Preliminary draft

Measuring and Analyzing Cross-country Differences in Firm Dynamics

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Abstract

The process of creative destruction is being documented for a growing number of countries as the required firm-level data are becoming more easily accessible to researchers. Some early attempts have been made to compare results from the individual country studies and to gain insights into the sources of the variation in firm dynamics across countries. Comparative studies may be particularly useful to test the hypothesis that market structure and institutional differences across countries affect the observed magnitude, nature and efficiency of the creative destruction process. However, these "meta analyses" or ex-post comparisons of country studies are inherently difficult given differences in measurement and methodology across studies. Ideally, firm-level data would be pooled across countries in a harmonized fashion in order to exploit within and between country variations in a fully consistent manner. While there has been some progress in creating comparable firm-level data through surveys sponsored by international organizations, the pooled firm-level datasets rarely reflect representative samples of firms in each of the countries. The pooling of nationally representative firm-level data used by national statistical agencies is essentially impossible given privacy and confidentiality restrictions on micro data.

This paper highlights the measurement and analytical challenges incurred using an alternative approach, namely the compilation of harmonized detailed statistics on firm dynamics obtained by applying common definitions and extraction criteria across countries. Even this ex-ante harmonization of definitions and extraction criteria does not prevent problems of cross-country comparability, since there are idiosyncratic features in the country datasets that cannot be reconciled. A closely related problem with such cross-country comparisons of measures of firm dynamics is that measurement errors vary across countries, especially with respect to the coverage of different types of businesses and the quality of longitudinal linkages. For measures of firm dynamics both are critical and imply that the direct comparison of the magnitude of creative destruction across countries is problematic. In this paper we present comparisons of those measures where the problems are less severe. Further, many cross-country comparisons are made by exploiting the within-country variation, i.e. by performing difference-in-difference comparisons. We illustrate these measurement issues taking advantage of a newly assembled dataset that draws from separate national micro-data sources (business registers, census, or representative enterprise surveys) but with ex-ante harmonization of the metadata and computational methods.

JEL classification: L11, G33, D92,

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Introduction

Cross-country comparisons and analysis of firm dynamics are inherently interesting, but also inherently difficult. Such comparisons are important because they provide evidence of the allocative efficiency of an economy. Empirical evidence for developed economies shows that healthy market economies typically exhibit a high pace of churning of outputs and inputs across businesses.[2] An obvious question is the extent to which the pace and nature of the churning process across businesses is productivity enhancing, i.e. outputs and inputs are being reallocated from less productive to more productive businesses. In turn, the question is whether certain regulations and institutions in different markets affect the churning process in a manner that slows the reallocation of resources towards more productive uses. And, on the flip side, since a high pace of churning inevitably involves substantial costs to firms and workers, the overall economic impact of such churning is important.[3]

In this paper 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 different performances 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.[4]

In principle, using firm-level data to assess cross-country differences in performance is attractive. It avoids some of the problems of interpreting broader cross-country differences in economic performance. For example, economists have long struggled to explain the observed large differences in income per capita across countries or even growth rates of GDP and productivity. Interpreting persistent differences in economic performance is a challenge, not because of the lack of candidate explanations, but rather because of the overwhelming number of possible explanations. As such, the finding of a statistically significant correlation between cross-country differences in economic performance and any possible policy, institutional or

2. See Caves, 1998; Bartelsman and Doms, 2000; and Ahn, 2000 for surveys. In all countries studied, there is evidence that the population of firms undergo significant changes over time, both through resource reallocation between existing firms and the process of firm entry and exit. For the study of productivity, the role of within-firm productivity growth *vs*. the productivity growth induced by the reallocation of resources from less productive to more productive businesses has been the focus of much recent research (see, e.g., Olley and Pakes (1996), Griliches and Regev (1995) and Foster, Haltiwanger and Krizan (2001,2002)).

3. The idea that workers and firms incur significant search and other adjustment costs has been the subject of much recent analysis (see, e.g., Mortensen and Pissarides, 1999; and Caballero and Hammour, 2000).

4. Recent papers that explore whether firm-level dynamics appear to be crucial for the relative success of developed economies include Eslava et. al., (2004), Roberts and Tybout (1997), Aw, Chung and Roberts (2002) and Brown and Earle (2004).

structural variable is fraught with problems of interpretation given the (many) omitted variables.[5] 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 dynamics approach potentially 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 meaningfully may be related to all regulatory or institutional issues. 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. Figure 1 shows the rank ordering of countries according to firm turnover and levels and growth rates of GDP per capita.[6] 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 for firm turnover is 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).[7] We argue in the paper 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 paper, 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 measures of firm dynamics by imposing the same meta-data requirements and aggregation methods as best as possible on the firm-level data. Second, while harmonization is necessary, it is far from sufficient. Unfortunately, as illustrated in Figure 1, some core cross-country comparisons will be problematic. However, the third message is that there are ways to overcome these problems. While the details differ

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5. This explains the difficult in obtaining robust empirical results from macro growth regressions. From the seminal work of Barro and Sala i Martin (1995) based on simple cross-country regressions, the empirical literature has evolved into using panel data dynamic regression that exploit the time dimension in the data and possible differences in the speed of adjustment. More recently, some authors (Doppelhofer, Miller and Sala i Martin, 2004), employ a Bayesian Averaging of Classical Estimates (BACE), which constructs estimates as a weighted average of OLS estimates for every possible combination of included variables. Only 11 of the 32 chosen explanatory variables were found to be robustly correlated with long term growth, and among them the strongest evidence is for the initial level of GDP per capita.

6. As we will emphasize, the countries presented in this paper are those that conducted ‘distributed micro-data analysis’ as described below. We made every attempt to harmonize the statistics by providing detailed protocols and programs to researchers with access to the confidential micro-level datasets in their countries. The indicators in our database are built up from these (confidential) micro-level sources.

