the world

How do entry, growth and exit regulations vary across world regions? Although governments oversee and extract revenues from business activities in all countries -and quite heavily in many– there is considerable variation in the intensity of regulation across regions.

Table 1.1 presents the summary statistics of the seven indices mentioned above. Industrial countries tend to adopt heavy fiscal regulation, medium labor regulation, and low regulation in trade, financial markets, entry, bankruptcy, and contract enforcement. Developing regions cannot be characterized as simply as the OECD as they show varying patterns for each type of regulation.

[10] See, for instance, Claessens and Klapper (2002).

Table 1.1: Summary statistics of regulation indices by region

Indicator	No. Obs.	Mean	Std. Dev.	Min	Max	Indicator	No. Obs.	Mean	Std. Dev.	Min	Max
Africa						East Asia and Pacific					
Entry	17	0.419	0.120	0.186	0.680	Entry	6	0.311	0.118	0.166	0.512
Financial Mkt.	17	0.541	0.137	0.319	0.808	Financial Mkt.	6	0.382	0.064	0.273	0.445
Contracts	17	0.631	0.195	0.367	0.988	Contracts	6	0.428	0.100	0.293	0.597
Trade	17	0.718	0.182	0.333	0.944	Trade	6	0.538	0.243	0.345	1.000
Labor	16	0.444	0.178	0.185	0.767	Labor	6	0.372	0.184	0.135	0.537
Fiscal	17	0.497	0.132	0.311	0.751	Fiscal	6	0.415	0.059	0.358	0.499
Bankruptcy	12	0.485	0.147	0.321	0.742	Bankruptcy	5	0.524	0.183	0.277	0.762
Product Mkt.	17	0.571	0.121	0.370	0.769	Product Mkt.	6	0.437	0.082	0.339	0.536
Overall	17	0.541	0.098	0.375	0.702	Overall	6	0.423	0.061	0.337	0.495
OECD						Latin America and Caribbean					
Entry	22	0.177	0.107	0.011	0.367	Entry	21	0.384	0.124	0.171	0.685
Financial Mkt.	22	0.190	0.126	0.016	0.441	Financial Mkt.	21	0.427	0.175	0.111	0.789
Contracts	22	0.215	0.094	0.000	0.419	Contracts	21	0.647	0.164	0.341	0.927
Trade	22	0.114	0.072	0.000	0.276	Trade	21	0.574	0.169	0.248	0.881
Labor	21	0.444	0.168	0.132	0.783	Labor	21	0.558	0.154	0.258	0.773
Fiscal	22	0.705	0.131	0.390	0.917	Fiscal	21	0.359	0.117	0.105	0.529
Bankruptcy	21	0.238	0.168	0.000	0.675	Bankruptcy	17	0.454	0.143	0.171	0.655
Product Mkt.	22	0.186	0.086	0.084	0.330	Product Mkt.	21	0.501	0.104	0.329	0.767
Overall	22	0.296	0.081	0.165	0.411	Overall	21	0.488	0.077	0.339	0.638
Middle East and North Africa						South Asia					
Entry	6	0.322	0.071	0.230	0.396	Entry	4	0.331	0.075	0.234	0.404
Financial Mkt.	6	0.582	0.327	0.308	1.000	Financial Mkt.	4	0.465	0.077	0.379	0.541
Contracts	6	0.544	0.115	0.439	0.753	Contracts	4	0.468	0.148	0.261	0.605
Trade	6	0.868	0.123	0.653	1.000	Trade	4	0.797	0.173	0.553	0.963
Labor	6	0.476	0.110	0.340	0.648	Labor	4	0.411	0.056	0.352	0.486
Fiscal	6	0.711	0.126	0.516	0.908	Fiscal	4	0.484	0.125	0.308	0.600
Bankruptcy	6	0.434	0.089	0.337	0.589	Bankruptcy	4	0.360	0.147	0.148	0.479
Product Mkt.	6	0.550	0.081	0.486	0.675	Product Mkt.	4	0.484	0.044	0.423	0.528
Overall	6	0.562	0.059	0.514	0.660	Overall	4	0.474	0.034	0.424	0.498

Source: Authors' estimation

For example, with respect to the OECD, labor regulation is almost 16% lower in East Asia and the Pacific, while 26% higher in Latin America and the Caribbean.[11] The most striking difference between the OECD and developing-country groups is in trade regulation, where all developing regions have indices at least 150% higher than the OECD group, reaching an enormous 710% difference in the case of the Middle East and Northern Africa. On the other hand, in the case of fiscal regulation, differences across regions are not nearly as pronounced.

Which countries regulate the most? Although heavy regulators are mainly found among

[11]These numbers are calculated on the basis of Table 1, for example, the mean of the "Labor" indicator is 0.44 in the OECD and 0.37 in the EAP region, so that the difference is $(0.37 - 0.44) * 100/0.44 = -15.9\%$.

developing countries, OECD countries rank highest in fiscal regulation: Belgium ranks number one, Italy number two, and France is number four (Syria is number three).

The country with the lowest fiscal-regulation score is Haiti.[12] On average, labor regulation is highest in Latin America and the Caribbean, followed by the Middle East and Northern Africa. OECD countries do not have high labor regulation on average, but they do exhibit large dispersion: over the entire sample (all regions combined), Portugal has the highest labor regulation score while the United States has the lowest. In the remaining areas OECD countries always occupy the bottom of the distribution. For instance, The Netherlands reaches the lowest score in financial regulation, Finland in bankruptcy and trade, Iceland in contract enforcement, and Canada in entry regulation. The harshest regulatory environments are in Sierra Leone (contract enforcement), Haiti (entry), Syria and Iran (financial markets), Tunisia and Papua New Guinea (trade), and the Philippines (bankruptcy).

Table 1.2: Correlation coefficients between regulation indices

	Entry	Financial Markets	Contract Enforcement	Trade	Bankruptcy	Labor	Fiscal Burden
Entry	1						
Financial Markets	0.6686*	1					
Contract Enforcement	0.6747 *	0.6034*	1				
Trade	0.6373*	0.7269*	0.6246*	1			
Bankruptcy	0.5236*	0.4415*	0.5301*	0.5078*	1		
Labor	0.4127*	0.1415	0.4665*	0.0702	0.1413	1	
Fiscal	-0.5045*	-0.2824*	-0.5714*	-0.3386*	-0.3770*	-0.1806	1
1st Princ. Comp.	0.8594*	0.7737*	0.8600*	0.8551*	0.7111*	0.2923*	-0.5715*
2nd Princ. Comp.	0.1057	-0.3769*	0.1597	-0.2823*	-0.0274	0.9007*	-0.1069
3rd Princ. Comp.	0.1605	0.3393*	-0.0921	0.1672	-0.1536	0.2778*	0.7632*

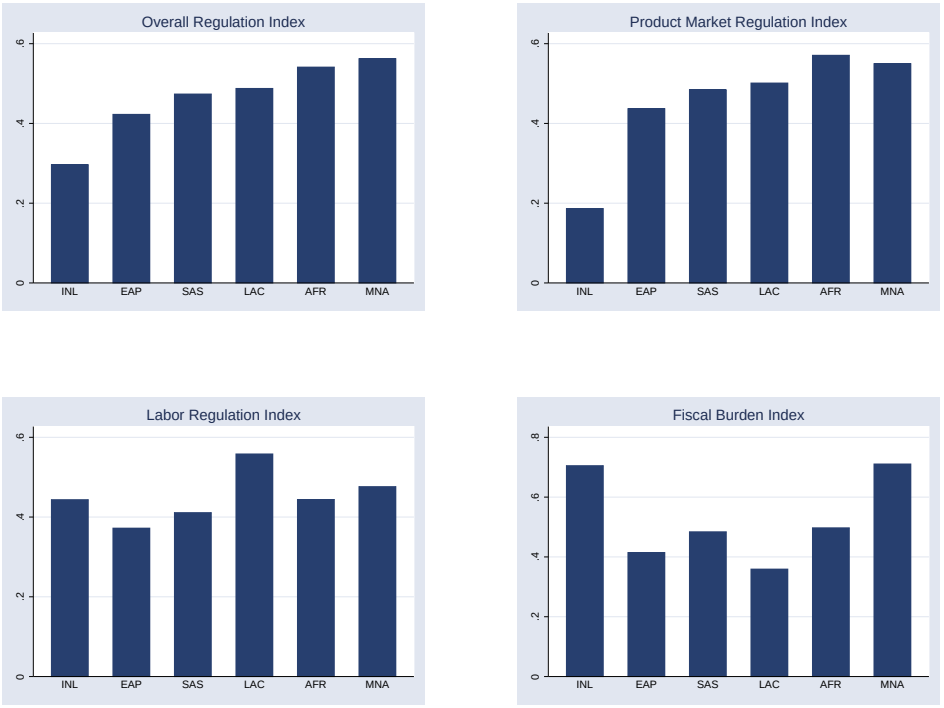
	Product Market	Labor	Fiscal	Overall
Product Market	1			
Labor	0.2914*	1		
Fiscal	-0.4985*	-0.1806	1	
Overall	0.9678*	0.4445*	-0.3263*	1
1st Princ. Comp.	0.9798*	0.2923*	-0.5715*	0.9348*
2nd Princ. Comp.	-0.1453	0.9007*	-0.1069	-0.0037
3rd Princ. Comp.	0.1131	0.2778*	0.7632*	0.3315*

Notes: * denotes significance at the 5% level.
Source: Authors' estimation

[12]Keep in mind that the rank of a country is relative to the sample, therefore changing the composition of the sample will most likely alter the ranking as well.

Table 1.2 shows simple correlations between the regulation indices. The strongly positive correlations among all but the fiscal burden and labor indices suggest that regulation policy comes in "packages". Judging from these correlations, we can distinguish three regulation categories: fiscal burden, labor, and "product market," where the latter is a composite of the entry, trade, financial markets, bankruptcy, and contract enforcement indices.[13] We obtain the product market index by averaging the scores of the five components; we also compute an "overall" regulation index by averaging the scores of all seven components. We choose to give equal weights to all components despite the strong correlation among the first five because we don't have any priors about the importance of labor market or fiscal regulation relative to the others.

Figure 1.1: Regulation around the world

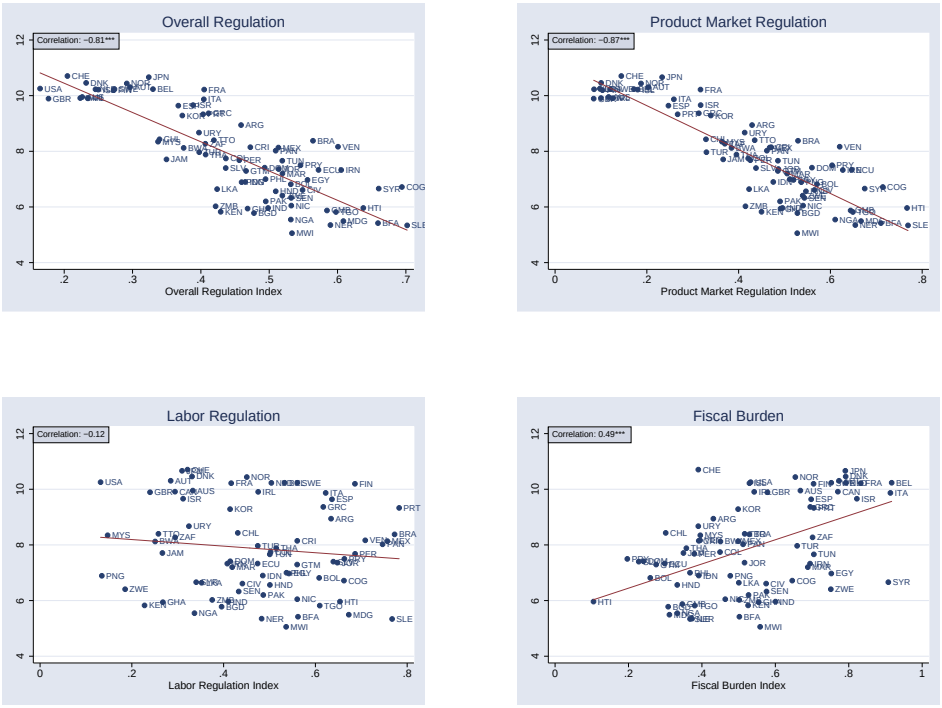


Note: AFR: Africa region, EAP: East Asia and Pacific region, INL: OECD, LAC: Latin America and the Caribbean region, MNA: Middle East and North Africa region, SAS: South Asia region

The arrangement of the regulation indices into these three groups receives additional statistical support from factor analysis. The first three principal components obtained from factor

[13]The term "product market regulations" is taken from Nicoletti et al. (2000).

Figure 1.2: GDP per capita vs. regulation indices



Note: *, **, and *** denote significance at the 10%, 5%, and 1% level respectively.

analysis of the seven basic indices explain, respectively, 53%, 15%, and 12% of their overall variance. These principal components have a close one-to-one match with the indices resulting from the three categories. For the first principal component, the five "product market" regulation indices receive high and similar loadings, and not so the labor and fiscal regulation indices. For the second principal component, the labor regulation index receives the highest loading, while the other six indices get only low positive or negative weights. Analogously, the third principal component loads heavily only on the tax regulation index. The close connection between the principal components and our regulation categories is clearly demonstrated by the pattern of correlation coefficients shown in Table 1.2.[14]

Figure 1.1 provides a regional comparison of the overall, product market, fiscal, and labor regulation indices. In addition, figure 1.2 depicts scatter plots of these indices against the (the log

[14]Other studies, such as Nicoletti et al. (2000) or Klapper et al. (2004) also use factor analysis to decompose regulation measures, and they further replace the measures with their principal components in the regressions. Because of the strong correlation between the components and our indices (see Table 1.2), we choose not to use the principal components in our regressions.

of) GDP per capita of all countries in the sample. Looking at the first three panels, it becomes clear that employment regulation, fiscal burden, and product market regulation stand apart from each other. Indeed, while there seems to be little relation between a country's average income and the strength of labor regulation, the relationship with income is positive and significant in the case of fiscal burden and clearly negative in the case of product market regulation. The overall regulation index is negatively related to per capita GDP, which is not surprising given the large weight of product market regulation in the overall index.

1.2.5 Regulation and governance

The effect of regulation on firm dynamics and, ultimately, macroeconomic performance is likely to depend on the institutional context in which regulation is enacted. For example, countries with better institutions create regulatory environments that actually try to improve business conditions rather than privilege a few interest groups; they also limit the interaction between regulation and abuses of power in the public sector that place many firms in disadvantage, sometimes forcing them to operate in the informal sector (see for instance De Soto, 1989). We use an index of "governance quality" in order to assess the quality of regulation itself and the general context that determines how regulation functions. We construct this index using measures from the International Country Risk Guide, which evaluates a country's risk for international investment by looking at its social and political situation. Specifically, we average the values of indicators measuring the absence of corruption in the political system, the prevalence of law and order, and the level of democratic accountability.[15]

1.3 Regulation and macroeconomic performance

Having described how the regulatory environment varies across countries, our objective for this section is examining whether regulations have an impact on macroeconomic performance. Regulations are imposed for a variety of reasons. Officially, they are enacted to serve specific

[15]See Appendix A for a more detailed description of these components.

social purposes, from consumer health safety to the protection of domestic employment. In reality, however, the imposition of regulation follows a more complex political economy process, where legitimate social goals are mixed with the objectives of particular interest groups (see Djankov, La Porta, López-de-Silanes, and Shleifer 2002). Whatever their justifications and objectives, regulations are likely to have an impact beyond their area of control. Here we examine whether they have an aggregate effect, specifically on economic growth and volatility. Together these variables provide a comprehensive, yet succinct, evaluation of macroeconomic performance.

In assessing the effect of the regulatory environment, it is important to consider that the quality of regulation is profoundly affected by the institutional context in which it is imposed. Thus, the ultimate impact that regulation may have on macroeconomic performance is likely to be affected by the country's level of institutional development. In order to explore the interaction between institutional progress and regulatory environment, we extend the basic empirical analysis by allowing the effect of regulation to vary with a measure of governance.

Our empirical analysis also considers the likely endogeneity of the regulatory environment. In particular, economic growth and volatility may shape to some extent the type and strength of regulation imposed in a country. For instance, governments of economies subject to external shocks and associated volatility may want to impose labor constraints in an attempt to protect domestic employment. Also, stagnant economic growth may prompt governments to increase public infrastructure spending, having to finance it with a heavier fiscal burden. Although the regulatory environment is likely to be affected by macroeconomic performance, it is not clear in what direction and to what extent. In order to identify the effect of regulation on macroeconomic performance, we use instrumental variables that isolate the exogenous variation in regulation.

1.3.1 Sample and specification

Our empirical methodology is based on cross-country regression analysis. We conduct separate regressions for each dependent variable of interest, namely, economic growth and macroeconomic volatility. In each case, we use as explanatory variables a measure of regulation and a set

of basic control variables. All variables included in the empirical exercises are briefly presented below, except the regulation indices that were introduced in the previous section.

Our sample consists of 74 - 76 countries, depending on the regression exercise. In the largest sample, we have 22 developed and 54 developing countries, of which 21 belong to Latin America, 23 to Africa and the Middle East, and 10 to Asia. Country observations for each variable correspond to averages for the 1990s. We are constrained to this decade because internationally comparable regulation measures are available only for this period.

The dependent variables are defined as follows. As is standard in the literature, economic growth is measured as the average annual rate of per capita real GDP growth. Macroeconomic volatility is represented by the standard deviation of the output gap, obtained as the difference between actual and trend per capita real GDP. Trend output is estimated using the band-pass filter of Baxter and King (1999).

As described in the previous section, our explanatory variables of interest are indices that quantify a country's regulatory burden. We consider, in turn, the overall regulation index and its three main components, that is, the product market, labor, and fiscal regulation indices. In an extension to the basic specification, we interact the regulation index with a governance proxy, which as already noted is constructed from information on experts' perceptions on public accountability, absence of corruption, and rule of law, as reported by the International Country Risk Guide.[16]

The instrumental variables, used to isolate the exogenous variation in the regulation indices, are selected considering the recent literature on the determinants of the regulatory environment (see Djankov et al., 2004 and Bolaky and Freund, 2004). They are the initial level of per capita GDP, binary variables that denote legal origin (British, French, German, and Nordic), and proxies for the degree of Western influence based on the fraction of the population that speaks a major European language.[17]

[16]We don't include governance as a separate explanatory variable because it is highly collinear with the governance-regulation interaction term. If we did it, we would find that neither governance per se nor interacted with regulation is statistically significant.

[17]An alternative instrument for the latter would be a dummy variable taking a value equal to one if the country has a colonial past; while this would be more in line with the growth regressions literature, it would not allow for varying degrees of influence by an external culture. Nevertheless it would be worthwhile to replace this instrument as a robustness check.

Finally, the set of control variables for the growth regressions consists of the initial level of per capita real GDP (to account for convergence effects), the initial rate of secondary enrollment (as proxy for human capital investment), the initial ratio of private domestic credit to GDP (to account for financial depth), and a Sub-Saharan dummy variable that controls for the particular conditions of civil conflict, mismanagement, and disease affecting this region, and that cannot be captured by initial GDP alone.[18]

The set of control variables for the volatility regressions represent the major causes of macroeconomic fluctuations, as identified in the literature. They are the standard deviation of terms of trade shocks, a measure of real exchange rate overvaluation, and the frequency of systemic banking crisis.

1.3.2 Results and discussion

By way of illustration, Figures 1.3 and 1.4 show scatter plots that represent the simple relationship between the regulation indices and, respectively, economic growth and macroeconomic volatility. The graphs using overall regulation consistently suggest that more heavily regulated economies tend to experience lower economic growth and higher volatility. Observations reflecting poor macroeconomic performance and high overall regulatory burden belong mostly to developing countries, while developed economies tend to occupy the other end of the distribution. The negative link between macroeconomic performance and overall regulation seems to be driven by product market regulation and, to a lesser extent, labor regulation. On the other hand, the connection with the fiscal burden appears to go in the opposite direction, so that fiscally more regulated economies show slightly better performance, although the association is not very strong.

[18]The "Africa dummy" has a long tradition in empirical growth studies; see for example Easterly and Levine (1997). We believe it is important to account for the particular conditions of the African continent when we look at regulation, so as to avoid overstating the effect of regulation on macroeconomic aggregates. Indeed, removing the dummy increases the magnitude of the regulation coefficients, particularly the "product market" index; at the same time, when we include the dummy our regulation coefficients are still statistically and economically significant.

Figure 1.3: Growth of GDP per capita vs. regulation indices

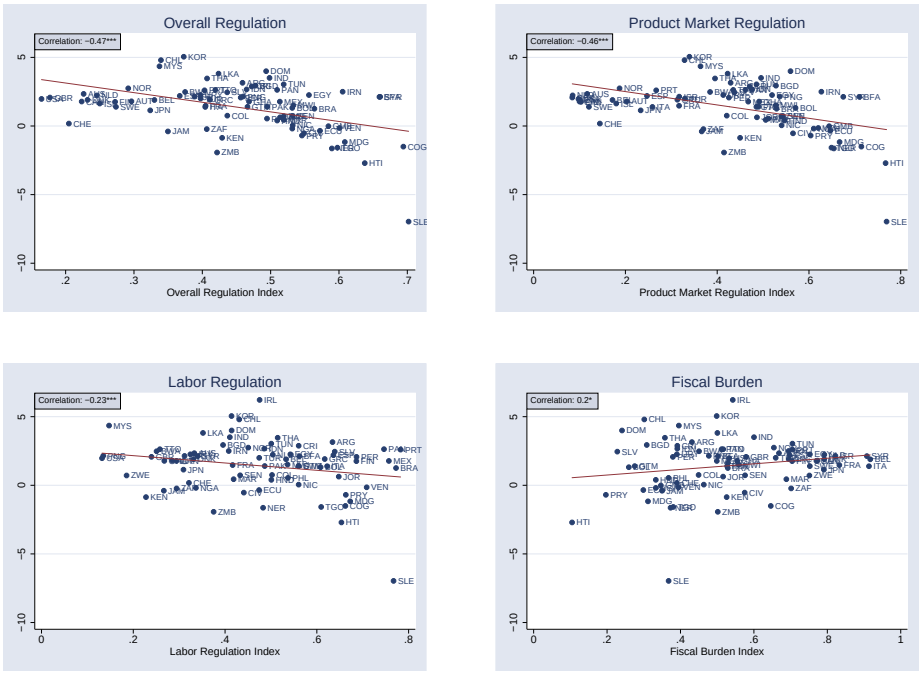
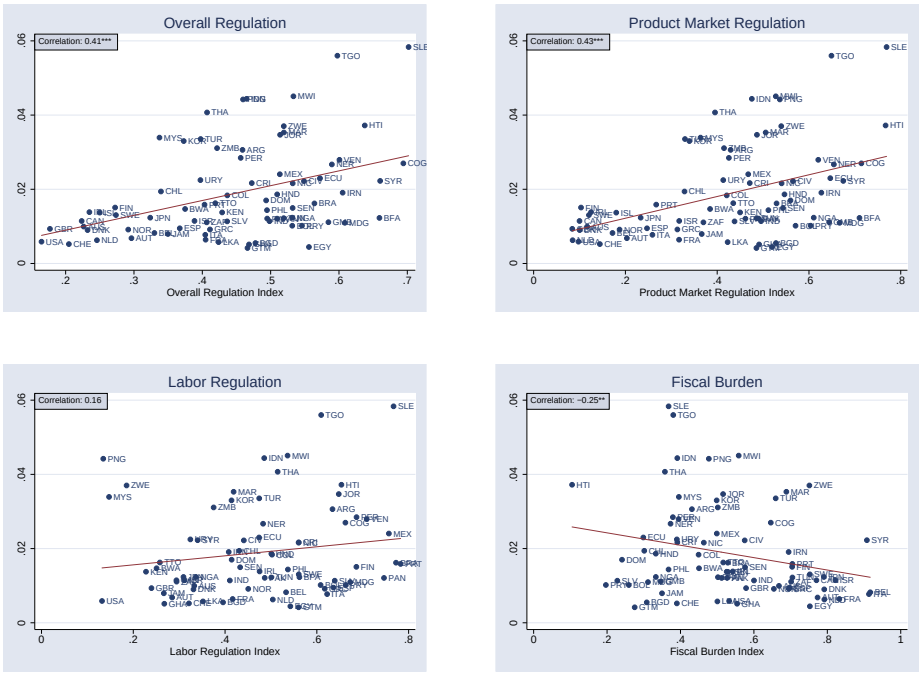


Figure 1.4: Volatility of output gap vs. regulation indices



Note: *, **, and *** denote significance at the 10%, 5%, and 1% level respectively.

A more formal evaluation of the link between the regulation indices and the measures of macroeconomic performance requires multiple regression analysis, to which we turn now. The regression results are organized as follows. We first present the results of a basic specification where the regulation indices are taken as independent variables and their effects as unrelated to governance.

Then, we allow for the effects of regulation on macro performance to vary with the quality of governance. Finally, keeping the regulation-governance interaction, we further control for the likely endogeneity of the regulation indices through an instrumental variable procedure.

Table 1.3 and Table 1.4 present the basic specification results on economic growth and macroeconomic volatility, respectively. The overall index of regulation has a negative and significant association with economic growth, and so do the product market and labor regulation indices. The index of fiscal burden has no significant link with economic growth. The results on macroeconomic volatility are similar for overall and product market regulation: both are positively related to volatility. Conversely, labor regulation has no significant link with macroeconomic volatility, and a heavier fiscal burden even appears to be related to lower volatility. Whereas some of these initial results are strengthened in the richer regression specifications discussed next, others change radically -such is the case of the negative connection between the fiscal burden and macroeconomic volatility.

Table 1.5 and Table 1.6 present the estimation results when we allow for the effect of regulation on growth and volatility to vary with the quality of governance. In the case of economic growth, the overall, product market, and labor regulation indices all carry significantly negative signs and their interaction terms with governance show a positive and significant coefficient.

Thus, the negative association of these regulation indices with economic growth appears to be mitigated when the quality of governance rises. Indeed, the point estimates seem to suggest that at the theoretical maximum level of governance quality (equal to one) the impact of product market and labor regulation could even turn positive; however, the test results reported in the last row of Tables 1.5 and 1.6 cannot reject the hypothesis that under such optimal governance the

impact of regulation is nil.[19]

A potential problem of including governance as a control for the institutional quality of the country is that there is a high (negative) correlation between the governance index and the product market regulation index. It is possible indeed that macroeconomic performance really depends on institutional quality, and not on regulation, but the correlation between the two causes the effect of regulation to appear as significant. To test for this possibility, we ran regressions with the corresponding regulation index and governance as a control, but no interaction term. We find that in the case of product market regulation, the coefficient of regulation is still negative and significant, while the coefficient of governance is insignificant, and we find the opposite results for the labor market and fiscal regulation indices, that is, the regulation index coefficient is insignificant, while the governance coefficient is positive and significant. Thus, introducing governance as a control does not alter our results from the basic specification, which indicates that regulation indeed has explanatory power beyond its correlation with governance.

