Volume Title: Producer Dynamics: New Evidence from Micro Data

Volume Author/Editor: Timothy Dunne, J. Bradford Jensen, and Mark J. Roberts, editors

Volume Publisher: University of Chicago Press

Volume ISBN: 978-0-226-17256-9

Volume URL: http://www.nber.org/books/dunn05-1

Conference Date: April 8-9, 2005

Publication Date: January 2009

Chapter Title: Measuring and Analyzing Cross-country Differences in Firm Dynamics

Chapter Author: Eric Bartelsman, John Haltiwanger, Stefano Scarpetta

Chapter URL: http://www.nber.org/chapters/c0480

Chapter pages in book: (15 - 76)

1

Measuring and Analyzing Cross-Country Differences in Firm Dynamics

Eric Bartelsman, John Haltiwanger, and Stefano Scarpetta

1.1 Introduction

Cross-country comparisons and analysis of firm dynamics are inherently interesting, but also inherently difficult. Such comparisons are important because they provide insights into the efficiency with which resources are allocated in the economy and its effects on output, productivity, and employment. Empirical evidence for developed economies shows that healthy market economies typically exhibit a high pace of churning of outputs and inputs across businesses.[1] Moreover, the evidence shows that this churning is productivity enhancing as outputs and inputs are being reallocated from less productive to more productive businesses. These findings raise the question as to whether differences in economic performance across countries can be accounted for by differences in the efficiency of the churning process across countries. A closely related question is whether certain regulations and institutions in different markets affect the churning

Eric Bartelsman is a professor of economics at the VU Amsterdam, and a research fellow of the Tinbergen Institute. John Haltiwanger is a professor of economics at the University of Maryland, and a research associate of the National Bureau of Economic Research. Stefano Scarpetta is Head of the Country Studies Division III in the Economics Department of the Organization for Economic Cooperation and Development (OECD), and a Research Fellow and Deputy Program Director at IZA.

We would like to thank our discussant Timothy Dunne and the participants to the 2005 NBER Conference on Research on Income and Wealth on "Producer Dynamics: New Evidence from Micro Data" (April, Washington, D.C.) for insightful and useful comments. We are grateful to the World Bank for financial support of this project and to Karin Bouwmeester, Helena Schweiger, and Victor Sulla for excellent research assistance. The views expressed in this chapter are those of the authors and should not be held to represent those of the institutions of affiliation.

1. See Caves (1998), Bartelsman and Doms (2000); Ahn (2000); and Foster, Haltiwanger, and Krizan (2001) for surveys.

process in a manner that slows the reallocation of resources towards more productive uses.

In this chapter, we adopt the working hypothesis that policy and institutions affecting the business climate (broadly defined) may have important implications for the magnitude but also the effectiveness of firm dynamics and resource reallocation. While individual country studies can provide important insights into this issue by looking at within-country variation in performance of sectors or individual firms, another way to test the hypothesis is to link firm performance across countries that differ in their regulatory and policy settings. This strategy, however, involves an ongoing measurement and research agenda to develop comparable measures of firm dynamics across countries that can be directly related to business climate conditions. The interest in this type of analyses is rapidly spreading beyond the industrial countries and involves many developing and emerging economies that are struggling with regulatory reforms to stimulate private investment and productivity growth.[2]

In principle, using firm-level data to assess cross-country differences in economic performance is attractive. It avoids some of the problems typically affecting macro analyses. For example, interpreting the observed persistent differences in income per capita across countries or even growth rates of GDP and productivity has been a challenge for a long time. This is not because of the lack of candidate explanations, but rather because of the overwhelming number of possible factors. As such, the finding of a statistically significant correlation between cross-country differences in economic performance and any possible policy, institutional, or structural variable is fraught with problems of interpretation given the (many) omitted variables.[3] It is misleading to argue that the firm dynamics approach overcomes the omitted variable and associated unobserved heterogeneity problems that afflict macro analyses. But the firm-level approach potentially offers a tighter theoretical link between specific institutional measures and relevant outcomes. For example, indicators of firm dynamics allow testing whether regulatory distortions that impinge on entry costs indeed affect the pace and nature of firm entry.

In practice, cross-country comparisons of measures of firm dynamics suffer from significant definitional and measurement problems. Changes at the firm level take different forms, and no single indicator is likely to capture this complexity in a way that can be related to all regulatory or insti-

2. A number of works have recently explored the role of firm dynamics for productivity and growth in developing and emerging economies. They include Eslava et al. (2004); Roberts and Tybout (1997); Aw, Chung, and Roberts (2003); and Brown and Earle (2004).

3. This explains the difficulty in obtaining robust empirical results from macro growth regressions (e.g., Barro and Sala-i-Martin [1995] and Doppelhofer, Miller, and Sala-i-Martin [2004]). See Scarpetta (2004) for recent attempts at estimating macro growth regressions for the OECD countries.

tutional issues in a meaningful way. This conceptual problem is often confounded by measurement problems induced by cross-country differences in coverage, unit of observation, classification of activity, and data quality.

The combination of conceptual and measurement problems can be illustrated by considering the most basic measures of firm dynamics—the rates of firm entry and exit—and comparing them across countries with indicators of economic performance. Figure 1.1 shows the rank ordering of countries according to gross firm turnover (entry plus exit rates) and GDP per capita levels and growth rates.[4] We consider these rank orderings for a set of countries for which we have harmonized statistics on firm turnover rates. The rank ordering of GDP per capita levels and growth rates are quite plausible. But while the rough order of magnitude reported in figure 1.1 for firm turnover is also reasonable, the rank ordering across countries of the firm turnover rates is more difficult to interpret. Relatively 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).[5] We argue in the chapter that this is because it is not clear whether there is an unequivocal relationship between firm turnover and economic performance, but also because there could be measurement problems that affect the cross-country comparisons of firm turnover.

In this chapter, we review the measurement and analytical challenges of handling firm-level data so as to provide a user's guide on how to construct and how to compare measures of firm dynamics across countries. In broad terms, we have three basic messages. First, it is very important to make every attempt to harmonize the indicators of firm dynamics by imposing the same metadata requirements and aggregation methods on the raw firm-level data. Second, while harmonization is necessary, it is far from sufficient. As illustrated in figure 1.1, some core cross-country comparisons will not only be problematic because of remaining possible measurement problems, but also because some firm-level indicators cannot be unequivocally linked to better or worse economic performance. However, the third message is that there are ways to overcome at least some of the measurement problems. While the details differ depending on the type of measure and question of interest, we show that by using measurement or analytic methods that amount to some form of *difference-in-difference* approach, the problems we identify can be significantly reduced.

The chapter proceeds as follows. In section 1.2, we describe our *distrib-*

4. This chapter draws on firm-level indicators for a sample of countries that participated in the distributed micro-data analysis. We made every attempt to harmonize the statistics by providing detailed protocols and programs to researchers with access to the confidential micro-level data sets in their countries. The indicators in our database are built up from these (confidential) micro-level sources.

5. Note that the correlation between firm turnover and the GDP/capita measures is low (–0.22 using GDP per capita levels; and 0.18 using GDP per capita growth).

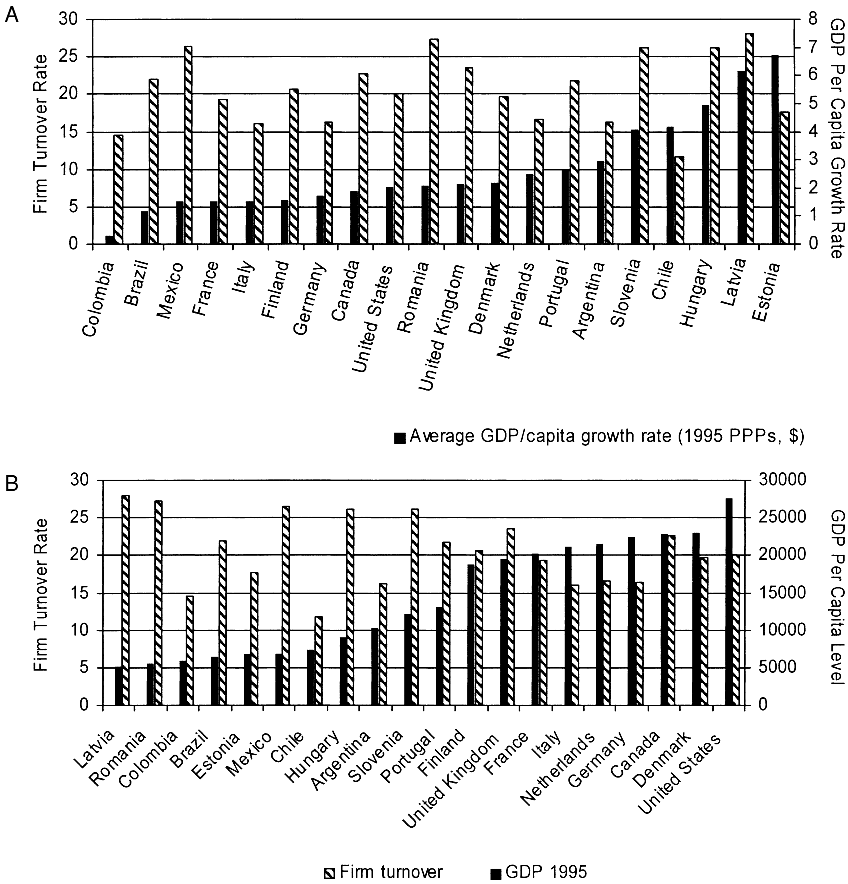


Fig. 1.1 Comparisons of GDP per capita growth and firm turnover: *A*, GDP per capita and firm turnover, 1996; *B*, GDP per capita growth and firm turnover, 1990–2003

Note: For transition economies (Estonia, Latvia, Hungary, Romania, and Slovenia) 1996–2003

uted micro-data analysis that we advocate and have used in our cross-country comparison project. As we make clear, the problems illustrated in figure 1.1 are much worse if there is not an attempt at harmonization. In section 1.3, we describe the data collected in the World Bank and Organization for Economic Cooperation and Development (OECD) firm-level projects. In section 1.4, we provide a canonical representation of the possible sources of measurement problems in using firm-level statistics for comparative purposes. We use this representation to help us think through what types of comparisons are likely to be robust and what types of comparisons will not be robust to measurement error of different types. Sections 1.5 and 1.6 explore cross-country comparisons that can be made using our harmonized data. We present basic facts from these data, which are of interest in their own right, but discuss them in light of the measurement challenges we have described. In section 1.5, we first present the distribution of firms by size; we then document the magnitude and key features of firm dynamics (entry and exit of firms) and, finally, we study post-entry performance of different cohorts of new firms. In section 1.6 we analyze the effectiveness of creative destruction for productivity growth. We distinguish between the productivity contribution coming from the process of creative destruction (entry and exit of firms) to that stemming from within-firm efficiency improvements and reallocation of resources across incumbents. In the last section, 1.7, we draw conclusions and discuss next steps for this approach for cross-country comparisons of firm dynamics. In this discussion, we present some ideas of the dos and don'ts of working with firm-level data for purposes of constructing and analyzing cross-country measures of firm dynamics.

1.2 Distributed Micro-Data Analysis

The indicators used for cross-country comparisons in this chapter have been collected by a network of researchers with access to (confidential) micro data. The construction of the indicators in each country followed a common methodology and led to a cross-country harmonized metadata. This collection method is an attempt at the generation of comparable cross-country statistics. It is part of a long tradition of statistical harmonization that has resulted in a wide variety of cross-country sources of economic data, ranging from national accounts information to internationally harmonized surveys. Over the past decades, much institutional effort has been devoted to harmonize national accounts data across countries in order to allow meaningful cross-country comparisons. While the nominal and real indicators of GDP available in each country's national accounts are generally comparable over time, divergence between exchange rates and purchasing power have often clouded cross-country comparisons. Several sources (including the OECD for its member countries and the World Bank for a larger set of countries) now provide Purchasing Power Parity indicators (PPPs) to convert various expenditure components of GDP into internationally comparable units.

Significant efforts have also been made to produce comparable statistics at *the sectoral level* (e.g., the OECD Structural Analysis database—STAN—the United Nations Industrial Development Organization [UNIDO], and more recently, the EUKLEM databases). While the main underlying sources of these data are sectoral disaggregations from national accounts, other sources such as labor accounts and production statistics are generally used to fill holes. Essentially, these data sets are top down, in that sectoral output and compensation add up to national accounts totals, up to various adjustments (such as owner-occupied housing, etc.). These adjustments are often not well known, and applied researchers using these data (Bernard and Jones 1996a; Griffith, Redding, and Van Reenen 2000; Nicoletti and Scarpetta 2003) generally take these sectoral data as given.

Comparable micro-level data sets are even less frequent, and comparability issues are generally more severe. However, several attempts have been made to harmonize household panel surveys and labor force surveys to improve cross-country comparability. The Luxembourg Income Study, the European Community Household Panel (ECHP), or the Integrated Public Use Microdata Series (IPUMS) data sets are all examples of this effort to compile and use comparable micro data sets. Standardized Labor Force Surveys, following International Labour Organization (ILO) definitions, are also available for a large set of countries.

At the *firm-level*, no comprehensive survey exists with data for multiple countries, nor are there international data sets that contain micro-level data for comprehensive samples of firms.[6] The EU Statistical Office (EUROSTAT) has recently made a major effort in assembling a data set on firm demographics for a number of EU member countries, using common definitions and classifications.[7] The data collection is based on existing data sources and some idiosyncrasies in the data cannot be eliminated. At the same time, the World Bank has been collecting data on relatively small samples of firms in more than fifty developing and emerging economies worldwide (World Bank 2004).[8] These data are often limited to a few industries and do not allow tracking firm dynamics.

1.2.1 How to Collect and Compare Firm-Level Data

A data set consisting of stacked micro-level data sets from multiple countries will contain the necessary information lacking from either single-country micro data sets or multiple-country sectoral data sets. Unfortunately, owing to the legal requirement of maintaining confidentiality of firms' responses in many countries, micro data sets from individual countries cannot be stacked for analysis. Creating public use data from the underlying sources is a possible workaround for disseminating otherwise confidential data. For firm-level data, a public-use data set made through

6. Commercially published data sets such as Compustat or Amadeus provide panel data on financial information of publicly traded corporations.

7. See EUROSTAT (2004). The Eurostat data focus on eleven European countries over the period 1997–2000, and considers all firms, including those with zero employees.

8. This data collection is based on Investment Climate Assessment (ICA) surveys, including information on firm characteristics and performance as well as perceptions of managers about the regulatory and political environment in which they operate. A discussion of the advantages and disadvantages of the alternative approaches as well as the relationship on key findings from the ICA data set versus the type of firm-level data used here is provided in Haltiwanger and Schweiger (2004). Recent works that have used the ICA data to study firm performance include Bastos and Nasir (2004), Dollar, Hallward-Driemeier, and Mengistae (2003), Hallward-Driemeier, Wallsten, and Xu (2003).

randomization or micro-aggregation is often not feasible without the loss of necessary information.

Another possible work-around is to create a data set consisting of results from single-country studies that become the input for a meta-analysis. For example, a collection of results from single-country studies on the link between Information and Communication Technology (ICT) and growth at the firm-level were presented in a recent volume of the OECD (2004). However, the combination of results of analyses from single-country studies will not provide a solution if the focus of the analysis is not identical or if methodologies differ significantly.

In the World Bank and OECD firm-level projects, a hybrid approach was followed that mitigates many of the discussed problems. Given the impossibility of stacking together firm-level data for different countries, a common protocol was used to extract from the raw country data set of detailed indicators. The protocol was designed after face-to-face meetings with country experts and collection of metadata describing each country's data sets.[9] The protocol was then run on micro-level data sets in each country separately by experienced researchers. The decentralized output was combined and provided the information necessary for the cross-country analysis. This approach was first developed for the OECD firm-level growth project and is known as distributed micro-data analysis (Bartelsman 2004). It requires tighter coordination and less flexibility in research design in each country than for meta-analysis, where the methodology and output may vary across samples.[10]

The method of *distributed micro-data analysis* maintains the advantages of multicountry studies with aggregated data because the output provided by each country consists of indicators aggregated to a prespecified level of detail that passes disclosure in all countries. The method also maintains information on behavior of agents residing in micro data because the computed indicators on the (joint) distribution of variable(s) are designed to capture hypothesized behavior. While not allowing the full flexibility of re-

9. In addition to the authors of this chapter, the researchers involved in the distributed micro-data analysis network for the various projects are: John Baldwin (Canada); Tor Erickson (Denmark); Seppo Laaksonen, Mika Maliranta, and Satu Nurmi (Finland); Bruno Crépon and Richard Duhautois (France); Thorsten Schank (Germany); Fabiano Schivardi (Italy); Karin Bouwmeester, Ellen Hoogenboom, and Robert Sparrow (the Netherlands); Pedro Portugal Dias (Portugal); Ylva Heden (Sweden); Jonathan Haskel, Matthew Barnes, and Ralf Martin (United Kingdom); Ron Jarmin and Javier Miranda (United States); Gabriel Sánchez (Argentina); Marc Muendler and Adriana Schor (Brazil); Andrea Repetto (Chile); Maurice Kugler (Colombia and Venezuela); David Kaplan (Mexico); John Earle (Hungary and Romania); Mihails Hazans (Latvia); Raul Eamets and Jaan Maaso (Estonia); Mark Roberts (Korea, Indonesia, and Taiwan [China]); Milan Vodopivec (Slovenia).

10. The methodology for the International Wage Flexibility Project (Dickens and Groshen 2003), evolved over time from meta-analysis to a more coordinated system with centralized research protocols, distributed computation, and centralized analysis, and now is very similar to distributed micro-data analysis.

search design available with multicountry stacked micro data, distributed micro-data analysis provides a skilled researcher the ability to use cross-country variation to identify behavioral relationships.

1.3 Description of the Data

The firm-level project organized by the World Bank involves fourteen countries (Estonia, Hungary, Latvia, Romania, Slovenia, Argentina, Brazil, Chile, Colombia, Mexico, Venezuela, Indonesia, South Korea, and Taiwan [China]) This project complements a previous OECD study that collected—along the same procedure—firm-level data for ten industrial countries: Canada, Denmark, Germany, Finland, France, Italy, the Netherlands, Portugal, United Kingdom, and the United States. Both projects use a common analytical framework that involves the harmonization, to the extent possible, of key concepts (e.g., entry, exit, or the definition of the unit of measurement) and the definition of common methods to compute the indicators.

The distributed micro-data analysis was conducted for two separate themes. The first theme focused on firm demographics, and collected indicators such as entry and exit, job flows, size distribution, and firm survival. The second theme gathered indicators of productivity distributions and correlates of productivity. In particular, information was collected on the distribution of labor and/or total factor productivity by industry and year, and on the decomposition of productivity growth into within-firm and reallocation components. Further, information was collected on the averages of firm-level variables by productivity quartile, industry, and year. The key features of the micro-data underlying the analysis are as follows:

Unit of observation: Data used tend to conform to the following definition (EUROSTAT 1998): "an organizational unit producing goods or services which benefits from a certain degree of autonomy in decision-making, especially for the allocation of its current resources." Generally, this will be above the establishment level. However, firms that have operating units in multiple countries will have at least one unit counted in each country. Of course, it may well be that the national boundaries that generate a statistical split-up of a firm in fact split a firm in a real sense as well. Also related to the unit of analysis is the issue of mergers and acquisitions. Only in some countries does the business register keep close track of such organizational changes within and between firms. In addition, ownership structures themselves may vary across countries because of tax considerations or other factors that influence how business activities are organized within the structure of defined legal entities.