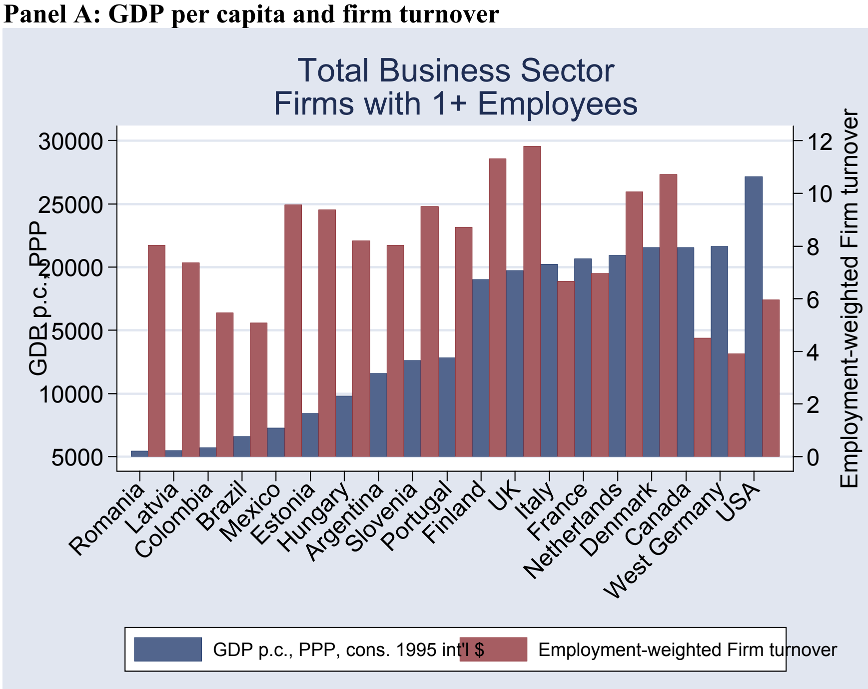
7. Note amongst other things the correlation between these measures is very low (-0.002 using the GDP per capita level and 0.169 using the GDP per capita growth).

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.

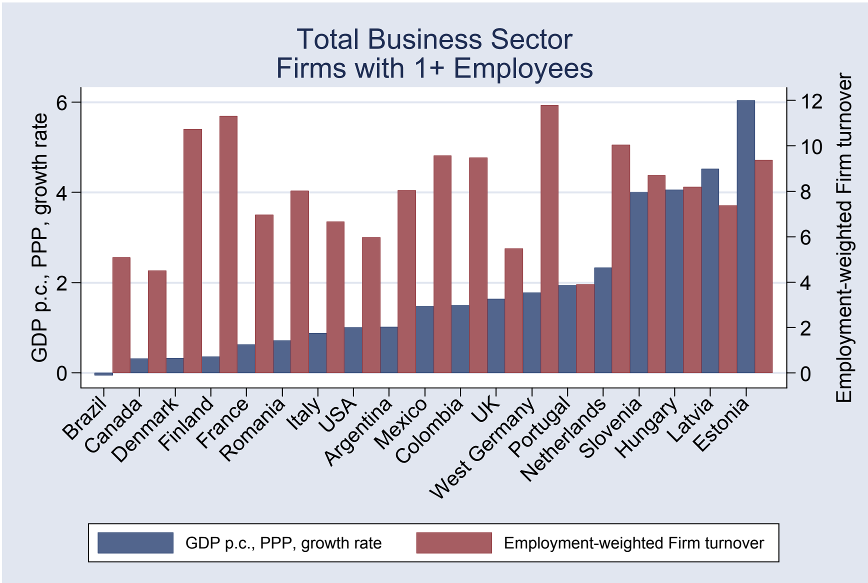
The paper proceeds as follows. In Section 2, we describe the approach – *the distributed micro-data analysis* -- that we advocate and have used in our cross-country comparison project. As we make clear the problems illustrated in Figure 1 are much worse if there is not an attempt at harmonization. In section 3, we describe the data collected in the World Bank and OECD firm-level projects. In section 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 5 and 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 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 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, 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.

Figure 1 Comparisons of GDP per capita growth and firm turnover

Panel A: GDP per capita and firm turnover



Panel B: GDP per capita growth and firm turnover



1. Distributed micro-data analysis

The indicators used for cross-country comparisons in this paper have been collected by a network of researcher with access to (confidential) micro data using a common methodology and harmonized meta-data. This collection method is an attempt in the generation of comparable cross-country statistics, and is part of a long tradition of statistical harmonization, which has resulted in a wide variety of cross-country sources of economic data available to applied researchers, ranging from national accounts information to internationally harmonized surveys. Much institutional effort has been devoted to harmonize national accounts data across countries in order to improve comparability. 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 often cloud cross-country comparisons. Several sources (including the OECD for its member countries and the World Bank for a larger set of countries) provide Purchasing Power Parity indicators (PPPs) to convert various expenditure components of GDP into internationally comparable units. Most applied research using these sources take the published data as given.

Significant efforts also been made to produce comparable statistics at *the sectoral level* (e.g. the OECD Structural Analysis database or the UNIDO 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, the dataset is 'top down', in that sectoral output and compensation add up to national accounts totals (up to various adjustments such as owner occupied housing). Applied researchers using these data (e.g. Bernard and Jones 1998, Griffith, Redding and Van Reenen, 2000; and Nicoletti and Scarpetta, 2003) generally take these sectoral data as given and focus on the economic theory and econometric techniques needed to test their hypotheses.

Comparable micro-level datasets are even less frequent, and comparability issues are generally more severe. 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 or the IPUMS datasets are all examples of this effort to compile and use comparable micro datasets. Standardized Labor Force Surveys following ILO definitions are also available for a large set of countries.

At the *firm-level*, no comprehensive surveys exist that collect data of firms in multiple countries, nor are there datasets that contain micro-level data for comprehensive samples of firms.[8] The EU Statistical Office (Eurostat) has recently made a major effort in assembling a dataset on firm demographics for a number of EU member countries, using common definitions and classifications.[9] 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 sample of firms in more than 50 developing and emerging economies world-wide (see World Bank, 2004).[10] These data are often limited to a few industries and do not allow tracking firm dynamics.

How to collect and compare firm-level data

A dataset consisting of 'stacked' micro-level datasets from multiple countries will contain the necessary information lacking from either single-country micro datasets or multiple-country sectoral datasets. Unfortunately, owing to the legal necessity of maintaining confidentiality of firms' responses in many countries, micro datasets 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 dataset made through randomization or micro-aggregation often is not feasible without the loss necessary information.

Another possible workaround is to create a dataset consisting of results from single-country studies that become the input for 'meta-analysis.' For example, a collection of results from single-country studies on the link between ICT and growth at the firm-level, were presented in a recent volume of the OECD (2003b). However, the combination of results of analyses from single-country studies will not provide a solution if the effect of interest is not identifiable within a single country. Further, meta-analysis becomes difficult when the details of the underlying micro-datasets are not well documented. The construction of longitudinal firm-level data is often complex, and requires researchers to have specialized knowledge and experience of the data sources. For example, tracking firms through business registers requires an in-depth understanding of how registers are designed and changes that occur to them over time. Firm-level data are also subject to various protocols (often embodied in legal requirements) relating to the protection of information. The data are typically only accessible to designated individuals and output prepared for wider circulation usually has to be vetted before being released

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

9. See EUROSTAT, 2004. The Eurostat data focus on 11 European countries over the period 1997-2000, and consider all firms, including those with zero employees.