As for the fiscal burden, neither its direct coefficient nor the coefficient on the interaction term is statistically significant in the growth regression. The results on macroeconomic volatility are broadly similar. The overall, product market, and labor regulation indices carry positive and significant coefficients and their corresponding interaction terms with governance have negative signs, which are significant for overall and labor regulation. Again, this evidence is suggestive that good governance moderates the association between heavier regulation and larger volatility.

As before, the fiscal burden appears to behave differently from other regulations: Only the interaction term is significant, indicating as before that when the quality of governance is high, heavier fiscal regulation is related to lower volatility.

[19]Note that the impact of regulation under the highest level of governance quality is given by the sum of the coefficients in the first two rows of the tables.

Table 1.3: Economic growth and burden of regulation: Basic specification

Sample: 74-76 countries, 1990 - 2000	Method of estimation: Ordinary Least Squares			
Dependent variable:				
Economic growth: Average annual growth rate of GDP per capita, 1990-2000				
	Type of regulation index:			
	Overall	Product Market	Labor	Fiscal
	[1]	[2]	[3]	[4]
Regulation	-7.025	-6.435	-2.415	0.918
(index ranging from 0 to 1, higher meaning more regulated)	[-2.710]	[-3.030]	[-2.130]	[0.730]
Control Variables:				
Initial GDP per capita	-0.709	-0.879	-0.277	-0.396
(in logs)	[-2.540]	[-2.890]	[-1.160]	[-1.530]
Initial education	0.630	0.543	0.532	0.628
(log of secondary enrollment rate in 1990)	[1.410]	[1.310]	[1.150]	[1.200]
Initial financial depth	0.424	0.423	0.440	0.600
(log of private domestic credit / GDP in 1990)	[1.290]	[1.250]	[1.310]	[1.650]
Sub-Saharan Africa dummy	-1.996	-2.095	-2.172	-2.026
(1 if country belongs to Sub-Saharan Africa and 0 otherwise)	[-3.710]	[-3.880]	[-3.730]	[-3.190]
Constant	6.656	7.953	1.659	0.027
	[3.090]	[3.400]	[1.230]	[0.020]
No. of observations	76	76	74	76
R-squared	0.407	0.421	0.368	0.341

Notes:
(a) Standard errors are robust to heteroscedasticity (Newey-West)
(b) t-Statistics are presented in brackets below the corresponding coefficient.
Source: Authors' estimation

Table 1.4: Macroeconomic volatility and burden of regulation: Basic specification

Sample: 74-75 countries, 1990 - 2000	Method of estimation: Ordinary Least Squares			
Dependent variable:				
Macroeconomic Volatility: Standard deviation of the per capita GDP gap, 1990-2000				
	Type of regulation index:			
	Overall	Product Market	Labor	Fiscal
	[1]	[2]	[3]	[4]
Regulation	0.029	0.024	0.009	-0.011
(index ranging from 0 to 1, higher meaning more regulated)	[3.120]	[3.300]	[1.030]	[-1.680]
Control Variables:				
Volatility of terms of trade shocks	0.000	0.000	0.001	0.001
(standard deviation of annual terms of trade growth)	[1.760]	[1.320]	[3.370]	[2.660]
Real exchange rate overvaluation	0.000	0.001	-0.002	0.000
(proportional index, where overvaluation if index¿100)	[-0.100]	[0.200]	[-0.670]	[-0.130]
Systemic Banking Crises	-0.007	-0.007	-0.007	-0.008
(frequency of years under crisis, ranging from 0 to 1)	[-1.260]	[-1.270]	[-1.310]	[-1.360]
Constant	0.006	0.004	0.021	0.023
	[0.310]	[0.220]	[1.220]	[1.370]
No. of observations	75	75	74	75
R-squared	0.224	0.236	0.182	0.192

Notes:
(a) Standard errors are robust to heteroscedasticity (Newey-West).
(b) t-Statistics are presented in brackets below the corresponding coefficient.
Source: Authors' estimation

Table 1.5: Economic growth and burden of regulation: Governance interactions

Sample: 74-76 countries, 1990 - 2000	Method of estimation: Ordinary Least Squares			
Dependent variable:				
Economic growth: Average annual growth rate of GDP per capita, 1990-2000				
	Type of regulation index:			
	Overall	Product Market	Labor	Fiscal
	[1]	[2]	[3]	[4]
Regulation	-9.345	-9.165	-5.490	0.699
(index ranging from 0 to 1, higher meaning more regulated)	[-3.280]	[-3.950]	[-2.980]	[0.460]
Governance-Regulation interaction	9.057	9.675	6.676	0.377
(Governance index * Regulation index)	[2.560]	[3.050]	[2.680]	[0.230]
(Gov. index ranges from 0 to 1, higher meaning better governance)				
Control Variables:				
Initial GDP per capita	-1.046	-1.076	-0.659	-0.433
(in logs)	[-3.370]	[-3.760]	[-2.340]	[-1.300]
Initial education	0.658	0.529	0.485	0.648
(log of secondary enrollment rate in 1990)	[1.670]	[1.420]	[1.180]	[1.270]
Initial financial depth	0.442	0.453	0.370	0.599
(log of private domestic credit / GDP in 1990)	[1.270]	[1.310]	[1.040]	[1.630]
Sub-Saharan Africa dummy	-1.933	-1.912	-2.287	-2.026
(1 if country belongs to Sub-Saharan Africa and 0 otherwise)	[-3.820]	[-3.830]	[-4.340]	[-3.170]
Constant	8.309	8.840	4.983	0.243
	[3.340]	[3.460]	[2.750]	[0.120]
No. of observations	76	76	74	76
R-squared	0.484	0.519	0.445	0.341
P-value of Ho: sum of regulation coefficients = 0	0.465	0.426	0.209	0.236

Notes:
(a) Standard errors are robust to heteroscedasticity (Newey-West).
(b) t-Statistics are presented in brackets below the corresponding coefficient.
Source: Authors' estimation

Table 1.6: Macroeconomic volatility and burden of regulation: Governance interactions

Sample: 74-75 countries, 1990 - 2000	Method of estimation: Ordinary Least Squares			
Dependent variable:				
Macroeconomic Volatility: Standard deviation of the per capita GDP gap, 1990-2000				
	Type of regulation index:			
	Overall	Product Market	Labor	Fiscal
	[1]	[2]	[3]	[4]
Regulation	0.029	0.027	0.020	0.006
(index ranging from 0 to 1, higher meaning more regulated)	[3.120]	[3.510]	[2.100]	[0.580]
Governance-Regulation interaction	-0.027	-0.019	-0.028	-0.022
(Governance index * Regulation index)	[-1.640]	[-1.060]	[-2.920]	[-2.790]
(Gov. index ranges from 0 to 1, higher meaning better governance)				
Control Variables:				
Volatility of terms of trade shocks	0.000	0.000	0.000	0.000
(standard deviation of annual terms of trade growth)	[1.460]	[1.220]	[2.040]	[1.650]
Real exchange rate overvaluation	0.000	0.001	0.000	0.001
(proportional index, where overvaluation if index¿100)	[0.110]	[0.210]	[-0.080]	[0.390]
Systemic Banking Crises	-0.007	-0.007	-0.006	-0.007
(frequency of years under crisis, ranging from 0 to 1)	[-1.240]	[-1.260]	[-1.150]	[-1.270]
Constant	0.008	0.006	0.015	0.014
	[0.430]	[0.330]	[0.890]	[0.830]
No. of observations	75	75	74	75
R-squared	0.243	0.246	0.236	0.239
P-value of Ho: sum of regulation coefficients = 0	0.419	0.246	0.208	0.009

Notes:
(a) Standard errors are robust to heteroscedasticity (Newey-West).
(b) t-Statistics are presented in brackets below the corresponding coefficient.
Source: Authors' estimation

Table 1.7 and Table 1.8 report the results when we both allow for the governance-regulation interaction and control for the likely endogeneity of the regulation indices. Given that now reverse causation is controlled for, the interpretation of the regression coefficients goes beyond the mere association between regulation and the indices of macroeconomic performance. The coefficients can now be interpreted as effects of changes in the regulation indices on economic growth and macroeconomic volatility. All regulation indices show a direct negative impact on economic growth, and this impact is statistically significant for all except fiscal regulation. The governance-regulation interaction term carries a significantly positive coefficient in all cases. Therefore, for overall, product market, and labor regulation, we find that a larger regulatory burden brings about a decrease in growth, but such effect is mitigated by better quality of governance. In the case of fiscal regulation, the estimates are less precise but suggest a potentially beneficial impact on growth that drops when the quality of governance quality decreases. Regarding macroeconomic volatility, the direct coefficients on all regulation indices are positive and significant, including the elusive one on fiscal regulation. The interaction term carries a negative coefficient for all regulation indices, but it is significantly so only in the cases of labor and fiscal regulations.

Taken together, this means that a heavier burden of overall, product market, labor or fiscal regulation leads to higher macroeconomic volatility, and this harmful effect is mitigated by better governance only in the cases of fiscal and labor regulation.

Table 1.7: Economic growth and burden of regulation: Accounting for endogeneity and governance interactions

Sample: 74-76 countries, 1990 - 2000	Method of estimation: Two-Stage Least Squares			
Dependent variable:				
Economic growth: Average annual growth rate of GDP per capita, 1990-2000				
	Type of regulation index:			
	Overall	Product Market	Labor	Fiscal
	[1]	[2]	[3]	[4]
Regulation	-6.444	-6.685	-4.903	-2.120
(index ranging from 0 to 1, higher meaning more regulated)	[-1.960]	[-2.460]	[-2.650]	[-0.620]
Governance-Regulation interaction	7.420	7.502	5.602	5.474
(Governance index * Regulation index)	[1.820]	[1.620]	[2.290]	[1.790]
(Gov. index ranges from 0 to 1, higher meaning better governance)				
Control Variables:				
Initial GDP per capita	-0.867	-0.885	-0.601	-0.926
(in logs)	[-3.540]	[-3.260]	[-1.960]	[-2.320]
Initial education	0.689	0.587	0.500	0.892
(log of secondary enrollment rate in 1990)	[1.760]	[1.560]	[1.170]	[1.450]
Initial financial depth	0.511	0.505	0.389	0.581
(log of private domestic credit / GDP in 1990)	[1.350]	[1.360]	[0.970]	[1.520]
Sub-Saharan Africa dummy	-1.906	-1.893	-2.259	-2.047
(1 if country belongs to Sub-Saharan Africa and 0 otherwise)	[-3.930]	[-3.960]	[-5.130]	[-3.100]
Constant	5.590	6.277	4.377	3.197
	[1.720]	[1.550]	[2.560]	[1.730]
No. of observations	76	76	74	76
R-squared	0.473	0.507	0.495	0.2993
R-squared 1st stage (partial due to excluded instruments)	0.400	0.346	0.401	0.223
Hansen's J-test of overidentifying restrictions (p-value):	0.439	0.687	0.421	0.248
P-value of Ho: sum of regulation plus regulation*governance coefficients = 0	0.437	0.448	0.395	0.054

Notes:
(a) Standard errors are robust to heteroscedasticity (Newey-West).
(b) t-Statistics are presented in brackets below the corresponding coefficient.
(c) Instruments for regulation and interaction: log of per capita GDP in 1990, binary variable of legal origin (British,French, German, Nordic), variables indicating fraction of population that speaks a major European language, and governance index.
Source: Authors' estimation

Table 1.8: Macroeconomic volatility and burden of regulation: Accounting for endogeneity and governance interactions

Sample: 74-75 countries, 1990 - 2000	Method of estimation: Two-Stage Least Squares			
Dependent variable:				
Macroeconomic Volatility: Standard deviation of the per capita GDP gap, 1990-2000				
	Type of regulation index:			
	Overall	Product Market	Labor	Fiscal
	[1]	[2]	[3]	[4]
Regulation	0.031	0.028	0.018	0.036
(index ranging from 0 to 1, higher meaning more regulated)	[2.750]	[3.480]	[1.660]	[1.830]
Governance-Regulation interaction	-0.025	-0.027	-0.029	-0.035
(Governance index * Regulation index)	[-1.510]	[-1.350]	[-3.110]	[-2.910]
(Gov. index ranges from 0 to 1, higher meaning better governance)				
Control Variables:				
Volatility of terms of trade shocks	0.000	0.000	0.000	0.000
(standard deviation of annual terms of trade growth)	[1.340]	[1.170]	[2.000]	[1.780]
Real exchange rate overvaluation	0.000	0.001	0.000	0.000
(proportional index, where overvaluation if index¿100)	[0.130]	[0.210]	[0.000]	[0.030]
Systemic Banking Crises -0.007 -0.007 -0.006 -0.006				
(frequency of years under crisis, ranging from 0 to 1)	[-1.280]	[-1.310]	[-1.190[	[-1.050]
Constant	0.007	0.007	0.015	0.007
	[0.390]	[0.430]	[0.930]	[0.430]
No. of observations	75	75	74	75
R-squared	0.243	0.244	0.234	0.149
R-squared 1st stage (partial due to excluded instruments)	0.746	0.784	0.468	0.373
Hansen's J-test of overidentifying restrictions (p-value):	0.422	0.391	0.372	0.358
P-value of Ho: sum of regulation plus regulation*governance coefficients = 0	0.314	0.308	0.185	0.459

Notes:
(a) Standard errors are robust to heteroscedasticity (Newey-West).
(b) t-Statistics are presented in brackets below the corresponding coefficient.
(c) Instruments for regulation and interaction: log of per capita GDP in 1990, binary variable of legal origin (British,French, German, Nordic), variables indicating fraction of population that speaks a major European language, and governance index.
Source: Authors' estimation

One potential concern with these results is their sensitivity to outlying observations. Figures 1.3 and 1.4 suggest that some countries, such as Sierra Leone, are atypical and may be having an unduly large influence on the estimated parameters. To discard the possibility that our results are driven by outliers, we rerun the regressions with the most complete specification for growth and volatility (as in Tables 1.7 and 1.8) but excluding clearly atypical cases. We use Cook's D ratio as the criterion for exclusion of outliers. Specifically, we exclude the countries whose Cook's ratio consistently exceeds the threshold of 0.1 in our basic regressions.[20] This threshold turns out to be the value below which the influence of the vast majority of countries on the estimated parameters becomes very similar to each other (see Cook, 1979 and Fox, 1997). For growth regressions, the potential outliers are Burkina Faso, Nicaragua, and Sierra Leone; and for volatility regressions, they are Nigeria and Sierra Leone. We find that the regressions results without potential outliers are quite similar to the regressions with the original sample.[21] The coefficient signs remain the same. The magnitude of the coefficients change slightly, usually in the direction of somewhat smaller regulation effects, but their statistical significance improves as they are estimated more precisely. Given that excluding potential outliers does not change the results in any relevant way, we conduct the rest of the analysis using the parameters obtained with the original sample.

How important are the regulation effects economically? Using the point estimates of the regression that accounts for governance interactions and controls for joint endogeneity, we can perform some illustrative exercises. If a country's overall index of regulation was increased by one standard deviation in the cross-country sample (0.13) and its level of governance is equal to the world median (0.44), then its annual rate of per capita GDP growth would decrease by 0.4 percentage points. If a typical developing country were to decrease its product market regulation to the median level of industrial countries (that is, from 0.51 to 0.17) while maintaining its level of governance (equal to the median of developing countries, 0.37), then its annual growth rate would

[20] Cook's D ratio measures the change in the regression estimates that results from eliminating one observation from the sample. A large value of the ratio attributed to one observation indicates that eliminating the observation from the regression significantly changes the results. The usual reference threshold to determine whether an observation has high influence is $4/N$. We identify the outliers by applying the Cook's ratio criterion to the OLS regressions only, in accordance with theory. However, once the non-outlier sample is selected, we use it for estimation via instrumental variables.

[21] The results on the sample without potential outliers are not presented here but are available upon request.

rise by about 1.3 percentage points. The point estimates of the coefficients are such that if the quality of governance is sufficiently high, an increase in regulation can have a positive impact on growth. [22]For overall, product market, and labor regulations, this threshold level is quite high, comparable approximately to the quality of governance in the United States or England. Regarding fiscal regulation, the threshold above which an increase in the fiscal burden can have a positive growth impact is smaller and comparable to that of Mexico.

We can perform similar exercises regarding regulation's impact on macroeconomic volatility. If a typical (or median) country in the world experiences a one-standard-deviation increase in the overall index of regulation, its volatility will rise by about 18%. If a typical developing country were to decrease its product market regulation to the median level of industrial countries, its volatility would fall by about 31%. These calculations use the point estimates of the coefficient on the interaction term, even though they are not statistically significant at standard levels for the overall and product market regulation indices. If we were to assume a zero coefficient on the governance-regulation interaction term, the corresponding effects would be considerably larger (0.28% and 0.49%, respectively). For labor regulation, the threshold level of governance above which higher regulation decreases volatility is around the 70th percentile, comparable to that of Korea. For fiscal regulation, the volatility-increasing effect would disappear only under a perfect governance score.

1.4 Conclusion

Regulation is increasingly viewed as a key explanatory factor for the diversity of aggregate economic performance across countries. In this Chapter we have provided an empirical assessment of the macroeconomic impact of regulation in a large sample of industrial and developing economies. For this purpose, we have built a set of synthetic regulation indicators encompassing a broad array of regulatory dimensions relevant to firms' economic activity: firm entry, labor, taxation, trade, finance, contract enforcement, and bankruptcy.

[22]As noted above, however, we cannot reject the hypothesis that the impact of regulation on growth (or volatility, for that matter) is statistically zero when governance is at its maximum (see the test results presented in the last row of Tables 1.7 and 1.8).

These synthetic regulation indicators allow us to characterize the stylized facts concerning regulation around the world. Two main findings emerge in this regard. First, the burden of regulation shows considerable variation across countries, but in ways that appear systematically related to countries' level of development. Taxes are most heavily regulated in rich countries, while in all other areas developing countries show the harshest regulatory environments. Second, the overall regulatory framework can be conveniently summarized by the extent of regulation in three major dimensions: fiscal, labor and output market, where the latter encompasses the regulation of entry, trade, financial markets, bankruptcy and contract enforcement.

Using this summary representation of the regulatory environment, we have assessed empirically the impact of regulation on two key measures of aggregate performance, namely the growth rate of GDP per capita and the volatility of the output gap. Our estimations take into account the fact that the quality of regulation is likely to vary considerably across countries, reflecting primarily the quality of their overall institutional framework. In addition, we also control for the potential endogeneity of regulation, which could itself be driven in part by aggregate economic performance. This allows us to interpret our empirical results as reflecting the causal impact of regulation on the macroeconomic variables of interest, rather than just mere association between the former and the latter.

On the whole, our estimates suggest that regulation tends to reduce growth. This is clearly the case for product and labor market regulation. In the case of fiscal regulation, however, the results are less conclusive. Regarding macroeconomic volatility, our finding is that all three kinds of regulation tend to increase it. However, the quality of regulation -as captured by the overall institutional framework– makes a big difference. In most instances we find that better institutions help mitigate, and even eliminate, the adverse impact of regulation on macroeconomic performance.

Does the negative macroeconomic effect of regulations imply that they should be eliminated altogether? As warned in the introduction, this Chapter does not intend to assess the impact of regulation on social goals that could arguably be beyond the sphere of direct influence of economic growth -broad goals such as social equity and peace, or narrow ones such as worker safety, environ-

mental conservation, and civil security– which typically motivate specific regulations. Thus, our conclusions on the role of regulation must necessarily be weighed in a more comprehensive context before drawing definitive social welfare implications. At any rate, to the extent that economic growth and macroeconomic stability are important goals too, our findings imply that streamlining regulation and strengthening governance in highly regulated countries could have a significant payoff in terms of macroeconomic performance.

Chapter 2

Regulation and Microeconomic Dynamics: A Comparative Assessment for Latin America

2.1 Introduction

The effects of microeconomic regulation on aggregate economic performance have recently attracted renewed attention in the policy debate. Intricate regulation and its arbitrary enforcement are listed by the World Bank (2005) among the key obstacles to growth in developing countries, while excessive regulation has been likewise blamed by many observers for Europe's lagging performance vis-à-vis the U.S.

Some recent empirical studies have been concerned with the impact of regulation and deregulation on aggregate growth in a cross-country setting. Koedijk and Kremers (1996) find a negative association between measures of product market regulation and GDP growth among 11 European countries. In contrast, they find that labor regulations have no significant association with growth performance. Dutz and Hairy (1999) apply extreme-bounds analysis to estimate the contribution to growth of a variety of (mostly subjective) regulation and competition indicators in a sample of industrial and developing countries. They find significant effects of measures of anti-trust policy and the average age of large firms (taken as proxy for entry and exit barriers). In contrast, Card and Freeman (2002) fail to find any significant association between subjective measures of economic regulation and growth performance in a panel regression covering OECD countries over 1970-99.

Chapter 1 of this thesis explores the growth impact of synthetic indicators of product market, labor market and fiscal regulation, using a large cross-country sample. On the whole, results show that product market and labor regulation unambiguously deter per capita income growth, while for fiscal regulation the findings are more mixed. Furthermore, the adverse growth impact of

regulation is exacerbated under conditions of poor governance.

While these studies summarize the empirical relation between regulation and growth performance, they are not directly informative about the mechanisms at work. Conceptually, there are several channels through which regulation may affect aggregate performance (see, e.g., Griffith and Harrison, 2004). First, regulation affects the allocation of resources across firms and sectors with different productivity levels, thus impacting on overall efficiency. Second, regulation also affects the level of productivity of existing firms, by changing their incentives to reduce slack and utilize factors more or less intensely. And third, regulation also has an impact on firms' incentives to innovate and introduce new products and processes, and hence on the pace of expansion of the technological frontier.

The analytical literature has devoted particular attention to the allocative mechanism -the Schumpeterian process of external restructuring whereby market selection reallocates resources from low-efficiency to high-efficiency firms, through contraction and exit of the former, and expansion and new entry by the latter. Regulatory barriers that disrupt this "creative destruction" process cause a deterioration in aggregate economic performance, by allowing low-productivity activities to survive too long, and discouraging the adoption of new high-productivity activities (Caballero and Hammour, 1998).

In turn, the theoretical literature offers conflicting predictions regarding the effect of deregulation on the incentives to innovate. On the one hand, the reduction in rents resulting from increased market contestability may discourage the introduction of new products and processes. On the other hand, incumbent firms may face an increased incentive to innovate in order to escape the pressure of competition (Aghion *et al.*, 2001). Thus, the net effect of regulation on innovation is ambiguous on conceptual grounds, and can be determined only empirically.

This Chapter assesses empirically the role of firm dynamics as the mechanism linking regulation and growth -specifically, the growth rate of output per worker– using both aggregate and sector-wise manufacturing data for a set of OECD and Latin American countries. The analysis follows a two-stage approach. In the first stage, we assess the empirical link between regulation

and firm turnover. We employ both overall manufacturing data as well as sector-level data on firm entry and exit rates. In the second stage, we relate growth in output per worker to firm turnover using overall manufacturing data. This is done using both OLS regressions as well as instrumental-variable regressions with regulatory indices as instruments for firm turnover, to isolate the variation in the latter due to regulation. Such procedure allows us to assess if firm dynamics provides the link between regulation and productivity performance, as predicted by the "creative destruction" view.

This chapter relates closely to other recent attempts to shed light on the link between regulation and aggregate performance. Griffith and Harrison (2004) follow a similar two-step approach to study product-market regulatory reform, but rather than firm turnover they stress instead the role of markup variations. Their implicit assumption is that regulatory reforms impact on performance only through their effect on the degree of competition among firms, as captured by markup levels. Their empirical tests, using data from OECD countries, yield mixed results: decreased regulation does lead to lower markups, but these in turn seem to be associated with lower, rather than higher, levels and growth rates of productivity and R&D effort. Moreover, in many cases they find that regulatory variables appear to have an independent effect on aggregate performance, above and beyond the effect occurring through the markup. Other papers focus instead on the Schumpeterian mechanism of firm entry and exit –like we do here. Klapper, Laeven and Rajan (2004) assess the effects of regulation on firm entry using firm-level data for developed and transition European countries. On the whole, they find that regulation deters entry, and also hampers industry-level productivity growth. Cincera and Galgau (2005) are likewise concerned with firm entry and exit, and take a two-step approach similar to ours. They asses the impact of (subjective) product-market regulation measures on entry and exit rates by sector in 9 OECD countries, and examine also the effect of entry and exit on sector-wise productivity. On the whole, their results indicate that product market deregulation increases entry and exit rates, while these in turn have a (weakly) positive impact on the growth of output and labor productivity.

Our Chapter expands this literature in several dimensions. First, unlike most previous

studies, which have focused on selected OECD economies, we consider both industrial and Latin American countries. Second, rather than confining the analysis to product-market regulation alone, which is the concern of the recent literature, we consider three different kinds of regulations -those affecting the product market, those affecting the labor market, and fiscal regulations. Third, we distinguish among the various components of observed productivity growth -i.e., those due to entry, exit, reallocation among incumbent firms, and productivity growth within incumbent firms– to assess if they are affected in different ways by regulation.

The rest of the Chapter is organized as follows. Section 2 provides a description of firm dynamics and productivity growth in Latin America and a sample of industrial countries. Section 3 discusses differences in regulation across countries, with particular attention to Latin America. In section 4, we lay out the main questions we explore and our estimation strategy, and present results. Section 5 concludes.

2.2 Microeconomic dynamics in Latin America

The starting point of our analysis is the harmonized data set constructed by Bartelsman, Haltiwanger and Scarpetta (2004) that covers 24 industrialized, developing, and transition countries. The data set provides demographics and productivity data for manufacturing, such as the number (and total employment) of entrants, continuers, and exiting firms by (ISIC 3-digit) industry, size class, and year. It also reports the 5-year labor productivity average growth rate by industry and year, together with the contribution to labor productivity growth of entering, continuing, and exiting firms computed following Foster, Haltiwanger and Krizan (2000), and Griliches and Regev (1995). We select all Latin American countries available in the data set, and compare them to industrial economies.[1] Our basic working sample consists of the following countries: Argentina, Brazil, Chile, Colombia, Venezuela, Finland, France, The Netherlands, the UK, and the US.

[1] We refer the reader to Bartelsman *et al.* (2004) for a detailed description of the data collection protocol, as well as important discussions of the main indicators constructed.