Size threshold: While some registers include even single-person businesses (firms without employees), others omit firms smaller than a certain size, usually in terms of the number of employees (businesses without employees), but sometimes in terms of other measures such as sales (as is the case in the data for France). Data used in this study exclude single-person businesses.[11] However, because smaller firms tend to have more volatile firm dynamics, remaining differences in the threshold across different country data sets should be taken into account in the international comparison.[12]

Period of analysis: Firm-level data are on an annual basis, with varying time spans covered.

Sectoral coverage: Special efforts have been made to organize the data along a common industry classification (ISIC Rev.3) that matches the OECD-STAN database. In the panel data sets constructed to generate the tabulations, firms were allocated to one STAN sector that most closely fit their operations over the complete time span. In countries where the data collection by the statistical agency varied across major sectors (e.g., construction, industry, services), a firm that switched between major sectors could not be tracked as a continuing firm but ended up creating an exit in one sector and an entry in another. For industrial and transition economies, the data cover the entire nonagricultural business sector, while for most of Latin America and East Asia data cover the manufacturing sector only.

Unresolved data problems: An unresolved problem relates to the artificiality of *national boundaries* to a business unit. As an example, say that the optimal size of a local activity unit is reached when it serves an area with ten million inhabitants. In smaller nations, one activity unit must be supported by the administrative activities of a business unit. If the EU boundaries were to disappear, the business unit could potentially serve twenty-seven activity units. This geographic consideration may contribute to explain why we observe a larger average firm size in a country like the United States in our sample, although this is not the case in another large country, Brazil. From a policy perspective, this difference may point towards aligning regulations in a manner that would allow busi-

11. The share of firms without employees is large in most countries for which data are available (see EUROSTAT 2004). Their inclusion in the analysis of firm demographics is problematic for a number of reasons, however. Zero employee firms may include part-time activities and formally self-employed people who work regular hours on a long-term basis for a sole client, thus appearing more like dependent employees for most purposes. To the extent that people involved in this false self-employment have little intention to expand their business or innovate, they are of limited interest for studies investigating the role of the entrepreneurial process for technological change, employment growth, and economic performance. In some countries/sectors, the amount of false self-employment may be quite sizeable, and possibly depends on different regulations affecting hiring and firing costs as well as taxes on labor use.

12. The productivity data are collected at different levels of aggregation in different countries and very few are able to work at more than one level. A sensitivity analysis of the productivity decompositions suggests, however, that this issue does not significantly affect the results.

ness units to enjoy transnational scale economies in meeting administrative requirements. Also related to the unit of analysis is the issue of *mergers and acquisitions*: only in some countries business registers have been keeping track of such organizational changes within and between firms in the most recent years.

1.3.1 The Source of the Data: Firm Demographics

The analysis of firm demographics is based on business registers (Canada, Denmark, Finland, Netherlands, United Kingdom, United States, Estonia, Latvia, Romania, and Slovenia), social security databases (Argentina, Germany, Italy, and Mexico), or corporate tax roles (France, Hungary) (table 1.1). Enterprise census data were used for Brazil, Korea, and Taiwan (China), while annual industry surveys—albeit generally not the best source for firm demographics, owing to sampling and reporting issues, were used for Chile, Colombia, and Venezuela. Data for Portugal are drawn from an employment-based register containing information on both establishments and firms, while data for the three East Asian countries are from census of manufacturing firms. All these databases allow firms to be tracked through time because addition or removal of firms from the registers (at least in principle) reflects the actual entry and exit of firms. However, the three to five year frequency of manufacturing census in East Asia precludes computing many of the demographics indicators.

1.3.2 The Source of the Data: Productivity Decompositions

The productivity analysis requires information on output, employment, and possibly other productive inputs such as intermediate materials and capital services. For this reason, enterprise surveys were used for most countries. Using these source data, indicators are calculated on labor and/or total factor productivity disaggregated by STAN industry and year, and on the decomposition of productivity growth into within-firm and reallocation components. The underlying source data and availability of the indicators are provided in table 1.2.

Indicators Collected

Depending on the availability of output and input measures, we have calculated different indicators of labor and total factor productivity. A number of issues emerged in the calculation of labor and total factor productivity, including:

- Labor input was generally based on the number of employees with no correction for hours worked.
- Sales and gross output data do not include correction for inventory accumulation.
- Capital stock, in countries where available, is based on book values.

Table 1.1 **Data sources used for firm demographics**

Country	Source	Period	Sectors	Availability of survival data	Threshold
Canada	Business register	1984–1998	All Economy	No	Emp ≥ 1
Denmark	Business register	1981–1994	All	No	Emp ≥ 1
Finland	Business register	1988–1998	All	Yes	Emp ≥ 1
France	Fiscal database	1989–1997	All	Yes	Turnover: Man: Euro 0.58m Serv: Euro 0.17m
Germany (West)	Social security	1977–1999	All but civil service, self-employed	Yes	Emp ≥ 1
Italy	Social security	1986–1994	All	Yes	Emp ≥ 1
Netherlands	Business register	1987–1997	All	Yes	None
Portugal	Employment-based register	1983–1998	All but public administration	Yes	Emp ≥ 1
U.K.	Business register	1980–1998	Manufacturing	Yes	Emp ≥ 1
U.S.	Business register	1988–1997	Private businesses	Yes	Emp ≥ 1
Argentina	Register, based on Integrated System of Pensions	1995–2002	All	Yes	Emp ≥ 1
Brazil	Census	1996–2001	Manufacturing	Yes	Emp ≥ 1
Chile	Annual Industry Survey (ENIA)	1979–1999	Manufacturing	Yes	Emp ≥ 10
Colombia	Annual Manufacturing survey (EAM)	1982–1998	Manufacturing	Yes	Emp ≥ 10
Estonia	Business Register	1995–2001	All	Yes	Emp ≥ 1
Hungary	Fiscal register (APEH)	1992–2001	All	Yes	Emp ≥ 1
Indonesia	Manufacturing survey	1990–1995	Manufacturing	No	Emp ≥ 10
Korea	Census	1983–1993 (3 years)	Manufacturing	No	Emp ≥ 5
Latvia	Business register	1996–2002	All	Yes	Emp ≥ 1
Mexico	Social security	1985–2001	All	Yes	Emp ≥ 1
Romania	Business register	1992–2001	All	Yes	Emp ≥ 1
Slovenia	Business register	1992–2001	All	Yes	Emp ≥ 1
Taiwan (China)	Census	1986–1991 (2 years)	Manufacturing	No	Emp ≥ 1
Venezuela	Annual Industrial Survey	1995–2000	Manufacturing	No	Emp ≥ 1; sample for 1–15

Table 1.2 **Summary of the data used for productivity decompositions**

Country	Source	Periods: First	Periods: Last	Coverage: Mfg	Coverage: Serv	Productivity: LPV, LPQ	Productivity: TFP	Productivity: MFP	Unit	Threshold
Finland	Census	1975–1980	1989–1994	✓		✓	✓	✓	Firm	Emp > 5
France	Fiscal database with additional information from enterprise surveys	1985–1990	1990–1995	✓		✓	✓	✓	Firm	Turnover €0.58m
Germany (W)	Survey	1992–1997	1993–1998	✓	✓	✓	✗		Plant	Emp > 1
Italy	Survey	1982–1987	1993–1998	✓	✓	✓	✓		Firm	Turnover €5m
Netherlands	Survey	1983–1988	1992–1997	✓	Some	✓	✓	✓	Firm	Emp > 20, emp < 20 → Sample
Portugal	Employment-based register	1986–1991	1993–1998	✓	✓	✓	✗		Firm	Emp > 1
U.K.	Survey	1980–1985	1987–1992	✓		✓	✓	✓	Estab	Emp > 100, emp < 100 → Sample
U.S.	Census	1987–1992	1992–1997	✓		✓			Estab	Emp > 1
Argentina	Annual Industrial Survey (INDEC)	1990–1995	1996–2001	✓		✓			Estab	Emp ≥ 9 and $2m threshold
Brazil	Annual Industrial Survey	1997–2001		✓		✓	✓		Estab	Emp ≥ 30 + sample of 10–29
Chile	Annual Industry Survey (ENIA)	1980–1985	1994–1999	✓		✓	✓	✓	Plant	Emp ≥ 10
Colombia	Annual Manufacturing survey (EAM)	1982–1986	1994–1998	✓		✓	✓	✓	Estab	Emp ≥ 10
Estonia	Business Register	1995–2000	1996–2001	✓	✓	✓	✓	✓	Firm	Emp ≥ 1
Hungary	Fiscal register (APEH)	1992–1996	1997–2001	✓	✓	✓	✓		Plant	Emp ≥ 1
Indonesia	Manufacturing survey	1990–1995		✓		✓			Firm	Emp ≥ 10
Korea (Rep.)	Census	1988–1993		✓		✓			Firm	Emp ≥ 5
Latvia	Business register	1996–2001	1997–2002	✓	✓	✓			Firm	Emp ≥ 1
Romania	Business register	1995–1998	1996–1999	✓	✓	✓	✓	✓	Firm	Emp ≥ 1
Slovenia	Business register	1992–1997	1997–2001	✓	✓	✓		✓	Firm	Emp ≥ 1
Taiwan (China)	Census	1986–1991	1991–1996	✓		✓			Firm	Emp ≥ 1
Venezuela	Annual Industrial Survey	1995–1999	1996–2000	✓		✓	✓		Firm	Emp ≥ 1; sample for 1–15

Note: Mfg = manufacturing; Serv = business services; LPV = labor productivity based on value added; LPQ = labor productivity based on gross output; Emp = employment.

- Total Factor Productivity (TFP) at the firm level is the log of deflated output (measured as value added) minus the weighted log of labor plus capital, where the weights are industry-specific and the same for all countries. The weights were calculated using the expenditure shares of inputs for an industry using the cross-country average from the OECD-STAN database. In the World Bank project, TFP was also computed using country and industry-specific average expenditures shares of firms.
- Multifactor Productivity (MFP) calculations use expenditure shares for labor, capital, and materials.
- Labor productivity estimates are based either on deflated growth output (LPQ) or on deflated value added (LPV). Similarly, MFP estimates are based on deflated gross output and TFP estimates are based on deflated value added.
- Deflators for output, value added, and materials are at the two to three digit industry level, usually based on National Accounts sources.

Using common factor shares across countries for a particular industry allows, in principle, for cross-country comparisons of productivity levels. However, different measurement units for the inputs, notably capital, make cross-country comparisons of TFP or MFP levels problematic. To benchmark the levels of TFP and MFP, the measured units of capital are adjusted with a multiplicative factor, such that value added minus payroll (or gross output minus payroll and materials expenditures) represents a return to capital of eight percent.[13]

1.4 A Canonical Representation of the Measurement Problems

As discussed in the previous section, despite all efforts to harmonize the data, measurement issues remain that can affect cross-country comparisons. In reviewing such measurement issues we use the following simple notation: the indicator I is some aggregate of a (vector of) variables X, with aggregation taking place across units (firms or establishments) f that are element of the (sub)population Ω:

$$I = A[X_f \mid f \in \Omega]. \tag{1}$$

For simplicity, we drop all subscripts (i.e., for countries as well as for disaggregated groupings), such as industry or size-class. These disaggregations are dealt with by adding an appropriate subscript to I and X, and by aggregating over individual firms in an appropriately defined subset of Ω. With this notation framework, we assess measurement problems for a host of indicators. In particular, we consider various aggregator functions, A[..],

13. This adjustment is similar to the arbitrary adjustments to TFP made by Bernard and Jones (1996b) in order to compare apples and oranges.

such as sums, means, variances, covariances, or statistical analyses yielding reduced-form or structural coefficients (e.g., the aggregator function could be the ordinary least squares (OLS) estimator from a multivariate regression).[14] The variable itself may be an aggregation of a function of one or more micro-level variables, such as a ratio (e.g., output per unit of labor) or a transformation using firm-level observations from multiple periods, such as a first difference. Alternatively, the indicator may be a function of aggregated variables (e.g., aggregate productivity as ratio of aggregate output to labor). Finally, the indicators may vary by the (sub)set of firms over which the aggregation takes place. For example, the typical productivity decompositions (see following equations) focus on the contribution to aggregate productivity growth of different sets of firms (e.g., continuing, exiting, and entering firms).

Measurement errors can be analysed in a typical *errors-in-variable* framework, such as:

$$X = X^* + \varepsilon \tag{2}$$

where the observed value, X, is equal to the actual value, X^*, plus an error term.

For the computed indicators, a necessary extension to the framework is that the observed and the actual set of firms, Ω^*, may differ as well:

$$\Omega = \Omega^* + \Psi \tag{3}$$

where Ψ is a general form of disturbance to the correct or actual set of firms in Ω^*. The disturbance takes away—or adds—units to the actual set. A simple example is when the focus of the analysis is on firms in a given industry, but some firms are erroneously classified in this industry even if they largely operate in another industry. Similarly, the actual set of continuing firms needed for decompositions of productivity growth is given by the intersection of the actual sets of firms at time t and firms at time $t - s$. Through errors applied to the actual sets at t or $t - s$ the observed set of continuers may deviate from the actual, as will the complementary sets of observed exiting firms and entrants.

As an added complication, it may be that the observed set differs from the actual set, but that the actual set is a statistical sample drawn from the actual universe. Or it may be that the observed set is a statistical sample drawn from the observed universe, which itself is a noisy version of the actual universe. We abstract from this by taking the sampling scheme and the errors in classification to both be represented by Ψ, regardless of the order in which the sampling process and the errors drive a wedge between the actual universe and the observed set of firms.

14. The latter possibility includes treating estimated parameters from studies of individual countries as aggregate indicators.

Once a differentiation is made between the location of the errors, namely in the measurement of the variable(s) at the micro level or in the sampling or registration of the micro-units over which aggregation is made, the effects of the various measurement problems can be traced and different forms of errors may be compared. It should be stressed that while these two types of errors affect the analysis of firm-level data in each individual country, differences in characteristics of these errors across countries influence even more cross-country comparisons.

In the remainder of this subsection, we explore some examples of how measurement error in both the measures of economic activity and measurement error due to sample selection can impact the measures of the distribution of output, employment, productivity levels, and productivity dynamics drawn from firm-level data.

1.4.1 Mean or Sum

Both measurement errors discussed above affect aggregation indicators such as the mean or sum of firm-level data. We first discuss the case when Ψ generates random errors in obtaining the observed set of firms from the actual set. When the indicator of interest is the mean employment per firm, we get a consistent estimate by taking a normal average.[15] Without measurement error of the firm-level variable, the variance of this estimator of the first moment is negligible, given the generally large size of available samples (often 90 percent or more of total employment is in the sample). With classical measurement error in employment at the firm level, ε increases the standard deviation of the (unbiased) estimate of the first moment. The estimate of mean firm-size across industries is unbiased, as the extra firms allocated to one industry represent a loss in another and, on average, the effect will be zero. With measurement error ε proportional to size, for example because of weighted sampling by size strata, sample weights are needed to get consistent estimate of first moment of the firm-size distribution.

When the indicator of interest is the difference between the mean (or the sum) of two different level measures (e.g., labor productivity can be viewed as the difference of the [log] of aggregate output and employment), the previous remarks apply. The differencing does not solve the problem, or even creates further problems if the expected value of the measurement error of both measures is zero. But the variance of the estimated mean is the sum of the two classical measurement error variances, so, in this example, we have a noisier estimate of mean productivity. We need to take this into account when comparing productivity levels across countries. But having an estimate of the variance of ε would help to assess whether differences in mean productivity across country are significant.

15. It should be stressed that, given data availability, we define labor input as the number of employees and do not control for hours worked.

1.4.2 Mean or Sum; Endogenous (Sub)samples

The measures of mean firm-size and number of firms by size class fall into this category, and will be noisy owing to misclassification. The size-class criterion used to split the subsample is not independent of ε: firms with positive noise are more likely to be above a threshold, firms with negative noise more likely below. This is a typical problem (e.g., the well known result of nonclassical measurement errors of dichotomous 0–1 indicator variables built from continuous variables with classical noise). A typical solution for this type of problem is to base the classification of firm-size on average employment in two periods. However, using only firms observed in two periods may, depending on the indicator of interest, introduce a selection bias. This problem of interaction between ε and characteristic used to make the (sub)samples in aggregation shows up for means by quartiles, for job flows, and for other such splits with endogenous classification. The problem is exacerbated if sampling errors (Ψ) vary systematically with the same characteristics. In principle, weighted results can overcome this problem, but in many cases the at-risk population for the analysis is above a minimum size threshold.

1.4.3 Mean or Sum; Longitudinal Linkages and Measures of Change

If aggregations are to be made over subsamples that are based on longitudinal linkages over time, such as entry/exit/continuer status, the sampling noise becomes quite important. For example, if we consider the employment of entering, exiting, and continuing firms, the measurement error in firm-level employment is coupled with possible mismeasurement of the status variables due to poor longitudinal IDs. In addition to measurement in the firm-level indicator and status variables, sample selection can play a large role here since under-sampled groups may exhibit very different firm dynamics.[16]

1.4.4 Higher Moments (Variances)

In computing the variance of the distribution of our firm-level variables (e.g., employment) we start by assuming no sampling errors. The estimated variance of the variable will be true variance in the universe plus the variance of ε. Without knowing the distribution of micro-level measurement errors, higher moments cannot be compared directly across countries. One practical solution is to compute the variance of the distribution of employment averaged over two periods (e.g., the decomposition of productivity by Griliches and Regev [1995]). The difference between estimate of the variance and (the average of) the variances estimated from the two an-

16. Martin (2005) provides details on how sample weights should be used for computing productivity contributions from exit and entry.

nual samples equals half the variance of ε. In other words, if the underlying true variance of our variable does not change over the two periods, the reduction in variance moving from the standard to the two-period average variance is a consistent estimate of 0.5 * var(ε). However, this approach only works for calculating the variance of the cross-sectional distribution of the firm-level variable for continuing firms. We would also need to find out how the exit or entrant subsamples affect the variance of the full annual distribution of firm employment. No correction can be made for measurement error of employment for these firms. A closely related alternative is available if the distribution of the measurement error is common to all firms in a country. In this case, disaggregating the data by, for example, industry and then using a difference-in-difference comparison of the relative cross-industry variances for different countries can be made.

Next consider a divergence between the observed and actual sample. If the sampling errors vary systematically by firm-size, we need to do appropriate weighting. If the sample varies, not because of sampling rules, but owing to error, this only matters if the errors are correlated with employment. If they are correlated, no consistent estimate can be made of higher level moments of the employment distribution.

1.4.5 Higher Moments (Covariances and Correlations)

All of the previously mentioned problems apply to covariances, correlations, and, by association, estimates from regressions or other related multivariate statistical procedures. The problem with covariances is more complex since we must now deal with the covariance between the measurement error of two variables (either the same variable at different points in time or different variables at the same unit of time). Classical measurement error will bias any given correlation, but in many cases the measurement error may be systematic in complex ways. While the general intuition is that the classical measurement error implies lower covariances and correlations, in this setting the measurement error may yield different results. For example, one key question with firm-level data is whether more productive businesses have higher market shares. Classical measurement error in output measures will yield spuriously high covariances between the output share of a business and its measure of productivity, while classical measurement error in labor input will result in spuriously low covariances between employment share of a business and its measure of productivity.