10. 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 dataset vs. the type of firm-level data used here is provided in Haltiwanger and Schweiger (2004). Recent papers that have used the ICA data to study firm performance include Bastos and Nasir (2004), Dollar *et. al.* (2003), Hallward-Driemeier *et al.* (2003).

In the World Bank and OECD firm-level projects, a hybrid approach was followed that mitigates many of the discussed problems. The project does not use 'stacked' data. Instead, identical analysis was conducted separately by experienced researchers using micro-level datasets residing in participating countries. The analysis was designed and programmed after face-to-face meetings with country experts and collection of meta-data describing each country's datasets.[11] The analysis was run in each country separately and produced output that could be collected centrally. The combined output provided the information necessary for 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). This method requires tighter co-ordination and less flexibility in research design in each country than for 'meta-analysis,' where the methodology and output may vary across samples.[12] Further, the approach is fairly costly in terms of the coordination effort involved in keeping the analyses in the separate countries on track. The method of distributing work to participating countries and analyzing the comparable output centrally arguably provides better results than meta-analysis of single country micro-level studies or multi-country studies with aggregated data.

The method of *distributed micro-data analysis* maintains the advantages of multi-country studies with aggregated data, because the output provided by each country consists of indicators aggregated to a pre-specified 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 research design available with multi-country stacked micro data, distributed micro-data analysis provides a skilled researcher the ability to use cross-country variation to identify behavioral relationships.

2. Description of the data

The firm-level project organized by the World Bank involves 14 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 collect – along the same procedure -- firm-level data for 10 industrial countries:: Canada, Denmark, Germany, Finland, France, Italy, the Netherlands, Portugal, United Kingdom and United States. The work makes use of a common analytical framework and was conducted by active experts in each of the countries. The framework involves the harmonization, to the extent

11. In addition to the authors of this paper, 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).
12. The methodology for the International Wage Flexibility Project (Dickens and Groshen 2004), 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.

possible, of key concepts (e.g. entry, exit, or the definition of the unit of measurement) as well as the definition of common methods to compute the indicators.

The distributed micro-data analysis was conducted for two separate themes. The first set of analysis gathered data relating to firm demographics, such as entry and exit, jobs 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 labour and/or total factor productivity by industry and year, on the decomposition of productivity growth into within-firm and reallocation components. Further, information is provided on the means 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 in the study refer to the firm as the unit of reference, with a few exceptions (see below for country details). More specifically, most of the OECD data used 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 in the EU 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.
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> **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, although the data were tabulated for all firms in countries where available.[13] However, because smaller firms tend to have more volatile firm dynamics, remaining differences in the threshold across different country datasets should be taken into account in the international comparison.[14]
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> **Period of analysis:** Firm-level data are on an annual basis, with varying time spans covered.

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13. 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 however problematic for a number of reasons. 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.

14. 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.

Sectoral coverage: Special efforts have been made to organize the data along a common industry classification (ISIC Rev.3) that matches the STAN database. In the panel datasets 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 sector (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 non-agricutural business sector, while for most of Latin America and East Asia data cover the manufacturing sector only (see below for details).

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 10 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 25 activity units. This geographic logic may contribute to the larger average firm size observed in the large countries in the sample (U.S. and Brazil). From a policy perspective, this difference may point towards aligning regulations in a manner that would allow business units to enjoy transnational scale economies in meeting administrative requirements. Also related to the unit of analysis is the issue of *mergers and acquisitions*. No systematic attempts were made to follow these in a comparable manner across countries. In some countries, the business registers have been keeping track of such organizational changes within and between firms in the most recent years, but this information is not used in the present study

The source of the data: Firm demographics

The analysis of firm demographics is based on business registers (Canada, Denmark, Finland, Netherlands, United Kingdom and United States, Estonia, Latvia, Romania, Slovenia), social security databases (Germany, Italy, Mexico) or corporate tax roles (Argentina, France, Hungary) (Table 1). Annual industry surveys are generally not the best source for firm demographics, owing to sampling and reporting issues, but have been used nonetheless for Brazil, 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 3-5 year frequency of manufacturing census in East Asia precludes computing many of the demographics indicators.

Table 1. Data sources used for firm demographics

Country	Source	Period	Sectors	Availability of survival data	Threshold
Canada	Business register	84-98	All Economy	No	1+
Denmark	Business register	81-94	All	No	Emp ≥ 1
Finland	Business register	88-98	All	Yes	Emp ≥ 1
France	Fiscal database	89-97	All	Yes	Turnover: Man: Euro 0.58m Serv: Euro 0.17m
Germany (West)	Social security	77-99	All but civil service, self employed	Yes	Emp ≥ 1
Italy	Social security	86-94	All	Yes	Emp ≥ 1
Netherlands	Business register	87-97	All	Yes	None
Portugal	Employment-based register	83-98	All but public administration	Yes	Emp ≥ 1
UK	Business register	80-98	Manufacturing	Yes	Emp ≥ 1
USA	Business register	88-97	Private businesses	Yes	Emp ≥ 1
Argentina	Register, based on Integrated System of Pensions	95-02	All	Yes	Emp ≥ 1
Brazil	Census	96-01	Manufacturing	Yes	Emp ≥ 1
Chile	Annual Industry Survey (ENIA)	79-99	Manufacturing	Yes	Emp. ≥ 10
Colombia	Annual Manufacturing survey (EAM)	82-98	Manufacturing	Yes	Emp. ≥ 10
Estonia	Business Register	95-01	All	Yes	Emp ≥ 1
Hungary	Fiscal register (APEH)	92-01	All	Yes	Emp ≥ 1
Indonesia	Manufacturing survey	90-95	Manufacturing	No	Emp. ≥ 10
Korea	Census	83-93 (3 years)	Manufacturing	No	Emp ≥ 5
Latvia	Business register	96-02	All	Yes	Emp ≥ 1
Mexico	Social security	85-01	All	Yes	Emp ≥ 1
Romania	Business register	92-01	All	Yes	Emp ≥ 1
Slovenia	Business register	92-01	All	Yes	Emp ≥ 1
Taiwan (China)	Census	86-91 (2 years)	Manufacturing	No	Emp ≥ 1
Venezuela	Annual Industrial Survey	95-00	Manufacturing	96-99	Emp ≥ 1; sample for 1-15

The source of the data: Productivity decompositions

The other major component of the OECD/World Bank project concerns productivity and its determinants. The data sources used for the analysis of productivity differ from those used for firm demographics in many countries. For productivity measures, data are needed on output, employment and possibly other productive inputs such as intermediate materials and capital services. Using these source data, indicators are calculated on labor and/or total factor productivity 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 2.