2.2.1 Firm entry, exit, and turnover

Numerous studies have documented evidence of heterogeneity across firms as well as intensive reallocation of resources across firms in industrial countries (see for instance, Dunne *et al.*, 1989, Bartelsman and Doms, 2000). All find that in the US and Europe the reallocation pace is high, for instance, Bartelsman *et al.* (2003) report that, on average, close to 20 percent of firms enter and exit the market every year in ten OECD countries. In addition, productivity varies greatly across firms, even within narrowly-defined industries (see Foster et al., 2001). More recently, a few studies have looked at firm dynamics in developing countries and have found, perhaps surprisingly, that reallocation and productivity dynamics are in fact similar to that in industrial countries (see, for instance, Roberts and Tybout, 1996).

Panel (a) of Figure 2.1 depicts the employment-weighted firm turnover rates for manufacturing in Latin America and industrial countries over the 1991-2001 period.[2] It is calculated as the sum of employment at entering and exiting firms divided by total employment in the current year.

From the first panel in the figure, it is evident that turnover rates are very similar in Latin America and the sample of industrial countries, with the exception of the US, where turnover is considerably higher.[3] All other countries have turnover rates between 10 and 20 percent. The case is similar for entry and exit rates.All other countries have turnover rates between 10 and 20 percent. The case is similar for entry and exit rates.

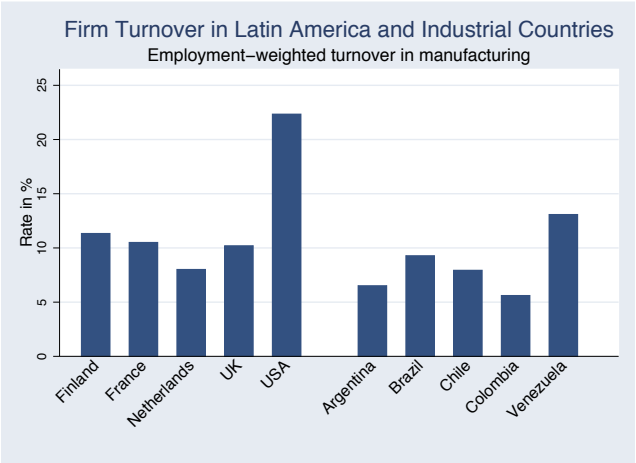
Several questions arise upon looking at this figure: first, are these "natural" turnover rates? Almost surely, the answer is "no." Indeed, our data covers in the best case the entire 1990s decade, but for Argentina, Brazil, Venezuela, and several industrial countries we have data only for the second half of the decade, and in some cases less than five years. Therefore, it is reasonable to believe that much of the movement of firms we observe is related to the cycle in each country.

The second question is then: does this movement accurately reflect responses to shocks? A

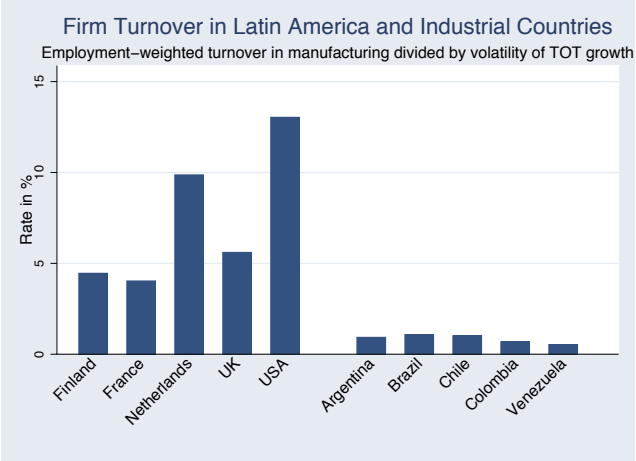
[2]Notice that employment-weighted firm turnover only takes into account job creation and job coming from the entry and exit of firms, and hence is not equal to the well-known "job reallocation" measure, which also takes into account job flows across continuing firms.

[3]Mexico, excluded from the sample because of lack of productivity data, has one of the highest turnover rates of the entire sample, along with the US.

Figure 2.1: Firm dynamics



(a)



(b)

Sources: Bartelsman, Haltiwanger and Scarpetta (2005), and authors' calculations

simple way to measure aggregate shocks is to look at the volatility of terms of trade growth. We use the standard deviation of the growth rate of terms of trade as a proxy for the volatility of the economy, which in turn is an indication of the frequency of the shocks that hit the economy. We prefer this measure to the volatility of, say, per capita GDP growth because, assuming that firms are price takers, shocks to terms of trade represent exogenous shocks to industries and hence are less likely to be affected by firms' dynamics.[4] As it turns out, Latin American countries exhibit much greater volatility of terms-of-trade growth than industrial countries, and industrial countries

[4]This addresses the debate about whether there is a feedback effect from reallocation to the business cycle. See Schuh and Triest (1998).

with high volatility of terms-of-trade growth also exhibit larger rates of entry, exit, and turnover of firms than other countries. In fact, simply dividing entry, exit, and turnover rates by this measure of volatility gives a completely different picture about firm dynamics: panel (b) in Figure 2.1 shows that, under this corrected measure, firm dynamics in Latin America are much lower than in most countries in the industrial sample. This picture gives us some preliminary evidence that, indeed, much of the movement of firms in and out of the market occurs as a response to macroeconomic shocks.

Third, we can ask ourselves whether the magnitude of the response in each country corresponds to an efficient scenario. To understand this, we need to look at the counterfactual of what would happen in the absence of barriers to adjustment, such as excessive entry, exit, or labor regulations. Again, by a simple examination of this picture it is reasonable to conjecture that adjustment in Latin America is far from efficient: indeed, given the magnitude of the shocks that hit these countries, adjustment should be much larger in order to obtain "corrected" measures that look similar to those in industrial countries.

2.2.2 Labor productivity growth

A natural question that arises from observing firm dynamics concerns the implications of having a more or less rapid turnover of firms on productivity gains at the firm and industry level. Indeed, a large number firms leaving and entering the market each year is not per se a desirable outcome; it only becomes so if, as a result of this process, the firms that stay in the market experience productivity gains, if not in the short run, at least in the medium to long term.[5]

Figure 2.2.2 presents the productivity growth decomposition for Finland, France, the UK, the Netherlands, the US, Argentina, Brazil, Colombia, Chile, and Venezuela. As in Griliches and Regev (1995), the decomposition of labor productivity growth between years $t-k$ and t ($k=5$ in

[5] According to theoretical explanations of the negative correlation between job reallocation and the business cycle, the job destruction that takes place during recessions is not entirely "creative destruction." In fact, in the presence of frictions, destruction can be highly inefficient (as in Caballero and Hammour, 1998, or Ouyang, 2004). However, we expect that in the long run, a relatively frictionless economy will experience productivity gains coming from the entry and exit of firms, a fact that has been documented for several industrial countries by Foster *et al.* (2001), Barnes *et al.* (2001), and others. In addition, an economy that undergoes a liberalization process by tearing down burdensome regulation should indeed experience productivity gains from inefficient firms losing ground to efficient ones.

our case) is as follows:

$$\Delta P_t = \sum_{i \in C} \overline{\theta_i} \Delta p_{it} + \sum_{i \in C} \Delta \theta_i (\overline{p_i} - \overline{P}) + \sum_{i \in N} \theta_{it} (p_{it} - \overline{P}) + \sum_{i \in X} \theta_{it-k} (p_{it-k} - \overline{P})$$

where P is productivity at the industry level, p_i is productivity at the firm level, and θ_i is the share of firm i in the industry (in terms of output). The first term in the decomposition represents the "within contribution" to productivity growth, that is, the amount of productivity growth coming from productivity increments within continuing firms; the second term is the "between" contribution, or the addition to productivity coming from reallocation of resources between firms; and the two last terms represent the portion of productivity growth coming from the entry and exit of firms in the industry. The upper bar over each variable represents the average value between the base and end years.

Since we are mostly interested in knowing whether regulation affects gains in productivity within firms or gains in productivity coming from the creative destruction process, we also look at the sum of all the contributions that come from reallocation, that is, we group the terms in the following way:

$$\begin{aligned} \Delta P_t &= \sum_{i \in C} \overline{\theta_i} \Delta p_{it} + \left\{ \sum_{i \in C} \Delta \theta_i (\overline{p_i} - \overline{P}) + \sum_{i \in N} \theta_{it} (p_{it} - \overline{P}) + \sum_{i \in X} \theta_{it-k} (p_{it-k} - \overline{P}) \right\} \\ &= within + reallocation \end{aligned}$$

Panel A of Figure 2.2.2 depicts the total growth of labor productivity and the contribution of incumbents that experience productivity gains (within), expand or contract (between), and the contribution of entrants minus exiting firms (net entry). To make our comparisons more meaningful, we use the average annual labor productivity growth rates over the relevant 5−year periods, instead of the 5-year growth rates. As in the case of firm dynamics, we can see here that the productivity picture is quite similar for Latin America and the industrial sample, or at least, there is no clear pattern that differentiates one group from another. For instance, Argentina and Colombia have experienced higher productivity gains than the US, the UK, the Netherlands, and

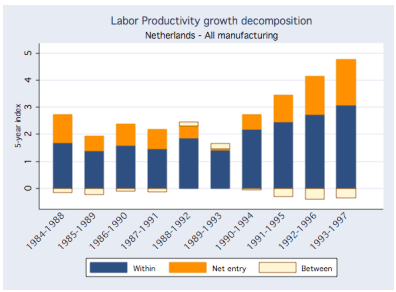
France. However, we should note again that the time coverage of the data is quite limited, so that the numbers for each country are not comparable, if only for the different years they cover.[6]

Figure 2.2: Labor productivity growth decomposition

[6]For instance, Brazil has data for only 2001, while Chile and Colombia have over ten years; moreover, the time periods my not overlap, as is the case for these three countries.

G

H



I

J

Note: the productivity decomposition showed is calculated following Griliches and Regev (1995). Labor productivity is a weighted average of firm productivity (weighted using value added), and the growth rate shown in the graphs corresponds to an average annual growth rate, based on the 5-year growth rate.

While attempting to draw any conclusions from a simple visual analysis of the data would be futile, a more serious econometric analysis is subject to important caveats as well, in particular relating to the use of labor productivity measures in lieu of more accurate measures of productivity, such as TFP. Labor productivity measures are sensitive not only to technological change, but also to temporary changes in utilization in response to shocks (see, for instance, Basu, Fernald and Kimball, 1998), especially in the presence of adjustment costs. This should be the case particularly in countries where barriers to adjustment add to the natural adjustment costs. Demand shocks are also likely to alter measured labor productivity, even in the absence of changes in TFP. Clearly, for our purposes, it would be preferable to use TFP, however, in the absence of such data our approach is to measure the long term effects that regulation has on labor productivity growth, either coming from a reduced pace of technological progress or from distortions to adjustment.

Similar to the turnover case, we try to understand to what extent the observed changes in productivity correspond to adjustment to temporary shocks unrelated to technological progress. With this purpose in mind, we look at the average growth of terms of trade during the period in

which productivity changes were measured (5 years). This measure is more appropriate than the standard deviation of terms of trade growth because we want to capture the direction of the shock, not just the magnitude. A large negative shock may cause a drop in labor productivity growth; in the absence of such shock, productivity growth may have been positive and high.

Panel B of Figure 2.2.2 shows changes in labor productivity and the average growth of terms of trade during the same period. It is clear from the picture that changes in terms of trade in Latin America are far larger than in industrial countries. However, if we use this measure of shocks to "correct" productivity growth, we could see that a large portion of the changes in labor productivity growth cannot be explained as a pure response to these temporary shocks.

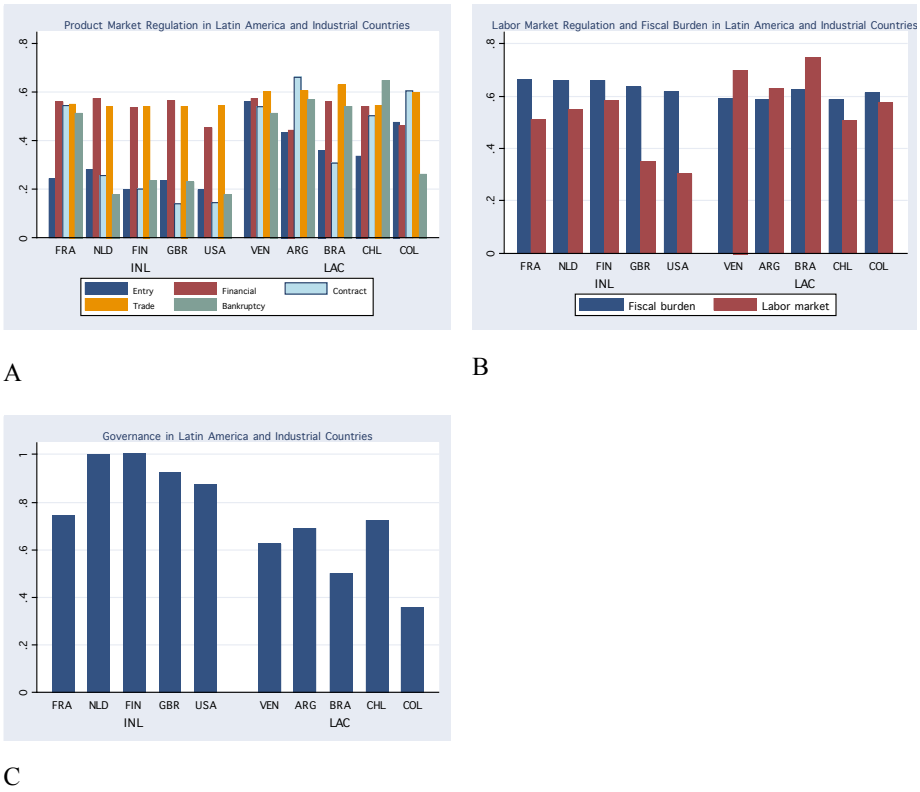
From these preliminary observations, we outline two main empirical questions: first, are firm movements in and out of the market related to the observed labor productivity gains (or losses)? Second, how much do differences in regulation explain of the differences in turnover and, ultimately, labor productivity gains? These are the main questions we address in Section 4.

2.3 Business regulation and reform in Latin America

2.3.1 Cross-country differences in regulation

To begin our assessment of regulation in Latin America, we make a static comparison of the severity of business regulation our sample countries. We use the indices presented in Chapter 1, which combine *de jure* and *de facto* measures of regulation, thus accounting for the practical restrictions and complications brought about by certain rules. Each index measures the intensity of the regulatory system on a scale from 0 to 1 (1 representing the highest regulation) in seven areas: entry, financial markets, trade, labor, difficulty in contract enforcement, bankruptcy, and fiscal burden. Because all measures used in the construction of these indices refer to the late 1990s, this initial comparison as useful starting point: it allows us to see where Latin America stands today vis-à-vis industrial countries in terms of regulation. Given that many countries (including, Argentina, Brazil, and Colombia) underwent large reform processes in the early 1990s, this is a useful evaluation of how far reforms have reached so far.

Figure 2.3: Regulation indices



Indices take values from 0 to 1, 1 representing the most stringent regulation (and best governance). See Chapter 1 and Appendix A for more details.

Panels A-C in Figure 2.3 present each index by country and region. The product market regulation index is the simple average of the entry, financial, contract, trade, and bankruptcy regulation indices, which typically consist of sub-indices that reflect the number of days, the number of procedures, and the cost of opening or closing a business, for example. The index of labor regulation combines the percentage of workers that belong to a union, the minimum mandatory working conditions, and the degree of hiring and firing flexibility granted by the law. The index of fiscal burden measures direct taxation -that is, the maximum tax rate applied to individuals and businesses– and fiscal spending. Except for the financial markets regulation index and the fiscal burden index, the correlation between the indices is positive and significant, and large (over 0.5), suggesting that countries that regulate heavily do so in various areas. For each index, the average score from the industrial sample is significantly lower than the average score

of the Latin American sample. For instance, the index of entry regulation in Latin America is 0.41 and while it is 0.24 in the industrial sample; likewise, the difficulty of contract enforcement index is 0.26 in the industrial sample and 0.57 in Latin America, and the index of bankruptcy regulation is 0.25 in the industrial sample and 0.49 in Latin America. Labor market regulation varies considerably across both samples of countries. The US and the UK reach the lowest scores (0.3 and 0.35), while the most stringent labor market regulation is in Brazil (0.75) followed by Venezuela (0.7). But some Latin American countries also display more flexible labor regulations than industrial countries, for instance Chile (0.5) and Colombia (0.57) have less stringent labor regulation than Finland (0.58).[7]

Given the current debate about the need for more flexible labor markets in developing economies, it is important to point out to the fact that, first, several developing countries have introduced substantial reforms, and second, labor markets present rigidities in developed countries as well. Although most studies tend to agree on the fact that reform is beneficial and rigidity is costly, the cross-country heterogeneity observed in firm dynamics and productivity suggests that more research needs to be done in order to assess the total cost of stringent labor market regulation on one hand, and the effects of reform on the other, in particular when reforms are not carried out on different dimensions of regulation.

The fiscal burden in industrial countries not only scores worse on average than in Latin American countries (0.65 versus 0.6); even the country with the best score in the industrial sample, the United States (0.62), stands below all Latin American countries but Brazil (0.62). Argentina, Chile, and Venezuela have the lowest scores (0.59), and Finland, France, and the Netherlands have the highest (0.66).

2.4 Regulation and microeconomic dynamics in Latin America

Having described how the regulatory environment varies across countries, our objective for this section is examining whether regulations have an impact on firm dynamics and ultimately on

[7]Further, other countries excluded from the sample, like Italy and Portugal, have even higher labor regulation scores than Argentina, Chile, Colombia, and El Salvador.

productivity growth performance. Our main question is: is firm dynamics the channel through which regulation affects labor productivity growth? In order to answer this question, we need to, first link regulation to firm dynamics; second, link firm dynamics to labor productivity growth rates, and finally, establish whether the effect of firm dynamics on labor productivity growth is explained by the component of firm dynamics due to business regulation flexibility (for which we use an instrumental variable procedure). In exploring the link between regulation and firm dynamics, we also look at the role of firm dynamics in the adjustment from macroeconomic shocks, and how it is affected in the presence of more or less flexible regulation.

2.4.1 Sample and specification

Our empirical methodology is based on panel regression analysis. We conduct separate regressions for each dependent variable of interest, namely, turnover rate, growth rate of labor productivity, and each of its components. We use as explanatory variables a measure of regulation and a set of basic control variables. All variables included in the empirical exercises are briefly presented below, except the regulation indices that were introduced in the previous section.

A further complication arises in the analysis from the fact that there is a large amount of heterogeneity across in firm dynamics and productivity, even within narrowly defined sectors. We deal with this by conducting regressions at several levels of aggregation, and introducing fixed effects for each category. The regression equations are presented below.

Our sample consists of the 10 countries mentioned before: Argentina, Brazil, Chile, Colombia, Finland, France, the Netherlands, the UK, the US, and Venezuela. All observations for each variable correspond to the period 1990−2001 for firm demographics and 1988−2001 for productivity, although our panel is unbalanced, so that for some countries the time variation is more limited. We voluntarily ignore observations before the late 1980s, as most internationally comparable regulation measures are available only for the 1990s and therefore including data for a much earlier period based on regulation data could be misleading. This is particularly the case for countries that carried out regulatory reforms during the 1908s and early 1990s, as many Latina American

countries did.

Within each country-year category, we observe employment-weighted turnover rates, and labor productivity growth and its components for 22 stan-0 industries, that is, we observe the contribution to productivity growth coming from "within," "between," and "net entry" in each country. As Bartelsman, Haltiwanger, and Scarpetta (2005) note, data were collected using a unified protocol, so that cross-country comparisons are less subject to measurement errors than previously available data. However, the availability of data is not uniform, so that in some countries data are provided at the firm level (e.g., in Finland, France, Italy, and Venezuela) and others at the establishment/plant level. The same is true for size classes: in most countries, there is a cutoff size for registering an establishment or firm (usually a minimum of one employee), but other countries, like France, establish a minimum revenue level. While we cannot exclude biases arising from this sample selection problem, we believe our sample to be "sufficient" in the sense that most of the components of our regulation indices typically refer to a "small to medium-size" business (between 10 and 100 employees), and therefore very few of the excluded firms are in fact relevant for our analysis.

Before laying out our estimation strategy, it is important to look at the predictions of the theory with respect to the impact of various regulations on firms dynamics and productivity. Industry evolution models with heterogeneous agents, such as Hopenhayn (1992), analyze the effect of different regulations on the entry and exit decision of firms, and on the resulting industry productivity distribution. For instance, and increase in entry costs reduces firm turnover, as fewer potential entrants have a present discounted value of entering high enough to cover the entry cost. At the same time, incumbent firms need to stay longer in the market in order to recover the entry cost. Chapter 3 of this thesis shows a similar effect on turnover of increasing exit costs. Hopenhayn and Rogerson (1993) show that introducing firing costs reduces firm turnover because it delays the destruction of jobs (and thus firm exit). Micco and Pagés (2004) show that the magnitude of the adjustment of labor (i.e. worker turnover) depends on the size of the aggregate shock faced by the sector, so that adjustment costs will have a greater impact on adjustment in sectors that

"naturally" suffer shocks of larger magnitude.

Increases in regulation that affect the cost of innovation have ambiguous effects on turnover. Chapter 3 of this thesis finds that increases in the cost of "active learning" (reflecting R&D expenditures, but also more general investments, such as technology adoption), actually increase turnover, as the share of incumbent firms that forego innovation grows, which forces them to leave the industry sooner. Comin and Mulani (2005) distinguish in their model between technology adoption and R&D, and their results suggest that regulations affecting R&D might encourage firms to invest more in adopting general innovations, and because R&D drives volatility of productivity growth at the firm level, a reduction in R&D spending should reflect in a decrease of firm level volatility, although not necessarily in aggregate volatility. This decrease in R&D spending will also decrease market turnover, measured as the rate at which the leader in the industry changes.

More generally, the size of adjustment (in terms of workers or firms) in each sector depends on the size of the shocks that affect that sector. A sector with more volatile shocks will tend to have also a more volatile adjustment pattern than a sector with smaller fluctuations. As a result, we expect the volatility of adjustment to be affected relatively more by restrictions to adjustment, in the form of regulations or otherwise.

The first part of our analysis relates firm dynamics, specifically firm turnover, and regulation. We measure whether the response of firm dynamics to macroeconomic shocks is hampered by the presence of burdensome regulation, taking into account the fact that the "natural" response to shocks may vary across sectors. Because firm dynamics in Latin America do not seem to differ much from dynamics in more developed economies, our question is not whether regulation impedes the movement from firms in and out of the market, but instead, whether in the face of large macroeconomic shocks, such as the shocks to terms of trade that hit Latin American countries during the 1990s, firms have the possibility to adjust fully. If they don't, the degree of "turbulence" observed could still be intense, although lower than it would be in a more flexible regulatory environment. For instance, if a negative shock hits the economy and a large number of firms is pushed to the destruction cutoff level (so that they would normally exit the market),

some firms may in fact remain in the market because dismissal and other bankruptcy costs are excessively high, thus weakening the adjustment that would otherwise take place.

With this idea in mind, we estimate the following regression equation:

$$z_{c,i,s,t} = \gamma_0 + \gamma_c + \gamma_i + \gamma_s + \gamma_t + \phi(R_c \times \overline{turnover_{US,i,s}}) + v_{c,i,s,t} \tag{2.1}$$

where z is the ratio of firm turnover to the standard deviation of terms-of-trade growth over the period 1985−2000, c = country, i = industry, s = size, and t = year. The regulation index in country c, R_c, is multiplied by the average (employment-weighted) turnover rate in the US, also divided by the standard deviation of terms-of-trade growth in the US over the period 1985−2000.[8]

We interpret the dependent variable as the level of adjustment beyond responses to exogenous aggregate shocks, and that takes place because of technological progress, idiosyncratic shocks, etc. This constitutes the "natural" movement of firms in and out of an industry, and is expected to fall in the presence of stringent regulation. Note that in equation (2.1) the interaction term accounts for the fact that firm dynamics may "naturally" vary across industries and sizes.

Regression (2.1) is similar in spirit to Rajan and Zingales (1998), in that the coefficient ϕ is interpreted as the effect of regulation on the dependent variable relative to a reference, or "natural" rate. Rajan and Zingales (1998) and following studies such as Klapper *et al.* (2004), and Micco and Pagés (2004), use the dependent variable in the same category (typically industry, year) in the US as the "natural" rate in the absence of burdensome or distortive regulation.[9] Such a specification allows for a difference-in-difference analysis whereby one can study the effect of a change in regulation on the "natural difference" of the dependent variable between two sectors, with the added advantage of reducing the distortion caused by measurement errors. We choose the average (employment-weighted) turnover rate in the corresponding category in the US as our

[8] An alternative way to account for the effect of volatility on firm dynamics is to add the volatility variable to the regression as an additional control variable, or alternatively, to regress turnover on volatility and then use the regression residual as a new dependent variable. In auxiliary regressions not reported here, we found that higher volatility is indeed associated with higher turnover, however, we prefer the specification above because it still allows us to introduce fixed effects for country, industry, and time, whereas including volatility -which only varies at the country level- would capture the effects of other unobserved variables.

[9] A recent study by Haltiwanger *et al.* (2006) using this methodology finds that the effect of labor market regulations varies significantly over firms size: job turnover in medium and large firms falls relatively more in countries that have more stringent regulations, while small firms do not display significant differences.

"natural" reference level in all regressions. We have two reasons for doing so: first, because US data are available for a smaller number of years (1990-1997 for dynamics; 1992 and 1997 for productivity) we use the average values, thereby abstracting from cyclical changes of the "natural" rate in the US. Second, we prefer to use the same measure across regressions, and we choose this particular measure over all others, because we start from the prior that creative destruction (measured by turnover) leads to increases in productivity, so that we should observe a stronger impact of regulation on productivity in sectors that are naturally experiencing higher turnover.

Our measure of macroeconomic shocks is given by the standard deviation of terms of trade growth, obtained from the World Bank Development Indicators (2003). We believe this measure to be preferable to, say, volatility of the real exchange rate, because it is the least subject to endogeneity concerns. In addition, there is a positive, significant correlation between the volatility of terms of trade growth and the volatility of GDP, suggesting that terms of trade reflect shocks to the overall economy.

As described in the previous section, our explanatory variables of interest are indices that quantify a country's regulatory burden. We consider, in turn, product market, labor, and fiscal regulation indices, where "product market" regulations include entry, trade, financial, contracting, and bankruptcy regulations. In all regressions, we use the cross-country regulation indices constructed in Chapter 1.