The previously mentioned issue needs to be addressed in particular for the indicator of the gap between weighted and unweighted productivity. The gap is proportional to the covariance between labor productivity and firm employment. If output and labor input are both measured with (classical) error, the gap will be underestimated, with the underestimation dependent on the variance of the measurement error in labor input. In this case, an estimate of the variance of the measurement error of the firm level variable will be useful to know how to adjust cross-country differences in the estimated gap. If instead, the statistical agency uses labor productivity as an analytical ratio to edit the underlying micro data, then the measurement error of productivity and labor may be uncorrelated, so that the gap measure will be unbiased. In either case, computing the covariance between the cross-section of the time average of productivity and the cross-section of the time average of employment will produce a gap estimate with a lower bias, because the mean measurement error goes to zero as more periods are added.

Further, difference-in-differences approaches, for example looking at relative movements between gaps in different industries, and comparing this across countries or over time, will provide robust estimates if the measurement error process of the firm-level variable does not change over time or across industries.

1.5 Assessing the Process of Creative Destruction

We start our review by looking at the distribution of firms by size, for the total business sector and the subsectors. We then turn to the analysis of firm demographics—the entry and exit of firms and their impact on employment. Finally, we look at the evolution of cohorts of new firms over the initial years of their life. In all cases, our objectives are to present some of the basic facts that emerge from the newly developed cross-country data and also to evaluate the measurement and inference problems that emerge from such comparisons.

In all our analysis we look at simple cross-country comparisons, but also at within-country variations along different dimensions (size, industry). We claim that the *difference-in-difference* approach is essential to extract valuable information from our distributed micro-data analysis for at least two reasons:

- First, despite our efforts to harmonize the data across countries, there remain some differences in key dimensions: size or output thresholds that exclude micro-units, differences in the sectoral coverage and in some cases as well as differences in the definition of the unit of observation. These differences may all contribute to limit simple cross-country comparisons using single indicators of the creative destruction process.
- Second, and probably more importantly, simple cross-country comparisons on specific dimensions of the process of creative destruction may be misleading or inadequate. Differences in market structures and in institutions may lead to differences in the nature of creative destruction rather than in its absolute magnitude. For example, high barriers to entry may not reduce the overall magnitude of firm turnover

but rather the composition of entrant and exiting firms. Facing high entry costs, new firms may choose to either enter very small and avoid the bite of regulations (especially in developing countries), or enter with a large size and smooth the entry costs over a larger capital investment. This may lead to bimodal distributions of firm entry by size but not a lower total entry rate. Likewise, in countries with high barriers to entry (and in turn high implied survival probabilities of marginal incumbents), the average productivity of entrants will rise while the average productivity of incumbents and exiting businesses will fall. Similar predictions apply to policies that subsidize incumbents and/or restrict exit in some fashion. These institutional distortions might yield a larger gap in productivity between entering and exiting businesses, but this gap is not by itself sufficient to gauge the contribution or efficiency of the creative destruction process.

In the empirical analysis presented in the remainder of this section and in the next section we focus on:

- The period from *1989 onward*, and use period averages instead of data for individual years to minimize business cycle effects and possible measurement problems.[17]
- *Twenty-three aggregate industries* that cover the entire business sector while maximizing country coverage from the forty-two three-digit (ISIC Rev. 3) industries that are available in some databases.[18]

1.5.1 Indicators Collected

The use of annual data on firm dynamics implies a significant volatility in the resulting indicators. In order to limit the possible impact of measurement problems, it was decided to use definitions of continuing, entering, and exiting firms on the basis of three (rather than the usual two) time periods. Thus, the tabulations of firm demographics is based on the following variables:

Entry$_{i,s,t}$: The number of firms entering in industry i, in the size class s and in year t. Also tabulated, if available, was the number of employees in entering firms. Entrant firms (and their employees) were those observed as (out, in, in) in the register at time $(t-1, t, t+1)$.

Exit$_{i,s,t}$: The number of firms—and related employees—that leave the register. Exiting firms were those observed as (in, in, out) the register in time $(t-1, t, t+1)$.

17. For Finland, we use the sample 1992–1998 because in the first years of the 1990s a number of large firms changed legal form in Finland, thus obtaining a different firm code in the business register. This reregistration would inflate firm turnover rates for large firms and distort the assessment of firm characteristics among entrants and exiting firms.

18. These twenty-three industries also correspond to the sectoral disaggregation of the OECD Structural Analysis (STAN) database. See www.oecd.org/data/stan.htm

One-year firms$_{i,s,t}$: The number of firms and employees in those firms that were present in the register for only one year. These firms were those observed as (out, in, out) the register in time ($t-1$, t, $t+1$).

Continuing firms$_{i,s,t}$: The number of firms and employees that were in the register in a given year, as well as in the previous and subsequent year. These firms were observed as in the register in time ($t-1$, t, $t+1$).

In practice, a number of complications arise in constructing and interpreting data that conform to the definitions of continuing, entering, and exiting firms described above. In particular, the one-year category, in principle, represents short-lived firms that are observed in time t but not in adjacent time periods and could therefore be treated as an additional piece of information in evaluating firm demographics. However, in some databases this category also includes measurement errors and possibly ill-defined data. Thus, the total number of firms in our analysis excludes these one-year firms.

Given the method of defining continuing, entering, and exiting firms, a change in the stock of continuing firms (C) relates to entry (E) and exit (X) in the following way:

$$C_t - C_{t-1} = E_{t-1} - X_t. \tag{4}$$

This has implications for the appropriate measure of firm turnover. Given that continuing, entering, exiting and one-year firms (O) all exist in time t then the total number of firms (T) is:

$$T_t = C_t + E_t + X_t + O_t. \tag{5}$$

From this, the change in the total number of firms between two years, taking into account equation 4, can be written as:

$$T_t - T_{t-1} = E_t - X_{t-1} + O_t - O_{t-1}. \tag{6}$$

Assuming that the one-year firms are measured with random noise, the difference of these firms in year t and $t-1$ is expected to be equal to zero. Thus, a turnover measure that is consistent with the contribution of net entry to changes in the total number of firms should be based on the sum of contemporaneous entry with lagged exit.

The above indicators were split into eight firm-size classes, including the class of firms without employees.[19] The data thus allow detailed comparisons of firm-size distributions between industries and countries.[20] Further,

19. The eight size classes are as follows: no-employees, 1–9 employees, 10–19, 20–49, 50–99, 100–249, 250–499; 500+. For the OECD countries there are only six size groups, with the two groups between one and twenty combined and the groups between 100 and 500 combined.

20. Available data also allow the calculation of total job turnover and the fraction of it due to the entry and exit of firms.

the collected data allow for survival analysis for a selection of countries over varying time periods.

1.5.2 The Distribution of Firms by Size

Firm size is an important dimension in our analysis for several reasons. The empirical literature suggests that small firms tend to be affected by greater churning, but also have greater potential for expansion.[21] Thus, a distribution of firms skewed towards small units may imply higher entry and exit, but also greater post-entry growth of successful firms. Alternatively, it may point to a sectoral specialization of the given country towards newer industries, where churning tends to be larger and more firms experiment with different technologies. Another factor relevant here is that small businesses may not be subject to the same regulations as large businesses, because they may be exempted to certain laws or regulations (e.g., labor regulations) or because they can more easily avoid them in countries with weak enforcement. In addition, the distribution of firm by size is likely to be influenced by the overall dimension of the internal market—especially for firms in nontradable sectors—as well as the business environment in which firms operate that can discourage firm expansion.

The analysis of firm size raises clear problems for cross-country comparability related to sample selection problems. For most of the countries in our sample, the data cover all firms with at least one employee, but the cutoff size is five employees in South Korea,[22] ten employees in Chile, Colombia, and Indonesia. And for France and Italy, the data exclude firms with sales below a certain threshold. Second, even amongst the countries for which data cover all firms with at least one employee, the unit of reference is the plant instead of the firm in some countries, and the definition of both may vary across countries. Finally, from a sectoral perspective, community services and utilities are more difficult to compare, given the important role of the public sector, whose coverage changes from country to country, and of regulation in these sectors.

Table 1.3 presents the share of firms—and associated employment—in the first two classes of our size distribution: firms with fewer than twenty employees (panel A) and firms with twenty to forty-nine employees (panel B). The table suggests that in all countries the population of firms is dominated by micro and small units. Micro units (fewer than twenty employees) account for at least 80 percent of the total firm population. Their share in total employment is much lower and ranges from less than 15 percent in some transition economies (e.g., Romania)—which still reflects the

21. See Sutton (1997) for a review of the literature.

22. The annual enterprise survey in Venezuela is representative of all firms with at least fifteen employees, and only includes a random sample of firms below this threshold. In our analysis, we have used the data for Venezuela with reference to firms with twenty or more employees, given the lack of coverage for the lower size classes.

Table 1.3 **Small firms across broad sectors and countries, 1990s**

	Firms				Employment			
	Total economy	Nonagriculture business sector[a]	Manufacturing	Total business services	Total economy	Nonagriculture business sector[a]	Manufacturing	Total business services
Panel A: The share of micro firms in the total population of firms and in total employment (firms with fewer than 20 employees as a percentage of total)								
Industrial countries								
Denmark	91.3	89.5	76.6	92.3	32.7	31.1	17.6	35.0
France	82.1	82.3	77.9	82.0	15.9	16.0	19.9	13.6
Italy	93.8	93.8	88.6	96.0	35.9	39.6	31.3	36.4
Netherlands	96.3	96.5	88.3	97.1	31.8	36.8	18.3	32.9
Finland	93.6	92.7	85.4	95.3	29.5	32.7	13.5	39.1
West Germany	89.6	85.8	83.3		25.8	23.8	16.6	
Portugal	89.2	88.9	75.3	93.8	32.2	31.4	18.9	42.9
U.K.			81.3				12.4	
U.S.	88.0	88.0	72.6	88.7	18.4	19.3	6.7	19.9
Latin America								
Brazil			82.4				17.7	
Mexico	90.1	90.0	82.8	92.2	23.2	24.5	13.9	28.5
Argentina	90.0	89.4	82.1	91.2	27.7	27.7	21.3	27.7
Transition economies								
Slovenia	87.7	88.0	71.6	93.1	13.4	13.5	5.1	26.0
Hungary	84.4	85.5	71.1	90.8	16.0	16.4	8.8	23.6
Estonia	80.6	81.3	64.6	87.1	22.8	22.6	11.5	34.2
Latvia	87.7	87.7	87.8	87.6	24.7	24.8	26.9	24.2
Romania	90.9	91.5	77.1	95.6	12.9	12.8	4.2	31.6
East Asia								
Korea[b]			57.0				11.1	
Taiwan (China)			82.5				26.6	

Panel B: The share of small firms in the total population of firms and in total employment (Firms with 20–49 employees as percentage of 20+)

Industrial Countries								
Denmark	67.6	66.9	60.4	69.7	22.5	22.9	19.5	22.0
France	53.2	53.3	63.0	49.9	12.9	12.9	20.0	11.2
Italy	67.3	69.4	67.0	65.5	20.0	22.8	23.0	15.6
Netherlands	58.8	62.9	53.9	58.5	15.3	18.6	14.2	13.9
Finland	61.0	62.0	54.3	65.2	16.3	18.9	10.3	19.0
West Germany	59.0	60.7	54.0		17.2	17.7	12.8	
Portugal	64.0	63.5	59.1	69.2	22.6	22.0	21.5	22.9
U.K.			51.2				11.4	
U.S.	62.7	65.0	55.0	63.1	12.2	13.5	7.3	12.7
Latin America								
Chile			51.4				15.3	
Colombia			49.0				13.9	
Mexico	59.0	58.9	51.2	62.9	15.1	16.0	11.5	17.1
Brazil			58.7				15.0	
Venezuela			24.9				4.5	
Argentina	61.1	61.7	59.8	60.6	18.4	18.6	19.0	16.8
Transition economies								
Slovenia	38.5	38.4	29.2	49.8	7.4	7.2	4.6	12.4
Hungary	54.6	56.2	48.3	61.9	12.9	12.5	10.1	14.3
Romania	45.3	46.2	39.2	55.1	5.7	5.5	3.3	11.2
Estonia	62.4	62.6	55.5	66.9	22.1	21.3	17.0	27.1
Latvia	58.1	57.9	60.1	58.0	17.8	17.9	20.1	17.5
East Asia								
Korea			59.4				17.3	
Indonesia			49.6				7.3	
Taiwan (China)			65.8				25.2	

[a]This aggregates excludes agriculture (ISIC 1–5) and community services (ISIC3: 75–79).

[b]In Korea, data cover firms with 5 or more employees.

presence of large (formerly or still) state-owned firms inherited from the central plan period—to less than 20 percent in the United States and around 30 percent or more in some small European economies. To check the robustness of these results, we also look at the incidence of small firms (i.e., the population twenty to forty-nine over the total population of firms with twenty or more employees). This allows for a larger country sample and greater comparability as it is not affected by differences in the threshold of micro units. Small firms account for about 50 percent of the total population of firms with twenty or more employees, again with the exception of the transition economies (e.g., Romania and Slovenia) still dominated by large firms. It is also important to notice that the rank ordering of countries obtained by focusing on the share of micro units (fewer than twenty) is only loosely correlated with the rank order of the same countries based on the share of small firms (twenty to forty-nine).[23]

Cross-country differences in firm size may reflect specialization towards industries with a small efficient scale. To assess the role of sectoral specialization *versus* within sector differences, we first look at the average firm size across industries in table 1.4. The first column of the table presents the cross-country average size for each industry and the other columns present the country/industry average relative to the industry cross-country average. If technological factors were predominant in determining firm size across countries, we should find that the values in the country columns to be concentrated around one. If, on the contrary, the size differences were explained mainly by country-specific factors inducing a consistent bias within industries, then we would expect the countries with an overall value above (below) the average (i.e., in the "Total" category) to be characterized by values generally above (below) one in the subsectors.

Among industrial countries, the United States has a very high proportion of industries with an above-average firm size, both in manufacturing and in business services. The Western European countries tend to have smaller firms in most industries, with several exceptions in heavy industries (e.g., Germany and Portugal), high-tech industries (e.g., Finland and, to a lesser extent, France and Italy), or some of the low-tech industries (e.g., United Kingdom) or in basic services (e.g., France and Portugal). Thus, it is not possible to map differences in firm size across countries according to either the overall size of the country (apart from the United States), the underlying technological level of the industry, or its degree of maturity.

Another way to shed light on country-specific factors *versus* industry-specific technological factors is to use a shift-and-share decomposition. The decomposition identifies the component due to cross-country differences in firm size within each sector, the component due to differences in the sectoral composition across countries, and a cross term that can be

23. The country rank correlation is only 0.3.

Table 1.4 **Within-industry average firm size, firms with 20 or more employees (as a share of cross-country sectoral average)**

Country	Cross-country average	Industrial	Other countries	Denmark	France	Italy	Netherlands	Finland	West Germany	Portugal	U.K.	U.S.
Total economy	118	0.87	1.20	0.76	1.11	0.84	0.38	1.01	0.88	0.72		1.32
Agriculture, hunting, forestry and fishing	77	0.67	1.49	0.44	1.02	0.84	0.21		0.54	0.74		1.00
Mining and quarrying	173	0.76	1.40	0.27	0.48	0.44	0.13	0.78	1.59	0.39		1.14
Total manufacturing	137	0.87	1.14	0.69	0.72	0.63	0.34	1.12	0.94	0.62	1.03	1.71
Food products, beverages, and tobacco	143	1.01	1.00	0.93	0.57	0.66	0.33	1.15	0.62	0.61	1.53	2.99
Textiles, textile products, leather, and footwear	115	0.79	1.25	0.55	0.68	0.50	0.22	0.78	0.89	0.76	1.07	1.58
Wood and products of wood and cork	81	0.82	1.20	0.71	0.68	0.58	0.25	1.73	0.91	0.70	0.86	1.00
Publishing, printing, and reproduction of recorded media	125	0.92	1.09	0.66	0.59	0.71	0.29	2.02	0.86	0.58	0.84	1.60
Coke, refined petroleum products, and nuclear fuel	870	0.89	1.10	0.10	0.78	0.34		0.92	0.33	2.52		1.54
Chemicals and chemical products	218	1.04	0.96	0.58	0.65	0.80	0.42	1.01	1.54	0.52		2.34
Rubber and plastics products	107	0.87	1.13	0.81	0.81	0.69	0.25	0.96	1.20	0.64		1.56
Other non-metallic mineral products	125	0.82	1.20	0.65	0.84	0.61	0.29	0.97	0.82	0.66	1.31	1.12
Basic metals	272	0.71	1.24	0.26		0.52	0.32	1.45		0.37	0.59	1.29
Fabricated metal products, except machinery and equipment	86	0.76	1.17			0.69	0.27	0.78		0.74	0.85	1.21
Machinery and equipment, N.E.C.	153	0.68	1.32	0.77	0.79	0.49	0.18	0.84		0.43	0.82	1.11
Office, accounting, and computing machinery	140	1.71	0.52			1.27	0.02	1.99		0.46		4.52
Electrical machinery and apparatus, nec	202	0.82	1.14		1.08	0.53	0.14	0.57		0.98		1.41
Radio, television, and communication equipment	204	1.00	0.99		0.92	0.82	0.06	1.39		1.58		1.12
Medical, precision, and optical instruments	148	0.95	1.04		0.72	0.62	0.17	0.95		0.90		2.13

(*continued*)

Table 1.4 (continued)

Country	Cross-country average	Industrial	Other countries	Denmark	France	Italy	Netherlands	Finland	West Germany	Portugal	U.K.	U.S
Motor vehicles, trailers, and semi-trailers	316	0.94	1.04		0.92	1.60	0.10	0.30		0.53		2.45
Other transport equipment	305	1.21	0.85		0.89	0.85	0.08	0.68		0.58		4.16
Manufacturing nec; recycling	92	0.87	1.13	0.77	0.95	0.60	0.88	0.73	0.88	0.56	0.97	1.39
Electricity, gas, and water supply	505	1.24	0.62	0.37	0.15	1.55	0.29	0.29	0.36	5.38		0.97
Construction	75	0.79	1.32	0.75	0.93	0.76	0.32	0.98	0.74	0.97		0.83
Services	111	0.95	1.07	0.84	1.30	1.13	0.43	0.90		0.80		1.35
Market services	107	0.94	1.08	0.82	1.36	0.98	0.37	1.15		0.88		1.24
Wholesale and retail trade; restaurants and hotels	79	0.93	1.09	0.83	1.45	0.76	0.36	1.21		0.76		1.36
Transport, and storage, and communication	250	1.00	1.00	0.41	0.38	0.71	0.21	0.75	0.41	3.64		0.86
Finance, insurance, Real Estate, and business services	135	1.07	0.91	0.98	1.29	1.58	0.37	0.85		1.52		1.23
Community, social, and personal services	123	0.94	1.06	0.92	1.04	1.21	0.52			0.58		1.55