Table 2 Summary of the data used for productivity decompositions

	Source	Periods		Coverage		Productivity			Unit	Threshold
Country		*First*	*Last*	*Mfg*	*Serv*	*LPV, LPQ*	*TFP*	*MFP*		
Finland	Census	75-80	89-94	✓		✓	✓	✓	Firm	Emp>5
France	Fiscal database with additional information from enterprise surveys	85-90	90-95	✓		✓	✓	✓	Firm	Turnover €0.58m
Germany (W)	Survey	92-97	93-98	✓	✓	✓	×		Plant	Emp>1
Italy	Survey	82-87	93-98	✓	✓	✓	✓		Firm	Turnover €5m
Netherlands	Survey	83-88	92-97	✓	Some	✓	✓	✓	Firm	Emp>20, emp<20→S
Portugal	Employment-based register	86-91	93-98	✓	✓	✓	×		Firm	Emp>1
UK	Survey	80-85	87-92	✓		✓	✓	✓	Estab	Emp > 100, emp<100→Sample
USA	Census	87-92	92-97	✓		✓			Estab	Emp>1
Argentina	Annual Industrial Survey. INDEC	90-95	96-01	✓		✓			Estab	Emp ≥ 9 & $2m threshold
Brazil	Annual Industrial Survey	97-01		✓		✓	✓		Estab	Emp ≥30 + sample of 10-29
Chile	Annual Industry Survey (ENIA)	80-85	94-99	✓		✓	✓	✓	Plant	Emp. ≥ 10
Colombia	Annual Manufacturing survey (EAM)	82-86	94-98	✓		✓	✓	✓	Estab	Emp. ≥ 10
Estonia	Business Register	95-00	96-01	✓	✓	✓	✓	✓	Firm	Emp ≥ 1
Hungary	Fiscal register (APEH)	92-96	97-01	✓	✓	✓	✓		Plant	Emp ≥ 1
Indonesia	Manufacturing survey	90-95		✓		✓			Firm	Emp ≥ 10
Korea (Rep.)	Census	88-93		✓		✓			Firm	Emp ≥ 5
Latvia	Business register	96-01	97-02	✓	✓	✓			Firm	Emp ≥ 1
Romania	Business register	95-98	96-99	✓	✓	✓	✓	✓	Firm	Emp ≥ 1
Slovenia	Business register	92-97	97-01	✓	✓	✓		✓	Firm	Emp ≥ 1
Taiwan (China)	Census	86-91	91-96	✓		✓			Firm	Emp ≥ 1
Venezuela	Annual Industrial Survey	95-99	96-00	✓		✓	✓		Firm	Emp ≥ 1; sample for 1-15

Indicators collected

Depending on the availability of output and input measures, productivity could be calculated in a variety of ways. The methods used are shown in Table 3 below:

Table 3 Methods used for the calculations of the different productivity measures

Productivity Measure	Gross output (or sales)	Value Added	Labor	Capital	Intermediate inputs
Labor productivity (gross output (LPQ)	✓		✓		
Labor productivity (value added (LPV)		✓	✓		
or					
TFP		✓	✓	✓	
MFP	✓		✓	✓	✓

Definitions of variables:

- Labor input: generally number of employees.
- Sales, gross output: No correction made for inventory accumulation.
- Capital stock: in countries where available, book value.
- 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 are 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 also is computed by using average expenditures shares of firms in an industry observed in each country's dataset.
- 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.

Using common factor shares across countries for a particular industry in principle allows cross-country comparison of productivity levels. However, differing units of measurement for the inputs, notably capital, make the cross-country comparison of TFP or MFP levels meaningless. 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. This adjustment is similar to the arbitrary adjustments to TFP made by Bernard and Jones (1996) in order to compare 'apples and oranges'.

Deflation

Firm-level nominal values of output, value added and materials are deflated at the industry level using deflators supplied by the team members. Table 4 shows the industry variation in deflation and the availability of separate value added or materials deflators.

Table 4. Available deflators in the firm-level data

Four-digit or plant level	Two-three digit	GDP deflator	Comments
	Finland		Value-added price data only available at the 2-digit level (about 15 industries). Producer price and unit value indices available at the 3 or 4-digit level.
France			All price data at the 'naf 36' level
	Italy		
	Netherlands		Producer price indices for total turnover. If available at the 3-digit level of ISIC; otherwise at the 2-digit level
	Portugal		2-digit level (from national accounts)
United Kingdom			4-digit for output and materials, 2/3-digit for capital
United States			4-digit SIC deflators
Argentina			
	Brazil		All price data at 2-digit level (nível 50)
	Chile		3-digit deflators taken from ECLAC (UN). Plant level deflators can be constructed for fuels only.
Colombia			Plant-level price deflators, depreciation, capital consumption allowances and inflation adjustment for fixed asset values
	Venezuela		PPI at the 2-digit ISIC level
Estonia			
		Hungary	
Latvia			
		Romania	
	Indonesia		Two-digit output price deflator
	Korea		Two-digit output price deflator
	Taiwan (China)		Two-digit output price deflator

3. 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:

$$I = A\lfloor X_f \mid f \in \Omega \rfloor \qquad (1)$$

For simplicity, we drop subscripts for countries, as the nature of our problem is such that each country is treated separately. Also, we suppress subscripts 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 firms in an appropriately defined subset of Ω.

With the above notational framework, the measurement problems for a host of indicators can be assessed. We can consider various aggregator functions, A[..],such as sums, means, variances, covariances, or statistical analyses yielding reduced-form or structural coefficients (e.g., the aggregator function could be the OLS estimator from a multivariate regression). The latter possibility includes treating estimated parameters from studies of individual countries as aggregated 'indicators.' The indicator to be aggregated may itself be 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 indicators (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. Thus, positive gross job flows among continuing firms are computed by adding up employment changes to a subset of the firm population, namely those existing in both periods and having positive employment changes. Likewise, the typical productivity decompositions (see below) focus on the contribution to aggregate productivity growth of different sets of firms (e.g., continuing, exiting and entering firms). We review below how different indicators used in our empirical analysis of firm dynamics and productivity are affected by the two types of errors, ε and Ψ.

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

$$X = X^* + \varepsilon \, , \qquad (2)$$

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 observed and actual set of firms, Ω^*, may differ as well.

$$\Omega = \Omega^* + \Psi \, , \qquad (3)$$

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 (e.g. steel) but some firms are erroneously classified in this industry even if they largely operate in another industry (e.g. chemicals) or some firms are missing from the analysis because they are classified elsewhere. 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.