In the second part of our analysis we study how regulation affects productivity growth. First, productivity growth can be directly affected by regulation, for instance, incentives for conducting R&D or adopting new technologies might be hurt in the presence of excessive regulation. In addition, if the movement of firms in and out of the market is really a "creative destruction" process, then productivity growth increases (at least to some extent) as more firms enter and leave the market.[10] This creates a second channel for regulation to affect productivity: the effect of regulation on firm dynamics will also have an effect on productivity growth.

To understand the direct and indirect effect of regulation on productivity growth, we esti-

[10]Things could be different if there exist frictions that give place to an inefficient selection process, as in Caballero and Hammour (1998), Ouyang (2004), and Chapter 3 of this thesis.

mate the following regression equations:

$$y_{c,t} = \alpha_0 + \gamma_1 \ln(GDP_c) + \gamma_2 avtotgr_{c,t} + \gamma_3 outgap_{c,t} + \beta(R_c \times \overline{turnover_{US}}) + \epsilon_{c,t} \quad (2.2)$$

$$y_{c,t} = \alpha_0 + \gamma_1 \ln(GDP_c) + \gamma_2 avtotgr_{c,t} + \gamma_3 outgap_{c,t} + \beta(\frac{turnover_{c,t-5}}{sdtotgr_{c,5}}) + \epsilon_{c,t} \quad (2.3)$$

where y is the dependent variable (each component of the labor productivity growth decomposition equation), and t represents the end year of a 5−year period. As in regression (2.1), the regulation index in country c is multiplied by the average rate of (employment-weighted) turnover in the US. In regressions (2.2) and (2.3), we only use observations aggregated at the manufacturing level. We include macroeconomic control variables, namely the average log GDP per capita over the period (different for each country) to control for development effects; the average (annual) growth rate of terms of trade over each 5−year period to control for exogenous external effects, and the output gap over each 5−year period to control for cyclical effects.

In regression (2.2) , we explore the direct relation between productivity growth and regulation; in regression (2.3) we look at the effect of regulation on productivity growth through the channel of firm dynamics. To this effect, we use the log of the (employment-weighted) turnover rate divided by the standard deviation of terms-of-trade growth in the 1985−2000 period. We estimate regression (2.3) using ordinary least squares and also by instrumental variable estimation, where our instruments are in fact the regulation indices. We discuss the choice of instruments as well as the results of these estimations in the next sub-section.

2.4.2 Results and discussion

Table 2.1 presents the results of the estimation of regression (2.1) for firm turnover. The coefficients of entry regulation, lack of contract enforcement, and bankruptcy regulation are negative and significant, meaning that in countries with more stringent regulation (an index closer to one), firm turnover is relatively lower in (industry-size) categories that naturally display sharper adjustment to shocks. Notice that the coefficients measure the effect of regulation on firm movements in

and out of the market that are additional to responses to aggregate shocks.

The coefficient of labor market regulation turns out to be insignificant. This is not to say, however, that labor market regulation does not have any effect on the absolute level of firm turnover, but it does not seem to have stronger effects in industries that display naturally higher levels of entry and exit for this working sample.[11] On the other hand, the coefficients of financial markets regulation and fiscal burden are positive and significant, which suggests that some forms of regulation are associated with higher turnover in industries with naturally high turnover. This result is not surprising, since stricter financial regulations typically reassure investors who lend to entrepreneurs, and force under-performing businesses to exit the market. Additionally, our fiscal burden index includes measures of fiscal spending, which in certain situations could be directed towards business creation.

The last row of Table 2.1 provides the results of a comparative exercise that computes the effect on the difference in firm turnover between two industries, one at the 10th percentile of turnover, and the other at the 90th percentile, in countries whose regulation index stands at the 10th and 90th percentiles, respectively. The nature of the dependent variable makes the interpretation of the numbers somewhat difficult, however, it is interesting to note that the strongest effects are for entry regulation, while the weakest are for bankruptcy and financial regulations.

The last two columns of the table provide results for the regressions that include two institutional quality variables: governance, and political stability.[12] Unsurprisingly, both coefficients are positive and significant, showing not only that the general institutional quality of the country matters for firm turnover, but that good institutions also foster firm movement relatively more in industries that adjust naturally more.

[11] Regressions conducted in earlier versions that included a larger number of countries showed a negative and significant coefficient for labor market regulation. These results are not included here in order to keep the sample consistent across regressions.

[12] The variable "political stability" is a composite index of various measures from the International Country Risk Guide, namely the presence of external conflict, the stability of the government, the presence of internal conflict, the investment "friendliness" of the country, the presence of a military, or religious government, and the socio-economic conditions of the country (a measure that includes inequality, unemployment, etc.).

Table 2.1: Firm turnover against regulation and institutional quality

Dependent variable: Log employment-weighted turnover divided by the standard deviation of terms-of-trade growth

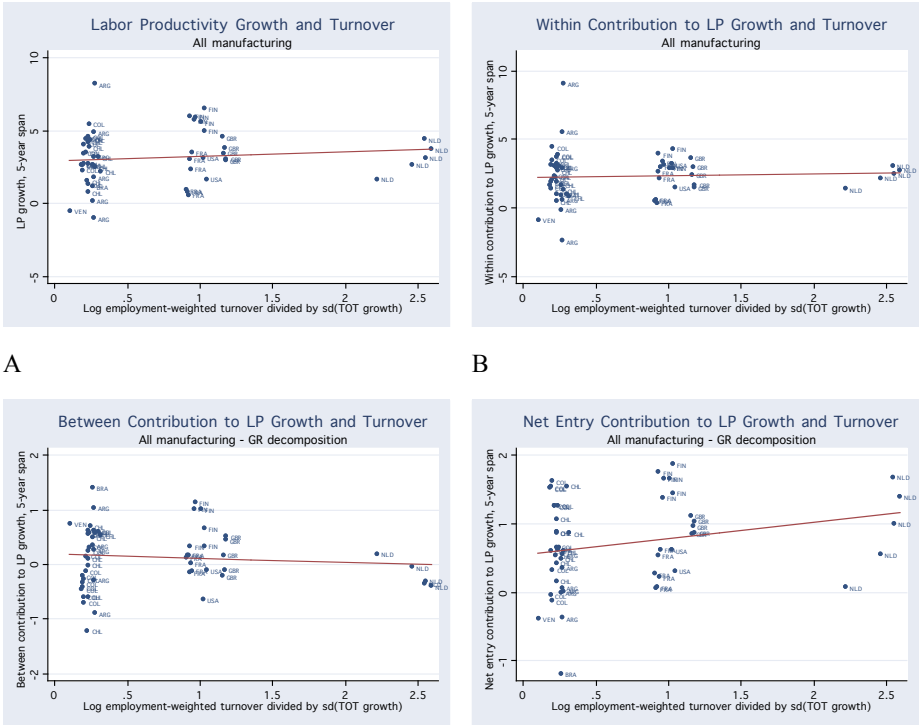
Regulation index:	Entry	Financial	Contracts	Trade	Fiscal burden	Labor	Bankruptcy	Political stability	Governance
Interaction	-1.828***	1.033*	-0.842***	-4.246***	4.433**	0.173	-0.428*	0.951**	0.680**
	[0.387]	[0.579]	[0.212]	[1.250]	[1.770]	[0.422]	[0.241]	[0.336]	[0.232]
Constant	0.413***	0.614***	0.475***	-0.077	1.207***	0.344**	0.324**	0.631***	0.582***
	[0.112]	[0.181]	[0.106]	[0.178]	[0.283]	[0.117]	[0.126]	[0.113]	[0.107]
Observations	865	865	865	865	865	865	865	865	865
R-squared	0.85	0.84	0.85	0.85	0.85	0.84	0.85	0.85	0.85
Effect 90-10 percentile	-0.6019	0.1573	-0.4543	-0.3372	0.3841	0.026	-0.235	0.4625	0.5125

Notes:
Interaction term: Regulation index*Log employment-weighted turnover in the US in the same industry/standard deviation of terms-of-trade growth in the US
Robust standard errors in brackets
* significant at 10%; ** significant at 5%; *** significant at 1%
Country, industry, and year fixed effects were included (coefficients not reported).
Industries: Food and beverages; Textiles; Wood and wood products; Paper and paper products; Fuel; Pharmaceuticals; Chemicals except pharmaceuticals; Rubber and plastics; Other non-metallic minerals; Basic metals; Fabricated metals; Machinery; Machinery n.e.c.; Office and computing equipment; Electric machinery n.e.c.; Radio, TV, and communications equipment; Medical and optical equipment; Motor vehicles; Ships and boats; Rail; Aircraft; Others.
Countries: Argentina, Brazil, Chile, Colombia, Finland, France, Netherlands, UK, Venezuela.
Years: 1988-2001

We now turn to the analysis of the impact of regulation on productivity growth. The first set of regressions look at the direct effect of labor, product market regulation, and fiscal burden on the components of labor productivity growth. Results are reported in Table 2.2.

The regressions in Table 2.2 follow the specification of regression (2.2) but use industry-level data organized in rolling five-year periods spanning 1984-2001. The regressions control for country, industry, and time (period) effects. In order to identify the effect of regulation (which doesn't vary over time or industries), we assume that it is directly proportionally related to optimal, benchmark turnover rates (given by those corresponding to the U.S.)

Figure 2.4: Labor productivity growth and firm dynamics



Note: the employment-weighted turnover rate was corrected by dividing it by the standard deviation of terms of trade growth over the 1985-2000 period. The time coverage for each country is as follows: Argentina, 1996-2001; Brazil, 2001; Chile, 1994-1999; Colombia, 1994-1998; Finland, 1994; France, 1994,1995; Netherlands, 1994-1997; USA, 1997; Venezuela, 1999.

Table 2.2: Labor productivity against regulation and institutional quality

Dependent variable: Within component

Regulation index:	Entry	Financial	Contracts	Trade	Fiscal burden	Labor	Bankruptcy	Political stability	Governance
	-0.926	1.997	-0.428	-3.955	0.019	-0.505	0.266	0.696	0.486*
	[0.606]	[1.610]	[0.337]	[2.378]	[1.542]	[0.591]	[0.244]	[0.406]	[0.248]
Constant	10.451***	-12.997	8.046***	44.169*	4.799	9.789*	3.424	-4.323	-1.241
	[3.354]	[16.009]	[2.020]	[22.566]	[18.323]	[5.165]	[2.098]	[6.581]	[4.543]
Observations	948	948	948	948	948	948	948	948	948
R-squared	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.27
Effect 90-10 percentile	-0.945	0.932	-0.716	-0.974	0.005	-0.235	0.404	0.99	1.135

Dependent variable: Between component

Regulation index:	Entry	Financial	Contracts	Trade	Fiscal burden	Labor	Bankruptcy	Political stability	Governance
	1.514**	-5.833***	1.102**	5.761*	-8.137***	0.435	0.774	-0.658	-0.332
	[0.580]	[1.018]	[0.371]	[2.905]	[2.104]	[0.925]	[0.477]	[0.478]	[0.324]
Constant	-0.884**	2.370***	-0.334	-2.067*	3.736***	-0.004	-0.905**	0.502*	0.319
	[0.343]	[0.468]	[0.369]	[1.059]	[1.012]	[0.303]	[0.350]	[0.279]	[0.213]
Observations	948	948	948	948	948	948	948	948	948
R-squared	0.14	0.14	0.14	0.14	0.14	0.13	0.14	0.13	0.13
Effect 90-10 percentile	1.514	-5.833	1.102	5.761	-8.137	0.435	0.774	-0.658	-0.332

Continues next page

Dependent variable: Net entry component

Regulation index:	Entry	Financial	Contracts	Trade	Fiscal burden	Labor	Bankruptcy	Political stability	Governance
	1.596	13.115*	0.887	-6.917	-21.451	1.004	4.743**	0.131	0.938
	[6.208]	[6.688]	[2.516]	[20.481]	[14.120]	[5.948]	[2.013]	[2.897]	[1.392]
Constant	2.747	-19.612*	3.398*	18.277	51.835	2.645	-1.019	4.198	1.979
	[4.943]	[10.912]	[1.712]	[38.463]	[33.158]	[9.183]	[1.189]	[10.289]	[5.929]
Observations	861	861	861	861	861	861	861	861	861
R-squared	0.19	0.21	0.19	0.19	0.22	0.19	0.25	0.19	0.19
Effect 90-10 percentile	1.596	13.115	0.887	-6.917	-21.451	1.004	4.743	0.131	0.938

Dependent variable: Reallocative component

Regulation index:	Entry	Financial	Contracts	Trade	Fiscal burden	Labor	Bankruptcy	Political stability	Governance
	-3.032***	5.007*	-1.269*	-15.648***	-5.401	-3.297***	1.443	1.916**	1.490***
	[0.814]	[2.645]	[0.675]	[3.408]	[5.226]	[1.033]	[1.161]	[0.661]	[0.437]
Constant	6.129***	-4.819	4.618***	-13.881***	-5.988	8.661***	1.900*	1.121	0.529
	[0.756]	[4.369]	[0.893]	[2.965]	[5.138]	[1.942]	[1.064]	[1.014]	[0.794]
Observations	859	859	859	859	859	859	859	859	859
R-squared	0.21	0.2	0.2	0.22	0.2	0.2	0.2	0.2	0.21
Effect 90-10 percentile	-2.013	1.521	-1.381	-2.506	-0.944	-0.999	1.425	1.773	2.264

Notes:
Robust standard errors in brackets. Errors are clustered by year.
* significant at 10%; ** significant at 5%; *** significant at 1%
Labor productivity growth and its components are converted into annual growth rates over the relevant 5-year period.
Country, industry, and year fixed effects were included (coefficients not reported).
Industries: Food and beverages; Textiles; Wood and wood products; Paper and paper products; Fuel; Pharmaceuticals; Chemicals except pharmaceuticals; Rubber and plastics; Other non-metallic minerals; Basic metals; Fabricated metals; Machinery; Machinery n.e.c.; Office and computing equipment; Electric machinery n.e.c.; Radio, TV, and communications equipment; Medical and optical equipment; Motor vehicles; Ships and boats; Rail; Aircraft; Others.
Countries: Argentina, Brazil, Chile, Colombia, Finland, France, Netherlands, UK, Venezuela.
Years: 1988-2001

Consistently with the analysis of Chapter 1, where we find evidence that business regulation negatively affects per capita GDP growth, our results at the micro level suggest that some types of business regulation indeed have a negative effect on the growth rate of output per worker, and this effect shows particularly in the effects of regulation on the "reallocative" component of labor productivity growth. The effects are particularly strong for entry, trade, and labor market regulations, while financial regulation exert a positive effect on this component and the effect of the fiscal burden is less clear.

To analyze the passage from regulation and firm dynamics to productivity growth, we start by depicting firm turnover against the components of labor productivity growth in our sample of countries. Figure 2.4 shows that there is a slightly positive relation between turnover and labor productivity growth across countries, and this relation is more marked in the case of the "net entry" component.

The results of regression (2.3) for the link between firm dynamics and productivity are provided in Table 2.3. In order to emphasize business regulation information as the main source of data variation, we work with country level data (at the manufacturing level). Also, for consistency with the industry-level exercises, we work with the same sample of OECD and Latin American countries organized in the same periods. First, we run OLS regressions of productivity growth rates on firm turnover. Then, we run IV regressions of productivity growth rates on firm turnover, where we isolate the variation of firm turnover due to business regulation. In both cases we control for country and time effects by including as explanatory variables the output gap at the beginning of the period, the level of per capita GDP, and the average terms of trade shocks.

The first panel reports results from the OLS regressions. When the full variation of firm turnover is used to explain the variation of productivity growth, firm dynamics appears to have no effect on productivity growth, except for the "between" component, where the effect is negative. However, in the IV estimation reported in panel 2, when variation of firm turnover is limited to the portion explained by business regulation (69%), firm turnover appears to significantly promote growth in the cases of total labor productivity and its net entry component.

Table 2.3: Labor productivity against firm dynamics

Ordinary least squares estimation

	Dependent variable				
	LP growth	Within component	Between component	Net entry component	Reallocative component
Average (log) GDP over period	0.252	-0.18	0.608***	-0.176	0.432
	[0.732]	[0.539]	[0.170]	[0.249]	[0.362]
Outout gap	4.185	2.609	0.534	1.042	1.576
	[17.469]	[16.233]	[3.614]	[5.461]	[7.833]
Average growth of TOT over 5-yr period	-0.005	0.056	-0.066	0.005	-0.061
	[0.159]	[0.161]	[0.054]	[0.034]	[0.074]
Log employment-weighted turnover /sd(TOT growth)	0.068	0.173	-0.408***	0.303	-0.105
	[0.545]	[0.467]	[0.104]	[0.192]	[0.234]
Constant	0.935	3.907	-5.157***	2.185	-2.972
	[6.233]	[4.558]	[1.499]	[2.165]	[3.140]
Observations	51	51	51	51	51
R-squared	0.01	0.01	0.21	0.06	0.06

Instrumental variable estimation

	Dependent variable				
	LP growth	Within component	Between component	Net entry component	Reallocative component
Average (log) GDP over period	-3.273**	-2.083	0.493*	-1.682***	-1.190**
	[1.288]	[1.405]	[0.276]	[0.356]	[0.478]
Outout gap	18.549	10.365	1.002	7.182	8.184
	[22.353]	[18.957]	[3.362]	[6.929]	[8.690]
Average growth of TOT over 5-yr period	0.163	0.147	-0.06	0.076**	0.016
	[0.160]	[0.149]	[0.050]	[0.037]	[0.069]
Log employment-weighted turnover /sd(TOT growth)	3.903**	2.244	-0.283	1.942***	1.659***
	[1.694]	[1.623]	[0.278]	[0.512]	[0.643]
Constant	30.467***	19.853*	-4.194*	14.809***	10.614***
	[10.615]	[11.612]	[2.344]	[3.015]	[4.044]
Observations	51	51	51	51	51
First stage centered R2	0.6855	0.6855	0.6855	0.6855	0.6855
Partial R2	0.2117	0.2117	0.2117	0.2117	0.2117
P-value of Hansen's J statistic	0.25344	0.51788	0.00759	0.50258	0.00791

Robust standard errors in brackets
* significant at 10%; ** significant at 5%; *** significant at 1%
Industries: all manufacturing
Countries: Argentina, Chile, Colombia, Finland, France, Netherlands, UK.
Years: 1988-2001
Instrumented variable: Log employment-weighted turnover divided by the standard deviation of terms-of-trade growth
Instruments: Product market regulation (mean of entry, financial, trade, contract, and bankruptcy regulation indices), labor regulation, and fiscal burden.

For the within component, regulation flexibility also carries a positive coefficient but not statistically significant.

2.5 Conclusion

The macroeconomic impact of microeconomic regulation has attracted renewed interest in the academic and policy debate. Recent empirical studies have examined the effects of regulatory barriers particularly those in the product market – on the growth rates of output and productivity at the aggregate level, mostly across industrial countries.

This Chapter has focused on the mechanism linking regulation and labor productivity growth. Much of the analytical literature points toward the dynamics of firm entry and exit i.e., the Schumpeterian process of "creative destruction" as the main channel through which microeconomic regulatory barriers are reflected in aggregate economic performance. This Chapter offers an empirical evaluation of this view following a two-stage approach, first relating regulation to firm dynamics, and then assessing the effects of firm dynamics on productivity growth. In contrast with most of the preceding literature, which has focused on the effects of product-market regulation in industrial countries, here we examine a variety of regulatory dimensions and consider both OECD and Latin American countries.

On the whole, our empirical results, using both sector-level and overall manufacturing data on productivity growth and firm dynamics, are moderately supportive of the role of firm entry and exit as transmission mechanism between regulation and aggregate performance. Regarding the link between regulation and firm entry and exit, using sector-level data we find that entry, trade, bankruptcy, and labor regulations, as well as the lack of effective contract enforcement affect negatively firm turnover in sectors that experience naturally high turnover. On the other hand, stricter financial market and fiscal regulations increase turnover in these sectors, relative to others.

As for the link between firm turnover and labor productivity growth, we find that it is positive (but not significantly different from zero) for overall productivity growth as well as its

separate components, except for that associated with resource reallocation across incumbent firms, which shows a negative (and significant) effect. However, when we restrict our attention to the variation in firm turnover accounted for by regulation using an instrumental variable estimation procedure – the positive effect now arises for both overall productivity growth as well as its net entry component, while the negative reallocation effect ceases to be significant.

Chapter 3

Uneven Regulation Enforcement, Firm Dynamics, and the Productivity Distribution

3.1 Introduction

How efficient is the reallocation process across countries?[1] According to Schumpeterian creative destruction theory, reallocation, either coming from firm entry and exit, or from the shift of resources from contracting to expanding businesses, should increase aggregate productivity.

While empirical evidence shows that reallocation contributes positively to aggregate productivity growth across countries, it also suggests that the contribution is smaller in countries with an "excessive" regulatory burden (see Chapter 2 of this thesis).[2] Moreover, many countries with seemingly high regulation exhibit large amounts of reallocation, which raises the question of the extent to which reallocation in these countries is efficient.

In this Chapter I study the effect of institutions on the innovative behavior of firms, and on the efficiency of the reallocation process. Several aspects of the institutional environment affect the cost of innovating, for instance, regulatory constraints, corruption, and political instability. I focus on two dimensions of regulation: its magnitude, and more importantly, the arbitrary enforcement of regulation across businesses, which I refer to as "regulation uncertainty." While the effect of higher regulation on innovative activity and reallocation has been explored in the literature, there have been few attempts at understanding the effects of regulation uncertainty.[3] The centerpiece of this paper is the idea that higher or more uncertain innovation costs distort firms' innovative behavior, and hence introduce inefficiencies in the reallocation process that lead to lower aggregate productivity.

[1] The term "reallocation" refers to labor and capital reallocation across establishments or firms. In this paper I focus on two measures of reallocation: firm turnover (the sum of entry and exit), and productivity dispersion.

[2] The contribution of firm entry and exit is typically measured at a 5-year or longer horizon. See Bartelsman and Doms (2000), Haltiwanger (2000), Foster, Haltiwanger and Syverson (2005), and Bartlesman *et al.* (2005).

[3] For instance, Lambson (1991) studies innovative behavior under uncertain demand conditions, which could be applied to the present context also.

There is growing evidence that policy- and in particular regulation- uncertainty is a major problem for entrepreneurs. To cite a few examples, the World Bank's *World Development Report* (2005) finds that in developing countries policy uncertainty is the most frequently cited "major or severe" constraint to business activities. Hallward-Driemeier and Stewart (2004) find that in Peru, 79% of firms surveyed by the World Bank's *Investment Climate Assessment* report that the interpretation of existing regulations is highly unpredictable. More generally, factual evidence suggests that firms often perceive regulation itself as a source of uncertainty. According to the Economist Intelligence Unit (2005), regulation "has become a major source of risk" for businesses, and "regulatory risk is seen by executives as the most significant threat to business, ahead of country risk, market and credit risk, IT and people risks, or terrorism and natural disasters." Stringent regulation is also likely to be unevenly enforced in countries with poor institutional quality, as regulation stringency is positively correlated with widespread corruption, lack of an independent and transparent judiciary system, and political instability across countries (see Chapter 1 of this thesis).

While this Chapter does not directly address the political economy process underlying the uneven enforcement of regulation, it is necessary to ask why such distortions exist in the economy, and more particularly, who benefits from them. As examples that follow suggest, uneven enforcement can arise in highly unstable political environments, where either government officials or incumbent firms can draw rents from enforcing regulations differently across firms. For instance, it is not uncommon in countries with high corruption levels that incumbent firms bribe government officials in order to receive "weaker" enforcement of some regulations (e.g., paying lower fees). Such arrangements provide rents to government officials while allowing inefficient firms to face lower operating costs and therefore survive despite their low productivity.[4]

A comparison of the privatization process that took place in Argentina and Chile illustrates how regulation tends to be more unstable when it is implemented in a poor institutional context.[5] At the beginning of the 1990s, Argentina began the privatization of telecommunications and utility

[4]This Chapter does not explicitly model such endogenous regulation enforcement, however this extension is planned in future research.

[5]A detailed comparative analysis of the two processes is provided by Bergara and Pereyra (2005).

companies (electricity, gas, water, and others), and regulatory agencies were created to design and enforce the regulation of the newly privatized industries. However, regulatory agencies were partly or entirely run by government bodies, and became hostages of political interests. Consequently, regulatory policy was highly volatile. Agencies often introduced arbitrary changes in the rules and violated established agreements, which resulted in endless legal disputes between the companies and the government. Moreover, the judiciary had little independence from the executive, impairing companies' recourse to the courts.

In contrast, the Chilean privatization process was marked by the desire of the government to develop a competitive market economy, with, for instance, the creation in 1973 of the Antitrust Commission to ensure competitive behavior by private firms in all industries. Regulatory policy -designed to increase competition rather than protect incumbents' interests- has been highly stable with respect to political fluctuations, and whenever deviations from established rules have occurred, these have in general been predictable. The stability of the policy in Chile is attributed to its high institutional quality, with a competent bureaucracy setting long-term goals and promoting transparency, an independent judiciary system, and overall political stability.

These two contrasting examples suggest that the institutional environment in which regulation is implemented affects the ultimate outcome, that is, firms' actions in the market. An increasingly unstable environment will likely make firms more sensitive to even small changes in regulation.

This Chapter takes a Schumpeterian approach to study the effects of regulation uncertainty on productivity dynamics, by focusing on how uncertain innovation costs affect innovation decisions, and the subsequent entry and exit of firms in the industry. While the ultimate interest is looking at average productivity effects, I also look at *productivity dispersion*, as the latter captures important characteristics of the reallocation process: that is, an efficient selection of firms should cause dispersion to contract as cohorts grow older. Moreover, productivity dispersion also provides information about the intensity of the "market experimentation" process: that is, a higher productivity dispersion should indicate that firms engage more in innovative investment, which has

random returns in terms of productivity gains. Recent studies, for instance, have documented that young firms in the U.S. display greater dispersion of productivity relative to Europe, which arguably points to a more intense market experimentation taking place in the U.S., especially among young businesses.[6] However, especially in developing countries, the empirical relationship between regulation, market experimentation, and reallocation measures remains unclear, because of measurement difficulties and endogeneity problems. I propose therefore to analyze the relationship between regulation and reallocation in a theoretical framework that allows for firm heterogeneity, and where the the industry is continuously renewed by the entry and exit of firms.

The model I use to explore the effects of regulation and institutional quality on reallocation is based on Hopenhayn (1992) and Hopenhayn and Rogerson (1993). This class of models has several advantages: first, firms are heterogeneous, which makes it possible to analyze the equilibrium effects of frictions on the behavior of firms across different levels of productivity. Second, in equilibrium the industry displays entry and exit, so that one can look at firm turnover and cohort effects. Finally, although there is intense activity at the micro level as firms enter, exit, and explore productive opportunities, the model produces a stationary equilibrium in which the characteristics of the industry as an aggregate are constant.