Country	Chile	Colombia	Mexico	Slovenia	Hungary	Indonesia	Korea	Taiwan (China)	Estonia	Brazil	Latvia	Romania	Argentina
Total economy			1.00	1.40	1.11				0.72		0.83	2.20	0.85
Agriculture, hunting, forestry, and fishing			1.56	2.05	1.20				0.83			1.77	0.71
Mining and quarrying			0.75	3.14	1.23				2.92	0.50	0.42		0.71
Total manufacturing	0.76	0.81	1.01	1.49	1.08	1.49	0.79	0.57	0.73	0.86	0.65	3.00	0.70
Food products, beverages, and tobacco	0.75	0.88	0.99	1.35	1.18	0.95	0.77	1.10	0.83	1.28	0.97		0.90
Textiles, textile products, leather, and footwear	0.85	0.99	0.98	2.50	1.24	2.82	0.91	0.71	0.97	0.88	0.81		0.73
Wood and products of wood and and cork	1.19	0.83	1.01	1.72	0.95	3.43	0.77	0.70	0.70	0.84	1.06		0.71

Publishing, printing, and reproduction of recorded media	0.95	0.85	0.83	1.62	0.84	1.39	0.64	0.51	0.54	0.99	0.67	2.61	0.74
Coke, refined petroleum products, and nuclear fuel	0.16	0.31	0.08	0.44	7.32	0.12	0.18		1.70	0.39	0.03	2.08	0.38
Chemicals and chemical products	0.56	0.63	0.68	1.37	1.42	0.86	0.56	0.52	0.58	0.68	0.28	3.01	0.56
Rubber and plastics products	0.82	0.90	0.88	1.82	0.91	1.98	0.70	0.62	0.48	0.84	0.49	2.66	0.60
Other non-metallic mineral products	0.83	1.05	0.98	1.45	1.33	0.80	0.76	0.51	0.79	0.60	0.79	3.44	0.80
Basic metals	1.03	0.67	0.69	1.79	1.04	0.94	0.52	0.25	0.21	0.66	0.10	5.19	0.50
Fabricated metal products, except machinery and equipment	0.98	0.94	0.98	1.79	1.02	1.81	0.91	0.56	0.69	0.92	0.71	2.27	0.65
Machinery and equipment, N.E.C.	0.62	0.52		1.23	0.72	1.05	0.53	0.35	0.59	0.79	0.84	6.47	0.43
Office, accounting, and computing machinery	0.18	0.35		0.27	1.22		0.91	0.90	0.25	0.92	0.73	0.81	0.32
Electrical machinery and apparatus, nec	0.52	0.58		1.48	1.40	1.15	0.52	0.41	0.89	0.75	0.22	4.10	0.38
Radio, television, and communication equipment	0.43	0.70		0.80	1.14	2.37	0.88		0.88	0.85	0.82	1.93	0.93
Medical, precision, and optical instruments	0.43	0.50		1.04	0.82	2.64	0.67	0.46	0.74	0.73	1.14	2.78	0.39
Motor vehicles, trailers, and semi-trailers	0.30	0.38	1.41	0.67	1.01	0.71	0.61	0.31	0.52	0.83	0.10	4.52	0.43
Other transport equipment	0.62	0.39	0.57	1.10	0.58	0.68	1.11	0.30	0.74	0.31	0.15	3.94	0.24
Manufacturing nec; recycling	0.80	0.68	1.06	1.32	1.04	1.86	0.91	0.67	1.37	0.77	0.56	2.91	0.52
Electricity, gas, and water supply			0.48	0.35	0.90				0.37		0.17	1.65	0.39
Construction			0.86	1.89	0.87				0.75		1.35	2.41	0.99
Services			0.99	1.13	1.19				0.65		0.90	1.40	0.99
Market services			0.90	1.20	1.27				0.69		0.93	1.44	1.00
Wholesale and retail trade; restaurants and hotels			0.95	1.47	1.12				0.65		1.16	1.14	0.88
Transport, storage, and communication			0.46	1.26	1.77				0.62		0.65	1.72	0.58
Finance, insurance, Real Estate, and business services			1.15	0.56	0.80				0.43		0.73	1.18	1.24
Community, social, and personal services			1.48	0.77	0.75				0.50		0.87	1.45	0.93

Table 1.5 **Shift and share analysis of the determinants of firm size**

	Contribution coming from differences in:			
Country	Sectoral composition	Average size of firms	Interaction between sectoral comp. and size	Total
Denmark	0.14	–0.03	–0.09	0.01
France	0.08	–0.05	–0.05	–0.02
Italy	–0.02	–0.17	–0.01	–0.20
Netherlands	0.01	–0.13	–0.04	–0.16
Finland	–0.02	–0.05	–0.02	–0.09
Portugal	–0.05	–0.04	0.02	–0.07
U.K.	–0.01	–0.02	–0.03	–0.06
U.S.	0.00	0.42	–0.07	0.34
Canada	0.01	0.03	–0.02	0.01
Brazil	0.00	–0.08	–0.01	–0.09
Mexico	0.06	–0.06	–0.02	–0.02
Argentina	0.04	–0.14	–0.02	–0.12
Slovenia	0.01	0.30	–0.07	0.24
Hungary	0.01	0.14	–0.02	0.12
Estonia	–0.03	0.07	0.02	0.06
Latvia	–0.03	–0.20	0.04	–0.20
Romania	0.08	0.97	–0.36	0.68
Korea	0.04	0.12	0.02	0.18
Taiwan (China)	0.03	–0.14	–0.03	–0.14

Note: The Total represents the percentage deviation of average size from the cross-country average; the other columns decompose the total into subcomponents.

interpreted loosely as an indicator of covariance: if it is positive, size and sectoral compositions deviate from the benchmark in the same direction.[24]

The decomposition (table 1.5) suggests that within-sector differences generally play the most important role in explaining differences in overall size across countries: this component is much larger (in absolute terms) that the sectoral composition component in many countries.[25] The within-industry size component is particularly large in the United States, con-

24. The decomposition is as follows:

$$\bar{s}_j - \bar{s} = \sum_i \omega_{ij} s_{ij} - \sum_i \bar{\omega}_i \bar{s}_i = \sum_i (\omega_{ij} - \bar{\omega}_i)\bar{s}_i + \sum_i (s_{ij} - \bar{s}_i)\bar{\omega}_{ii} + \sum_i (s_{ij} - \bar{s}_i)(\omega_{ij} - \bar{\omega}_i) =$$
$$= \Delta_{\omega} + \Delta_{s} + \Delta_{\omega s}$$

where $\bar{s}_j$ is the average firm size in country j, s_{ij} is the average firm size in subsector i, and ω_{ij} is the share of firms in subsector i with respect to the total number of firms; $\bar{s}$ is the overall mean across countries and $\bar{\omega}_i$ is the share of overall number of firms in subsector j.

25. In a sensitivity analysis, we have also replicated the decomposition for the sample of OECD countries and the non-OECD countries (including also Hungary and Mexico) separately. The results are broadly unchanged in the two subsamples. Moreover, we have replicated the decomposition at a finer level of sectoral disaggregation and again the results are broadly unchanged.

firming the idea that a larger internal market tends to promote larger firms, but also in some transition economies (e.g., Romania). However, the sectoral composition also plays an important role in some small European countries such as Denmark and Portugal, but also in a relatively larger country such as France and an emerging economy like Mexico.[26]

All in all, differences in average firm size seem to be largely driven by within-sector differences, although in some countries sectoral specialization also plays a significant role. Smaller countries tend to have a size distribution skewed towards smaller firms, but the average size of firms does not map precisely with the overall dimension of the domestic market.

1.5.3 Gross and Net Firm Flows

The second step in our analysis is to look at the magnitude and characteristics of firm creation and destruction. We present entry and exit rates for all firms with more than one employee, and for those firms with twenty and more employees, to avoid comparability problems related to size cutoffs in some country data. As discussed in the previous section, we focus on time averages (1989 onwards) rather than annual data to minimize possible measurement problems.

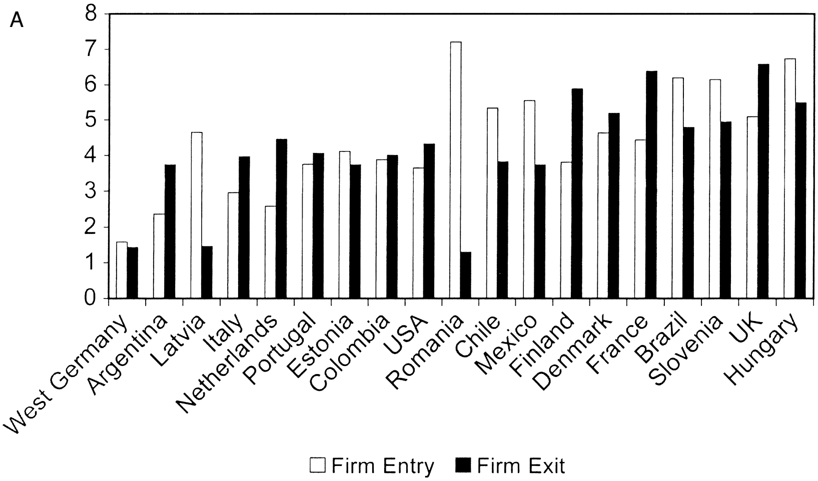
Figure 1.2 shows entry and exit rates for the business sector and for manufacturing. The results point to a high degree of turbulence in all countries (and confirm one of the regularities pointed out by Geroski [1995] for industrial economies). Many firms enter and exit most markets every year. Limiting the tabulations to firms with at least twenty employees to maximize the country coverage, total firm turnover (entry plus exit rates)[27] is between 3 and 8 percent in most industrial countries and more than 10 percent in some of the transition economies. If we extend the analysis to include micro units (one to nineteen employees), we observe total firm turnover rates between one-fifth and one-fourth of all firms. These data also confirm previous findings that in all countries net entry (entry minus exit) is far less important than the gross flows of entry and exit that generate it. This suggests that the entry of new firms in the market is largely driven by a search process rather than augmenting the number of competitors in the market (a point also highlighted by Audretsch [1995]).

There are also interesting differences across countries. The Latin American region shows a wide variety of experiences; for example, while Mexico

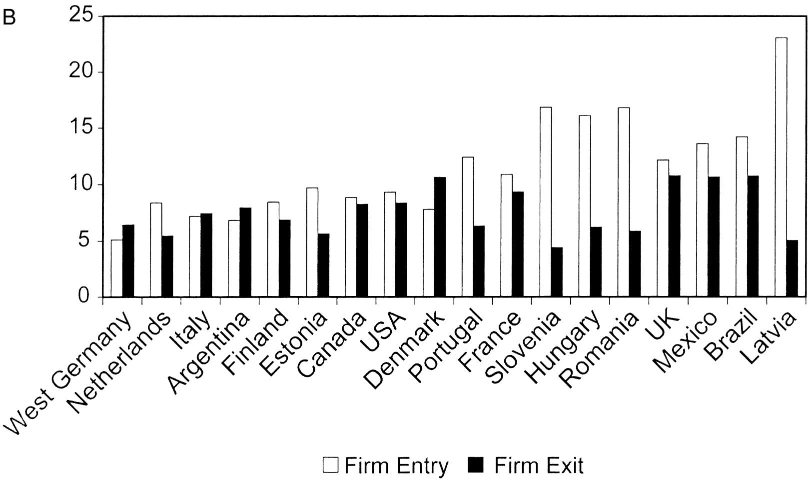
26. The decomposition also suggests that the two elements of the decomposition are not highly correlated; the interaction term is negative in most cases, and the sign of the two elements of the decomposition also tend to differ in most cases. In other words, there is no clear link between size structure and sectoral specialization tilted towards productions naturally characterized by large firms (see Davis and Henrekson [1999] for a discussion).

27. The entry rate is defined as the number of new firms divided by the total number of incumbent and entrants firms producing in a given year; the exit rate is defined as the number of firms exiting the market in a given year divided by the population of origin (i.e., the incumbents in the previous year).

A



B



C

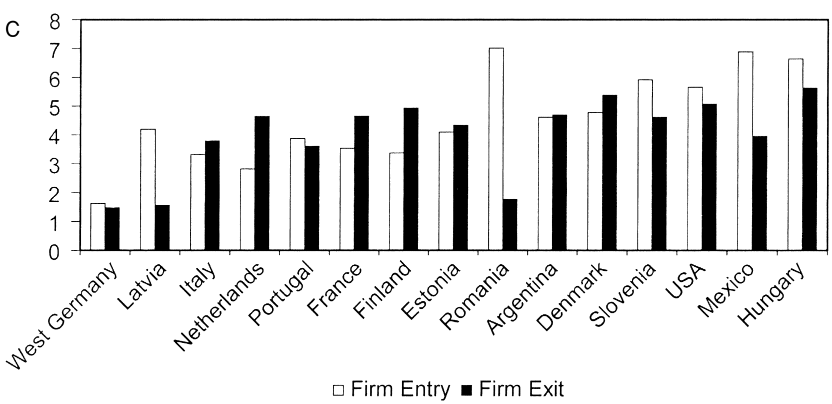


Fig. 1.2 Firm turnover rates in broad sectors, 1990s: *A*, manufacturing, firms with 20 or more employees; *B*, manufacturing, firms with at least 1 employee; *C*, total business sector, firms with 20 or more employees; *D*, total business sector, firms with at least 1 employee

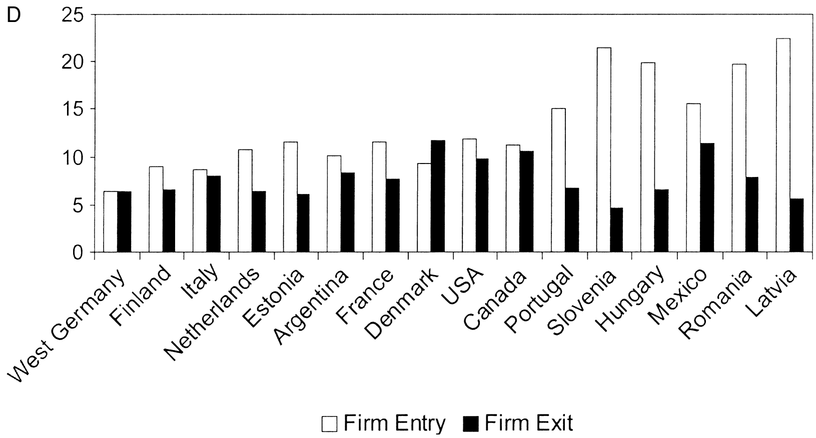


Fig. 1.2 (cont.)

and the manufacturing sector of Brazil show vigorous firm turnover, Argentina shows less turbulence, closer to the values observed in some continental European countries. The transition economies of Central and Eastern Europe provide other interesting features. In most of these countries, firm entry largely outpaced firm exit, while more balanced patterns are found in other countries. Obviously this is related to the process of transition to a market economy, and is not sustainable over the longer run. Still, it points to the fact that new firms not only displaced obsolete incumbents in the transition phase but also filled in new markets that were either nonexistent or poorly populated in the past.

As stressed in the previous section, differences in sample selection and measurement error in longitudinal linkages can yield spurious differences in measures of firm turnover. It is very difficult without detailed information about the statistical processing in each of these countries—as well as within country validation studies—to assess this problem. Instead, our approach is to consider related measures of firm dynamics that, in some fashion, attempt to overcome these measurement concerns.

We begin our inquiry into the validity of the turnover data by first weighting firm turnover by employment and then comparing the size of entrant firms with that of the average incumbent. If we focus on the entire population of firms with at least one employee, we see that less than 10 percent of employment is, on average, involved in firm creation and destruction. The difference between unweighted and employment-weighted firm turnover rates arises from the fact that both entrants and exiting firms are generally smaller than incumbents. For most countries, new firms are only 20 to 60 percent the average size of incumbents. But the small size of entrants relative to the average incumbents is driven by different factors across countries. In particular, we observe that entrant firms are relatively smaller in the

United States than in most of the other industrial countries. This is in part due to the larger market of the United States that leads to larger average size of incumbents.[28] But the wider gap between entry size and the minimum efficient size in the United States may also reflect economic and institutional factors (e.g., the relatively low entry and exit costs may increase incentives to start up relatively small businesses). In the transition economies, new firms are substantially different from most of the existing firms that were drawn from the centrally-planned period. Indeed, the net entry of firms (entry rate minus exit rate) is particularly large among micro units (twenty or fewer employees); during the centrally planned system there were relatively few of these micro firms, which exploded during the transition in most of business service activities, however.

Unfortunately, the observed differences in the relative size of entrants across countries may still reflect longitudinal linkages problems. If, in some countries spurious entry is more prevalent and the continuing businesses that are spuriously labeled entrants are larger than true entrants, then this will increase the relative size of entrants in the country.

An alternative approach to overcoming measurement problems in firm turnover measures is to disaggregate by some key business characteristic and compare within-country variations in firm turnover. One interesting characteristic in this context is obviously the business size. Figure 1.3 presents entry rates by different size classes in manufacturing. In most countries, entry rates tend to decline with firm size, consistent with the view that firms tend to enter small, test the market, and, if successful, expand to reach the minimum efficiency scale. But in some European countries, we observe a flattening of the entry rate for firms greater than twenty employees, or even a U-shaped relation whereby entry rates tend to increase for larger firms compared with small firms.[29] It is interesting to notice that those countries where we observe the flattening of the entry rates are those generally characterized by relatively high administrative costs to set up a business.[30] The latter may stimulate firms to enter very small—and thus partly avoid some of the entry costs that kick in at a given size—or enter at a larger size and thus spread these fix entry costs over a larger investment plan. This is only a working hypothesis, which is however corroborated by more detailed econometric analysis (see Scarpetta et al. 2002). Of course,

28. Geographical considerations are also likely to affect the average size of firms; firms with plants spreading into different U.S. states are recorded as single units, while establishments belonging to the same firm but located in different EU states are recorded as separate units.

29. Focusing on the total business sector suggests a more monotonic relationship between entry rate and size classes; however, the steepness of the downward relations is less marked in those countries where we observe a flattening or even a U-shaped relation in manufacturing.

30. For example, France (3.5), Italy (4.6), the Netherlands (1.6), and Finland (1.8) all have indicators of the administrative costs of setting up a business (least regulated = 0, most regulated = 6) largely above the United States (0.7) or the United Kingdom (0.8). See Nicoletti, Scarpetta, and Boylaud (1999) for details on these indicators.