Once a differentiation is made between the location of 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.

Table 5 below gives a list of indicators that are used as examples to assess the various effects of combined measurement errors, ε and Ψ. We review them in turn below.

Table 5 Firm-level variables, indicators and possible sources of measurement problems

Case	Variable	Aggregator	Disaggregation	Potential Problems
1a	Employment	Mean/Sum	Aggregate or Industry	Industry misclassification, Sample selection
1b	""	Mean/Sum	Size Class	Sample selection
1c	""	Mean/Sum	Firm Status (Continuer, Entrant, Exit)	Sample selection, Measurement error in longitudinal IDs
2a	""	Variance	Aggregate or Industry	Sample selection, Classical measurement error
1a	Productivity	Mean	Aggregate or Industry	Industry misclassification, Sample selection,
1b	Productivity	Mean	Productivity quartiles	Sample selection, Classical measurement error
1c	Prod change	Mean	Firm Status (Continuer, Entrant, Exit)	Sample selection, Measurement error in longitudinal IDs, Classical measurement error
2b	Productivity and Employment	Covariance	Aggregate, Industry, Firm Status	All of the above

1a. Mean or sum.

Both the measurement error of the firm-level variable and the errors in the sample over which aggregation takes place, play a role in computing the aggregate indicator. We first discuss the case when Ψ generates random errors in obtaining the observed set of firms from the actual set. If 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 in the firm-level databases (often 90 percent of universe of employment is in the sample). But classical measurement error in the registration of 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 other, and on average the effect will be zero. Next, we take the case where the sampling errors are proportional to size, for example because of weighted sampling by size strata. Here, we need the sample weights to get consistent estimate of first moment of the firm-size distribution. To compute aggregate employment, we always need sample weights.

If the indicator of interest is the difference between the mean or 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 above remarks apply. The differencing does not solve or create 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 (given under 2a) would help to assess whether differences in mean productivity across country are significant.

1b. Mean or Sum; Endogenous (sub)samples.

If aggregations are to be made by size-class, then the indicators will be noisy owing to mis-classification. The size-class criterion used to split the sub-sample 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 non-classical measurement errors of 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, this results in the estimate being based only on firms observed in both periods, the continuers, which depending on the indicator of interest may introduce '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.

1c. Mean or Sum; Longitudinal linkages and Measures of Change.

If aggregations are to be made by sub-samples 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 mis-measurement of the

15. An important note on mis-measurement of employment has to do with the concept being measured. In most of the firm-level datasets, the labor variable chosen is the number of employees. Of course, for many empirical studies, the desired concept is hours worked, or better yet, quality-adjusted hours worked. These measures are not available in the micro-level data in a consistent manner across countries. When estimates of labor inputs are provided across countries, for example the hours variable in the STAN dataset, they have been created using a variety of methodologies and different underlying surveys and registers linked in to the sectoral data at a fairly aggregate level.

status variables due to poor longitudinal *IDs*. For example, poor tracking of mergers and acquisitions will tend to reduce the share of continuers and increase the share of entering and exiting units. 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]

2a *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 error, 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 (see e.g. the decomposition of productivity by Griliches and Regev below). The difference between estimate of the variance and (the average of) the variances estimated from the two annual 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 $0.5 * \text{var}(\varepsilon)$. However, the trick 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 sub-samples 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.

2a *Higher moments (Covariances and correlations).*

All of the above problems apply to covariances, correlations and by association estimates from regression 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 classical measurement error implies lower covariances and correlations, in this setting the measurement error may yield higher covariances and correlations given the nature of the measures. 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.

For the indicator of the gap between weighted and un-weighted productivity, the above issue needs to be addressed. The gap is proportional to the covariance between labor productivity

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

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 co-variance 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 one believes that the measurement error process of the firm-level variable does not change over time or across industries.

4. Assessing the process of creative destruction

Bearing in mind the measurement problems associated with the analysis of firm-level data, we start our review of the cross-country evidence. We start by looking at the distribution of firms by size, for the total business sector and the sub-sectors. 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 but 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:

- Firstly, 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 may all contribute to limit simple cross—country comparisons using single indicators of the creative destruction process.

- Secondly, 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 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 end exiting firms. Facing high entry costs, new firms may choose to either enter very small and avoid abiding to 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 bi-modal distributions of firm entry by size but not a lower level of total entry rate. Likewise, in countries with high barrier 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]

- *23 aggregate industries* that cover the entire business sector while maximizing country coverage from the 40 two-digit (ISIC Rev. 3) industries that are available in some databases. [18]

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 contained the following variables:

Entry: The number of firms entering a given industry in a given year. Also tabulated, where available, was the number of employees in entering firms. Entrant firms (and their employees) were those observed as (out, in, in) the register in time (t_{-1}, t, t_{+1}).

Exit: The number of firms that leave the register and the number of people employed in these firms. Exiting firms were those observed as (in, in, out) the register in time (t_{-1}, t, t_{+1}).

One-year firms: 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: 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 in our analysis excludes these "one-year" firms.

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 re-registration would inflate firm turnover rates for large firms and distort the assessment of firm characteristics amongst entrants and exiting firms.

18. These 23 industries also correspond to the sectoral disaggregation of the OECD Structural Analysis (STAN) database. See www.oecd.org/data/stan.htm

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:

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

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:

$$T_t = C_t + E_t + X_t + O_t \qquad 5$$

From this, the change in the total number of firms between two years, taking into account equation 1, can be written as:

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

Assuming that the one-year firms are measured with noise, the difference of these 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 8 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]

Survival data are available for a selection of countries over varying time periods. The data are tabulated from firm-level sources and track the survival in year t_{+i} of firms that exist in year *t*. To determine if a firm exists in year *t* we look at employment and the following should be true: employment is non-missing in year *t* → firm exists in year *t*. But in some cases zero employment means the same as missing employment. Therefore a firm exists in year *t* if:

- it has non-zero employment
- it has zero employment, but in the previous ánd next year(s) employment was nonzero and non-missing

In the last case an imputation procedure is used to determine employment.[21]

For our survival analysis we considered only firms that entered (status = EN or OY) during the period under review. Table 1 shows this period for the different countries and also shows the

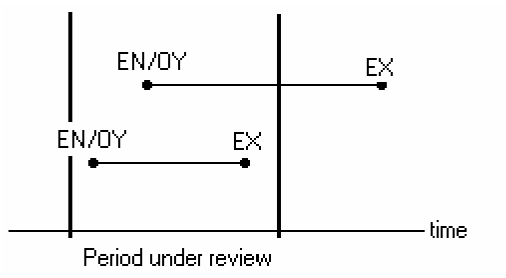
19. The 8 size classes are as follows: no-employees; 1-9 employees; 10-19; 20-49; 50-99; 100-249; 250-499; 500+. For the OECD countries there are only 6 size groups, with the two groups between 1 and 20 combined and the groups between 100 and 500 combined.