My model departs from Hopenhayn (1992) in two respects: first, following Ericson and Pakes (1995), I allow firms to engage in costly innovation to increase their future productivity, thus capturing market experimentation effects.[7] Second, I allow for uncertainty in the cost of innovation (which captures regulation uncertainty). Specifically, in each period each firm receives a random realization of the investment cost, so that firms with similar characteristics end up facing different costs.

I begin by calibrating a version of the model without regulation uncertainty to match key moments of firm dynamics and the productivity distribution in the U.S., my benchmark economy.[8]

[6] They also find that post-entry growth is higher in the U.S., firms are more heterogenous, and differences in dispersion are more apparent in IT-intensive industries. See Haltiwanger *et al.* (2003), and Bartelsman *et al.* (2004)

[7] In contrast to other models of innovation, in this model there are no externalities or spillovers from innovation.

[8] Several recent empirical studies, such as Rajan and Zingales (1998), Klapper *et al.* (2004), or Micco and Pagés (2004) have taken the U.S. as a benchmark economy when addressing frictions in developing economies, the rationale being that the U.S. represents a relatively less distorted economy. The same argument is used in Chapters 2 and 3 of this thesis.

Next, I analyze the effect of changes in the *magnitude* and *uncertainty* of the innovation cost on firm turnover, productivity, size, and investment, for different cohorts of firms. Namely, I compare the effects of a change in the magnitude of the cost (which corresponds to the "traditional" effect of stringent regulation), versus introducing uncertainty in the cost in the form of a mean-preserving spread.

I find that more uncertain innovation costs have similar, (negative) effects on average productivity, size, and investment, than when the innovation cost increases because of more stringent regulation. In equilibrium, uncertainty distorts the selection process by allowing some inefficient firms to delay their exit, while some potentially good firms are eliminated from the industry. This ultimately leads to lower aggregate productivity and innovative investment. Similarly, a higher (deterministic) innovation cost reduces innovative investment at all productivity levels, causing incumbent firms to receive lower future productivity shocks, and low-productivity firms to stop investing altogether, leading to a drop in aggregate productivity.

Interestingly, I find that neither a higher nor a more uncertain innovative cost reduce measures of reallocation such as firm turnover and the dispersion of the productivity distribution. In fact, both of them change the nature of the reallocation process, giving rise to strong inefficiencies: uncertainty, by delaying exit of inefficient firms, and higher innovation costs, by selecting entering firms (which tend to be less productive than incumbents) out of the market. Taken together these results suggest that, in addition to the magnitude, regulation uncertainty is an important channel through which institutions affect firm behavior. This paper offers therefore a possible explanation for the limited success of regulatory reforms in developing countries, and suggests that countries could achieve larger productivity gains if regulation uncertainty was reduced.

The Chapter is organized as follows. Section 2 offers an overview of firm and productivity dynamics across countries, as well as a comparison of institutional quality indicators, and discusses the related literature. Section 3 describes a model of industry evolution, the calibration procedure, and the numerical solution for the benchmark model. Section 4 provides results of the simulation exercise when regulation is combined with uncertainty, and Section 5 concludes.

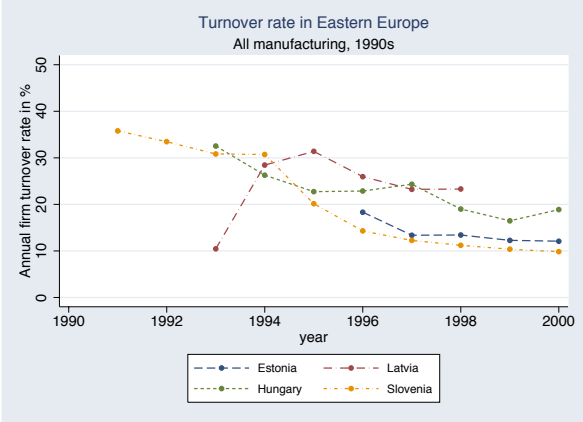
3.2 Reallocation, productivity, and institutions

There is little question that the reallocation of resources across firms accounts for a significant share of aggregate productivity growth.[9] From a Schumpeterian perspective this is hardly surprising, since it is precisely the reassignment of resources from less towards more productive units that is at the heart of the "creative destruction" process.

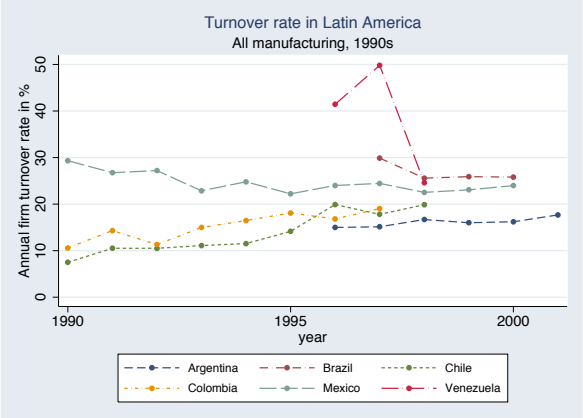
Yet, it would be incorrect to conclude that increased reallocation automatically translates into higher productivity growth. Consider, for instance, firm entry and exit. Figure 3.1 depicts turnover rates (i.e., the sum of entry and exit) in manufacturing for three groups of countries: Eastern Europe, Latin America, and the E.U. and U.S. They show that firm turnover is equally high among developed and developing countries, and sometimes higher in the latter. (Even abstracting from the unusually high turnover taking place in Eastern Europe in the early transition years, levels remain comparable to industrial countries toward the end of the 1990s.) This stylized fact has been noted before in firm-level empirical studies: for instance, Roberts and Tybout (1996) note that "the degree of flux in the manufacturing sectors of semi-industrialized countries is on average *greater* than that found in the North." More recently, Bartelsman *et al.* (2004, 2005) provide detailed documentation on firm dynamics and productivity for a group of OECD and developing countries, finding similar patterns. They observe that "[r]elatively high firm turnover rates are observed both in countries with high income levels and/or high growth rates as well as in poorer and/or slow-growth countries (and vice-versa)." This evidence compels us to examine whether the observed measures truly reflect high competition and efficient creative destruction, or rather wasteful reallocation.

[9] For the U.S., see for instance Davis and Haltiwanger (1999), Haltiwanger (2000), and Foster *et al.* (2001); for other countries, Aw, Chen and Roberts (1997), Roberts and Tybout (1996), Tybout (1999), and more recently, Bartelsman *et al.* (2004, 2005)

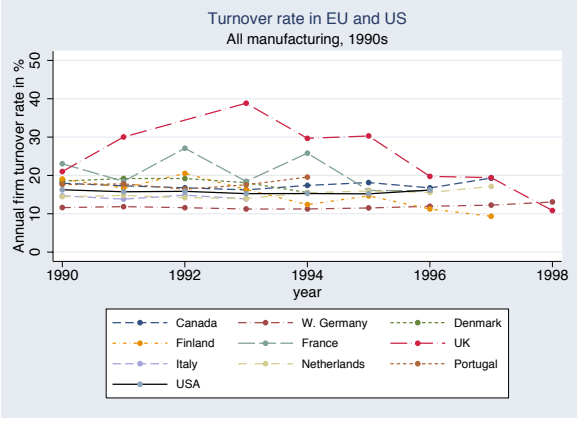
Figure 3.1: Turnover rates



(a) Eastern Europe



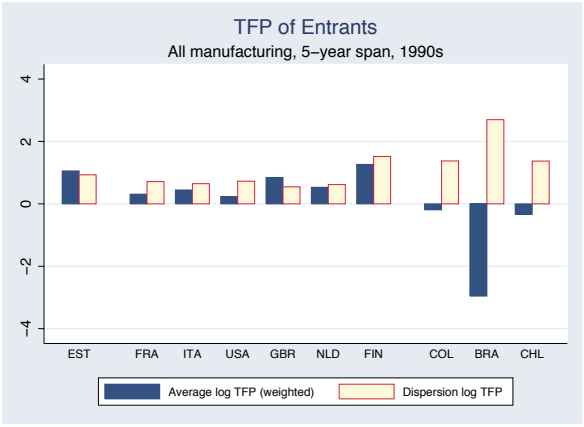
(b) Latin America



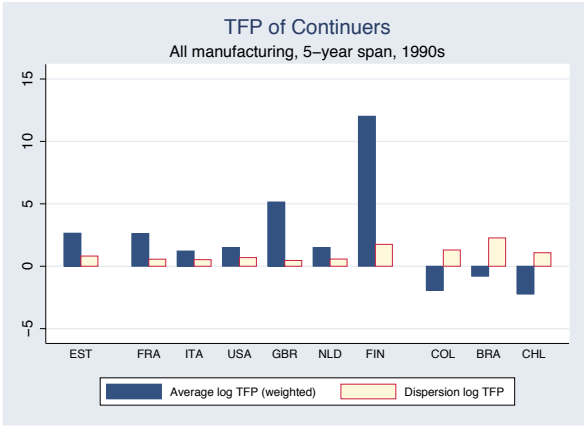
(c) EU and US

Sources: Bartelsman, Haltiwanger and Scarpetta (2005), and author's calculations

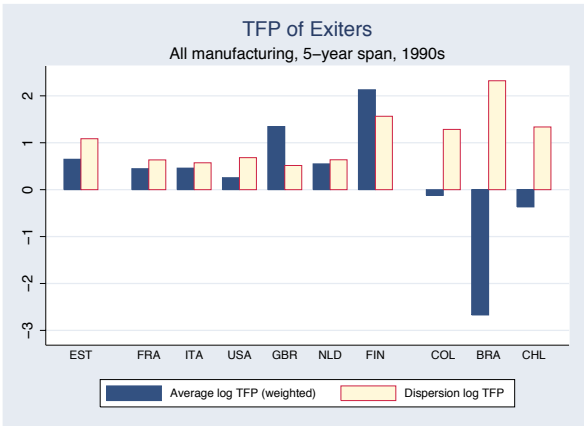
Figure 3.2: Labor productivity by cohort



(a) Entering firms



(b) Continuing firms



(c) Exiting firms

Source: Bartelsman, Haltiwanger and Scarpetta (2005)

Table 3.1: TFP across countries

TFP for entrants - 5 year span			
Country	Unweighted mean	Weighted mean	Dispersion
Brazil	-1.11	-2.24	2.46
Chile	-0.45	-0.12	1.20
Colombia	-0.95	-0.15	1.14
Estonia	4.16	1.56	0.82
Finland	10.13	1.55	1.51
France	3.20	0.36	0.59
UK	6.12	0.92	0.51
Italy	2.05	0.50	0.57
Netherlands	2.47	0.68	0.40
USA	2.02	0.34	0.64
TFP for continuers - 5 year span			
Country	Unweighted mean	Weighted mean	Dispersion
Brazil	-0.06	-0.49	2.31
Chile	-1.04	-1.44	0.99
Colombia	-0.73	-1.21	1.09
Estonia	4.05	2.56	0.73
Finland	11.54	11.83	1.70
France	3.12	2.73	0.40
UK	6.15	5.34	0.45
Italy	1.85	1.33	0.41
Netherlands	2.49	1.81	0.39
USA	2.04	1.88	0.61
TFP for exiters - 5 year span			
Country	Unweighted mean	Weighted mean	Dispersion
Brazil	-0.95	-2.24	2.24
Chile	-0.98	-0.24	1.17
Colombia	-0.38	-0.09	1.16
Estonia	3.85	1.29	0.99
Finland	10.28	2.19	1.76
France	3.20	0.45	0.52
UK	6.05	1.45	0.49
Italy	1.69	0.51	0.47
Netherlands	2.34	0.72	0.43
USA	1.96	0.34	0.60

Source: Bartelsman, Haltiwanger and Scarpetta (2005)

Another important dimension of the creative destruction process is productivity dispersion. For instance, if selection effects are solely determined by market forces, the initial productivity dispersion across entering firms should progressively contract as firms become more efficient, and less productive firms are forced out of the market.[10] Hence, the pace and the magnitude of changes in the productivity dispersion can provide substantial information about the selection process. So far, only a handful of empirical studies have attempted to find patterns in the productivity dynamics of young firms across countries. Among them, Bartelsman *et al.* (2003) find that employment in young American firms increases faster than in young European firms, and Haltiwanger *et al.* (2003) find that the dispersion of technology investment per worker decreases with age faster in the U.S. than in Europe, which is consistent with the fact that in the U.S. young firms display greater productivity dispersion relative to Europe.[11]

Table 3.2: TFP relative to the U.S.

	Entrants			Continuers			Exiting		
	mean	sd	cv	mean	sd	cv	mean	sd	cv
Brazil	-12.581	3.715	12.969	-0.534	3.273	8.668	-10.454	3.402	9.392
Chile	-1.440	1.889	2.758	-1.491	1.562	1.954	-1.439	1.958	2.876
Colombia	-0.810	1.894	2.775	-1.291	1.879	2.680	-0.478	1.882	2.674
Estonia	4.488	1.282	1.440	1.771	1.177	1.262	2.538	1.591	2.009
Finland	5.380	2.090	3.346	8.037	2.528	4.767	8.335	2.293	3.868
France	1.321	0.983	0.976	1.745	0.814	0.759	1.752	0.930	0.905
UK	3.581	0.751	0.679	3.442	0.669	0.590	5.265	0.755	0.688
Italy	1.895	0.891	0.854	0.815	0.761	0.694	1.797	0.839	0.790
Netherlands	2.264	0.851	0.803	1.001	0.831	0.779	2.152	0.934	0.911
USA	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Mean TFP corresponds to input-weighted mean of log TFP, calculated as explained in the appendix. The standard deviation (sd) is the simple standard deviation of log TFP, and the coefficient of variation (cv) is the ratio of the standard deviation to the mean of TFP (level) across firms. Source: Bartelsman, Haltiwanger and Scarpetta (2005) and author's calculations.

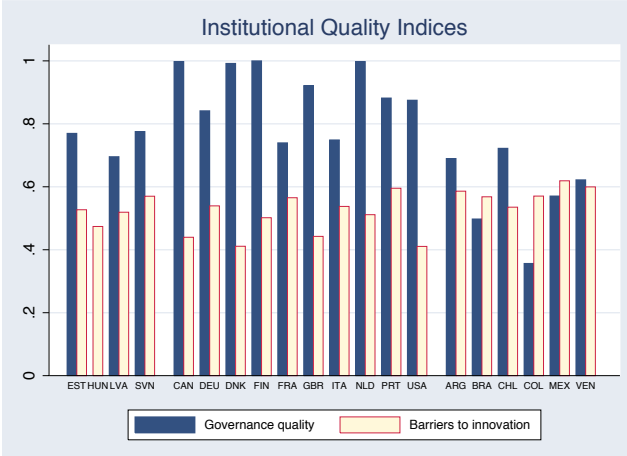
These facts suggest that young firms in the U.S. should have a larger scope for "market experimentation", that is, they should be better able to allocate resources to the search for the best combination of factor inputs and technology. By the same token, in countries where barriers to experimentation are large, one should observe (other things equal) a less disperse productivity

[10] This is the case, for instance, in the theoretical model of Jovanovic (1982).

[11] They also find that there is greater dispersion in productivity, payroll per worker, skill mix of workers, and technology investment per worker among U.S. businesses that invest in technology most actively, than among less active businesses, whereas there seems to be little systematic difference in dispersion between active and inactive businesses in Germany.

distribution among young firms, and a slower fall in productivity dispersion with age. Table 3.2 shows the mean and dispersion of TFP for a sample of industrial and emerging countries relative to the U.S. While the argument appears to hold for most European countries, where regulation is higher and dispersion is lower than in the U.S., it is less clear when emerging countries are included in the picture, since they display higher regulation, poorer institutional quality, but much larger dispersion than the U.S. Differences in regulation and institutional quality are visible in Figure 3.3, which presents a comparison of governance and regulation indices described in Chapter 1. The dark bars represent a governance index that combines measures of corruption, rule of law, and government accountability. The light bars represent an index of regulation that affects the innovation process of firms (namely labor regulation, financial regulation, trade restrictions, fiscal regulation, and the effectiveness of contract enforcement regulation). All values are between 0 and 1, where 1 is the worst measure in the case of regulation, and the best in the case of governance. Clearly, a visual comparison of Table 3.2 and Figure 3.3 seems to contradict the claim that in countries with more business friendly environments firms have more "market experimentation" opportunities, and hence display a more disperse productivity distribution.

Figure 3.3: Institutional Quality



This is not to say that econometrically such a relationship is inexistent. For instance, Micco and Pagés (2004) look at the effect of labor regulation on job reallocation, Klapper *et al.* (2004) study the effect of entry regulation on firm entry, while Chapter 2 of this thesis looks at the

effects of various regulations on firm turnover and on the contribution of net entry to aggregate productivity growth. All conclude that, to some degree, regulation affects reallocation negatively.

However, results from cross-country studies that use industry-level data are subject to major caveats: first, comparability across countries is often problematic, as data are collected separately in each country, sometimes using different protocols.[12] Second, the presence of measurement error in dependent and explanatory variables (particularly in institutional variables) is likely to cause biases in the estimated coefficients. It is therefore important to develop theoretical frameworks that allow us to understand better the mechanisms underlying the observed relationships.[13]

Likewise, few empirical studies have looked at the influence of institutional quality on the way that regulation is enforced. For instance, Chapter 1 of this thesis and Loayza *et al.* (2006) find that labor market, product market, and fiscal regulation hamper GDP growth, exacerbate volatility, and increase the size of the informal sector. Furthermore, the negative effects of excessive regulation are aggravated in countries with poor governance. In looking at firm dynamics, Oviedo (2004) finds that relaxing entry regulation together with improving institutional quality benefits the entry of small firms relatively more, and this result is most significant in transition economies.

On the theoretical side, a number of studies have highlighted the role of institutions in explaining inefficiencies in the reallocation of jobs. Bertola and Rogerson (1997) focus attention on the surprisingly similar job flows, yet large differences in labor market legislation between Europe and the U.S. They show that wage compression in the E.U., in combination with labor market rigidities, leads to rates of job turnover comparable to those observed in the U.S., although workers in the more rigid economy experience longer unemployment spells. Caballero and Hammour (1996, 1998) explore reallocation inefficiencies that arise because workers and firms engage in relations that entail a certain degree of specificity; as a result, when the relation dissolves some of its value is lost, which causes an ex-post holdup problem. They argue that synchronized job creation and destruction indicate an efficient reallocation process, and they find evidence of inefficiencies in the U.S. over the course of the business cycle, as job destruction outpaces job creation during

[12] One exception is Bartelsman *et al.* (2005).

[13] Schiantarelli (2005) offers a complete review of the literature on product market regulation and economic outcomes.

downturns, and depressed job creation lingers even as the economy recovers. The presence of inefficiencies in economies like the U.S., with relatively few institutional failures, suggest that in developing economies, which typically suffer from deep institutional deficiencies, reallocation inefficiency may be quite large.

The analysis in this Chapter relates to two strands of the literature on "creative destruction." The first one evaluates the productivity gains from the wave of market-oriented reforms that began in the 1980s across many parts of the world. Following the seminal paper by Olley and Pakes (1996), who find that deregulation in telecommunications in the U.S. led to significant productivity gains, Pavcnik (2000) and Bergoeing *et al.* (2005) find that trade liberalization (and other market-oriented reforms) in Chile led to steady increases in productivity, coming both from within firms and from the entry of new, more efficient ones.[14] Likewise, Eslava *et al.* (2004, 2005a, and 2005b) find that reforms in Colombia are associated with a more efficient selection process (especially on the exit margin), although productivity gains have been modest.[15] Kugler (2000) studies the effect of the Colombian labor reform of 1990 on worker flows, and finds that hazard rates into- and out of unemployment increased after the reform. Alonso *et al.* (2005) use a general equilibrium approach to evaluate the impact of the liberalization of fixed-term contracts in Spain. They find that the use of fixed-term contracts increases equilibrium unemployment, but also increases productivity.

The second, led by Aghion *et al.* (1992, 2001), focuses on the innovation process itself. In contrast to these models, however, in my model firms do not innovate in order to capture rents, but rather to survive the competitive pressure of outside, more efficient firms. To a lesser extent, my model also relates to Parente and Prescott (1994), who study the effects on productivity of barriers to technology adoption in a model with firm heterogeneity. Although their predictions are similar in terms of average productivity effects, their model ignores the effects on reallocation, since it displays no entry or exit, and they do not address the effects on dispersion.

Finally, this Chapter relates closely to Aghion *et al.* (2005), who study the effects of entry

[14]Recent theoretical work (for instance, Bernard *et al.*, 2003, and Melitz, 2003) has supported these findings by showing how, in a market with heterogeneous producers, lowering external barriers encourages the reallocation of resources in favor of more productive firms.

[15]A possible explanation for this, as Bond *et al.* (2005) argue, is that in "crisis-prone" countries, like Colombia, trade liberalization is often accompanied by surges in volatility, which distort the selection process and lead to lower aggregate productivity.

liberalization in India on the productivity distribution. They build a Schumpeterian model to study heterogeneous firms' innovative response to external competitive pressures. In the model, external pressure causes productive firms to innovate more, while less productive firms innovate less; as a result, increased entry leads to larger within-industry productivity dispersion, which is corroborated by the data. However, my paper differs in an important aspect, namely the presence of uncertainty as a second channel by which regulation affects reallocation and productivity. As I discuss later on, this second channel opens the possibility for inefficiencies in the reallocation process, and shows that lowering barriers to reallocation may have smaller effects in a poor institutional environment.

3.3 An industry evolution model

In this section I explain the industry evolution model I develop to analyze the effects of poor institutional quality on productivity dynamics. The basic structure of the model follows Hopenhayn (1992) and Hopenhayn and Rogerson (1993). The industry is characterized by a continuum of heterogeneous firms producing a homogeneous good in a perfectly competitive market. There is only one input - i.e. labor - denoted by z, and each firm produces according to a stochastic production function $f(s, z)$, where s is an idiosyncratic productivity shock. The production function is strictly increasing in s and strictly concave in z, and satisfies $f_s > 0$, $f_z > 0$, and $f_{zz} < 0$.

In the model, the optimal choice of the input z depends on current productivity s, and output and input prices, p and w. We assume that w is exogenously determined, and, being in a competitive industry, that firms take p as given (in equilibrium p is determined by the market clearing condition; for now let us just assume it is given). Thus, in each period firms solve the following static problem:

$$\max_z pf(s, z) - wz - pc_f \tag{3.1}$$

where c_f denotes a fixed cost incurred in each period by each incumbent firm, measured in units of output. The term pc_f implies that firms with low current productivity will find it too costly to

stay in the market. In fact, the presence of a fixed operating cost is necessary to ensure a positive amount of exit in equilibrium; otherwise, firms with low productivity will choose to produce no output and wait indefinitely until they get a favorable shock. In what follows, I choose wage to be the numéraire and set $w = 1$. Thus, given s and p, rewrite the per-period profit as follows:

$$\pi(s,p) = pq(s,p) - z(s,p) - pc_f \tag{3.2}$$

where $q(s,p)$ represents optimal production.

Next, I turn to productivity shocks and the process of "market experimentation." Productivity shocks are independently distributed across firms with conditional cumulative distribution $F(s'|s,x)$, where s' is next period's productivity shock, x represents innovative investment, and F is assumed to be continuous and strictly decreasing in s and x ($F_s < 0$ and $F_x < 0$). Innovative investment can be interpreted as "active learning," as firms invest to explore profit opportunities. Namely, in every period firms may improve their productive prospects by investing a variable amount x in innovation. Moreover, because innovative investment is an inherently risky activity, it is assumed that a higher investment x increases the conditional mean but also the *variance* of s'. The cost of innovating is quadratic and given by $c_x x^2$, where c_x represents barriers to investment due to the regulatory environment.

A poor institutional environment typically affects not only the mean (regulation related) investment cost, but it also generates uncertainty about how the cost is enforced. As discussed earlier, the uneven enforcement of regulation has many possible origins, such as corruption or political instability. I assume therefore that, before choosing the amount to invest in innovation, firms receive a draw from a random cost variable, so that c_x can take two values, $c_x = c_x^h$ ("high") with probability p_x, and $c_x = c_x^l$ ("low") with probability $1 - p_x$, and c_x is *i.i.d.*. The distance between c_x^h and c_x^l reflects therefore the amount of uncertainty faced by firms when investing in a poor institutional environment.

Decisions are made according to the following timing: at the beginning of each period, before

receiving any information, an incumbent firm decides whether to stay or exit the industry. If the firm decides to exit, it incurs the corresponding (constant) bankruptcy fee, denoted by ϕ. If the firm decides to stay, it incurs the fixed cost pc_f, observes its current productivity shock s and innovation cost c_x, and makes production and investment decisions. The incumbent firm's value function can be therefore written as follows:

$$V(s, c_x, p) = \max_{x \geq 0} \left\{ \pi(s, p) - c_x x^2 + \beta \left[\max\{-\phi, E[V(s', c'_x, p)|s, x]\} \right] \right\} \tag{3.3}$$

where $E_{s'}[V(s', c'_x, p)|s, x]$ is the firm's expected future value over productivities, given the output price and future investment cost, and conditional on the current productivity s and investment x. The first order condition of the value function implies that the optimal choice of x depends on the current innovation cost c_x and on the marginal expected value of investing, given by the (expected) marginal gain in productivity. In what follows, I denote the decision rules generated by the maximization problem (3.3) as $I(s, c_x, p)$ and $\chi(s, c_x, p)$, where $I(s, c_x, p)$ represents investment in innovation, and $\chi(s, c_x, p)$ the exit rule (so that $\chi = 1$ if the firm exits, and $\chi = 0$ if it stays).

Notice that, as $\pi'(s) > 0$, $F_s < 0$, and $F_x < 0$, future expected profits $E[V(s'c'_x, p)|s, x]$ are strictly increasing in s and x. In addition, given the productivity shock structure chosen in section 3.2, a higher persistence of the productivity shock will, *ceteris paribus*, increase optimal investment x, as the gains from investment are likely to last longer. Likewise, for a given persistence, higher current productivity increases the optimal choice of investment, as higher current productivity implies both larger current revenue and better future survival prospects. Finally, a higher output price increases current and future revenue at all levels of output, thus increasing the optimal amount of innovative investment x.