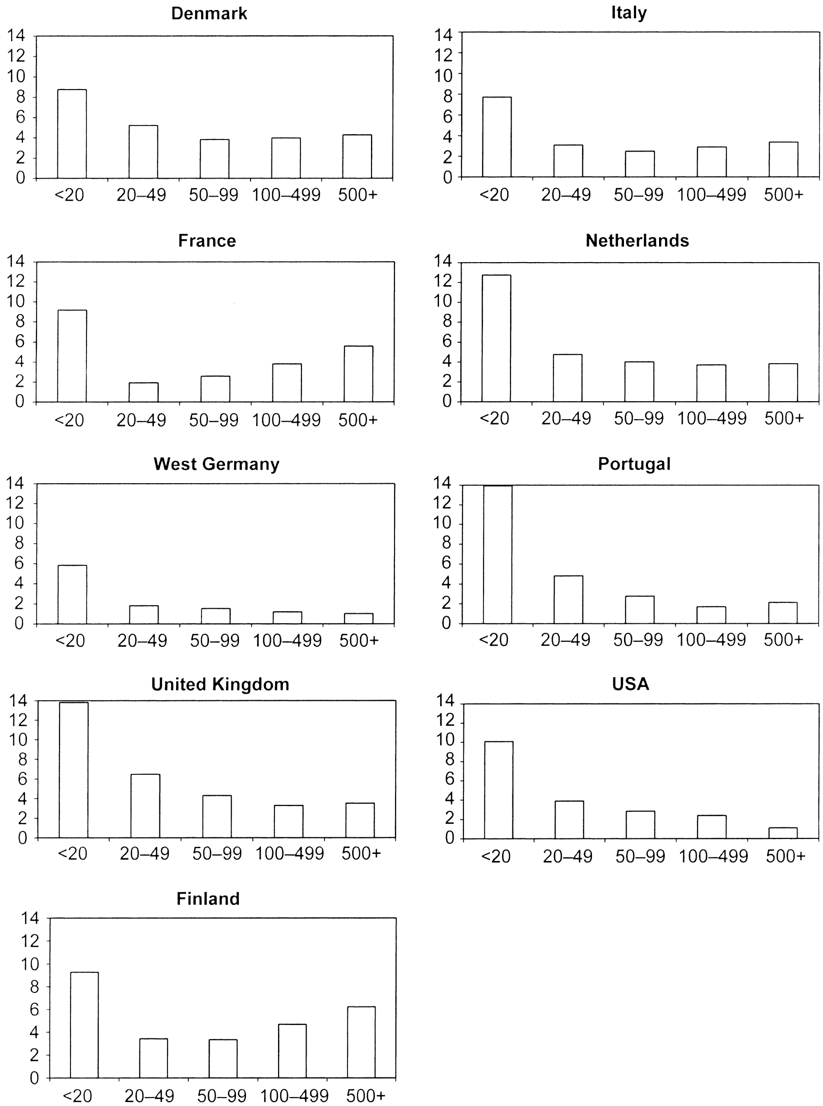


Fig. 1.3 Entry rates by firm size, manufacturing, 1990s
Note: Data for Finland are from 1992 to 1998.

the specific difference-in-difference approach works only if the measurement error in firm turnover does not vary systematically by size class. Longitudinal linkage problems interacting with sample selection problems that vary by size may be a problem in some countries.

Another dimension that can be used for this difference-in-difference approach is clearly the *industry*. Sectoral variation within and between countries may reflect a rich mix of the technological, cost, and demand factors driving firm dynamics, as well as market structure and institutions in the country. Table 1.6 presents sectoral gross firm turnover rates (entry plus exit rates weighted by employment) normalized by the overall cross-country industry average. As before, if technological and cost factors were predominant in determining the heterogeneity of firm dynamics across countries, we should find that the values in the country columns of table 1.6 are concentrated around one. The first element to report is that the variability of turnover rates for the same industry across countries is comparable in magnitude to that *across industry* in each country. Turnover rates (especially if weighted by employment) are somewhat higher in the service sector (especially in trade) than in manufacturing.[31] However, in most countries, some high-tech industries with rapid technological changes and market experimentation had relatively high entry rates in the 1990s (e.g., *office*; *computing and equipments*; and *radio*, *TV*, *and communication*). Transition countries, as well as Mexico, tend to have greater firm churning than industrial countries, on average.

The finding of important industry effects that hold across countries suggests a possible future avenue for the difference-in-difference approach to shed light on the role of institutions in shaping firm dynamics. Taking the U.S. firm dynamics as a benchmark for the underlying churning that is needed by technological and costs factors, it is possible to compare the cross-industry variation in the United States with that of other countries with stricter business regulations. If these regulations were indeed constraining firm dynamics, we should observe smaller variance in countries with stricter regulations. Some recent studies have indeed found some preliminary evidence that this is indeed the case.[32]

1.5.4 The Post-Entry Performance of Firms

Another useful metric to characterize firm dynamics is to examine post-entry performance of firms. Understanding the post-entry performance sheds light on the market selection process that separates successful entrant firms that survive and prosper from others that stagnate and eventually exit. In addition, post-entry performance is a measure that exploits variation that may be less subject to measurement error. Conditional on

31. In Italy, however, there appears to be only small differences in churning between manufacturing and services. This is particularly evident for the employment-weighted turnover and likely reflects the small differences in average size of firms between manufacturing and services. The lower turnover rate in the French service sector compared with that in manufacturing is likely to depend on the existence of a size threshold in the French data, which tends to be more binding in the service sector than in manufacturing. As an indication, the French data also suggest a higher average size of firms in the service sector than in manufacturing, in contrast with all other countries.

32. See Micco and Pages (2006); Klapper, Laeven, and Rajan (2006).

Table 1.6 **Gross firm turnover across countries and sectors (as a ratio of cross-country industry average)**

	Cross-country average	Industrial	Other countries	Denmark	France	Italy	Netherlands	Finland	West Germany	Portugal	U.K.	U.S.	Canada
Total economy	21.6	0.90	1.16	0.91	0.89	0.74	0.77	0.96	0.76	1.00		0.93	1.05
Agriculture, hunting, forestry, and fishing	19.8	1.02	0.97	0.98	1.08	0.78	0.66		1.14	1.36		1.09	1.03
Mining and quarrying	18.9	0.90	1.17	0.79	0.85	0.61	1.21	0.94	0.47	1.02		1.07	1.12
Total manufacturing	19.0	0.89	1.18	0.97	1.06	0.77	0.72	0.91	0.61	0.96	1.24	0.93	0.91
Food products, beverages, and tobacco	17.6	0.89	1.19	1.06	1.06	0.83	0.54	0.95	0.57		1.43	0.98	0.89
Textiles, textile products, leather, and footwear	22.2	0.94	1.11	1.02	0.88	0.79	0.80	0.90	0.73	1.03	1.13	1.19	1.02
Wood and products of wood and cork	19.8	0.85	1.27	0.93	0.80	0.69	0.62	0.92	0.49	1.13	1.12	1.05	0.91
Publishing, printing, and reproduction of recorded media	19.6	0.87	1.21	0.95	0.99	0.71	0.77	0.84	0.66	0.87	1.12	0.91	0.91
Coke, refined petroleum products, and nuclear fuel	19.7	0.75	1.38		1.18	0.51	0.63	0.94	0.53			0.82	0.69
Chemicals and chemical products	15.5	0.94	1.09	1.17	1.17	0.83	0.93	0.86	0.67	0.88		0.95	1.01
Rubber and plastics products	16.8	0.87	1.19	0.88	0.94	0.78	0.72	0.93	0.67	0.89		0.98	0.95
Other non-metallic mineral products	18.1	0.89	1.19	0.92	0.97	0.67	0.76	0.94	0.53	0.95	1.48	0.83	0.88
Basic metals	18.0	0.76	1.30	0.98		0.59	0.81	0.80		0.86	0.74	0.81	0.55
Fabricated metal products, except machinery and equipment	19.1	0.83	1.19			0.73	0.70	0.87		1.01	1.04	0.77	0.69
Machinery and equipment, N.E.C.	17.5	0.94	1.09	0.98	1.06	0.74	0.63	1.08			1.37	0.82	0.83
Office, accounting, and computing machinery	24.1	0.96	1.05			1.02	0.86	0.94		2.49	1.36	0.98	0.48
Electrical machinery and apparatus, Nec	17.6	0.97	1.05		1.08	0.81	0.94	0.88		1.03	1.39	0.83	0.86
Radio, television, and communication equipment	19.5	1.00	1.00		0.95	0.80	0.95	0.93		1.17	1.37	0.93	0.90
Medical, precision, and optical instruments	17.1	0.97	1.04		1.12	1.00	0.67	0.74		1.01	1.57	0.82	

(*continued*)

Table 1.6 (continued)

	Cross-country average	Industrial	Other countries	Denmark	France	Italy	Netherlands	Finland	West Germany	Portugal	U.K.	U.S.	Canada
Motor vehicles, trailers, and semi-trailers	17.5	0.92	1.10		0.95	0.81	0.64	0.93		0.69	1.51	0.94	0.83
Other transport equipment	20.7	0.94	1.08		0.91	0.76	0.72	0.97		0.71	1.39	0.92	0.99
Manufacturing Nec; recycling	20.4	0.88	1.18	0.97	0.88	0.73	0.81	0.85	0.61	0.64	1.48	1.00	0.93
Electricity, gas, and water supply	13.5	1.00	1.00	0.89	1.47	0.58	1.80	0.54	0.44	1.85		0.54	1.39
Construction	23.3	0.85	1.23	0.82	0.81	0.83	0.57	1.04	0.62	1.10		0.97	0.94
Services	22.7	0.89	1.14	0.89	0.84	0.70	0.76	0.92		0.97		0.87	1.04
Bus sector services	23.3	0.90	1.13	0.95	0.83	0.75	0.78	0.90		0.95		0.94	0.97
Wholesale and retail trade; restaurants and hotels	22.9	0.88	1.16	0.95	0.78	0.76	0.66	0.88		0.93		0.95	0.99
Transport, and storage, and communication	24.0	0.95	1.08	0.80	0.76	0.69	0.70	0.94	0.84	1.74		1.00	0.96
Finance, insurance, Real Estate, and business services	23.9	0.94	1.08	1.03	0.91	0.74	0.92	0.90		1.13		0.90	0.92
Community, social and personal services	21.7	0.82	1.20	0.63	0.85	0.56	0.63			0.97		0.67	1.31

	Cross-country average	Mexico	Slovenia	Hungary	Estonia	Brazil	Latvia	Romania	Argentina
Total economy	21.6	1.22	1.21	1.21	0.81		1.30	1.26	0.75
Agriculture, hunting, forestry, and fishing	19.8	0.92	1.27	1.00	0.77			0.98	0.56
Mining and quarrying	18.9	1.27	1.00	1.05	0.35	1.16	2.15		0.85
Total manufacturing	19.0	1.29	1.12	1.17	0.81	1.31	1.48	1.19	0.78
Food products, beverages, and tobacco	17.6	1.23	1.06	1.32	0.78	1.51	1.54		0.86
Textiles, textile products, leather, and footwear	22.2	1.30	1.02	1.03	0.65	1.31	1.31		0.86
Wood and products of wood and cork	19.8	1.48	1.13	1.39	0.96	1.29	1.42		0.79

Publishing, printing, and reproduction of recorded media	19.6	1.25	1.30	1.26	0.76	1.20	1.52	1.23	0.75
Coke, refined petroleum products, and nuclear fuel	19.7	1.07	1.81	1.16	5.07	0.54	2.49	0.55	0.86
Chemicals and chemical products	15.5	1.11	0.96	1.12	0.57	1.42	1.44	1.32	0.73
Rubber and plastics products	16.8	1.22	1.39	1.25	1.02	1.22	1.29	1.12	0.76
Other non-metallic mineral products	18.1	1.33	0.98	1.32	0.86	1.18	1.72	1.10	0.74
Basic metals	18.0	1.25	1.11	1.36	2.78	1.25	2.32	0.93	0.68
Fabricated metal products, except machinery and equipment	19.1	1.32	1.27	1.20	0.70	1.20	1.56	1.08	0.71
Machinery and equipment, N.E.C.	17.5		1.12	1.03	0.62	1.19	1.78	0.96	0.76
Office, accounting, and computing machinery	24.1		0.73	0.94	0.69	1.22	1.36	1.33	1.16
Electrical machinery and apparatus, Nec	17.6		1.06	1.14	0.86	1.27	1.09	1.14	0.69
Radio, television, and communication equipment	19.5		0.93	1.00	0.96	1.38	1.27	0.95	0.74
Medical, precision, and optical instruments	17.1		0.92	1.09	0.73	1.38	1.54	1.05	0.60
Motor vehicles, trailers, and semi-trailers	17.5	1.26	1.28	1.04	0.77	1.31	1.27	0.92	0.63
Other transport equipment	20.7	1.10	1.12	1.32	0.69	1.21	1.31	0.92	0.77
Manufacturing Nec; recycling	20.4	1.41	1.11	1.24	0.86	1.22	1.41	1.03	0.77
Electricity, gas, and water supply	13.5	0.69	0.60	1.43	0.90		2.01	1.23	0.48
Construction	23.3	1.76	1.11	1.10	0.74		1.22	0.95	1.03
Services	22.7	1.16	1.23	1.23	0.82		1.23	1.27	0.75
Bus sector services	23.3	1.16	1.19	1.20	0.80		1.20	1.24	0.82
Wholesale and retail trade; restaurants and hotels	22.9	1.18	1.27	1.21	0.82		1.22	1.26	0.82
Transport and storage and communication	24.0	1.10	1.18	1.09	0.71		1.12	1.14	0.92
Finance, insurance, Real Estate, and business services	23.9	1.11	1.04	1.18	0.79		1.17	1.28	0.73
Community, social, and personal services	21.7	1.03	1.60	1.39	0.83		1.32	1.32	0.57

the sample or register capturing an entrant firm, there is a reasonable chance that the sample or register will be able to follow the firm over time.

Figure 1.4 presents nonparametric (graphic) estimates of survivor rates. The survivor rate specifies the proportion of firms from a cohort of entrants that still exist at a given age. In the figure, the survival rates are averaged over different entry cohorts (those that entered the market in the late 1980s and 1990s) to minimize possible business cycle effects and possible measurement problems.

Looking at cross-country differences in survivor rates, about 10 percent (Slovenia) to more than 30 percent (in Mexico) of entering firms leave the market within the first two years (fig. 1.4). Conditional on overcoming the initial years, the prospect of firms improves in the subsequent period; firms that remain in the business after the first two years have a 40 to 80 percent chance of surviving for five more years. Nevertheless, only about 30 to 50

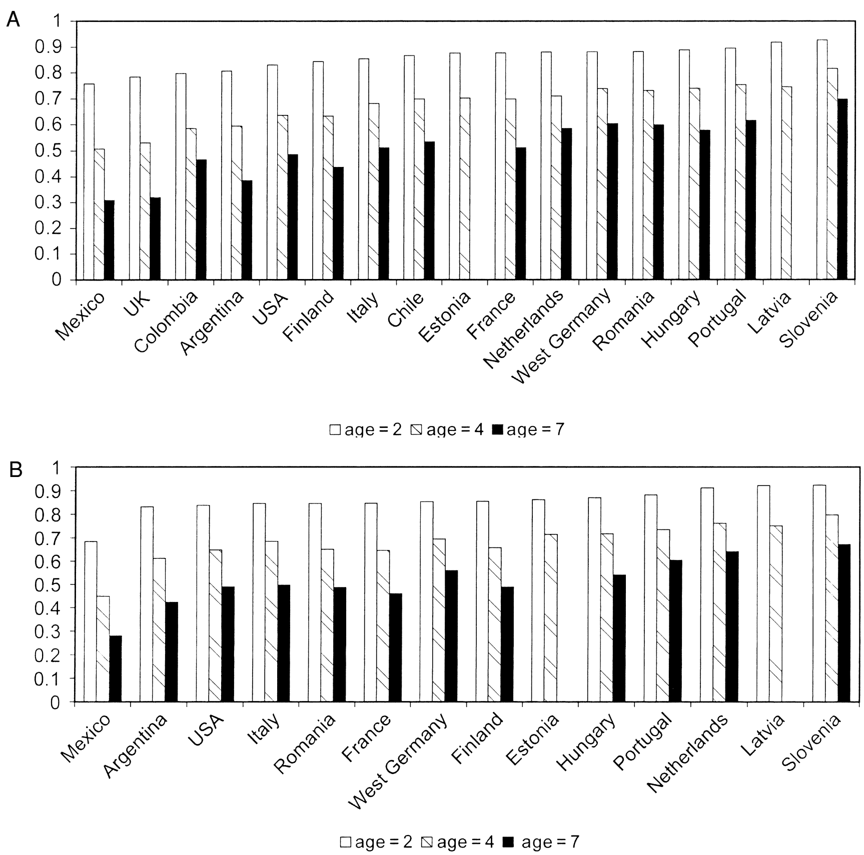


Fig. 1.4 Firm survival at different lifetimes, 1990s: *A*, manufacturing; *B*, total business sector

percent of total entering firms in a given year survive beyond the seventh year in industrial and Latin American countries, while higher survival rates are found in transition economies.[33]

For most countries, the rank ordering of survival is similar whether using a two-year, four-year, or seven-year horizon, suggesting that there is an important country effect that impacts the survival function. However, there are a few interesting exceptions. The United States has relatively low survival rates at the two-year horizon but relatively higher survival rates at the seven-year horizon. This pattern might reflect the relatively rapid cleansing of poorly performing firms in the United States.

Table 1.7 provides details on the survival rates at four years of age across industries and countries. The structure of the table is similar to those presented previously. Notably, the variation across countries is more systematic than that across industries. Across industries, between 60 and 80 percent of firms survive after four years, while for example, the survival rate in office and computing equipment deviates across countries from 40 percent below to 40 percent above the cross-country average of 70 percent.

The total employment in each given cohort tends to increase in the initial years because failures are highly concentrated among its smallest units and because of the significant growth of survivors. These facts are best presented by looking at gains in average firm size amongst surviving firms.

Given differences in data collection, the reference average size of entrants is that at duration one for industrial countries and duration zero for other countries, but excluding firms with zero employment. The choice for the industrial countries is dictated by the fact that entrant firms include zero-employee firms. For example, in the United States, the time when the firm is registered and when its employment is recorded differ, giving rise to the possibility that firms are recorded as having zero employees in the entry year and positive employment in the second year.[34] This, however, may represent an overcorrection as it eliminates employment growth in firms with positive employment at registration.

Figure 1.5 shows the evolution in average firm size of survivors as they age, corrected for possible changes in entry size of the actual survivors by age. In the figure, the average size of survivors at different duration is compared with that at entry. The difference in post-entry behavior of firms in the United States[35] compared with the western European countries is partially

33. Survivor rates for firms with twenty or more employees at age one are similar to those observed in the newly compiled EUROSTAT firm-level database (EUROSTAT 2004).

34. However, recent work by the U.S. Census Bureau shows that even after correcting for the zero-employee problem, the size expansion of entrant firms in the United States exceeds that in other industrial countries by a wide margin. The growth in firm size in the ensuing years shows that the United States continues to perform much better than other OECD countries.

35. The results for the United States are consistent with the evidence in Audretsch (1995). He found that the four-year employment growth among surviving firms was about 90 percent. See also Dunne, Roberts, and Samuelson (1988, 1989).