20. Available data also allowed assessing changes in employment of existing firms which, combined with the information about the changes in employment due to firm entry and firm exit allows calculating total job turnover and fraction of it due to creative destruction.

21. In countries where zero employment may signal a missing value, the method for imputing differs between the database used for firm entry/exit and job flows and the database for survival analysis.

economic sectors covered (data generally are available for disaggregated industry within the sectors). While we know the status of firms in the first year of analysis (underlying raw data started one year earlier), for the last year the exact status is unknown,, i.e. the data are right-censored (see Figure 2) .

Figure 2 Right censored data



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. 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 institutional factors as large businesses, because they are exempt by law or because they can more easily avoid them in practice. In addition, the distribution of firm by size is likely to be influenced by the overall dimension of the internal market – especially for non-tradables – as well as the business environment in which firms operate that can discourage firm expansion (see below).

The analysis of firm size raises clear problems of cross-country comparability induced by sample selection problems. For most countries, the data cover all firms with at least one employee, but the cutoff size is 5 employees in South Korea,[22] 10 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, data for a few countries are at the plant level instead of the firm or establishment level, 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 6 presents the share of firms – and associated employment -- in the first two classes of our size distribution: firms with fewer than 20 employees (Panel A) and firms with 20-49 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 20 employees) account for at least 80 per cent of the total firm population. Their share in total employment is much lower and

22. The annual enterprise survey in Venezuela is representative of all firms with at least 15 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 20+ employees, given the lack of coverage for the lover size classes.

ranges from less than 15 percent in some transition economies (e.g. Romania) -- which still reflects the 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 per cent 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 20-49 over the total 20+). This allows for a larger country sample and greater comparability as it is not affect by differences in the threshold of micro units. Small firms account for about 50 percent of the total population of firms with 20 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 20) is only loosely correlated with the rank order of the same countries based on the share of small firms (20-49).[23] In some countries, firms tend to remain very small or move to higher size classes, while in others there is amore smooth distribution of firms in the initial size classes. In the former, institutional factors (e.g. regulations and policy-related adjustment costs) may push firms to stay very small or to move to higher scales and smooth these fixed costs. We will come back to this issue later in the context of firm turnover.

Cross-country differences in firm size may largely result from a *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. The first column of Table 7 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 in Table 7 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 sub-sectors.

Among industrial countries, the US 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 extend 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 (a part from the US), the underlying technological level of the industry or its degree of maturity.

23. The country rank correlation is only 0.3.

Table 6 Small firms across broad sectors and countries, 1990s

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)

	Firms				Employment*			
	Total economy	Non-Agriculture Business Sector (1)	Manufacturing	Total business services	Total economy	Non-Agriculture Business Sector (1)	Manufacturing	Total business services
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	0.0	25.8	23.8	16.6	0.0
East Germany	87.5	88.4	81.1	90.3	27.5	33.3	22.9	28.2
Portugal	89.2	88.9	75.3	93.8	32.2	31.4	18.9	42.9
UK			81.3				12.4	
USA	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 (2)			57.0				11.1	
Taiwan (China)			82.5				26.6	

* Share of Employment with less than 20 employees

(1) This aggregates excludes agriculture (ISIC 1-5) and community services (ISIC3: 75-79)

(2) In Korea, data cover firms with 5 or more employees.

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+)

	Firms				Employment			
	Total economy	Non-Agriculture Business Sector (1)	Manufacturing	Total business services	Total economy	Non-Agriculture Business Sector (1)	Manufacturing	Total business services
Industrial Countries								
Denmark	67.6	60.4	69.7	66.9	22.5	19.5	22.0	22.9
France	53.2	63.0	49.9	53.3	12.9	20.0	11.2	12.9
Italy	67.3	67.0	65.5	69.4	20.0	23.0	15.6	22.8
Netherlands	58.8	53.9	58.5	62.9	15.3	14.2	13.9	18.6
Finland	61.0	53.5	65.4	61.8	16.3	10.5	21.8	19.1
West Germany	59.0	54.0		60.7	17.2	12.8		17.7
East Germany	62.8	60.4	60.0	65.7	22.9	22.7	19.3	27.8
Portugal	64.0	59.1	69.2	63.5	22.6	21.5	22.9	22.0
UK		51.2				11.4		
USA	62.7	55.0	63.1	65.0	12.2	7.3	12.7	13.5
Latin America								
Chile		51.4				15.3		
Colombia		49.0				13.9		
Mexico	59.0	51.2	62.9	58.9	15.1	11.5	17.1	16.0
Brazil		58.7				15.0		
Venezuela		24.9				4.5		
Argentina	61.1	59.8	60.6	61.7	18.4	19.0	16.8	18.6
Transition economies								
Slovenia	38.5	29.2	49.8	38.4	7.4	4.6	12.4	7.2
Hungary	54.6	48.3	61.9	56.2	12.9	10.1	14.3	12.5
Romania	45.3	39.2	55.1	46.2	5.7	3.3	11.2	5.5
Estonia	62.4	55.5	66.9	62.6	22.1	17.0	27.1	21.3
Latvia	58.1	60.1	58.0	57.9	17.8	20.1	17.5	17.9
East Asia								
Korea		59.4				17.3		
Indonesia		49.6				7.3		
Taiwan (China)		65.8				25.2		

Table 7 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	UK	USA
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**
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**

(as a share of cross-country sectoral average)

Country	Chile	Colombia	Mexico	Slovenia	Hungary	Indonesia	Korea	Taiwan (China)	Estonia	Brazil	Latvia	Romania
Total economy			**1.00**	**1.40**	**1.11**				0.72		0.83	**2.20**
Agriculture, Hunting, Forestry And Fishing			**1.56**	**2.05**	**1.20**				0.83			**1.77**
Mining And Quarrying			0.75	**3.14**	**1.23**				**2.92**	0.50	0.42	
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**
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	
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	
Wood And Products Of Wood And Cork	**1.19**	0.83	**1.01**	**1.72**	0.95	**3.43**	0.77	0.70	0.70	0.84	**1.06**	
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**
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**
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**
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**
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**
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**
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**
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**
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
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**
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**
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**
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**
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**
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**
Electricity, Gas And Water Supply			0.48	0.35	0.90				0.37		0.17	**1.65**
Construction			0.86	**1.89**	0.87				0.75		**1.35**	**2.41**
Services			0.99	**1.13**	**1.19**				0.65		0.90	**1.40**
Market Services			0.90	**1.20**	**1.27**				0.69		0.93	**1.44**
Wholesale And Retail Trade; Restaurants And Hotels			0.95	**1.47**	**1.12**				0.65		**1.16**	**1.14**
Transport And Storage And Communication			0.46	**1.26**	**1.77**				0.62		0.65	**1.72**
Finance, Insurance, Real Estate And Business Services			**1.15**	0.56	0.80				0.43		0.73	**1.18**
Community Social And Personal Services			**1.48**	0.77	0.75				0.50		0.87	**1.45**