Let us now turn attention to entry decisions. There is a continuum of identical potential entrants that decide whether to enter by comparing the one-time entry cost pc_e to the value of entering the industry. Once they enter, they receive an initial productivity shock s_e, drawn from an initial productivity distribution $v(\cdot)$, and then evolve as any other incumbent with $x_{t-1} = 0$. Initial

productivities are identically and independently distributed across entering firms, so that the expected value of the potential entrant is equal to:

$$V_e(p, c_x) = \int V(s_e, c_x, p) v(s_e) ds_e \tag{3.4}$$

Hence, firms will enter each period if their expected value is larger than the entry cost. Denote M the mass of entering firms in equilibrium, where $V_e = pc_e$. In this model, the previous level of investment x is not a state variable in the incumbent's maximization problem, although it *does* determine the conditional distribution of the current shock s. Hence, the state of the industry can be fully summarized by the distribution of firms along s and c_x at time t, which I denote by $\mu_t(s, c_x)$. In the numerical solution, s is discretized, so that $\mu_t(s, c_x)$ gives the the mass of firms at each productivity level and cost. Moreover, given (s, c_x, p), the decision rules $I(s, c_x, p)$ and $\chi(s, c_x, p)$ will bring the industry from state μ_t to a new state μ_{t+1}. The dynamics of the whole economy can be therefore summarized by an operator $T(\mu, M, p)$, with $\mu_{t+1} = T(\mu_t, M, p)$, so that one can define a *stationary equilibrium* by the values $p^* \geq 0$, $M^* \geq 0$, and μ^* satisfying the following conditions:

(i) entry satisfies $V_e(p^*) \leq p^* c_e$, with equality if $M^* > 0$

(ii) the distribution over states is stationary, that is, $\mu^* = T(\mu^*, M^*, p^*)$

(iii) the equilibrium price p^* is determined by aggregate supply and demand, that is, $Q^s(\mu^*, M, p^*) = \int q(s, p^*) \mu^*(s, c_x) ds + M \int q(s_e, p^*) v(s_e) ds_e = Q^d(p^*)$

where the demand function $Q^d(p^*)$ is exogenously given, with $Q^d_p(p^*) < 0$. The stochastic structure of the shocks in this model guarantees that, in the stationary equilibrium, the productivity distribution and aggregate supply are constant. Thus, the equilibrium output price will also be constant, and it will satisfy condition (i). Note that, by condition (ii), the number of firms in the industry is constant. This implies that if a number M of firms enter each period, an equal number M must exit, so that net entry is equal to zero. Finally, Hopenhayn (1992) shows that the operator T is homogeneous of degree one in M and μ. Homogeneity implies that the equilibrium

rate of entry –the ratio of M to μ- is independent of the actual number of firms, since, to keep the distribution constant, doubling the number of total firms requires doubling the number of entrants.

To conclude, note that regulation in this model is captured by three parameters: the entry cost, the bankruptcy cost, and the innovation cost. Arguably, the choice of innovation cost to be the only regulation parameter that creates uncertainty is arbitrary. However, introducing similar randomness in entry or exit costs would cause the equilibrium distribution to change over time. Under this scenario, firms would have to take into account the entire productivity distribution in their optimization problem, and the productivity distribution itself would become an additional state variable, which complicates the numerical solution considerably.[16] Moreover, introducing uncertainty in either entry or exit costs should not fundamentally change my results, as additional uncertainty is likely to make the selection process even more "noisy," increasing the resulting productivity dispersion. Next, I describe the algorithm for finding the equilibrium with entry and exit, and the calibration procedure to generate the numerical solution.

3.3.1 Algorithm

To find the equilibrium values p^*, M^*, and μ^*, I follow the algorithm described in Hopenhayn and Rogerson (1993), which consists of three steps. First, for an initial p and a given set of parameters, I solve (3.3) via value function iteration. I integrate then the value function over the productivity distribution of entrants to obtain V_e, and compare it to the cost of entering, pc_e. If $V_e > pc_e$, I reduce p and solve (3.3) again, repeating the procedure until condition (i) of the equilibrium is satisfied.

Second, following condition (ii), I find μ^* up to a scale factor.[17] That is, given p^* and an arbitrary number of entrants $\widetilde{M}$, I use the decision rules $\chi(s, c_x, p^*)$ and $I(s, c_x, p^*)$ to compute the transition function $T(\mu, \widetilde{M}, p^*)$ that reassigns firms in μ_t to μ_{t+1}. Starting from an arbitrary distribution μ^0, I reassign firms using T until a fixed point is reached. I call this invariant distribution

[16] Ways to simplify the problem have been put forth, for instance, by Krusell and Smith (1998).

[17] The linear homogeneity of T with respect to M and μ implies that, if $\hat{\mu}$ is the fixed point when $M = 1$, then $\widetilde{M}\hat{\mu}$ is the fixed point when $M = \widetilde{M}$.

$\tilde{\mu}$.

Finally, I compute aggregate supply using the invariant distribution $\tilde{\mu}$, and I compare it to the industry demand corresponding to p^* (condition (iii)). If $Q^s(\tilde{\mu}, M, p^*) > Q^d(p^*)$, I reduce the number of entrants to reduce aggregate supply, and compute the invariant distribution for the new M. I repeat the procedure until the market clears. The resulting M^* and μ^* complete the stationary industry equilibrium.

The definition of the equilibrium in the previous section states that the industry could display an equilibrium with or without entry and exit. Since the economies under study display large amounts of entry and exit each year, it is natural to focus on the case generating entry and exit in equilibrium.[18] Hence, the choice of parameters for the numerical solution are such that in equilibrium the industry displays positive entry and exit.

3.3.2 Benchmark model and calibration

I begin the analysis by calibrating a version of the model with constant innovation costs c_x to match a set of statistics for the U.S. There are two reasons for doing so. First, the goal is to study the effect of distortions caused by poor institutional quality, therefore, it seems natural to begin by studying a benchmark economy with relatively few distortions and good institutions. Second, a multitude of studies have used similar models to reproduce patterns observed in the U.S., and being able to compare their results to mine is of interest. I then vary innovation costs in the calibrated model: I first increase them, and then make innovation costs random, and for each case I solve the model and compute the resulting invariant productivity distribution. Finally, I simulate an industry to obtain productivity and size statistics for several cohorts of firms. The main parameters of the calibration are summarized in Table 3.3.

The idiosyncratic productivity s is set to follow a mean-reverting process of the form

$$s_{t+1} = \rho s_t + x_t \epsilon_{t+1} \qquad 0 \leq \rho < 1 \tag{3.5}$$

[18] Hopenhayn (1992) shows that the equilibrium with entry and exit is unique; on the other hand, in the case without entry/exit, there is a continuum of equilibria.

Table 3.3: Parameters for benchmark model

Fixed operating cost c_f	0.9500
Bankruptcy cost ϕ	2.0000
	(0.4634 in output units)
Entry cost c_e	0.9000
Investment cost c_x (constant)	0.0850
	(0.0197 in output units)
Labor cost share α	0.5000
Discount factor β	0.9500

Idiosyncratic shock process	
μ_ϵ	-5.3517
σ_ϵ (at $\bar{x} = 9.073$)	1.4987
At $\bar{x} = 9.073$	
$E(\epsilon)$	0.0142
$sd(\epsilon)$	0.0410
$E(s)$	1.2300
$sd(s)$	0.8800

where the shock ϵ is an *i.i.d.* log-normal random variable and where $\log(\epsilon)$ has mean μ_ϵ and standard deviation σ_ϵ. Note that the distribution of the productivity shock depends on the amount x invested in innovation last period, and, because investment multiplies the shock, it will affect the mean and the variance of s.[19] Notice also that if a firm does not invest, its future productivity declines by a proportion equal to $1 - \rho$: this captures the competitive pressure that outside technological progress exerts on the firm, forcing it to innovate or exit.[20] The pace of "technological change" $1/\rho$ has an ambiguous effect on the firm's incentives to innovate. If ρ is low, the firm can only survive to the extent that it invests to keep its productivity from falling; if ρ is too low, however, the benefits of investing are short-lived, and hence the firm may be better off shutting down.

I make a discrete approximation for the process (3.5) by constructing a grid of 200 points for s, and 250 points for x, for a given set of parameters ρ, μ_ϵ, and σ_ϵ.[21] Since x is endogenously

[19] More formally, $E(s|x = x_0) = \frac{x_0 E(\epsilon)}{(1-\rho)}$ and $var(s|x = x_0) = \frac{x_0^2 var(\epsilon)}{(1-\rho^2)}$, where $E(\epsilon) = \mathsf{e}^{\mu_\epsilon + \frac{\sigma_\epsilon^2}{2}}$ and $var(\epsilon) = \mathsf{e}^{2\mu_\epsilon + \sigma_\epsilon^2}(\mathsf{e}^{\sigma_\epsilon^2} - 1)$

[20] While outside competitive pressure has been traditionally modeled also as coming from vintage effects, in this model entering firms are less productive on average than incumbents, which is consistent with the data. Therefore, it is assumed that outside competitive pressure is reflected in the pace at which the technology of incumbent firms becomes obsolete.

[21] The large number of grid points for s allows me to have a wide range for s, yet with small gaps between the grid points. This is necessary since the range of s widens as x increases.

determined, I choose the grid such that firms' choices are not constrained by the upper bound of x, while the range of s is chosen so that its upper bound stands three standard deviations away from the mean when x is equal to its upper bound. I then construct a matrix of transition probabilities for each value of x, so that a total of 250 matrices of dimension 200-by-200 were constructed.

The parameters ρ, μ_ϵ, and σ_ϵ are chosen to match the estimates of the first and second moments of the profitability shock process estimated by Cooper and Haltiwanger (2000), henceforth CH, using data for approximately 7,000 U.S. large manufacturing plants continually in operation between 1972 and 1988. While the distinction between *productivity* and *profitability* shocks is empirically important, in the model it is not, since p and s multiply each other (see Foster, Haltiwanger and Syverson, 2005).

CH decompose the stochastic process of productivity into aggregate and idiosyncratic shocks; here, I abstract from aggregate shocks, and only consider the first and second moments of the productivity distribution, together with the persistence parameter ρ. Moreover, in contrast to CH, the process (3.5) is conditional on investment x. I need therefore to choose a value $\bar{x}$ such that the mean and the variance of s, given $\bar{x}$, match the estimated moments in CH. To do so, I set the persistence parameter equal to that estimated by CH, $\rho = 0.885$. Then, I set $\bar{x}$ to be 75 grid-points below the upper bound of x, and for this value the corresponding remaining parameter values μ_ϵ and σ_ϵ are chosen to generate a standard deviation for s equal to 0.88 and a mean value of 1.23. Admittedly, the choice of $\bar{x}$ is arbitrary. However, the choice of μ_ϵ and σ_ϵ adjust to $\bar{x}$ so that the resulting moments for s match those in CH. Hence, neither s nor the numerical results depend on $\bar{x}$.

In the model it is important to work with short time periods, as much of the effects of regulation happen through selection of young firms, who either grow or exit. I therefore set the time period to be one year, and attempt to match the 1990s. Accordingly, the discount rate β is set to 0.95, which corresponds to an annual interest rate of roughly 5.26 percent. Although the time period matches the measure of turnover rates and size distributions provided by Bartelsman *et al.* (2005), the same authors provide productivity statistics only at five-year spans; to make my

model implications comparable, I will also present the productivity statistics over a period of five years. In the model, the production technology is standard:

$$f(s,z) = sz^{\alpha} \qquad \alpha < 1 \tag{3.6}$$

where α is set to be equal to 0.5. After some algebra, firms' profits can thus be written as follows:

$$\pi(s',p) = (\gamma-1)\left(\frac{1}{\gamma}p\right)^{\frac{\gamma}{\gamma-1}}\left(\rho s + x\epsilon'\right)^{\frac{\gamma}{\gamma-1}} - pc_f \tag{3.7}$$

where $\gamma = 1/\alpha$. [22] Finally, in what follows I consider a linear demand function with intercept D, so that $Q^d(p) = D - p$. Recall from the previous section that the operator T is homogeneous of degree one in μ and M. As a result, in equilibrium the entry/exit rate is independent of the actual number of firms, and this number will vary across experiments.

The remaining parameters, namely the entry cost c_e, the exit cost ϕ, the fixed operating cost c_f, the demand parameter D, and the initial productivity distribution $v(\cdot)$ are chosen so that the resulting industry equilibrium matches the U.S. annual turnover rate, the size distribution of firms, the employment distribution across sizes, and the coefficient of variation of the productivity of entering and incumbent firms.[23] Following Hopenhayn and Rogerson (1993), the initial productivity distribution is chosen to be uniform over the lower third of the productivity range for incumbents. Having a lower average productivity for entrants guarantees that the size distribution of entrants displays a lower average than for incumbents. In addition, it is reasonable to assume that, on average, entrants start off less productive, and are more likely to exit, than incumbents, as the data show for the U.S. and other countries. The innovation cost c_x (constant in the benchmark case) is set so that the average expenditure on investment relative to sales matches the U.S. R&D expenditure-to-sales ratio for manufacturing firms performing R&D in 2000, reported by the National Science Foundation 's *Research and Development in Industry* (see the Appendix).

[22] The reason to set the share of labor at 0.5 is that profit should not increase in x faster than the cost of x, which is quadratic. From equation (3.7), we can see that profit is quadratic in x when α is 0.5

[23] "Size" is defined by employment z.

With the parameters in hand, I proceed to solve the model numerically as described previously. That is, I solve the firm's problem by value function iteration, obtain the policy functions χ for exit and I for investment, and calculate the invariant productivity distribution and the equilibrium firm entry/exit rate. The policy functions and invariant distribution also allow me to compute the distribution of firms over different size categories, as well as the share of total employment that each size category accounts for.

Next, I simulate a panel of firms and compute statistics for entering, continuing and exiting firms by cohort. The simulated industry consists of 500 firms, and it is simulated for 500 periods, where I discard the first 50 periods to eliminate the influence of the initial distribution.[24] In each period I use the exit rule χ to determine the number of firms that exit, and replace those firms by an equal number of entrants. Using the investment rule I, I calculate investment decisions for each incumbent and entering firm, which in turn determine the conditional probability distribution of shocks for the period after. Then, in each period, each firm receives an idiosyncratic shock, drawn from the probability distribution implied by last period's investment (for entering firms, the shock is a draw from a uniform distribution, with upper bound set at the lower third of the incumbents' productivity range). I then construct productivity statistics (mean and dispersion) in the same manner as Bartelsman *et al.* (2005), by considering as entrants all firms that entered between t and $t-5$, continuers all firms that are observed between $t-5$ and $t+5$, and exiting firms all firms that exit between t and $t+5$ (see the Appendix). I also calculate the average and standard deviation of size, productivity, and investment for different cohorts of continuing firms.

In the next section I introduce institutional quality by, first, allowing the investment cost to increase, and, second, by allowing the investment cost to be a random variable. Using the same set of parameters as in the benchmark model, I then compare the resulting invariant distribution to that of the benchmark model. I also report the results of simulation exercises that provide size, productivity, and investment statistics for several cohorts of firms.

[24] Although the sample size for this simulation might seem small, it is computationally difficult to increase it much further, because the productivity shock must be computed individually for each firm; in addition, one must be able to track each firm over its lifetime in order to establish the entering, continuing and exiting cohorts. Alternative simulations with a larger sample but less time periods show similar results, and in future work I plan to increase the sample further and repeat the simulation several times in order to obtain more robust results.

3.4 Results

Table 3.4: Comparison of basic statistics for the U.S. and benchmark model

A: Turnover and productivity distribution

	U.S.	**Model**
Innovative investment as a share of sales	3.74%	3.28%
Turnover rate	15.7813	15.6945
Coefficient of variation of entering firms*	1.0155	1.2746
Coefficient of variation of continuing firms*	0.9400	1.1087
Coefficient of variation of exiting firms*	0.9295	0.9131

B: Size Distribution

	< 20	20-49	50-99	100-499	> 500
U.S.					
Firms	0.726	0.151	0.061	0.049	0.012
Employment	0.067	0.068	0.063	0.145	0.657
Model					
Firms	0.489	0.212	0.113	0.148	0.039
Employment	0.031	0.058	0.067	0.263	0.581

*The coefficient of variation is the standard deviation of productivity s across firms, divided by the mean across firms. As in the data, the mean and standard deviation of productivity are calculated for entering, continuing, and exiting firms at 5-year spans. See the Appendix for details about the calculations.

Table 3.4 presents summary statistics in the data and the statistics produced by the calibration. The coefficient of variation for entering, continuing, and exiting businesses reported in Panel A is calculated at 5-year intervals in the data, as well as in the model, using the simulated panel. The share of innovative investment to total sales and the firm turnover rate are also reported in Panel A. Panel B provides the size distribution of firms, as the share of firms in each size category, and the share of total employment in each size categoty. Where comparable, the results produced by the benchmark model are similar to Hopenhayn and Rogerson (1993). Most firms are small (although the share of firms with less than 20 employees is significantly smaller in the model than in the data), but most of the employment is concentrated in large firms. In addition, the productivity distribution of entering firms displays larger dispersion (and lower mean) than that of incumbent firms. To be sure, the parsimonious nature of the model makes it difficult to

Table 3.5: Statistics for alternative costs

	Benchmark 0.085	Constant 0.09	Random [0.075,0.095]	Random [0.065,0.09]
Price	100	102.662	98.997	98.631
Firm turnover rate	100	114.905	99.913	100.436
Average overall productivity	100	93.418	98.935	96.314
Coefficient of variation productivity	100	102.022	100.688	101.796
Average size of firms (Employment)	100	94.255	96.708	92.162
Average investment	100	92.589	98.782	95.866
Dispersion of investment	100	96.772	102.532	103.368

capture many industry characteristics, however, the calibration fits quite well the main characteristics that I am interested in studying here, namely the innovative behavior, the entry/exit rate, and productivity dispersion.

I study the effects of a deterioration in the investment climate by first conducting a "traditional" exercise, where I keep the innovation cost deterministic but change its magnitude. In the calibration the cost is increased from the benchmark case of $c_x = 0.085$ to $c_x = 0.09$ (a 5.6% change). Keeping all other parameters unchanged, I solve the model, obtain the invariant distribution, and simulate a new industry. Results are reported in the second column of Table 3.5, where all results are relative to the benchmark case. Firm turnover increases by 15% with respect to the benchmark setup, while average productivity falls by 6.58%, and dispersion (measured by the coefficient of variation) actually increases by 2%. Intuitively, all firms invest lower amounts in innovation, which has two consequences. First, incumbent firms receive lower future productivity shocks, which reduces aggregate productivity; second, investment of firms that are close to the exit cutoff level (many of them entrants) drops to zero, forcing these firms to exit more rapidly (hence the cutoff productivity level increases). Because in equilibrium the number of firms is constant , this increased exit also causes the composition of the industry to change towards a larger number of young (thus small and less productive) firms. Overall, average investment decreases by 7.4%, and because low-productivity firms are more likely to exit than to invest, the dispersion of investment falls.

Table 3.6 presents the impact of the higher innovation cost on productivity for entering, continuing, and exiting firms. To be consistent with the data, the calculations are made at a 5-year span: they therefore ignore the selection taking place at high frequencies, giving us medium-term effects of the change in the investment cost. Interestingly, the drop in average productivity is relatively larger for continuing firms, since their average productivity falls by 3.6%, while the average productivity of entering and exiting firms falls by 2.9% and 1.8%, respectively. On the other hand, while the dispersion of productivity for entering and continuing firms remains practically unchanged, it increases slightly for exiting firms. This can be explained by the increase in the cutoff productivity level, which also increases the range of productivity levels for exiting firms. However, because the number of firms at low productivity levels increases, the average productivity of exiting firms falls. The size distribution statistics, presented in Table 3.7, shows that the share of small ($z < 20$) firms increases, as turnover is higher and most entering/exiting firms are small.

Next, I allow the cost to be random, taking values $c_x^h = 0.095$ and $c_x^l = 0.075$ with equal probability. Note that the *average* cost remains the same as in the benchmark case ($\overline{c_x} = 0.085$), so that the only "additional" effect I consider with respect to the benchmark case is uncertainty. Assuming that half of the firms get a high realization and half get a low realization is an extreme example of the "capriciousness" of regulation; however, I study it as a starting point, and will later provide results for an alternative case in which the probabilities of the high and low cost are asymmetric, offering more realistic representations of the uncertainty caused by poor institutional quality.

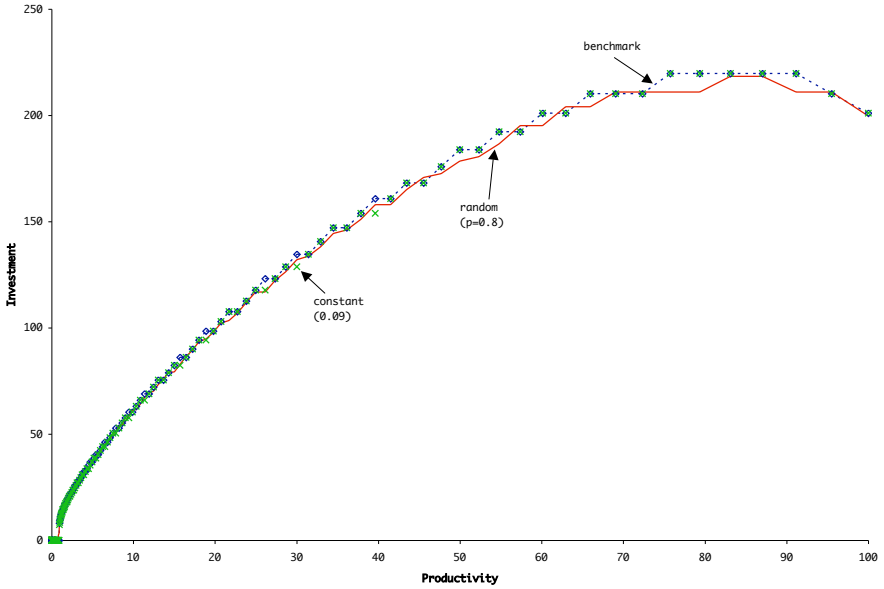
The third column of Table 3.5 reports the results of this calibration exercise. At first sight, results differ only by small amounts with respect to the benchmark case. Firm turnover does not change significantly (it decreases by less than 0.1%), the market-clearing price decreases slightly, average productivity decreases by 1.065%, and the coefficient of variation increases by 0.7%. There are more noticeable effects for average size and investment, which fall by 3.29% and 1.22% respectively, and on investment dispersion, which increases by 2.53%.

In fact, although uncertainty does not affect average churning, it significantly affects the

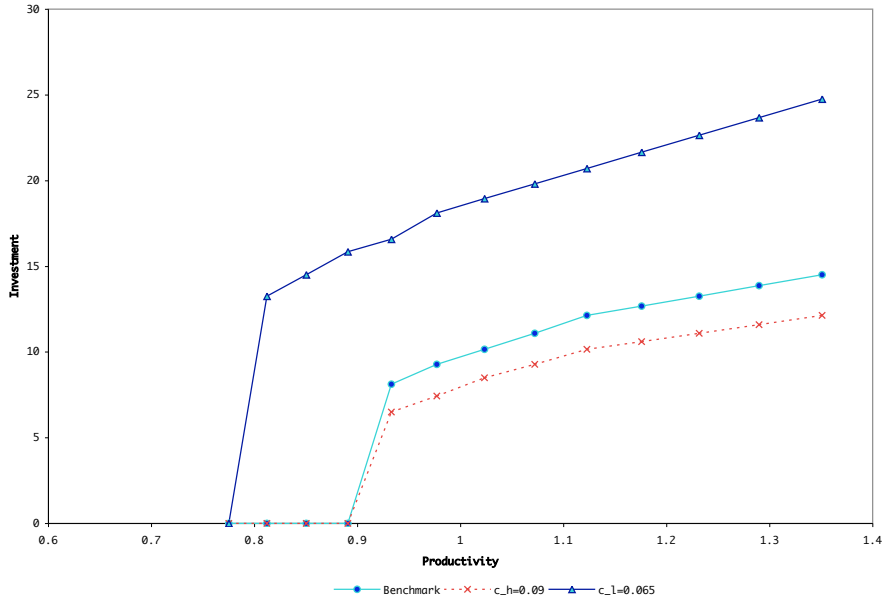
nature of churning, and the distribution of firms' characteristics. Table 3.6 shows the effects of uncertainty in innovation costs on the productivity of entrants, incumbents, and exiters. Unlike the previous case of increased innovation costs, under uncertain costs it is exiters that see the largest change with respect to the benchmark case. Indeed, the average productivity of exiters falls by slightly over 4%, while the average productivity of entrants falls by about 2%, and the average productivity of continuers firms falls by less than 1%. Intuitively, a fraction of low-productivity firms receives a low cost draw, and hence are able to continue investing and delay their exit. Moreover, a fraction of "potentially good" young firms receive a high cost draw, therefore stop investing and exit the industry faster. As a result, average productivity of exiters falls. Investment also falls sharply among exiting firms (16.5%), while it falls modestly for entering and continuing firms (less than 3% for entrants and less than 1% for continuers). Not surprisingly, investment dispersion increases for all firms, as firms face uneven costs in this setup. Table 3.7 shows that the size distribution shifts slightly towards small firms, although less than in the previous case of a higher cost.

I conclude the analysis by solving a more realistic specification of the model, where the probability of getting a high or low cost is asymmetric. In particular, the cost now takes values $c_x^h = 0.09$ with probability $p_x = 0.8$ and $c_x^l = 0.065$ with probability $1 - p_x$. This specification corresponds to a more realistic case in which the majority of firms face a high cost (relative to the benchmark), and a smaller number of "lucky" firms receive a low draw of the cost. While in this model all firms face the same probability structure, which would not be the case if regulation enforcement were endogenous, the asymmetric probability case can be interpreted as uneven enforcement coming over which the firm has no influence, for instance, due to an ineffective bureaucracy subject to volatile, inconsistent policies.