Table 1.7 **Survival rate (4 years of age) across countries and industries (as a ratio to cross-country sectoral average)**

	Cross-country average	Industrial	Other countries	Finland	France	U.K.	West Germany	Italy	Netherlands	Portugal	U.S.
Mining and quarrying	0.69	1.05	0.94	1.07	0.91		1.14	1.10	1.15	1.11	0.85
Total manufacturing	0.67	1.00	1.00	0.94	1.02	0.79	1.10	1.04	1.07	1.12	0.95
Food products, beverages, and tobacco	0.69	1.02	0.98	0.92	1.10	0.69	1.10	1.08	1.01	1.35	0.91
Textiles, textile products, leather, and footwear	0.59	0.96	1.03	0.95	0.98	0.75	0.99	1.04	1.02	1.14	0.81
Wood and products of wood and cork	0.64	1.04	0.97	0.95	1.10	0.86	1.12	1.09	1.19	1.04	0.99
Publishing, printing, and reproduction of recorded media	0.69	0.98	1.01	0.97	0.92	0.82	1.04	1.03	1.03	1.13	0.94
Coke, refined petroleum products, and nuclear fuel	0.73	1.05	0.96	1.05	1.05	0.67	1.20	1.23	1.13	1.37	0.79
Chemicals and chemical products	0.69	1.02	0.99	0.89	0.96	0.88	1.09	1.11	1.04	1.14	1.01
Rubber and plastics products	0.73	0.98	1.01	0.91	0.97	0.96	1.00	1.00	1.06	1.06	0.90
Other non-metallic mineral products	0.68	1.02	0.98	0.96	1.08	0.76	1.11	1.10	1.08	1.16	0.97
Basic metals	0.69	0.99	1.01	0.94		0.85		1.08	1.15	1.01	0.93
Fabricated metal products, except machinery and equipment	0.69	1.01	0.99	0.95		0.90		1.05	1.08	1.12	1.00
Machinery and equipment, N.E.C.	0.73	1.01	0.99	0.96	1.03	0.70		1.00	1.09	1.29	0.99
Office, accounting, and computing machinery	0.70	0.88	1.10	0.92		0.61		1.05	1.03	1.13	0.80
Electrical machinery and apparatus, Nec	0.74	0.93	1.06	0.90	1.01	0.71		1.00	1.00	0.99	0.91
Radio, television, and communication equipment	0.71	0.92	1.08	0.99	0.86	0.73		1.00	0.91	1.00	0.95
Medical, precision, and optical instruments	0.77	0.96	1.04	1.03	0.88	0.70		0.92	1.08	1.15	0.95
Motor vehicles, trailers, and semi-trailers	0.70	0.99	1.01	0.87	1.03	0.72		1.08	1.05	1.29	0.92
Other transport equipment	0.65	0.98	1.01	0.78	1.00	0.77		1.05	1.14	1.25	0.95

Manufacturing Nec; Recycling	0.66	1.02	0.98	0.93	0.99	0.78	1.14	1.04	1.11	1.29	0.92
Electricity, gas, and water supply	0.82	1.01	0.99	1.14	0.98		1.01	1.00	0.99	1.01	0.95
Construction	0.64	1.07	0.94	1.00	1.00		1.10	1.03	1.18	1.18	0.98
Market services	0.66	1.02	0.98	0.99	0.96		1.01	1.02	1.14	1.09	0.96
Wholesale and retail trade; restaurants and hotels	0.64	1.02	0.98	0.91	1.01		1.02	1.03	1.07	1.12	0.96
Transport, storage, and communication	0.66	0.98	1.02	1.22	1.05		1.00	1.04	1.07	0.45	0.94
Finance, insurance, Real Estate, and business services	0.70	1.01	0.99	1.01	0.85		1.00	1.01	1.16	1.10	0.95
Total nonagricultural business sector	0.65	1.02	0.99	1.00	0.99	0.82	1.05	1.04	1.16	1.13	0.97

	Cross-country average	Industrial	Other countries	Estonia	Hungary	Latvia	Romania	Slovenia	Argentina	Chile	Colombia	Mexico
Mining and quarrying	0.69	1.05	0.94	0.49	1.11	0.98		1.40	0.84			0.69
Total manufacturing	0.67	1.00	1.00	1.05	1.10	1.11	1.09	1.22	0.89	1.04	0.87	0.76
Food products, beverages, and tobacco	0.69	1.02	0.98	1.02	1.03	1.09		1.15	0.86	1.03	0.95	0.80
Textiles, textile products, leather, and footwear	0.59	0.96	1.03	1.19	1.21	1.30		1.20	0.91	1.08	0.87	0.80
Wood and products of wood and cork	0.64	1.04	0.97	1.01	1.08	1.04		1.26	0.83	1.13	0.77	0.69
Publishing, printing, and reproduction of recorded media	0.69	0.98	1.01	0.95	1.04	1.08	1.06	1.23	0.93	1.09	1.02	0.77
Coke, refined petroleum products, and nuclear fuel	0.73	1.05	0.96		0.97	1.14	1.37	1.37	0.83	0.93	1.11	0.92
Chemicals and chemical products	0.69	1.02	0.99	0.95	1.04	1.07	1.09	0.95	1.02	1.00	1.00	0.86
Rubber and plastics products	0.73	0.98	1.01	1.14	1.10	1.12	1.05	1.20	0.94	1.02	0.90	0.81
Other non-metallic mineral products	0.68	1.02	0.98	1.11	1.04	1.17	1.09	1.22	0.89	0.98	0.83	0.74
Basic metals	0.69	0.99	1.01		0.97	1.35	1.03	1.32	0.90	1.13	0.92	0.78

(*continued*)

Table 1.7 (continued)

	Cross-country average	Industrial	Other countries	Estonia	Hungary	Latvia	Romania	Slovenia	Argentina	Chile	Colombia	Mexico
Fabricated metal products, except machinery and equipment	0.69	1.01	0.99	1.12	1.12	1.21	1.09	1.27	0.85	1.00	0.82	0.70
Machinery and equipment, N.E.C.	0.73	1.01	0.99	1.01	1.09	0.96	1.03	1.20	0.86	0.97	0.75	
Office, accounting, and computing machinery	0.70	0.88	1.10	1.42	1.16	1.10	1.02	1.22	0.60	1.42	1.42	
Electrical machinery and apparatus, Nec	0.74	0.93	1.06	1.02	1.06	1.05	1.10	1.13	0.93	1.14	0.98	
Radio, television, and communication equipment	0.71	0.92	1.08	0.95	1.07	1.27	1.07	1.22	0.86	1.06	1.04	
Medical, precision, and optical instruments	0.77	0.96	1.04	1.30	1.07	1.15	1.01	1.12	0.99	1.04	0.81	
Motor vehicles, trailers, and semi-trailers	0.70	0.99	1.01	1.07	1.14	1.43	1.14	1.16	0.95	0.96	0.83	0.81
Other transport equipment	0.65	0.98	1.01	1.37	1.13	1.43	1.21	1.06	0.83	0.88	0.88	0.76
Manufacturing Nec; recycling	0.66	1.02	0.98	1.05	1.11	1.20	1.11	1.17	0.89	1.07	0.78	0.70
Electricity, gas, and water supply	0.82	1.01	0.99	0.95	0.98	1.12	1.05	1.06	0.95			0.88
Construction	0.64	1.07	0.94	1.16	1.16	1.21	1.17	1.31	0.66			0.32
Market services	0.66	1.02	0.98	1.07	1.06	1.12	0.96	1.19	0.89			0.73
Wholesale and retail trade; restaurants and hotels	0.64	1.02	0.98	1.06	1.07	1.13	0.98	1.20	0.87			0.74
Transport, storage, and communication	0.66	0.98	1.02	1.15	1.11	1.22	1.04	1.14	0.98			0.78
Finance, insurance, Real Estate, and business services	0.70	1.01	0.99	1.06	1.06	1.13	1.00	1.20	0.91			0.75
Total nonagricultural business sector	0.65	1.02	0.99	1.09	1.10	1.15	1.00	1.23	0.88	1.07	0.90	0.67

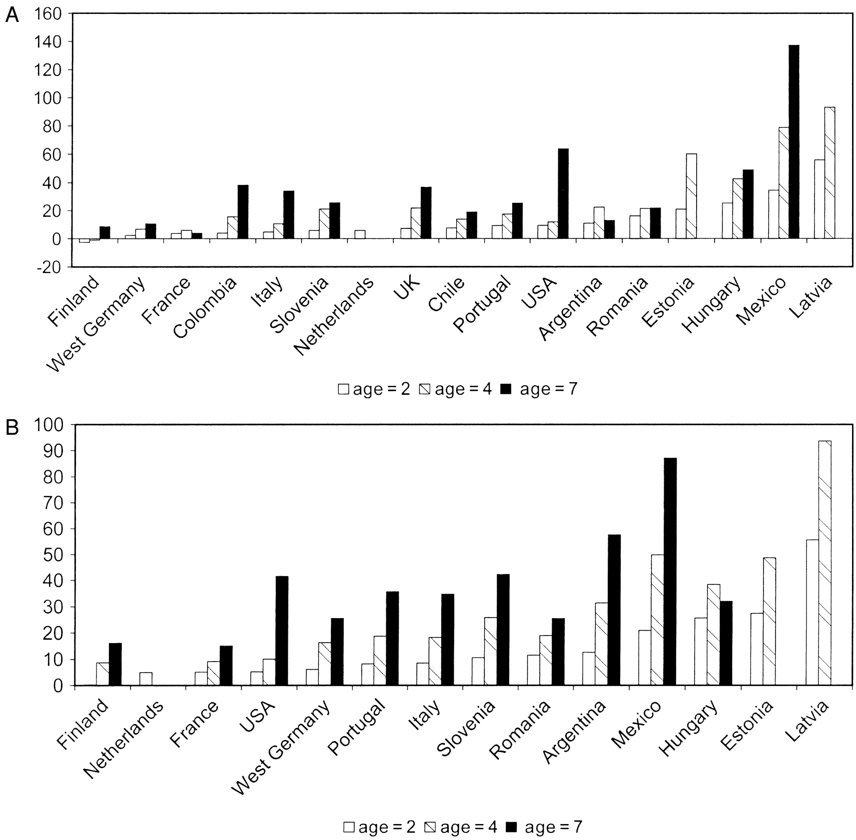


Fig. 1.5 Average firm size relative to entry, by age: *A*, manufacturing; *B*, total business sector

due to the larger gap between the size at entry and the average firm size of incumbents (i.e., there is a greater scope for expansion among young ventures in the U.S. markets than in Europe). In turn, the smaller relative size of entrants can be taken to indicate a greater degree of experimentation, with firms starting small and, if successful, expanding rapidly to approach the minimum efficient scale.[36]

Latin American countries also offer a wide range of post-entry performance of firms. Argentina has very limited post-entry expansion of successful firms in manufacturing, while in Mexico selection of small firms is stronger than in all other countries. However, post-entry growth of successful firms is also very strong, pointing to vigorous market selection process but also to sizeable rewards for successful new firms.

36. This greater experimentation of small firms in the U.S. market may also contribute to explain the evidence of a lower than average productivity at entry.

Transition economies also show a different behavior from most other countries on firm survival. They tend to show higher survivor rates and large post-entry growth of successful firms, which confirm the hypothesis that new firms enjoyed a period of relatively low market contestability, especially in new low populated markets. Romania is obviously an outlier among transition economies; not only are failure rates higher than in the other countries, but even successful entrants have more limited opportunities of expanding.

1.6 The Effects of Creative Destruction on Productivity

1.6.1 Reallocation and Productivity: Growth versus Level Comparisons

In the previous two sections we have presented evidence of significant cross-country differences in firm characteristics, their market dynamics, and post-entry performance, which cannot be fully explained by differences in sectoral composition of the economy but rather points to salient differences in market characteristics and in business environment. The next obvious question is, do these differences matter for aggregate performance? We address this question in a number of ways. First, we examine the connection between productivity growth and the reallocation dynamics that we have documented in the prior sections. We are particularly interested in the contribution of entering and exiting businesses as well as the contribution of the reallocation of activity among continuing businesses. However, this analysis of dynamic efficiency, while inherently interesting, is fraught with interpretational and measurement difficulties. We attempt to overcome some aspects of these difficulties by exploiting sectoral variation within countries and then, in turn, comparing such sectoral differences across countries. In addition, we explore static efficiency by viewing a cross-sectional decomposition of productivity. The latter turns out to be simpler and more robust in terms of theoretical predictions and measurement problems.

The approach taken in much of the empirical literature is to use accounting decompositions that decompose aggregate growth into components that reflect the contributions of productivity growth within continuing firms, the firm turnover process, and the reallocation of resources across continuing firms. The decompositions are correct in an accounting sense but interpreting the results is, as noted, fraught with challenges. Part of the problem here is to develop tight links between theoretical models of productivity enhancing reallocation and these empirical decompositions. One way to think about the empirical decompositions is that they provide a set of moments that models should match. Lentz and Mortensen (2005) take this approach by using a model of reallocation where the key frictions are in the labor market (via search frictions). Levinsohn and Petrin (2005) provide a related useful benchmark by showing that in a model without frictions and without entry and exit, aggregate productivity growth is given by the weighted average of the productivity growth of continuing firms. In other words, without frictions there is no contribution of reallocation to aggregate productivity growth. These two studies remind us that the role of reallocation in productivity growth is inherently related to underlying frictions in the markets. For example, for net entry to be important it must be the case that it is costly for firms to enter and exit. If it is costless in terms of time and resources for firms to enter or exit, we would not observe any difference in the productivity at the margin between entering and exiting businesses. While frictions are at the core of this connection between productivity and reallocation, precisely how these frictions interact with the connection between productivity and reallocation is complicated both conceptually and in the evidence that emerges from cross-country evidence. We turn to these issues and findings now.

1.6.2 Reallocation and Productivity Growth

Let's define the sector-wide productivity level in year t, P_t as:

$$P_t = \sum_i \theta_{it} p_{it} \tag{7}$$

where θ_i is the input share of firm i and P_t and p_{it} are a productivity measure.[37] In this chapter we focus on labor productivity based on gross output data, although other measures are available for a subset of countries/sectors. We also use a decomposition suggested by Baily, Hulten, and Campbell (BHC henceforth, 1992) and in turn modified by Foster, Haltiwanger, and Krizan (FHK henceforth, 2001). BHC and FHK decompose aggregate (or industry-level) productivity growth into five components, commonly called the *within effect*, *between effect*, *cross effect*, *entry effect*, and *exit effect*, as shown in order below:

$$\begin{aligned}\Delta P_t = {} & \sum_{i \in C} \theta_{it-k} \Delta p_{it} + \sum_{i \in C} \Delta\theta_{it} (p_{it-k} - P_{t-k}) + \sum_{i \in C} \Delta\theta_{it} \Delta p_{it} \\ & + \sum_{i \in N} \theta_{it} (p_{it} - P_{t-k}) - \sum_{i \in X} \theta_{it-k} (p_{it-k} - P_{t-k})\end{aligned} \tag{8}$$

where Δ means changes over the k-years' interval between the first year $(t - k)$ and the last year (t); θ_{it} is as before; C, N, and X are sets of continuing, entering, and exiting firms, respectively; and P_{t-k} is the aggregate (i.e., weighted average) productivity level of the sector as of the first year $(t - k)$.[38]

The FHK method uses the first year's values for a continuing firm's share

37. A variety of measures of productivity have been used in the literature including labor productivity, measures of total factor productivity that vary from estimated residuals from production functions to divisia index approaches to multilateral index number approaches.

38. The shares are usually based on employment in decompositions of labor productivity and on output in decompositions of total factor productivity.

(θ_{it-k}), its productivity level (P_{it-k}), and the sector-wide average productivity level (P_{t-k}). One potential problem with this method is that, in the presence of measurement error in assessing market shares and relative productivity levels in the base year, the correlation between changes in productivity and changes in market share could be spurious, affecting the within- and between-firm effects.

To tackle these potential problems, we have also used the approach proposed by Griliches and Regev (1995), which uses the time averages of the first and last years for them ($\bar{\theta}_i$, $\bar{p}_i$, and $\bar{P}$). As a result the cross-effect, or covariance term, disappears from the decomposition. The averaging of market shares reduces the influence of possible measurement errors, but the interpretation of the different terms of the decomposition is less clear-cut as the time averaging makes the within-effect term affected by changes in the firms' shares over time, and the between-effect term affected by changes in productivity over time. The results obtained using this method are qualitatively similar to those obtained using the FHK and are not presented in the chapter.

As a final sensitivity analysis, we also use the method proposed by Baldwin and Gu (BG henceforth, 2002) that uses, as a reference for the calculations of the relative productivity of the different groups, the average productivity of exiting firms. With this method, the contribution from exiting firms disappears and the entry component is positive if, on average, their productivity is higher than those of firms they are supposed to replace (the exiting firms).

In all of these decompositions, the baseline analysis is based on five-year rolling windows for all periods and industries for which data are available. We also present results for three-year rolling windows and test the hypothesis that the contribution from entry changes with the time horizon considered. However, care has to be taken in interpreting the entry and exit components as they do not always reflect a comparison between productivity levels at the same point in time. For example, in the version of the FHK decomposition used here, the entry component comprises the difference between average productivity among entrants at the end of the three- to five-year period with overall productivity at the beginning. Therefore, it is obvious that a positive entry component does not necessarily mean that productivity among entering firms is above average in relation to their contemporaries.

Before discussing the results of these decompositions, it is important to notice that their interpretation is not always straightforward from a theoretical, as well as measurement, point of view. The working hypothesis that poor market structure and institutions will distort the contribution of the creative destruction process has complex implications when using these basic accounting decompositions. The reason is that distortions may affect the reallocation dynamics on different margins in a variety of ways. For example, artificially high barriers to entry will lead to reduced firm turnover and to a less efficient allocation of resources. But given the high barrier to entry (and in turn the implied ability of marginal incumbents to increase survival probabilities), the average productivity of entrants will rise while the average productivity of incumbents and exiting businesses will fall. Similar predictions apply to policies that subsidize incumbents and/or restrict exit in some fashion. The point is that institutional distortions might yield a larger gap in productivity between entering and exiting businesses, which will contribute to larger net entry term in the previous decompositions.

Alternatively, some types of distortions in market structure and institutions might make the entry and exit process less rational (i.e., less driven by market fundamentals but more by random factors). Such randomness may be associated with either a higher or lower pace of churning. Pure randomness would, in principle, increase the pace of churning, but the random factors might be correlated with other factors (e.g., firm size) and thus the impact would be to distort the relationship between churning and such factors with less clear predictions on the overall pace of churning. In any event, such randomness would imply less systematic differences between entering, exiting, and incumbent businesses—in the extreme when all entry and exit is random there should be no differences between entering, exiting, and incumbent businesses.[39]

Another related problem is that a business climate that encourages more market experimentation might have a larger long-run contribution but a smaller short-run contribution from the creative destruction process. That is, the greater market experimentation may be associated with more risk and uncertainty in the short run so that it is only after the trial and error process of the experimentation has worked its way out (through learning and selection effects) that the productivity payoff is realized. Thus, a business climate that encourages market experimentation might have a lower short-run contribution from entry and exit but a higher long-run contribution from entry and exit. Thus, in terms of these decompositions, the horizon over which the decomposition is measured may have a major effect on the contribution of net entry in a specific country in a manner that is idiosyncratic to that country, and therefore impact any cross-country comparisons.[40]

In short, the gap between the productivity of entering and exiting busi-

39. Oviedo (2005) models the randomness of institutional enforcement as a way of capturing variations in institutional quality across countries. She shows that such randomness reduces the link between firm turnover and allocative efficiency.

40. Foster, Haltiwanger, and Krizan (2001) found large differences in the contribution of entry and exit between five- and ten-year horizons in the United States. Their analysis suggests that this is because entering cohorts in the United States are very heterogeneous. The selection of the least productive entrants in the first several years as well as the relatively greater increases in productivity for surviving entrants, relative to more mature incumbents over the same period, imply that the impact of net entry is much larger at a ten-year horizon than a five-year horizon. They show that this holds even taking into account the inherently higher share of activity accounted for by entering and exiting businesses over a longer horizon.

nesses is not by itself sufficient to gauge the contribution or efficiency of the creative destruction process. In addition, different types of distortions might be acting simultaneously in a country. It might be that different policies act to subsidize incumbents (preferential treatment for incumbents), other policies artificially increase the barriers to entry (poorly functioning financial markets and/or regulatory barriers), while other policies make exit more random for some types of businesses (e.g., poorly functioning financial markets for young and small businesses). As such, there might be too little churning on some dimensions and too much on others, and the gap between entering and exiting businesses might be too large on some margins and too small on others.