Another way to shed light on country-specific factors *versus* industry-specific technological factors is to use a shift-and-share decomposition. The decomposition exploits the following identity: $\bar{s}_j = \sum_i \omega_{ij} s_{ij}$, where $\bar{s}_j$ is the average firm size in manufacturing in country j, s_{ij} is the average firm size in sub-sector i and ω_{ij} is the share of firms in sub-sector i with respect to the total number of firms in manufacturing. Define now $\bar{s}$ as the overall mean in manufacturing across countries and $\overline{\omega}_i$ as the share of overall number of firms in sub-sector j. Then the difference between country j and overall mean can be decomposed as follows:

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

$$= \Delta_{\omega} + \Delta_{s} + \Delta_{\omega s} \qquad 7$$

The first term accounts for differences in the sectoral composition of firms, the second for cross-country differences in firm size within each sector and the last an interaction term, which can be interpreted loosely as an indicator of covariance: if it is positive, size and sectoral compositions deviate from the benchmark in the same direction.

The decomposition (Table 8) 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.[24] The within-industry size component is particularly large in the United States, confirming the idea that a larger internal market tends to promote larger firms, but also in some transition economies. However, the sectoral composition also play 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.[25]

All in all, overall 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. The results also confirm an obvious but fundamentally important point. Differences in coverage of very small businesses across countries in samples and registers must be taken into account in cross-country studies.

24. 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 sub-samples. Moreover, we have replicated the decomposition at a finer level of sectoral disaggregation and again the results are broadly unchanged.

25. 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).

Table 8 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
UK	-0.01	-0.02	-0.03	-0.06
USA	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

The *Total* represents the percentage deviation of average size from the cross-country average: the other columns decompose the total into sub-components

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 two populations of firms : those with 20 and more employees – to avoid comparability problems related to size cut-offs in some country data– and all firms with more than one employee. As discussed in the previous section, we focus on time averages (1989 onwards) rather than annual data to minimize possible measurement problems.

Figure 3 shows entry and exit rates for the business sector and for manufacturing. Taking the results at face value, 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 20 employees to maximize the country coverage, total firm turnover (entry plus exit rates)[26] is in between 3-8 per cent in most industrial countries and more than 10 per cent in some of the transition economies. If we extend the analysis to include micro units (1 to 19 employees), we observe total firm turnover rates in between one-fifth and one-fourth of all firms. These data 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).

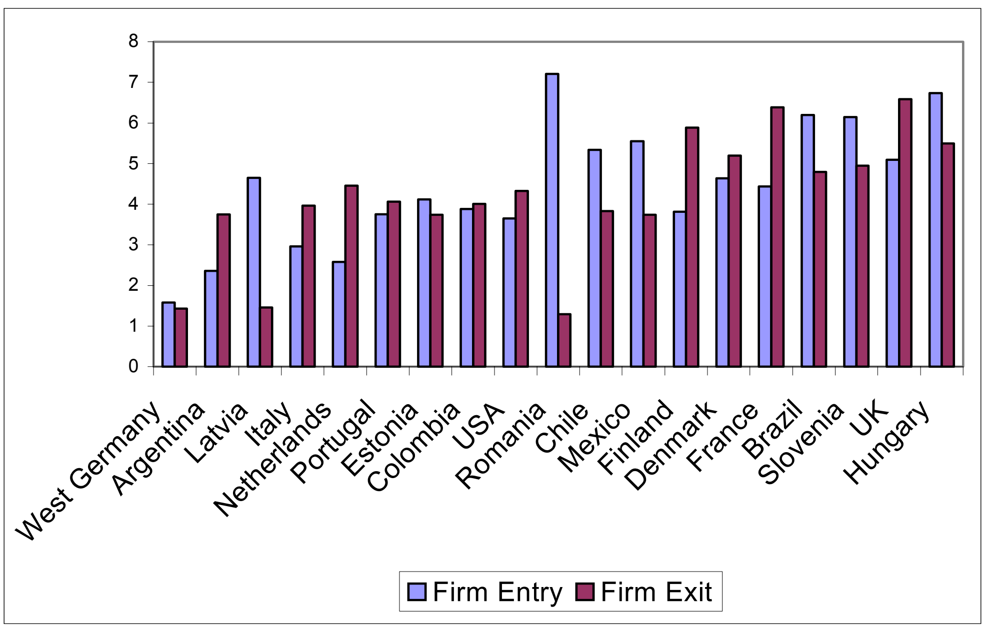
26. The entry rate is defined as the number of new firms divided by the total number of incumbent and entrants firms producing in a given year; the exit rate is defined as the number of firms exiting the market in a given year divided by the population of origin, *i.e.* the incumbents in the previous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

There are also interesting differences across countries. The Latin America region shows a wide variety of experiences: while Mexico and the manufacturing sector of both Chile and Venezuela show vigorous firm turnover, Colombia and especially Argentina show 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 out-paced firm exit, while more balanced patterns are found in other countries. Obviously this is related to the process of transition 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 which were either nonexistent or poorly populated in the past.