Figure 3.4: Investment Rule

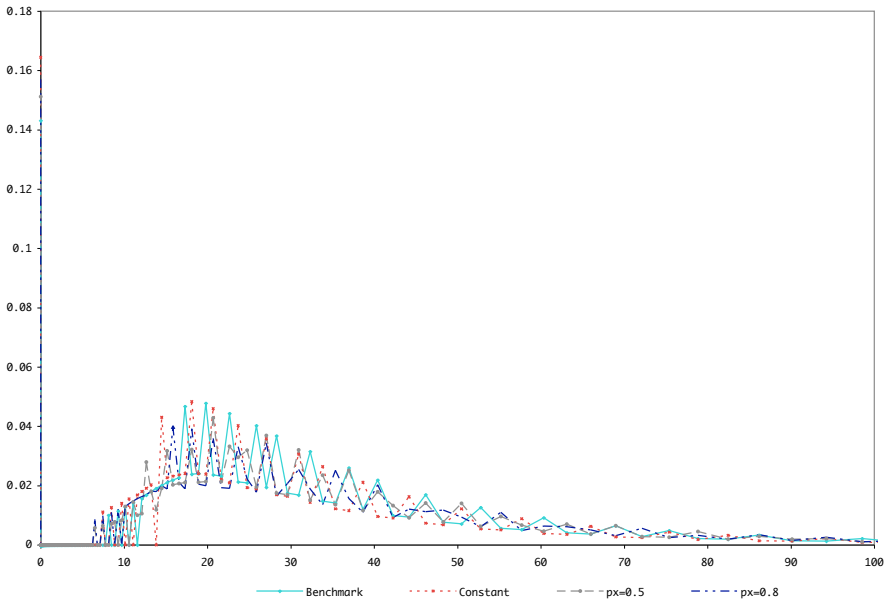


(a) All firms

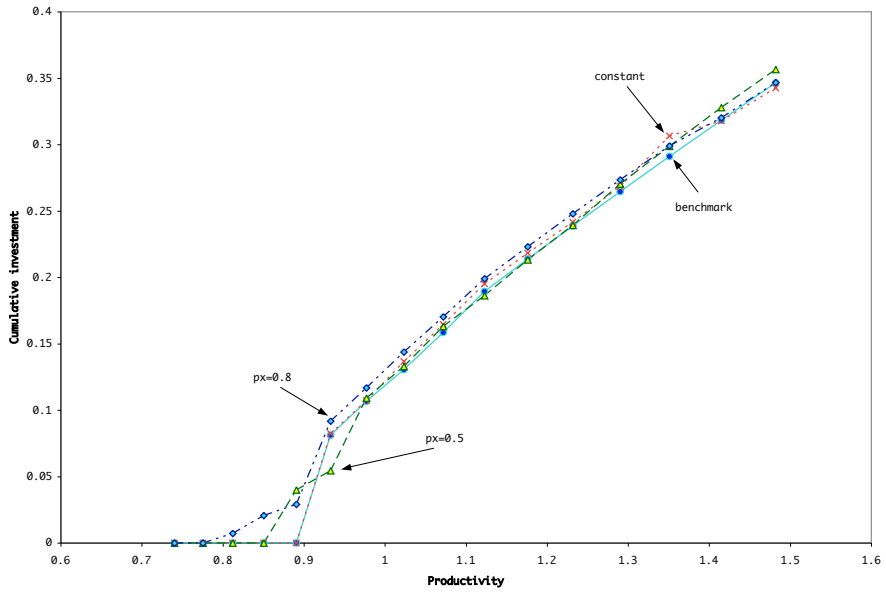


(b) Firms near exit cutoff level

Figure 3.5: Investment Distribution

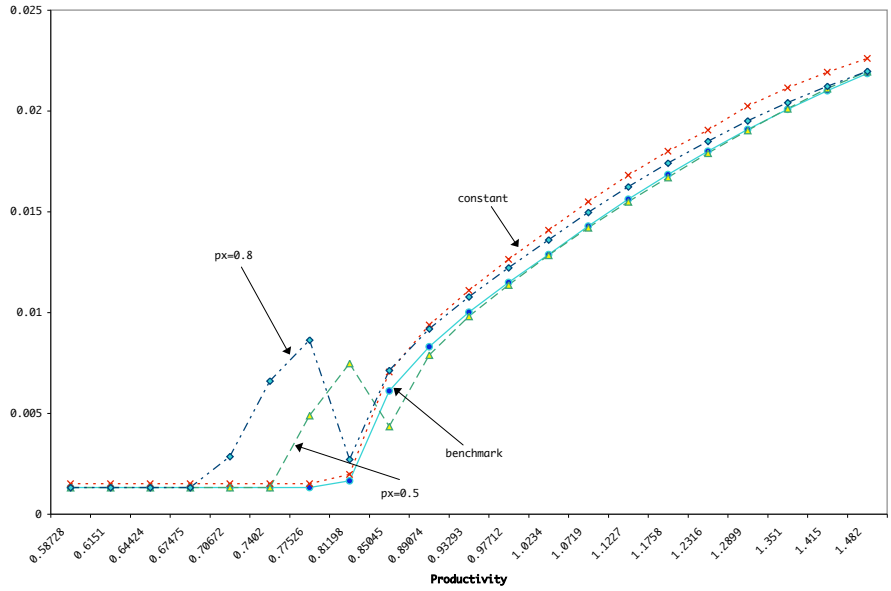


(a) All firms



(b) Firms near exit cutoff level

Figure 3.6: Productivity Distribution



Figures 3.4(a) and 3.4(b) show the policy function for investment for the benchmark model and the random cost with asymmetric probabilities. For the latter case, an "average" investment rule is plotted in Figure 3.4(a) instead of the policy rules for c_x^l and c_x^h, since it is the average investment that determines the equilibrium productivity distribution.[25] In Figure 3.4(b) however, the investment rule is plotted separately for firms with c_x^l and c_x^h and the figure focuses on the decision of firms whose productivity is around the exit cutoff level (between 0.8 and 0.9, being slightly lower for the random cost case). Note that the graphs do not display smooth lines due to the discretization of the state-space. Interestingly, firms with c_x^l invest always more than firms with the benchmark cost, and firms with c_x^h invest always less, but the "average" rule depicted in Figure 3.4(b) is systematically below the benchmark rule.

Figures 3.5(a) and 3.5(b) display the distribution of investment across firms and the cumulative investment for low-productivity firms, respectively. Although the differences appear to be generally small, the distribution of investment in the deterministic (but high-cost) and random cases show a slight shift to the left (Figure 3.5(a)), and there is a visible mass of investment at zero

[25]Note that innovative investment does not monotonically increase in productivity, this is due to the quadratic cost of investment.

for low productivity levels (Figure 3.5(b)), because firms receiving bad productivity shocks will opt to exit the industry and hence invest zero. In contrast to the deterministic case, however, the distribution of investment in the random cost cases shows that the gap between zero and positive investment is smaller, since firms with low productivity that receive the low cost draw will invest a positive amount instead of exiting. This is consistent with the fact that aggregate investment decreases for exiting firms, as shown in Table 3.6, because among exiting firms that invest positive amounts, the amount invested is lower than in the benchmark case.

Figure 3.6 shows the productivity distribution for firms near the exit cutoff level, for each of the deterministic and random cases discussed above. Consistently with previous results, the distribution of firms shifts towards the left in the random cases, as we observe a larger share of firms at low productivity levels. This explains the larger drop in aggregate productivity for the exiting firm cohort in the random cost case (see the last two columns of Table 3.6), since exiting firms will typically be significantly less productive compared to exiting firms in the benchmark case.

The overall effects of this setup are summarized in column 4 of Table 3.5. The effect of turnover is more marked than in the previous case, although the increase is not significant (0.44%). Average productivity, however, falls by 3.69%, while productivity dispersion increases by 1.8%, and more importantly, average size falls by over 7.84%. Average investment also falls more markedly (4.13%), while the dispersion of investment increases by 3.36%.

The simulation results in Table 3.6 provide a striking view of of how asymmetric random costs affect different groups of firms. First, average productivity of falls by 2.8% for entrants, 4.5% for continuers, and 7.1% for exiters. These results are similar in nature but more marked with respect to the symmetric random cost, in that exiting firms tend to be less productive because low-productivity firms that are "lucky" enough to receive a low draw of the cost are able to invest and remain above the exit cutoff level for a longer time, while "unlucky" young firms are forced out of the industry too quickly. The resulting size distribution –presented in Table 3.7- shows that the share of small firms increases, which suggests that the number of low-productivity firms

Table 3.6: Simulation results

	Productivity			
	Benchmark	Constant	Random	Random
	0.085	0.09	[0.075,0.095]	[0.065,0.09]
Entering				
Average	100	97.140	98.123	97.201
Dispersion	100	99.925	100.545	100.303
Continuing				
Average	100	96.354	99.617	95.506
Dispersion	100	100.402	98.780	98.476
Exiting				
Average	100	98.153	95.970	92.876
Dispersion	100	101.502	99.713	98.053

	Investment			
	Benchmark	Constant	Random	Random
	0.085	0.09	[0.075,0.095]	[0.065,0.09]
Entering				
Average	100	93.626	97.392	96.441
Dispersion	100	102.527	105.327	107.394
Continuing				
Average	100	95.345	99.167	95.380
Dispersion	100	102.744	104.395	109.036
Exiting				
Average	100	91.656	83.506	73.312
Dispersion	100	102.720	116.743	128.697

increases as less productive firms tend to be small. It is interesting to compare these results with the case of the deterministic, but higher cost. Note that in the deterministic cost case overall average productivity falls more, because turnover increases and all firms invest less; on the other hand, the average productivity of continuers and exiters falls more in the random cost case, and this effect is especially strong for exiters.

Taking into account the aggregate cost of the additional entry and exit generated by changing the innovative cost magnifies even further the distortive effects of changing the innovative cost. For instance, in the case with $c_x = 0.09$ revenues for entering and exiting cohorts are 95.6% and 99.6% of the benchmark case revenues, but if we account for the additional cost of entry and exit, revenues fall further to 91.4% and 93%. In the random cost case with $p_x = 0.5$ revenues go from 96.5% to 96% for entering firms and from 91.1% to 88.4% for exiting firms, and in the

Table 3.7: Size distribution

	< 20	$20 - 49$	$50 - 99$	$100 - 499$	> 500
Benchmark (cost = 0.085)					
Firms	0.4895	0.2117	0.1127	0.1476	0.0385
Employment	0.0311	0.0581	0.0669	0.2625	0.5814
Constant cost = 0.09					
Firms	0.5009	0.2096	0.1224	0.1296	0.0375
Employment	0.0318	0.0584	0.0775	0.2472	0.5851
Random cost [0.075,0.095]					
Firms	0.4959	0.2102	0.1113	0.1448	0.0378
Employment	0.0315	0.0584	0.0669	0.2609	0.5823
Random cost [0.065,0.09]					
Firms	0.5117	0.2058	0.1076	0.1387	0.0361
Employment	0.0330	0.0594	0.0674	0.2601	0.5801

case with $p_x = 0.8$ revenues decrease from 93.6% to 92.6% for entering firms and from 84.4% to 79.6% for exiting firms if we subtract the cost of entry and exit. This simple calculation suggests that in addition to productivity losses caused by reduced investment in innovation, changes in the innovative cost generate additional aggregate losses from the changes in the selection process of firms.

The results in panel B of Table 3.6 show that on average entrants and continuers invest less than in the benchmark case (3.6% and 4.6% less), and the dispersion of investment increases for all three groups of firms, most notably for exiting firms. Indeed, it is particularly striking that although the average productivity of exiting firms falls, its investment dispersion increases even more than for the other two groups (28.7% for exiters, 9% for continuers, and 7.4% for entrants). The results of this case show that firms that get the lower cost draw invest considerably more than those getting the high cost, which increases the dispersion of investment, although altogether firms invest less than in the benchmark case. For less productive firms the effects are larger since firms that get the high cost draw typically invest zero. Finally, notice that compared to the deterministic, higher cost case, entering firms invest more on average in the random cost case

(column 1 vs. column 3 in Table 3.6), although the resulting average productivity is lower.

To summarize, *on average*, the effects of introducing uncertainty in the innovation cost are smaller than in the case of increased deterministic costs. However, a disaggregated analysis shows that the *nature* of churning changes: exiting firms display a lower average productivity compared to the benchmark model, and the selection process of firms is distorted so that some low-productivity firms delay their exit while others exit prematurely. Hence, in the presence of unpredictable regulation inefficiencies arise in the reallocation process, even if the average level of regulation remains unchanged, which highlights the importance of complementing regulatory reform with improvements in overall institutional quality.

3.5 Conclusion

Why do we observe high amounts of reallocation (firm turnover, productivity dispersion) in countries with high levels of regulation? And why have reforms in some countries failed to increase the contribution of reallocation to aggregate productivity growth?

To answer those questions I build an industry equilibrium model where firms engage in innovation, but face costly *and* unpredictable barriers to innovation. This added friction is intended to capture poor institutional quality, and I show that it distorts the entry and exit decision of firms, and their innovative behavior, all of which determine the equilibrium productivity distribution.

I find that changes in innovative cost (either in magnitude or in nature) increase firm turnover and productivity dispersion. Thus, interpreting surges in such reallocation measures as improvements in the "creative destruction" process could be misleading, especially in countries where regulation is high and institutional quality poor. More importantly, the fact that *uncertainty alone* can cause inefficiencies in reallocation offers an explanation for the limited success of structural reforms implemented across developing countries in recent years, and highlights the importance of combining regulatory reform with improvements in the overall institutional quality.

Admittedly, the model does not incorporate important aspects of the relationship between regulation and firm dynamics: for instance, regulation enforcement, though uneven, is not purely

random in reality, as some firms are able to avoid compliance more often than others. Likewise, this model abstracts from strategic behavior present in models of imperfect competition, such as Ericson and Pakes (1995), which, in combination to institutional frictions, could generate important implications for firm dynamics. Extending the model to allow for multiple effects of regulation and institutional quality opens the possibilities for a more complete understanding of its ultimate effects on productivity. Another avenue for further research is the collection of institutional measures capturing the uncertainty associated to regulation, which could be used to test the predictions of the model by estimating reduced form relationships. The challenge is then obtaining objective and accurate measures of the "capriciousness" of regulation across countries or industries.

Appendix A

Sources and description of the components of our regulation indices

See following pages

ENTRY

Variable name in corresponding database (name in our database)	Scale		Description	Years	Source
Number of procedures (db_entry_proc)	Actual number		The number of different procedures that a start-up has to comply with in order to obtain a legal status, i.e. to start operating as a legal entity. The data cover (1) procedures that are always required; (2) procedures that are generally required but that can be avoided in exceptional cases or for exceptional types of businesses.	Survey conducted in 1999, updated to 2003	**Doing Business, The World Bank Group** see Djankov, La Porta, Lopez-de-Silanes and Shleifer, "The Regulation of Entry", Quarterly Journal of Economics, 117, 1-37, Feb. 2002. http://rru.worldbank.org/doingbusiness
Number of days (db_entry_days)	Actual number		Time recorded in calendar days. It is assumed that the minimum time required to fulfill a procedural requirement is one day. The variable measures the average duration estimated necessary to complete a procedure. The fastest procedure (independent of cost) is chosen. It is assumed that the entrepreneur completes the procedure in the most efficient way, ignoring the time that the entrepreneur spends in information gathering.		
Cost (db_entry_cost)	% GNI		Costs associated with starting-up a business, based on the texts of the Company Law, the Commercial Code, or specific regulations. If there are conflicting sources and the laws are not completely clear, the most authoritative source is used. If the sources have the same rank the source indicating the most costly procedure is used. In the absence of express legal fee schedules, a governmental officer's estimate is taken as an official source. If several sources have different estimates, the median reported value is used. In the absence of government officer's estimates, estimates of incorporation lawyers are used instead. If these differ, the median reported value is computed. In all cases, the cost estimate excludes bribes.		
Regulation (ief_regulation)	1	Very low	Existing regulations straightforward and applied uniformly to all businesses; regulations not much of a burden for business; corruption nearly nonexistent.	1995-2003 (annual)	**The Index of Economic Freedom, Heritage Foundation** Based on: Economist Intelligence Unit, Country Commerce and Country Report, 2001 and 2002, U.S. Department of State, Country Commercial Guide 24 and Country Reports on Economic Policy and Trade Practices for 2000, Office of the U.S. Trade Representative, 2002 National Trade Estimate Report on Foreign Trade Barriers, and official government publications of each country.
	2	Low	Simple licensing procedures; existing regulations relatively straightforward and applied uniformly most of the time, but burdensome in some instances; corruption possible but rare		

	3	Moderate	Complicated licensing procedure; regulations impose substantial burden on business; existing regulations may be applied haphazardly and in some instances are not even published by the government; corruption may be present and poses minor burden on businesses		http://www.heritage.org/research/features/index/index.html
	4	High	Government-set production quotas and some state planning; major barriers to opening a business; complicated licensing process; very high fees; bribes sometimes necessary; corruption present and burdensome; regulations impose a great burden on business		
	5	Very high	Government impedes the creation of new businesses; corruption rampant; regulations applied randomly		

TRADE

Variable name in corresponding database **(name in our database)**	**Scale**		**Description**	**Years**	**Source**
Trade (ief_trade)	1	Very low	Weighted average tariff rate less than or equal to 4 percent.	1995-2003 (annual)	**The Index of Economic Freedom, Heritage Foundation** Based on: The Economist Intelligence Unit, Country Report and Country Commerce, 2002; International Monetary Fund, Government Finance Statistics Yearbook and International Financial Statistics on CD–ROM, 2002; Office of the U.S. Trade Representative, 2002 National Trade Estimate Report on Foreign Trade Barriers; U.S. Department of State, Country Commercial Guide 3 and Country Reports on Economic Policy and Trade Practices for 2001 and 2002; World Bank, World Development Indicators 2002; World Trade Organization, Trade Policy Reviews, 1995 to June 2001; and official government publications of each country. For all the European Union countries, the authors have based the score on data reported by the World Bank.
	2	Low	Weighted average tariff rate greater than 4 percent but less than or equal to 9 percent		
	3	Moderate	Weighted average tariff rate greater than 9 percent but less than or equal to 14 percent		
	4	High	Weighted average tariff rate greater than 14 percent but less than or equal to 19 percent		
	5	Very high	Weighted average tariff rate greater than 19 percent.		
i Hidden import barriers (efw_bi)	0 to 10	(0= heavy regulation)	No barriers other than published tariffs and quotas.	1995, 2000, and 2001	**Economic Freedom of the World, The Fraser Institute** From Section: 4 Freedom to Exchange with Foreigners B. Regulatory Trade Barriers Based on: World Economic Forum (2001), *Global Competitiveness Report 2001-2002* (Oxford: Oxford Univ. Press). http://www.freetheworld.com/release.html
ii Costs of importing (efw_bii)			The combined effect of import tariffs, license fees, bank fees, and the time required for administrative red-tape raises costs of importing equipment by (10 = 10% or less; 0 = more than 50%). This component is based on survey responses to this question obtained from the Global Competitiveness Report 2000.		

FINANCIAL MARKETS

Variable name in corresponding database (name in our database)	Scale		Description	Years	Source
iv. Avoidance of interest rate controls and regulations that lead to negative real interest rates (efw_aiv)	0 to 10	(0= heavy regulation)	Data on credit-market controls and regulations were used to construct rating intervals. Countries with interest rates determined by the market, stable monetary policy, and positive real deposit and lending rates received higher ratings. When interest rates were determined primarily by market forces and the real rates were positive, countries were given a rating of 10. When interest rates were primarily market-determined but the real rates were sometimes slightly negative (less than 5%) or the differential between the deposit and lending rates was large (8% or more), countries received a rating of 8. When the real deposit or lending rate was persistently negative by a single-digit amount or the differential between them was regulated by the government, countries were rated at 6. When the deposit and lending rates were fixed by the government and the real rates were often negative by single-digit amounts, countries were assigned a rating of 4. When the real deposit or lending rate was persistently negative by a double-digit amount, countries received a rating of 2. A zero rating was assigned when the deposit and lending rates were fixed by the government and real rates were persistently negative by double-digit amounts or hyperinflation had virtually eliminated the credit market.	1970-2000 (5-year) and 2001	**Economic Freedom of the World, The Fraser Institute** From Section: 5: Regulation of Credit, Labor, and Business A. Credit Market Regulations Based on: International Monetary Fund, International Financial Statistics Yearbook (various issues, as well as the monthly supplements)
v. Interest rate controls (efw_av)			Reflects whether interest rate controls on bank deposits and/or loans are freely determined by the market.		Based on data provided by the World Economic Forum Global Competitiveness Report.
Banking and finance (ief_banking)	1	Very low	Government involvement in the financial sector negligible; very few restrictions on foreign financial institutions; banks may engage in all types of financial services	1995-2003 (annual)	**The Index of Economic Freedom, Heritage Foundation**
	2	Low	Government involvement in the financial sector minimal; few limits on foreign banks; country may maintain some limits on financial services; domestic bank formation may face some barriers		Based on: Economist Intelligence Unit, Country Commerce, Country Profile, and Country Report for 2001 and 2002; U.S. Department of State, Country Commercial Guide 19 ; U.S. Department of State, Country Reports on Economic Policy and Trade Practices for 2001; and official government publications of each country.
	3	Moderate	Substantial government influence on banks; government owns or controls some banks; government controls credit; domestic bank formation may face significant barriers		
	4	High	Heavy government involvement in the financial sector; banking system in transition; banks tightly controlled by government; possible corruption; domestic bank formation virtually nonexistent		

	5	Very high	Financial institutions in chaos; banks operate on primitive basis; most credit controlled by government and goes only to state-owned enterprises; corruption rampant		

CONTRACT ENFORCEMENT

Variable name in corresponding database (name in our database)	Scale	Description	Years	Source
Number of procedures (db_contr_proc)	Actual number	Number of procedures mandated by law or court regulation that demands interaction between the parties or between them and the judge or court officer. The questionnaire covers the step-by-step evolution of a debt recovery case before local courts in the country's most populous city.	Survey conducted in 1999, updated to 2003	**Doing Business, The World Bank Group.** See Simeon Djankov, Rafael La Porta, Florencio Lopez-de-Silanes, and Andrei Shleifer, "Courts", Quarterly Journal of Economics, May 2003.
Bureaucracy quality (icrg_bureau)	0 to 4	High points are given to countries where the bureaucracy has the strength and expertise to govern without drastic changes in policy or interruptions in government services. Countries that lack the cushioning effect of a strong bureaucracy receive low points because a change in government tends to be traumatic in terms of policy formulation and day-to-day administrative functions.	1990-2000	**International Country Risk Guide - PRS Group** http://www.prsgroup.com/icrg/icrg.html

FISCAL REGULATION

Variable name in corresponding database (name in our database)	Scale		Description	Years	Source
Fiscal burden (ief_taxation)			Individual Income Tax Grading Scale	1995-2003 (annual)	**The Index of Economic Freedom, The Heritage Foundation**
	1	Very low	Top income tax rate 0 percent. Marginal rate for the average taxpayer 0 percent.		
	2	Low	Top income tax rate greater than 0 percent and less than or equal to 25 percent. Marginal rate for the average taxpayer greater than 0 percent and less than or equal to 10 percent		Based on: Ernst & Young, 2002 The Global Executive and 2002 Worldwide Corporate Tax Guide; International Monetary Fund Staff Country Report,
	3	Moderate	Top income tax rate greater than 25 percent and less than or equal to 35 percent. Marginal rate for the average taxpayer greater than 10 percent and less than or equal to 15 percent.		Selected Issues and Statistical Appendix, 2000 to 2002; Economist Intelligence Unit, Country Commerce, Country Profile, and Country Report for 2001 and 2002; U.S. Department of State, Country Commercial Guide 9 ; and official government publications of each country. Sources other than Ernst & Young are noted in the text. For information on government expenditures, the authors' primary sources were Organisation for Economic Co-
	4	High	Top income tax rate greater than 35 percent and less than or equal to 50 percent. Marginal rate for the average taxpayer greater than 15 percent and less than or equal to 20 percent.		

	5	Very high	Top income tax rate greater than 50 percent. Marginal rate for the average taxpayer greater than 20 percent		operation and Development data (for member countries); International Monetary Fund, Government Finance Statistics Yearbook for 2001, and International Monetary Fund Staff Country Report, Selected Issues and Statistical Appendix, 2000 to 2002; Standard & Poor's, Sovereigns Ratings Analysis; Asian Development Bank, Key Indicators of Developing Asian and Pacific Countries 2001; African Development Bank, ADB Statistics Pocketbook 2002; European Bank for Reconstruction and Development, Country Strategies; Inter-American Development Bank; U.S. Department of State, Country Commercial Guide 10 ; and official government publications of each country. Sources other than the OECD and the IMF are noted in the text.
			Corporate Tax Grading Scale		
	1	Very low	Corporate tax rate less than or equal to 20 percent		
	2	Low	Corporate tax rate greater than 20 percent and less than or equal to 25 percent.		
	3	Moderate	Corporate tax rate greater than 25 percent and less than or equal to 35 percent.		
	4	High	Corporate tax rate greater than 35 percent and less than or equal to 45 percent.		
	5	Very high	Corporate tax rate greater than 45 percent.		
			Government Expenditures Scale for Developed Countries		
	1	Very low	Less than or equal to 15 percent.		
	2	Low	Greater than 15 percent but less than or equal to 25 percent		
	3	Moderate	Greater than 25 percent but less than or equal to 35 percent		
	4	High	Greater than 35 percent but less than or equal to 45 percent		
	5	Very high	Greater than 45 percent		
			Government Expenditures Scale for Developing Countries		
	1	Very low	Less than or equal to 15 percent		
	2	Low	Greater than 15 percent but less than or equal to 20 percent.		
	3	Moderate	Greater than 20 percent but less than or equal to 25 percent		
	4	High	Greater than 25 percent but less than or equal to 30 percent		
	5	Very high	Greater than 30 percent		
Corporate tax % (kpmg_tax)	%		Corporate tax rate. The above rates do not reflect payroll taxes, social security taxes, net wealth taxes, turnover/sales taxes and other taxes not levied on income.	1997-2003 (annual)	**Corporate Tax Rates Survey, KPMG, Switzerland**
			When 2 or more rates are reported, the highest number is chosen.		The survey (begun in 1993) currently covers 68 countries, including the 30 member countries of the Organization for Economic Cooperation and Development (OECD), and many countries in the Asia Pacific and Latin America regions. Local KPMG tax offices from these countries have contributed to this survey.
1D Top marginal tax rate (efw_d)		0 to 10	Average of 1.D.i. Top Marginal Income Tax Rate and 1.D.ii. Top Marginal Income and Payroll Tax Rate	1970-2000 (5-year) and 2001	**Economic Freedom of the World, The Fraser Institute**
					From Section:
			Countries with higher marginal tax rates that take effect at		1: Size of government

		lower income thresholds received lower ratings. The income threshold data were converted from local currency to 1982/1984 US dollars (using beginning-of-year exchange rates and the US Consumer Price Index).		Based on: Price Waterhouse, Individual Taxes: A Worldwide Summary (various issues)

LABOR

Variable name in corresponding database (name in our database)	Scale	Description	Years	Source
TUMMBR (ra_union)	%	Total trade union membership, in percent of the total labor force. Includes workers of both sexes in the public and the private sectors. In some countries, the union membership may include unemployed and retired workers who pay their dues. Based on the number of active contributors declared by the trade unions themselves and on labor force estimates. When declared membership is larger than the labor force, a 100 percent membership rate is reported.	1945-2000 (5 year)	**A Database of Labor-Market Indicators Across Countries** M. Rama and R. Artecona, The World Bank, 2002.
Flexibility-of-hiring index (db_flex_hiring)	0 to 100, higher values indicating more rigid regulation	Availability of part-time and fixed-term contracts	Survey conducted in 1997, updated to 2003	**Doing Business, The World Bank** see Botero, Djankov, La Porta, Lopez-de-Silanes, and Shleifer, "The Regulation of Labor", Working Paper 9756, National Bureau of Economic Research, June 2003 Based on: NATLEX database (International Labour Organization); Constitutions, available online on the U.S. Law Library of Congress website; International Encyclopaedia for Labour Law and Industrial Relations, and Social Security Programs Throughout the World. Legal advice from leading local law firms was solicited to confirm accuracy in all cases. Following the OECD Job Study and the International Encyclopaedia for Labour Law and Industrial Relations, the areas subject to statutory regulation in all countries were identified. Those include hiring of workers, conditions of employment, and firing of workers
Conditions-of-employment index (db_cond_empl)	0 to 100, higher values indicating more rigid regulation	Working time requirements, including mandatory minimum daily rest, maximum number of hours in a normal workweek, premium for overtime work, restrictions on weekly holiday, mandatory payment for nonworking days, (which includes days of annual leave with pay and paid time off for holidays), and minimum wage legislation. The constitutional principles dealing with the minimum conditions of employment are also coded.		
Flexibility-of-firing index (db_flex_firing)	0 to 100, higher values indicating more rigid regulation	Workers' legal protections against dismissal, including grounds for dismissal, procedures for dismissal (individual and collective), notice period, and severance payment. The constitutional principles dealing with protection against dismissal are also coded.		