With all of these caveats in mind, figure 1.6 presents the decomposition of labor productivity growth in the total business sector and figure 1.7 presents the decomposition of labor productivity for the manufacturing over the 1990s for a large sample of countries.

A number of elements emerge from these decompositions:

- Productivity growth is largely driven by *within-firm performance*. In industrial and emerging economies (outside transition), productivity within each firm accounts for the bulk of overall labor productivity growth. This is particularly the case if one focuses on the three-year horizon (not reported). Over the longer run (i.e., five-year horizon),

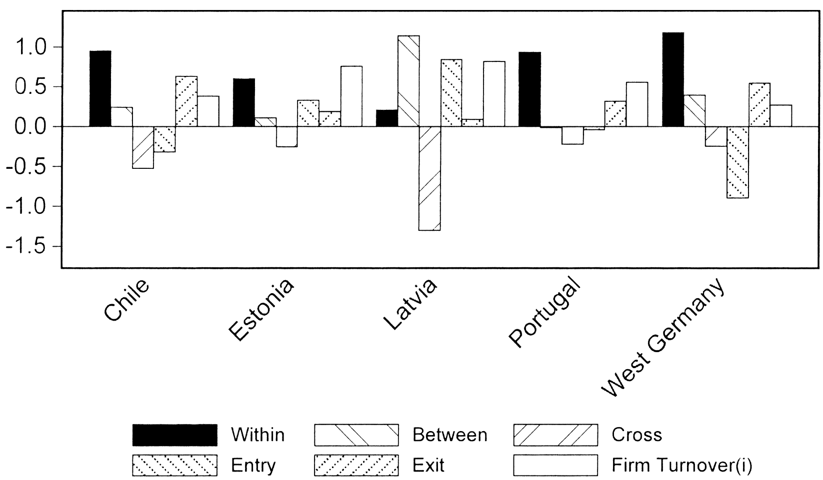


Fig. 1.6 Firm-level labor productivity decomposition for Total Business Sector

Notes: Chile: 1985–1999; Estonia 2000–2001; West Germany 2000–2002; Latvia 2001–2002; Portugal 1991–1994. Excluding Brazil and Venezuela. Within = within-firm productivity growth. Between = productivity growth due to reallocation of labor across existing firms. Entry = productivity growth due to entry of new firms. Exit = productivity growth due to exit of firms. Firm turnover = Entry plus exit rates.

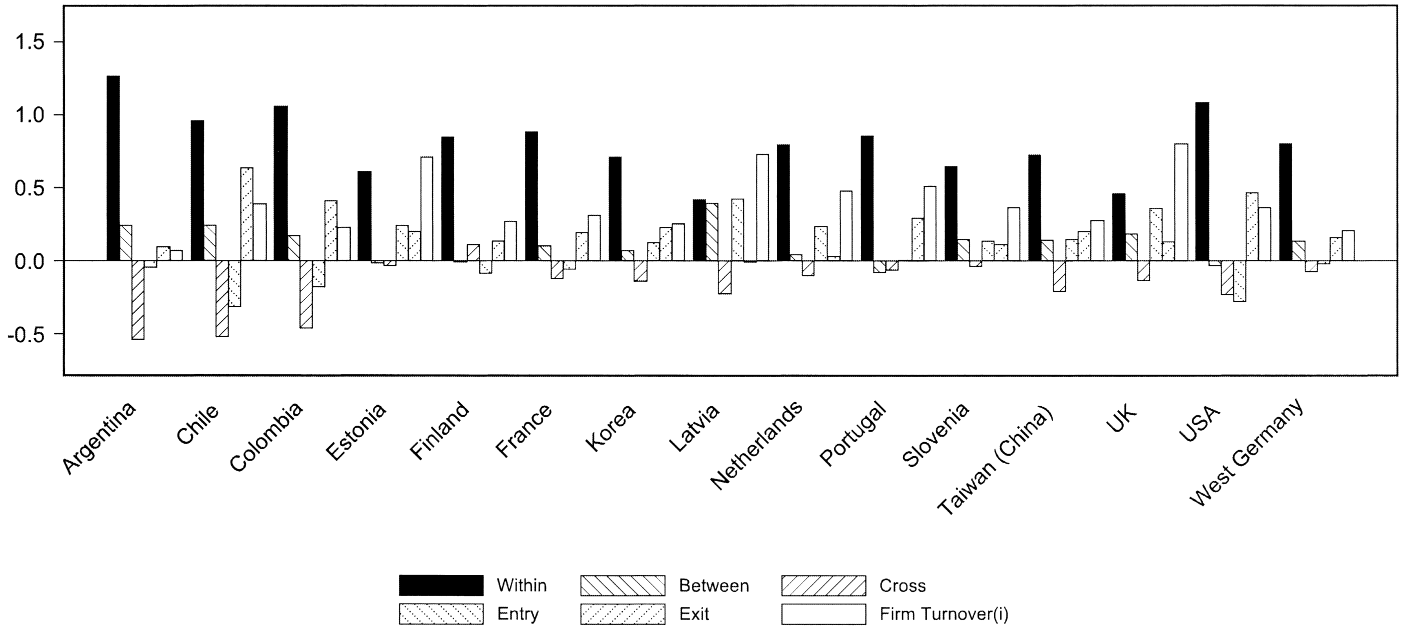


Fig. 1.7 Firm-level labor productivity decomposition for manufacturing

Notes: Argentina 1995–2001; Chile 1985–1999; Colombia 1987–1998; Estonia 2000–2001; Finland 2000–2002; France 1990–1995; West Germany 2000–2002; Korea 1988 and 1993; Latvia 2001–2002; Netherlands 1992–2001; Portugal 1991–1994; Slovenia 1997–2001; Taiwan 1986, 1991 and 1996; U.K. 2000–2001; U.S. 1992 and 1997. Excluding Brazil and Venezuela.

reallocation (and, in particular, the entry component) plays a stronger role in promoting productivity growth.

- The impact on productivity via the *reallocation of output across existing enterprises* (the between effect) varies significantly across countries. It is generally positive but small. This factor should be assessed together with the covariance (or cross) term, which combines changes in productivity with changes in employment shares. The *covariance term* is negative in most countries, including the transition economies. This implies that firms experiencing an increase in productivity were also losing market shares (i.e., their productivity growth was associated with restructuring and downsizing rather than expansion). This negative cross term, in a related way, is potentially associated with adjustment costs of labor. That is, in any given cross section there are some businesses that have recently had a productivity shock, but due to adjustment costs have not adjusted their labor inputs (at least fully). For businesses with a recent positive shock, the higher productivity will lead to a higher desired demand for labor and thus we will see such businesses increase employment, but due to diminishing returns (in the presence of any fixed factors at the micro level), a decrease in productivity.
- Finally, the contribution of *net entry* to overall labor productivity growth is generally positive in most countries, accounting for between 20 percent and 50 percent of total productivity growth. The exit effect is always positive (i.e., the least productive firms exit the market contributing to raise the productivity average of those that survive). Data for European countries show that new firms typically make a positive contribution to overall productivity growth, although the effect is generally of small magnitude. By contrast, entries make a negative contribution in the United States for most industries. Interpreting these findings without more information is difficult. The weak performance of entrants in the United States might reflect greater experimentation, so that for each entering cohort of entrants there is more selection and potentially more learning by doing.[41] In transition economies, in all but one country (Hungary over the three-year horizon) the entry of new firms makes a positive and often strong contribution to productivity. For most countries, while the contribution of net entry is posi-

41. Some evidence in favor of this interpretation is provided in Haltiwanger, Jarmin, and Schank (2003); Foster, Haltiwanger, and Krizan (2001, 2002); and Bartelsman and Scarpetta (2004). The former work provides evidence of greater market experimentation in the United States relative to Germany. The latter shows that as the horizon lengthens in the United States, the contribution of net entry rises disproportionately. Moreover, Foster, Haltiwanger, and Krizan (2001, 2002) show that the increased contribution of net entry is due to both selection of the low productivity entrants and due to learning by doing to successful entrants.

tive, it is less than proportionate relative to the share of employment accounted for by firm turnover.

An open question is whether the observed differences across countries are accounted for by differences in market institutions and policies or whether they reflect different circumstances and/or problems of measurement. As discussed above, drawing such inferences from cross-country evidence is difficult given that the policy environment may impact in a variety of ways and given the measurement problems. Consider, for example, the problem of measurement error in firm turnover that yields too high a measure of turnover for a country because of longitudinal linkage problems. Other things equal, spuriously high firm turnover will increase the share of activity associated with entering and exiting businesses and therefore increase the contribution of net entry to productivity growth. However, this same measurement error is likely to impact the differences in productivity between continuing, entering, and exiting businesses. If the true relationship is such that exiting businesses are less productive than continuing businesses, spurious entry and exit will tend to reduce this difference since some of the measured exiting businesses will in fact be continuing businesses. For entry, the relationship is potentially more complicated and also related to interpretation as well as differences across countries in the nature of their dynamics. For a country where entrants are immediately more productive than continuers, spurious measurement error will tend to reduce the gap and therefore decrease the contribution of net entry. For a country where entrants tend to be less productive than incumbents at entry perhaps due to market experimentation, as in the United States, spurious entry and exit will decrease the negative gap and therefore increase the contribution of net entry (since it will reduce a negative effect).

One set of countries where these measurement and interpretation problems appear to be interacting in interesting ways is for the transition economies (Estonia, Hungary, Latvia, Romania, and Slovenia). In these countries, there is a very high rate of firm turnover as a share of total employment and entry accounts for a large (but less than proportionate to the share of turnover) share of productivity growth. The large contribution of entry partly reflects the large rate of firm turnover, but it also reflects by construction a positive gap between entrants and incumbents productivity. In interpreting the latter finding, it is useful to put it in the context of the high pace of turnover. In general, it is difficult to interpret differences across countries in the magnitude of the gap between entering and exiting businesses. For example, this gap might reflect fundamentals driving market selection with new businesses adopting the latest business practices (or in transition economies, new businesses adopting market business practices relative to incumbents), or it might reflect a very high entry barrier so that only very productive new businesses enter. However, the latter explanation might suggest that firm turnover rates should be lower, which does not appear to be the case for the transition economies. Still, for these economies the contribution of net entry is far from proportionate, suggesting that there is substantial churning of businesses via entry and exit that is not productivity-enhancing.

Our data also allow checking the sensitivity of the contribution of firm entry to differences in the time horizon. Table 1.8 presents the difference in the components of the decomposition as the horizon increases from three to five years for selected countries. To make the three and five year components comparable, the components have all been annualized. For the selected countries, lengthening the horizon increases the annual contribution of net entry, decreases the annual contribution of the between component, and has a mixed impact on the within component. The increase in the net entry component is largest for the transition economies, with a relatively large increase of almost three percent for Estonia. For the transition economies at least, these findings are consistent with the hypothesis that learning and selection effects increase the contribution of net entry over a longer horizon.

There is also an important sectoral dimension to the process of restructuring, reallocation, and creative destruction. Figure 1.8 presents the productivity decompositions for two groups of industries in manufacturing: (a) the low technology industries, and (b) the medium-high-technology industries. The large negative cross-term discussed previously (i.e., the fact that firms with strong productivity growth downsized is evident in low-tech industries, while in medium-high-tech industries this effect, albeit still present, seems to be smaller). Even more interesting, the contribution of new firms to productivity growth is modest in low-tech industries, and even largely negative in a few countries, including the United States. But the entry effect is strongly positive in medium-high-tech industries. This result suggests an important role for new firms in an area characterized by stronger technological changes. Given our focus on measurement issues in this chapter, these findings provide another illustration why exploiting the

Table 1.8 **Time horizon differences**

	Difference in component from 5 to 3 years		
Country	Net entry	Between	Within
Argentina	0.001	–0.001	0.028
Chile	0.002	–0.005	–0.007
Colombia	0.001	–0.005	–0.004
Estonia	0.028	–0.006	–0.007
Latvia	0.019	–0.009	0.027
Slovenia	0.007	–0.001	0.001

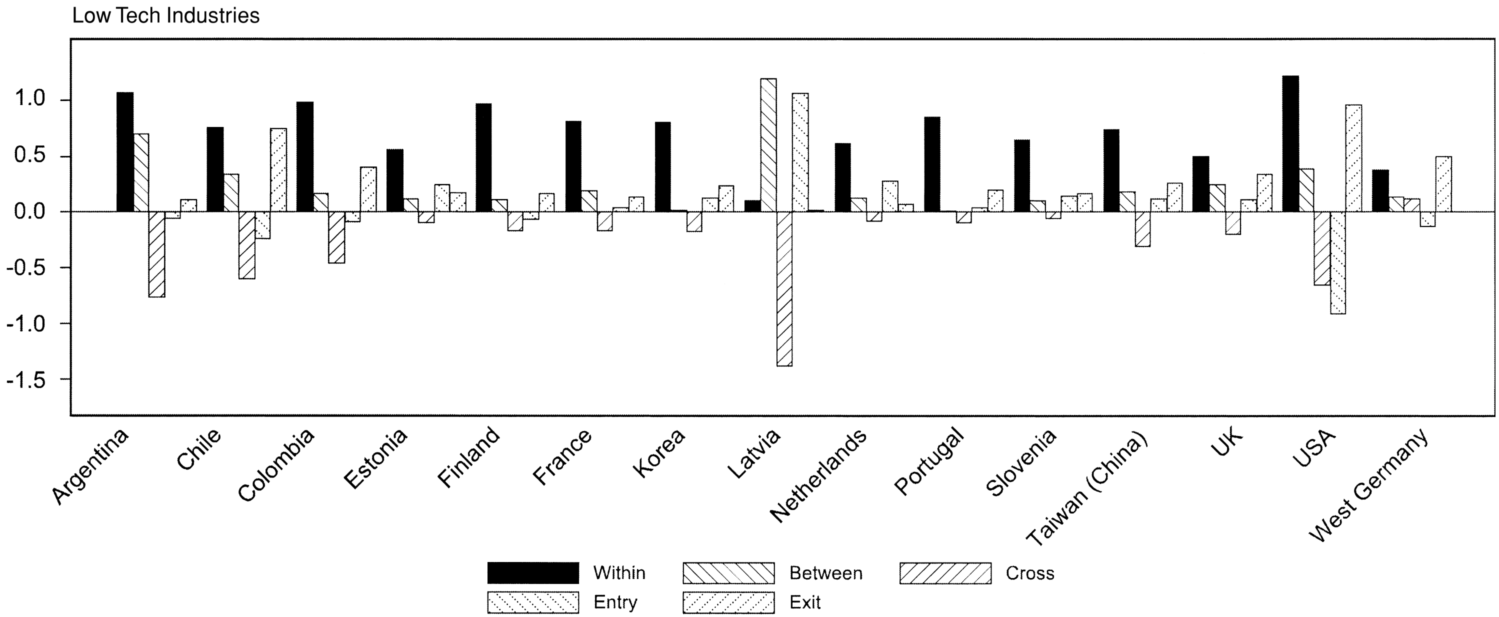


Fig. 1.8 Productivity decomposition by technology groups

Notes: Argentina 1995–2001; Chile 1985–1999; Colombia 1987–1998; Estonia 2000–2001; Finland 2000–2002; France 1990–1995; West Germany 2000–2002; Korea 1988 and 1993; Latvia 2001–2002; Netherlands 1992–2001; Portugal 1991–1994; Slovenia 1997–2001; Taiwan 1986, 1991, and 1996; U.K. 2000–2001; U.S. 1992 and 1997. Excluding Brazil and Venezuela.

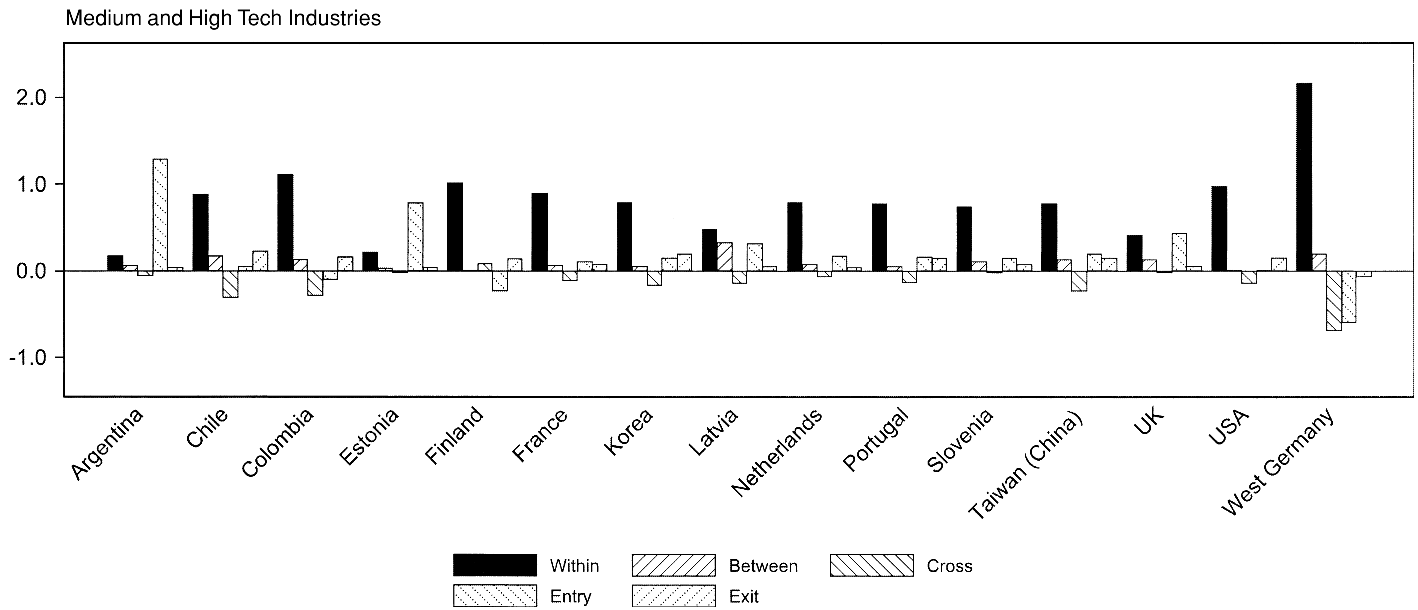


Fig. 1.8 (cont.)

Notes: Argentina 1995–2001; Chile 1985–1999; Colombia 1987–1998; Estonia 2000–2001; Finland 2000–2002; France 1990–1995; West Germany 2000–2002; Korea 1988 and 1993; Latvia 2001–2002; Netherlands 1992–2001; Portugal 1991–1994; Slovenia 1997–2001; Taiwan 1986, 1991 and 1996; UK 2000–2001; U.S. 1992 and 1997. Excluding Brazil and Venezuela.

Table 1.9 **Accounting for the differences between FHK and BG decompositions**

	Net entry difference	Exit/entry share difference	Incumbent/exit productivity difference
Argentina	–0.01	–0.012	0.098
Chile	–0.007	–0.022	0.432
Colombia	0.003	0.008	0.627
Estonia	–0.001	–0.031	0.28
Finland	–0.002	–0.013	0.251
France	0.003	0.034	0.107
Korea, Republic	–0.042	–0.122	0.495
Latvia	0.000	–0.001	–0.037
Netherlands	0.001	0.028	0.025
Portugal	–0.011	–0.039	0.394
Slovenia	0.010	0.059	0.252
Taiwan (China)	–0.014	–0.077	0.264
U.K.	0.005	0.148	0.051
U.S.	0.002	0.012	0.299
West Germany	0.000	0.001	0.274

Notes: The reported figures are the time series averages. The first column is the product of the second and third column. However, since the reported figures are averages over time, the identity may appear not to hold (the product of the averages is not the same as the average of the product).

cross-industry variation within countries is a useful approach in cross-country analysis.

Table 1.9 presents the difference in the net entry component (annualized) for the FHK and BG methodologies. Recall that a key difference is that FHK use the initial average productivity of all plants as the benchmark from which entering and exiting plants' productivity are compared, while BG use the exiters' productivity. Foster, Haltiwanger, and Krizan (2001) motivate their approach as having desirable accounting properties (i.e., entering plants contribute positively to industry productivity growth over time if they are above the initial average, while exiting plants contribute positively to industry productivity growth if they are below the initial average). Baldwin and Gu (2003) motivate their approach as being more appropriate to the extent that entrants are displacing exiting plants, so the correct reference group for entrants are the exiting businesses they are displacing.[42] For most countries the difference is small.

It is intuitive that the effects should in general be small because for both methods the net entry term depends critically on the difference between average productivity of entering and exiting businesses. In other words, both the entry and the exit term subtract off whatever base is used, so at first

42. One technical limitation of this alternative is that it implies, in turn, that the benchmark for the between component is the productivity of the exiters, which is difficult to motivate.

glance, it might appear that the base is irrelevant (the base term in each component cancels out in the net). Consistent with this perspective, computing the difference between the FHK and BG net entry terms yields:

$$FHK - BG = (\sum_{i \in X} \theta_{it-k} - \sum_{i \in N} \theta_{it})(P_{t-k} - P^X_{t-k}) \tag{9}$$

where P_{t-k} is the average productivity of incumbents and P^X_{t-k} is the average productivity of exiting businesses in the base year. Thus, if the share of activity (in this case employment) accounted for by entering and exiting businesses is the same, then the difference is zero. As seen in section 1.5, for most countries the share of activity accounted for by entry is about the same as that for exit, typically with the latter slightly larger since exiting businesses tend to be larger than entering businesses. Thus, this difference in weights does not matter for most countries. However, for Korea—and to a lesser extent Portugal and Taiwan (China)—the share of employment accounted for by exit is substantially less than the share of employment accounted for by entry, leading to larger differences between the two decomposition methods. This difference yields an especially big effect in Korea given that the gap between incumbents and exiting businesses is also large.

To conclude this discussion of dynamic decompositions, it is worth highlighting the range of problems in drawing inferences from cross-country comparisons of the contribution of net entry across countries. For one, these decompositions depend critically on accurately measuring the extent of entry and exit. As we have noted, spurious entry and exit will have complex implications for the contribution of net entry with effects working in potentially opposite directions. For another, horizon may play a critical role in these decompositions and such horizon differences are arguably different across countries (and industries). The horizon problems are mitigated if very long differences are used (e.g., ten years), but this in turn poses problems of data limitations and measurement (e.g., the measurement problems may be worse over a longer horizon). We believe that these dynamic decompositions highlight some interesting patterns that appear to reflect rich actual differences in the firm dynamics.

1.6.3 The Cross-Sectional Efficiency of the Allocation of Activity

So far, the creative destruction process has been discussed mostly from the point of view of productivity growth. This is natural in this context since the creative destruction process is inherently dynamic. However, as discussed previously at some length, measurement and interpretation problems raise questions about the comparisons of dynamic decompositions across countries. An alternative approach that is simpler and more robust is to ask the question, are resources allocated efficiently in a sector/country in the cross section at a given point in time? Dynamics can also be examined here to the extent that the nature of the efficiency of the cross-sectional allocation of businesses can vary over time.

This approach is based upon a simple cross-sectional decomposition of productivity growth developed by Olley and Pakes (1996). They note that in the cross section, the level of productivity for a sector at a point in time can be decomposed as follows:

$$P_t = (1/N_t)\sum_i P_{it} + \sum_i \Delta\theta_{it}\Delta P_{it} \tag{10}$$

where N is the number of businesses in the sector and Δ is the operator that represents the cross-sectional deviation of the firm-level measure from the industry simple average. The simple interpretation of this decomposition is that aggregate productivity can be decomposed into two terms involving the unweighted average of firm-level productivity, plus a cross term that reflects the cross-sectional efficiency of the allocation of activity. The cross term captures allocative efficiency since it reflects the extent to which firms with greater efficiency have a greater market share.

This simple decomposition is very easy to implement and essentially involves just measuring the unweighted average productivity *versus* the weighted average productivity. Measurement problems make comparisons of the levels of either of these measures across sectors or countries very problematic, but taking the difference between these two measures reflects a form of a difference-in-difference approach. Beyond measurement advantages, this approach also has the related virtue that theoretical predictions are more straightforward as well. Distortions to market structure and institutions unambiguously imply that the difference between weighted and unweighted productivity (or equivalently the cross term) should be smaller.

With these remarks in mind, figure 1.9 shows the measure of the gap between weighted and unweighted average productivity for a sample of countries. The results are obtained by applying the Olley Pakes (OP) decomposition at the industry level and then taking the weighted average across industries for the countries in the harmonized database. For virtually all countries, the gap is positive, suggesting that resources are allocated to more productive businesses. The South East Asian economies are on top, followed by the United States, while the Latin American countries (except Argentina) show higher productivity boosts through resource allocation than the EU, but lower than in Asia. The transition economies are generally weaker in terms of this measure of allocative efficiency. For many countries, the gap is not only positive but large. For the Asian economies and the United States, the allocative efficiency term accounts for about 50 percent or more of labor productivity. In the EU, the productivity boost is smaller, ranging from 15 to 38 percent.

The findings in figure 1.9 are striking and suggest that this measurement approach has great potential in a cross-country context. Moreover, the allocative efficiency measures can be computed for different years or for specific industries and/or other classifications of firms, suggesting that a

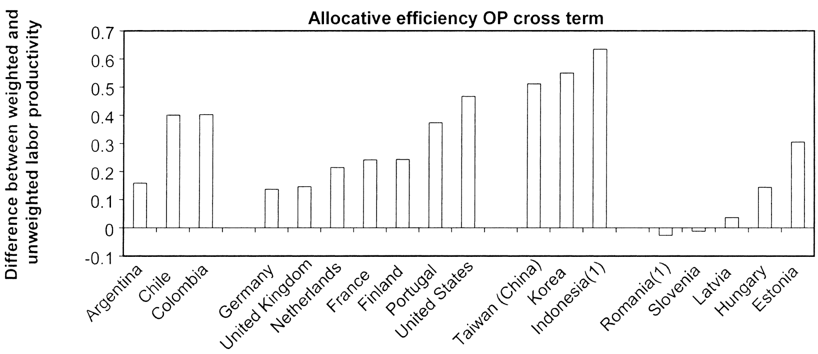


Fig. 1.9 The gap between weighted and unweighted labor productivity, 1990s
Note: Based on the three-year differences.

pooled country, firm-type data set of allocative efficiency measures would be valuable for further analysis. Note, however, that the allocative efficiency measures are not without problems and limitations. A key problem is that the measures by construction do not permit decomposing the contribution of entering, exiting, and continuing businesses. As such, in an analysis of the impact of institutions on reallocation and productivity dynamics, these allocative efficiency measures cannot be used to investigate the impact of institutions on such measures of firm dynamics and in turn, the contribution of those effects on productivity. Measurement error will also cloud the interpretation of the allocative efficiency measures. Classical measurement error in productivity at the micro level that is uncorrelated with market share will tend to drive the allocative efficiency to zero. Classical measurement error in productivity that is also correlated with market share (put differently, classical measurement error in output measures at the micro level) will work in the opposite direction.

1.7 Concluding Remarks

In this chapter we assess the measurement and analytic challenges for studying firm dynamics within and across countries. We use recently collected indicators of firm dynamics for a sample of more than twenty countries. Our cross-country data set has been assembled, paying great care to the harmonization of key concepts. Such harmonization is essential to conduct meaningful comparisons, but we acknowledge that our effort should probably be extended, as there remain measurement problems. While simple comparisons of firm dynamics across countries remain difficult to interpret, interesting inferences can be made by examining multiple indicators and by carefully considering the nature of the measurement errors. Since much of these errors are country-specific, using some form of difference-in-difference approach that eliminates overall country-specific effects helps enormously.

Bearing in mind these measurement problems, there is evidence in our data of a significant heterogeneity of firms in each market and country. This heterogeneity is manifested in large disparities in firm size, firm growth, and productivity performance. More in detail, we found:

- The *average size* of incumbent firms varies widely across sectors and countries. Differences in firm size are largely driven by within-sector differences, although in some countries sectoral specialization also plays a significant role. Smaller countries tend to have a size distribution skewed towards smaller firms, but the average size of firms does not map precisely with the overall dimension of the domestic market. An important message emerging from our analysis is that in the empirical analysis of firm dynamics, differences in the size composition across sectors and countries ought to be controlled for.
- *Firm churning*, taken at face value, is large; gross firm turnover is in the range of 10 to 20 percent of all firms in industrial countries, and even more in transition and other emerging economies. Entering, but also exiting, firms tend to be small and thus firm flows affect only about 5 to 10 percent of total employment. This may suggest that the entry of small firms is relatively easy while larger-scale entry is more difficult, but survival among small firms is also more difficult—many small newcomers fail before reaching the efficient scale of production. Given the measurement and interpretation issues related to firm turnover data, we suggest exploring the variation in firm turnover across sectors and firms of different sizes to shed some light on the different nature of creative destruction.
- *Market selection is pretty harsh.* About 20 to 40 percent of entering firms fail within the first two years of life. Confirming previous results, failure rates decline with duration; conditional on surviving the first few years, the probability of survival becomes higher. But only about 40 to 50 percent of total entering firms in a given cohort survive beyond the seventh year.
- *Successful entrants expand rapidly.* Surviving firms are not only relatively larger but also tend to grow rapidly. The combined effect of exits being concentrated among the smallest units and the growth of survivors makes the average size of a given cohort increase rapidly towards the efficient scale. Measuring the post-entry performance within countries appears to be somewhat more robust than the analysis of firm dynamics, since it implies following a cohort over time within a country.
- *Creative destruction is important for promoting productivity growth.* While the continuous process of restructuring and upgrading by incumbents is essential to boost aggregate productivity, the entry of new

firms and the exit of obsolete units also play an important role. In virtually all of our countries, the net entry process contributes positively to productivity growth. While measurement and interpretation problems associated with firm turnover cloud rank orderings across countries, within-country variations in the contribution of firm turnover to productivity growth may be an interesting avenue of research. For example, we observe a stronger contribution of net entry to productivity growth in high-technology industries compared with low-technology ones, and the differences between these two groups vary significantly across countries. This in turn may suggest a different role of creative destruction in promoting technological adoption and experimentation. Moreover, this pattern helps highlight the usefulness of exploiting the cross-industry variation within countries and in turn comparing that cross-industry variation across countries within this context.

- *Allocative efficiency is important in productivity levels, rank ordering of countries, and in productivity growth.* Allocative efficiency can be measured using cross-sectional data within a country or industry, or by using the covariance between market share and efficiency (i.e., measures of productivity). In using this measure, we find that virtually all countries exhibit positive allocative efficiency. Further, the rank ordering of countries on this basis appears more reasonable than other measures of the contribution of the reallocation process to growth.

References

Ahn, S. 2000. Firm dynamics and productivity growth: A review of micro evidence from OECD countries. OECD Economics Department Working Paper no. 297. Paris: Organization for Economic Cooperation and Development.

Audretsch, D. B. 1995. Innovation, growth and survival. *International Journal of Industrial Organisation* 13 (1995): 441–57.

Aw, B. Y., S. Chung, and M. Roberts. 2003. Productivity, output, and failure: A comparison of Taiwanese and Korean manufacturers. *Economic Journal* 113 (491): F485–F510.

Baily, M. N., C. Hulten, and David Campbell. 1992. Productivity dynamics in manufacturing establishments. *Brookings Papers on Economic Activity: Microeconomics*: 187–249. Washington, D.C.: Brookings Institution.

Baldwin, J. and W. Gu. 2002. Plant turnover and productivity growth in Canadian manufacturing. OECD Science, Technology, and Industry Working Papers 2002/2. OECD Publishing.

Barro, R. J., and X. Sala-i-Martin. 1995. *Economic growth.* New York: McGraw-Hill.

Bartelsman, E. J. 2004. The analysis of microdata from an international perspective. OECD Statistics Directorate, STD/CSTAT, 12. Paris: Organization for Economic Cooperation and Development.

Bartelsman, E., and S. Scarpetta. 2004. Experimentation within and between firms: Any role for policy and institutions? Paper presented at the 2004 American Economic Association Meeting. 3–5 January, San Diego.
Bartelsman, E. J., and M. Doms. 2000. Understanding productivity: Lessons from longitudinal microdata. *Journal of Economic Literature* 38 (3): 569–95.
Bartelsman, E. J., J. Haltiwanger, and S. Scarpetta. 2004. Distributed analysis of firm-level data from industrial and developing countries. Mimeograph.
Bastos, F., and J. Nasir. 2004. Productivity and the investment climate: What matters most? World Bank Policy Research Working Paper no. 3335.
Bernard, A., and C. J. Jones. 1996a. Productivity across industries and countries: Time series theory and evidence. *The Review of Economics and Statistics* 78 (1): 135–46.
———. 1996b. Productivity and convergence across U.S. states and industries. *Empirical Economics* 21:113–35.
Brown, D. J., and J. S. Earle. 2004. Economic reforms and productivity-enhancing reallocation in post-Soviet transition. Upjohn Institute Staff Working Paper no. 04-98.
Caves, R. E. 1998. Industrial organization and new findings on the turnover and mobility of firms. *Journal of Economic Literature* 36 (4): 1947–82.
Davis, S. J., J. Haltiwanger, and S. Schuh. 1996. *Job Creation and Destruction.* Cambridge, MA: The MIT Press.
Davis, S. J., and M. Henrekson. 1999. Explaining national differences in the size and industry distribution of employment. *Small Business Economics* 12:59–83.
Dickens, W. T., and E. L. Groshen. 2003. Status of the international wage flexibility project after the authors' conference. The Brookings Institution and the Federal Reserve Bank of New York, May.
Dollar, D., M. Hallward-Driemeier, and T. Mengistae. 2003. Investment climate and firm performance in developing economies. World Bank Policy Research Working Paper no. 3323. Washington, D.C.: World Bank, Development Research Group.
Dunne, T., M. Roberts, and L. Samuelson. 1989. The growth and failure of U.S. manufacturing plants. *Quarterly Journal of Economics* 104:671–98.
———. 1988. Patterns of firm entry and exit in U.S. manufacturing industries. *RAND Journal of Economics* 19 (4): 495–515.
Doppelhofer, G., R. Miller, and X. Sala i Martin. 2004. Determinants of long-term growth: A bayesian averaging of classical estimates (BACE) approach. *American Economic Review* 94 (4): 813–35.
Eslava, M., J. Haltiwanger, A. Kugler, and M. Kugler. 2004. The effects of structural reforms on productivity and profitability enhancing reallocation. *Journal of Development Economics* 75 (2): 333–71.
EUROSTAT. 1998. Enterprises in Europe, data 1994–95. Fifth Report European Commission.
———. 2004. Business demography in Europe—Results for 10 member states and Norway. Luxembourg: European Commission.
Foster, L., J. Haltiwanger, and C. J. Krizan. 2001. Aggregate productivity growth: Lessons from microeconomic evidence. In *New developments in productivity analysis*, ed. Edward Dean, Michael Harper, and Charles Hulten pp. 303–418. Chicago: University of Chicago Press.
———. 2002. The link between aggregate and micro productivity growth: Evidence from retail trade. NBER Working Paper no. 9120. Cambridge, MA: National Bureau of Economic Research, August.
Geroski, P. 1995. What do we know about entry? *International Journal of Industrial Organization* 13:421–40.

Griliches, Z., Regev, H. 1995. Firm productivity in Israeli industry: 1979–1988. *Journal of Econometrics* 65 (1): 175–203.

Griffith, R., S. Redding, and J. Van Reenen. 2000. Mapping the two faces of R&D: productivity growth in a panel of OECD industries. Institute for Fiscal Studies Working Papers no. 2.

Hallward-Driemeier, M., S. Wallsten, L. C. Xu. 2004. The investment climate and the firm: Firm-level evidence from China. World Bank Policy Research Working Paper no. 3003.

Haltiwanger, J., R. Jarmin, and T. Schank. 2003. Productivity, investment in ICT and market experimentation: Micro evidence from Germany and the U.S.. Center for Economic Studies Working Paper no. 03-06.

Haltiwanger, J., and H. Schweiger. 2004. Firm performance and the business climate: Where does ICA fit in? Mimeograph.

Klapper, L., L. Laeven, and R. Rajan. 2006. Entry regulation as a barrier to entrepreneurship. *Journal of Financial Economics* 82:591–629.

Levinsohn, A., and J. Petrin. 2005. Measuring industry productivity growth using plant-level data. Mimeograph.

Lentz, R., and D. Mortensen. 2005. Productivity growth and worker reallocation. *International Economic Review* 46 (3): 731–49.

Martin, R. 2005. Providing evidence based on business micro data: Methods and results. London School of Economics. Unpublished Manuscript.

Micco, A., and C. Pages. 2006. The economic effects of employment protection: Evidence from international industry-level data. IZA Discussion Papers no. 2433.

Nicoletti, G., and S. Scarpetta. 2003. Regulation, productivity and growth: OECD evidence. *Economic Policy* 18 (36): 9–72.

Nicoletti, G., S. Scarpetta, and O. Boylaud. 1999. Summary indicators of product market regulation with an extension to employment protection legislation. OECD Economics Department Working Paper no. 226. Paris: Organization for Economic Cooperation and Development.

Olley, G. S., and A. Pakes. 1996. The dynamics of productivity in the telecommunications equipment industry. *Econometrica* 64 (6): 1263–97.

Organization for Economic Cooperation and Development (OECD). 2004. The economic impact of ICT: Measurement, evidence, and implications. Paris: OCED.

Oviedo, A. M. 2005. Doing business in developing economies: The effect of regulation and institutional quality on the productivity distribution. Unpublished Manuscript.

Roberts, M., and J. Tybout. 1997. Producer turnover and productivity growth in developing countries. *The World Bank Research Observer* 12 (1): 1–18.

Scarpetta, S., ed. 2004. The sources of economic growth in OECD countries. Paris: OECD. http://ariel.sourceoecd.org/vl=1234676/cl=68/nw=1/rpsv/cgi-bin/fulltextew.pl?prpsv=/ij/oecdthemes/99980134/v2003n1/s11/p11.idx

Scarpetta, S., P. Hemmings, T. Tressel, and J. Woo. 2002. The role of policy and institutions for productivity and firm dynamics: Evidence from micro and industry data. OECD Economics Department Working Papers, no. 329.

Sutton, J. 1997. Gibrat's legacy. *Journal of Economic Literature* 35 (1): 40–59.

World Bank. 2004. *World development report: A better investment climate for everyone*. Washington, D.C.: World Bank.