BANKRUPTCY

Variable name in corresponding database (name in our database)	Scale	Description	Years	Source

Goals-of-insolvency index (db_close_insolv)	0 to 100	The measure documents the success in reaching the three goals of insolvency, as stated in Hart (1999). It is calculated as the simple average of the cost of insolvency (rescaled from 0 to 100, where higher scores indicate less cost), time of insolvency (rescaled from 0 to 100, where higher scores indicate less time), the observance of absolute priority of claims, and the efficient outcome achieved. A score 100 on the index means perfect efficiency.	2003	**Doing Business, The World Bank** See Djankov, Simeon, Oliver Hart, Tatiana Nenova, and Andrei Shleifer, "Efficiency in Bankruptcy", working paper, Department of Economics, Harvard University, July 2003.
Cost measure (db_close_cost)	%	Cost is defined as the cost of the entire bankruptcy process, including court costs, insolvency practitioners' costs, the cost of independent assessors, lawyers, accountants, etc. In all cases, the cost estimate excludes bribes. The cost figures are averages of the estimates in a multiple-choice question, where the respondents choose among the following options: 0-2 percent, 3-5 percent, 6-10 percent, 11-25 percent, 26-50 percent, and more than 50 percent of the insolvency estate value.	2003	
Court-powers index (db_close_court)	0 to 100	The measure documents the degree to which the court drives insolvency proceedings. It is an average of three indicators: whether the court appoints and replaces the insolvency administrator with no restrictions imposed by law, whether the reports of the administrator are accessible only to the court and not creditors, and whether the court decides on the adoption of the rehabilitation plan. The index is scaled from 0 to 100, where higher values indicate more court involvement in the insolvency process.	2003	

GOVERNANCE

Variable name in corresponding database **(name in our database)**	**Scale**	**Description**	**Years**	**Source**
Corruption (icrg_corrup)	0 to 6	This is an assessment of corruption within the political system. The most common form of corruption met directly by business is financial corruption in the form of demands for special payments and bribes connected with import and export licenses, exchange controls, tax assessments, police protection, or loans. Although our measure takes such corruption into account, it is more concerned with actual or potential corruption in the form of excessive patronage, nepotism, job reservations, 'favor-for-favors', secret party funding, and suspiciously close ties between politics and business.	1990-2000	**International Country Risk Guide, PRS Group**

Law and order (icrg_laworder)	0 to 6	The Law sub-component is an assessment of the strength and impartiality of the legal system, while the Order sub-component is an assessment of popular observance of the law. Thus, a country can enjoy a high rating – 3 – in terms of its judicial system, but a low rating - 1 – if it suffers from a very high crime rate of if the law is routinely ignored without effective sanction.
Democratic accountability (icrg_account)	0 to 6	Measure of the government's responsiveness to the people. The score depends on the type of regime: Alternating Democracy, Dominated Democracy, De-facto One-party State, or De-jure One-party State. Higher points are given to Alternating Democracies (see ICRG for details).

Index on Regulatory Burden

Components	**Method**
ENTRY	
TRADE	We apply the following standardization formula to each component described above:
FINANCIAL MARKETS	$(X_i-X_{min})/ (X_{max}-X_{min})$ if higher values indicate heavier regulation and
CONTRACT ENFORCEMENT	$(X_{max}-X_i)/ (X_{max}-X_{min})$ if lower values indicate heavier regulation.
BANKRUPTCY	Therefore, all values are distributed between 0 and 1, with higher values denoting heavier regulation.
LABOR REGULATION	
FISCAL BURDEN	Next we take the simple average of the components in each category to get the corresponding partial indicator. The overall index on regulatory burden is the simple average of the partial indicators.

Appendix B

Data used in calibration of industry evolution model

The data used to calculate firm- and productivity dynamics across countries come from Bartelsman, Haltiwanger, and Scarpetta (2005).[1] The data were collected as part of World Bank and OECD projects to obtain harmonized, industry-level indicators of firm dynamics and productivity. The main advantage of harmonized data is that it provides the researcher with comparable measures across countries, and it minimizes (as much as possible) biases due to measurement error. For the calibration of the model and the subsequent comparisons, I use data for the manufacturing sector, for all available years between 1990 and 2001.

Firm demographics

U.S. data come from the Census Business Register, 1990-1996.

Turnover: Firm turnover rates are computed as the sum of entering and exiting firms at time t, divided by the total number of firms at t, where entering firms are defined as firms that were not observed in $t-1$, but are observed in t and $t+1$. Employment-weighted turnover is the sum of employment in entering and exiting firms at time t, divided by total employment at t. I exclude one-year firms, as well as firms with less than 1 employee.

Size distribution: Calculated as the share of firms in each size category (<20,$20-49$,$50-99$,$100-499$, and 500+) with respect to the total number of firms, excluding firms with zero employees. The size-employment distribution, is calculated as the share of employment in each size category.

Productivity

U.S. data come from the Economic Census, 1992 and 1998. TFP is measured as the (log of) deflated output (measured as value added, deflated using 4-digit level price deflators), minus weighted (log of) labor and capital. Weights are industry-specific and common to all countries, and they are

[1] Because their study describes the data in great detail, I only highlight the relevant features of the data for this paper, and refer the interested reader to the original study.

calculated as the average expenditure shares of inputs in the OECD STAN database (alternatively, some calculations are based on country-specific weights). To mitigate the problem of having different units of measurement, the units of capital are adjusted with a multiplicative factor, such that value added minus payroll reflects a return to capital of eight percent.

Average and dispersion of TFP: Let A be the universe of firms, N the set of entering firms, defined as the set of firms that are observed in t, but not in $t-5$; C the set of continuing firms, defined as the set of firms that are observed both in t and in $t-5$; and X the set of exiting firms, defined as the set of firms that are observed in t, but not in $t+5$. Define w_i as the share of firm i in the industry (e.g., value added, or output share); and let *input* be the sum of input value at the firm level. Then, the un-weighted mean for entrants (similarly, continuers and exiting firms) is equal to

$$\frac{1}{N}\sum_{e\subset N}\log(TFP)_{e,t}$$

and dispersion is measured as the simple standard deviation of $\log(TFP)_{e,t}$. The weighted mean is equal to

$$\frac{1}{N}\sum_{e\subset N}\left(\frac{w_{e,t}input_{e,t}}{\sum_{i\subset A}w_{i,t}input_{i,t}}\right)\log(TFP)_{e,t}$$

R&D to sales ratio: Data come from the National Science Foundation (2000). It is the ratio of total R&D expenditures to net sales of R&D performing companies in manufacturing, in 2000 (measured in current dollars).

BIBLIOGRAPHY

[1] Aghion, Philippe and Peter Howitt, 1992. "A Model of Growth Through Creative Destruction," *Econometrica*, Vol. 60(2), 323-351.

[2] Aghion, Philippe, Christopher Harris, Peter Howitt and John Vickers, 2001. "Competition, Imitation, and Growth, with Step-by-Step Innovation" *Review of Economic Studies*, Vol. 68, 467-492.

[3] Aghion, Philippe, Robin Burgess, Stephen Redding and Fabrizio Zilibotti, 2005. "Entry Liberalization and Inequality in Industrial Performance," mimeo, Harvard-LSE-IIES.

[4] Ahn, Sanghoon, 2001. "Firm Dynamics and Productivity Growth: a Review of Micro Evidence From the OECD," OECD Economics Department.

[5] Ahn, Sanghoon, 2002. "Competition, Innovation and Productivity Growth: a Review of Theory and Evidence," OECD Economics Department Working Paper 317.

[6] Alesina, Alberto, Silvia Ardagna, Giuseppe Nicoletti and Fabio Schiantarelli, 2003. "Regulation and Investment," NBER Working Paper No. 9560.

[7] Alonso-Borrego, César, Jesús Fernández-Villaverde and José E. Galdón-Sánchez, 2005. "Evaluating Labor Market Reforms: A General Equilibrium Approach," NBER Working Paper No. 11519.

[8] Aw, Bee Yan, Xiaomin Chen and Mark J. Roberts, 2001. "Firm-level Evidence on Productivity Differentials and Turnover in Taiwanese Manufacturing," *Journal of Development Economics*, Vol. 66(1), 51-86.

[9] Barnes, Matthew, Jonathan Haskel and Mika Maliranta, 2001. "The Sources of Productivity Growth: Micro-level Evidence for the OECD," mimeo, Queen Mary, University of London.

[10] Barro, Robert and Jong-Wha Lee, 2000. "International Data on Educational Attainment: Updates and Implications," NBER Working Paper No. 7911.

[11] Bartelsman, Eric and Mark Doms, 2000. "Understanding Productivity: Lessons from Longitudinal Micro Datasets," *Journal of Economic Literature*, Vol. 38(3), 569-94.

[12] Bartelsman, Eric, John Haltiwanger and Stefano Scarpetta, 2004. "Microeconomic Evidence of Creative Destruction in Industrial and Developing Countries," Background Paper for the WDR 2005, The World Bank, Washington DC.

[13] ———————————, 2005. "Measuring and Analyzing Cross-Country Differences in Firm Dynamics," mimeo, University of Maryland and World Bank.

[14] Bartelsman, Eric, Stefano Scarpetta and Fabiano Schivardi, 2003. "Comparative Analysis of Firm Demographics and Survival: Micro-level Evidence for the OECD Countries," OECD Economics Department Working Paper NO. 348.

[15] Bassanini, Andrea and Ekkehard Ernst, 2002. "Labor Market Institutions, Product Market Regulations and Innovation: Cross Country Evidence," OECD Economics Department Working Paper 316.

[16] Basu, Susanto, John Fernald, and Miles Kimball, 1998. "Are Technology Improvements Contractionary?," NBER Working Paper No. 10592.

[17] Baxter, Marianne and Robert King, 1999. "Measuring Business Cycles: Approximate Band-Pass Filters for Economic Time Series," *Review of Economics and Statistics*, Vol. 81(4), 575-93.

[18] Bayoumi, Tamim, Douglas Laxton and Paolo Pesenti, 2004. "Benefits and Spillovers of Greater Competition in Europe: a Macroeconomic Assessment," Federal Reserve Bank of New York Staff Report 182.

[19] Bergara, Mario and Andrés Pereyra, 2005. "El Proceso de Diseño e Implementación de Políticas y las Reformas en los Servicios Públicos," mimeo, Inter-American Development Bank.

[20] Bergoeing, Raphaël, Andrés Hernando and Andrea Repetto, 2005. "Market Reforms and Efficiency Gains in Chile," CEA Working Paper, Universidad de Chile.

[21] Bergoeing, Raphaël, Norman Loayza and Andrea Repetto, 2004. "Slow Recoveries," NBER Working Paper No. 10584.

[22] Berkowitz, Jeremy and Michelle J. White, 2002. "Bankruptcy and Small Firms' Access to Credit," NBER Working Paper No. 9010.

[23] Bernard, Andrew B., Jonathan Eaton, J.B. Jensen, and Samuel Kortum, 2003. "Plants and Productivity in International Trade," *American Economic Review*, Vol. 93(4), 1268-1290.

[24] Bertola, Giuseppe and Richard Rogerson, 1997. "Institutions and Labor Reallocation," *European Economic Review*, Vol. 41, 1147-1171.

[25] Blanchard, Olivier and Francesco Giavazzi, 2001. "Macroeconomic Effects of Regulation and Deregulation in Goods and Labor Markets," NBER Working Paper No. 8120.

[26] Blanchard, Olivier and Justin Wolfers, 2000. "Shocks and Institutions in the Rise of European Unemployment: the Aggregate Evidence," *Economic Journal* 100, 1-33.

[27] Blanchard, Olivier, 2004. "The Economic Future of Europe," forthcoming in *Journal of Economic Perspectives*.

[28] Bolaky, Bineswaree and Caroline Freund, 2004. "Trade, Regulations, and Growth," Working Paper 3255, The World Bank, Washington DC.

[29] Bond, Eric, James Tybout and Hâle Utar, 2005. "Industrial Evolution in Crisis-Prone Economies," mimeo, Pennsylvania State University.

[30] Botero, Juan, Simeon Djankov, Rafael La Porta, Florencio Lopez-de-Silanes and Andrei Shleifer, 2004. "The Regulation of Labor," NBER Working Paper No. 9756.

[31] Brandt, N., 2004. "Business dynamics in Europe", STI Working Paper 2004/1.

[32] Business Risk Service Operations Risk Index, 2001-2003. Business Environment Risk Intelligence (BERI), S.A.

[33] Caballero, Ricardo and Mohamad Hammour, 1994. "The Cleansing Effect of Recessions," *American Economic Review*, Vol. 84, 1350-68.

[34] ———————————, 1996. "On the Timing and Efficiency of Creative Destruction", *Quarterly Journal of Economics*, Vol. 111(3), 805-852.

[35] ———————————, 1998. "The Macroeconomics of Specificity", *Journal of Political Economy*, Vol. 106, 724-767.

[36] Caballlero, Ricardo J., Eduardo Engel and Alejandro Micco, 2004. "Microeconomic flexibility in Latin America," NBER Working Paper No. 10398.

[37] Card, David and Richard B. Freeman, 2002. "What have two decades of British economic reform delivered?" NBER Working Paper No. 8801.

[38] CEPR-IFS, 2003. "The Link Between Product Market Reform and Macroeconomic Performance," final report ECFIN-E/2002.002.

[39] Cincera, M. and O. Galgau, 2005. "Impact of market entry and exit on EU productivity and growth performance", European Economy Economic Papers No. 222.

[40] Claessens, Stijn and Leora Klapper, 2002. "Bankruptcy Around the World: Explanations of its Relative Use," World Bank Working Paper No. 2865, The World Bank, Washington DC.

[41] Cook, R. Dennis, 1979. "Influential Observations in Linear Regression," *Journal of the American Statistical Association*, Vol. 74, 169 -174.

[42] Cooper, Russell and John Haltiwanger, 2005. "On the Nature of Capital Adjustment Costs," NBER Working Paper No. 7925.

[43] Davis, Steven and John Haltiwanger, 1999. "Gross Job Flows," *Handbook of Labor Economics*, Volume 3B, 1999, 2711-2805, Handbooks in Economics, Vol. 5. Amsterdam; New York and Oxford: Elsevier Science, North-Holland.

[44] De Soto, Hernando, 1989. *The Other Path: The Invisible Revolution in the Third World*, HarperCollins.

[45] Djankov, Simeon, Oliver Hart, Tatiana Nenova, and Andrei Shleifer, July 2003. "Efficiency in Bankruptcy," Working Paper, Department of Economics, Harvard University.

[46] Djankov, Simeon, Rafael La Porta, Florencio Lopez-de-Silanes and Andrei Shleifer, 2002. "The Regulation of Entry," *Quarterly Journal of Economics*, 117, pp. 1-37.

[47] Djankov, Simeon, Rafael La Porta, Florencio Lopez-de-Silanes and Andrei Shleifer, 2003. "Courts," *Quarterly Journal of Economics*.

[48] Doing Business, The World Bank, Washington DC. http://rru.worldbank.org/doingbusiness

[49] Dunne, Timothy, Mark Roberts and Larry Samuelson, 1989. "The Growth and Failure of U.S. Manufacturing Plants," *Quarterly Journal of Economics*, Vol.104(4), 671-98.

[50] Dutz, Mark A. and Aydin Hayri, 1999. "Does More Intense Competition Lead to Higher Growth?" CEPR Discussion Paper 2249.

[51] Easterly, William and Ross Levine, 1997. "Africas Growth Tragedy," *Quarterly Journal of Economics* 112, 1203-1250.

[52] Economist Intelligence Unit, 2005. "Regulatory Risk: Trends and Strategies for the CRO."

[53] Ericson, Richard and Ariel Pakes, 1995. "Markov-Perfect Industry Dynamics: A Framework for Empirical Work," *The Review of Economic Studies*, Vol. 62, 53-82.

[54] Eslava, Marcela, John Haltiwanger, Adriana Kugler and Maurice Kugler, 2004. "The Effect of Structural Reforms on Productivity and Profitability Enhancing Reallocation: Evidence from Colombia," *Journal of Development Economics*, Vol. 75, 333-371.

[55] ———————————, 2005(a). "Plant Survival, Market Fundamentals and Trade Liberalization," mimeo.

[56] ———————————, 2005(b). "Factor Adjustments After Deregulation: Panel Evidence from Colombian Plants," NBER Working Paper No. 11656.

[57] Forteza, Alvaro and Martn Rama, 2001. "Labor Market Rigidity and the Success of Economic Reforms across More than 100 Countries," Paper No. 2521, World Bank Country Economics Department, The World Bank, Washington DC.

[58] Foster, Lucia, John Haltiwanger and C.J. Krizan, 2001. "Aggregate Productivity Growth: Lessons from Microeconomic Evidence," in *New Developments in Productivity Analysis*, Hulten, Dean and Harper (eds), NBER Studies in Income and Wealth, Vol. 63, Chicago Press.

[59] Foster, Lucia, John Haltiwanger and Chad Syverson, 2005. "Reallocation, Firm Turnover, and Efficiency: Selection on Productivity or Profitability?," NBER, Working Paper No. 11555.

[60] Fox, John, 1997. *Applied Regression Analysis, Linear Models, and Related Methods*. Sage Publications.

[61] Griffith, Rachel and Rupert Harrison, 2004. "The link between product market reform and macroeconomic performance", European Economy Economic Papers No. 209.

[62] Griliches, Zvi and Haim Regev, 1995. "Productivity and Firm Turnover in Israeli Industry: 1979-1988," NBER Working Paper No. 4059

[63] Gwartney, James and Robert Lawson, 2002. *Economic Freedom of the World* - 2002 Annual Report, The Fraser Institute.

[64] Hallward-Driemeier, Mary and David Stewart, 2004. "How Do Investment Climate Conditions Vary Across Countries, Regions and Types of Firms?," background paper prepared for the *World Development Report*. The World Bank, Washington, DC.

[65] Haltiwanger, John, 2000. "Aggregate Growth: What Have We Learned from the Microeconomic Evidence?" OECD Economics Department Working Paper 267.

[66] Haltiwanger, John, Ron Jarmin and Thorsten Schank, 2003. "Productivity, Investment in ICT and Market Experimentation: Micro Evidence from Germany and the U.S," Friedrich-Alexander Universit´at Erlangen-N´urnberg, Lehrstuhl f´ur Arbeitsmarkt- und Regionalpolitik, Diskussionspapier Nr. 19.

[67] Haltiwanger, John, Stefano Scarpetta and Helena Schweiger, 2006. "The Relationship Between Job Flows Across Countries: The Role of Industry, Size and Institutions," mimeo, University of Maryland and The World Bank.

[68] Heckman, James and Carmen Pagés, 2000. "The Cost of Job Security Regulation: Evidence from Latin American Labor Markets," NBER Working Paper 7773.

[69] Hopenhayn, Hugo, 1992. "Entry, Exit, and Firm Dynamics in Long Run Equilibrium," *Econometrica*, Vol. 60(5), 1127-1150.

[70] Hopenhayn, Hugo and Richard Rogerson, 1993. "Job Turnover and Policy Evaluation: A General Equilibrium Analysis," *Journal of Political Economy*, Vol. 101(5), 915-38.

[71] International Country Risk Guide ICRG, 1999. Brief guide to the rating system. ICRG, http://www.icrgonline.com

[72] Investment Climate Survey, 2004. The World Bank, Washington DC.

[73] Jovanovic, Boyan, 1982. "Selection and the Evolution of the Industry," *Econometrica*, Vol. 50(3), 649-670.

[74] Kaufmann, Dani, Aart Kraay and Pablo Zoido-Lobatn, 1999. "Governance Matters," Policy Research Working Paper No. 2196, The World Bank, Washington, DC.

[75] Klapper, Leora, Luc Laeven and Raghuram Rajan, 2004. "Business Environment and Firm Entry: Evidence from International Data," NBER Working Paper No. 10380.

[76] Koedijk, Kees and Jeroen Kremers, 1996. "Market Opening, Regulation and Growth in Europe," *Economic Policy*, Vol. 23, 445-467.

[77] KPMG, Corporate Tax Rate Survey, March 1998 January 2003.

[78] Krusell, Per and Anthony Smith, 1998. "Income and Wealth Heterogeneity in the Macroeconomy," *Journal of Political Economy*, Vol. 106(5), 867-896.

[79] Kugler, Adriana, 2000. "The Incidence of Job Security Regulations on Labor Market Flexibility and Compliance in Colombia: Evidence from the 1990 Reform," Inter-American Development Bank, Research Network Working Paper No. R-393.

[80] La Porta, Rafael, Florencio López-de-Silanes, Andrei Shleifer and Robert Vishny, 1999. "The Quality of Government," *The Journal of Law, Economics, and Organization* 15, pp. 229-79.

[81] Lambson, Val E., 1991. "Industry Evolution With Sunk Costs And Uncertain Market Conditions," *International Journal of industrial Organization*, Vol.9, 171-196.

[82] Loayza Norman, Pablo Fajnzylber and César Calderón, 2004. "Economic Growth in Latin America and the Caribbean," mimeo, The World Bank, Washington DC.

[83] Loayza, Norman, Ana María Oviedo and Luis Servén, 2006. "The Impact of Regulation on Growth and Informality: Cross-Country Evidence", in *Linking the Formal and Informal Economy: Concepts and Policies*, WIDER Studies in Development Economics, Oxford University Press.

[84] Melitz, Marc J., 2003. "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity," *Econometrica*, Vol. 71(6), 1695-1725.

[85] Micco, Alejandro and Carmen Pagés, 2004. "Employent Protection and Gross Job Flows: A Differences-in-Differences Approach," Research Dept. Working Paper 508, Inter-American Development Bank, Washington DC.

[86] National Science Foundation, Division of Science Resources Statistics, 2003. "Research and Development in Industry: 2000," NSF 03-318, Project Officer, Raymond M. Wolfe (Arlington, VA).

[87] Nicoletti, Guiseppe, R.C.G. Haffner, Stephen Nickell, Stefano Scarpetta and G. Zoega, 2001 (a). "European Integration, Liberalization, and Labor Market Performance," in Nicoletti, Guiseppe, Stefano Scarpetta and Olivier Boylaud, 2000 *Summary Indicators of Product Market Regulation With an Extension to Employment Protection Legislation*, Economics Department Working Paper No. 226, Organisation for Economic Co-operation and Development.

[88] Nicoletti Guiseppe, Andrea Bassanini, Ekkehard Ernst, Sbastien Jean, Paulo Santiago and Paul Swaim, 2001 (b). "Product and Labor Markets Interactions in OECD Countries," OECD Economics Department Working Paper 312.

[89] Nicoletti, Guiseppe, Stefano Scarpetta and Olivier Boylaud, 2000. "Summary Indicators of Product Market Regulation With an Extension to Employment Protection Legislation," Economics Department Working Paper No. 226, Organisation for Economic Co-operation and Development.

[90] Nicoletti, Guiseppe and Stefano Scarpetta, 2003. "Regulation, Productivity and Growth: OECD Evidence," *Economic Policy* 9-72.

[91] O'Driscoll, Gerald, Edwin Feulner and Mary Anastasia O'Grady, 2003. 2003 *Index of Economic Freedom*, The Heritage Foundation and The Wall Street Journal.

[92] Olley, G. Steven and Ariel Pakes, 1996. "The Dynamics of Productivity in the Telecommunications Equipment Industry," *Econometrica*, Vol.64(6), 1263-97.

[93] Ouyang, Min, 2004. "The Scarring Effect of Recessions," mimeo, University of Maryland.

[94] Oviedo, Ana María, 2004. "The Burden of Regulation on Young Firms: A Cross-Country Evaluation," mimeo, University of Maryland.

[95] Pakes Ariel and Paul McGuire, 1994. "Computing Markov-Perfect Nash Equilibria: Numerical Implications of a Dynamic Differentiated Product Model," *The RAND Journal of Economics*, Vol. 25 No. 4, 555-589.

[96] Parente, Stephen and Edward Prescott, 1994. "Barriers to Technology Adoption and Development," *Journal of Political Economy*, Vol. 102(2), 298-321.

[97] Pavcnik, Nina, 2002. "Trade Liberalization, Exit, and Productivity Improvement: Evidence from Chilean Plants," *Review of Economic Studies*, Vol.69(1), 245-76.

[98] Rajan, Raghuram and Luigi Zingales, 1998. "Financial Dependence and Growth," *The American Economic Review*, Vol. 88, 559-586.

[99] Rama, Martin and Raquel Artecona, 2002. "A Database of Labor Market Indicators Across Countries, unpublished," The World Bank, Washington DC.

[100] Roberts, Mark J. and James R. Tybout (eds), *Industrial Evolution in Developing Countries*, 1996. The World Bank, Oxford University Press.

[101] Schiantarelli, Fabio, 2005. "Product Market Regulation and Macroeconomic Performance: A Review of Cross-Country Evidence," mimeo, Boston College.

[102] Schuh, Scott and Robert Triest, 1998. "Job Reallocation and the Business Cycle: New Facts for an Old Debate," in *Beyond Shocks: What Causes Business Cycles?* Proceedings from the Federal Reserve Bank of Boston Conference Series No. 42.

[103] Shleifer, Andrei and Robert Vishny, 1993. "Corruption," *Quarterly Journal of Economics*, Vol. 108, No. 3 (August), pp. 599-617.

[104] The World Bank, 2003. *World Development Indicators*. Washington DC.

[105] The World Bank, 2005. *World Development Report 2005: A Better Investment Climate For Everyone*, Washington, DC.

[106] Tybout, James R., 1999. "Manufacturing Firms in Developing Countries: How Well Do They Do, And Why?," mimeo, Pennsylvania State University.