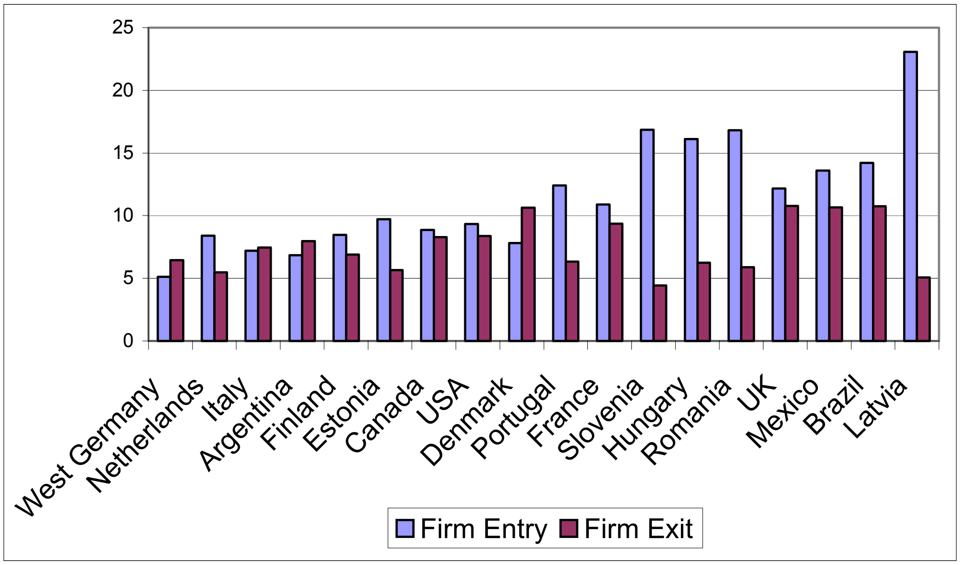
The open question is whether we should take these results at face value. As stressed in the previous section, differences in sample selection and measurement error in longitudinal linkages can yield spurious differences in measures of firm turnover. It is very difficult without detailed information about 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.

Figure 3 Firm turnover rates in broad sectors, 1990s

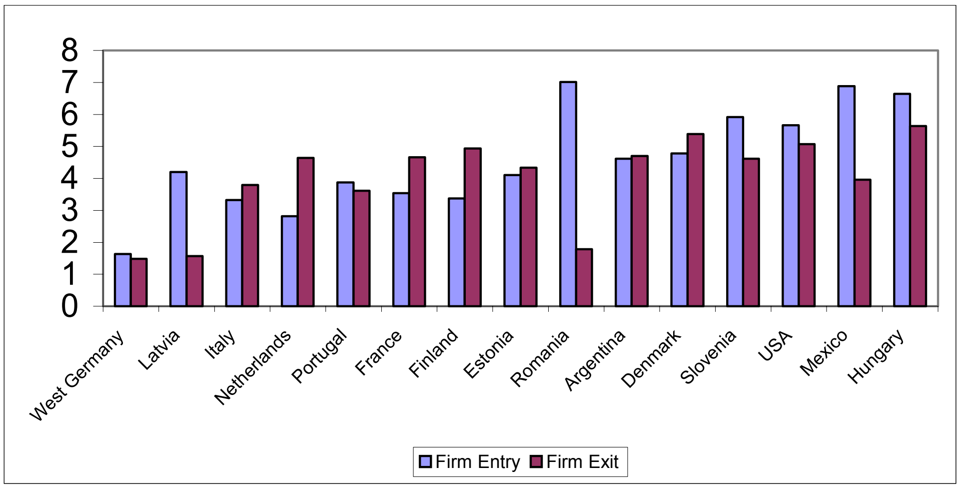
Panel A: Manufacturing, firms with 20 or more employees



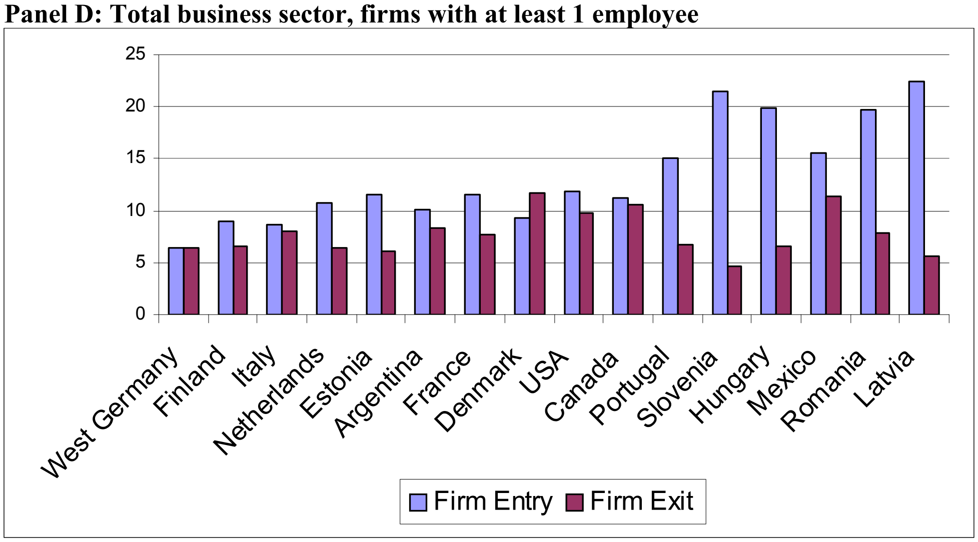
Panel B: Manufacturing, firms with at least 1 employee



Panel C: Total business sector, firms 20 or more employees



Panel D: Total business sector, firms with at least 1 employee



We begin our inquiry into the validity of the turnover data by considering how the entering and exiting firms compare with the average incumbent. This is a within country comparison that may be less subject to the measurement problems that plague comparisons of firm turnover across countries. We compute the relative size of entrant and exiting firms compared with the average size of incumbent and also present entry rates by size classes. If we focus on the entire population of firms with at least one employee, we see that less than 10 per cent of employment is, on average, involved in firm creation and destruction. The difference between un-weighted 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 per cent the average size of incumbents. But the small size of entrants relative to the average incumbents is driven by different factors across countries:

- In Canada and especially the United States the small relative size of entrants reflects both the large size of incumbents (see above) and the small average size of entrants compared to that in most other countries (in the United States, about 2.5 employees in the total economy and about 5 in manufacturing). In other words, entrant firms are further away from the efficient size in the United States than in most other countries for which data are available. There are a number of different possible explanations for this. First, the larger market of the United States may partly explain the larger average size of incumbents.[27] Second, the wider gap between entry size and the minimum efficient size in the United States may 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 amongst micro units (20 or fewer employees): during the centrally planned system there were relatively few of these micro firms which however exploded during the transition in most of business service activities.

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 differences across countries. One interesting characteristic in this context is obviously the business size. Figure 4 presents entry rates by different size classes in manufacturing. As discussed above, entry is concentrated in the smaller size classes (fewer than 20 employees). But it is interesting to notice how entry rate evolves for larger size classes. 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 20 employees, or even a U-shaped relation whereby entry rates tend to increase for larger firms compared with small firms.[28] As an illustration, the Figure also reports an indicator of the relative cost of setting up a

27. Geographical considerations may also affect the average size of firms: firms with plants spreading into different US states are recorded as single units, while establishments belonging to the same firm but located in different EU states are recorded as separate units.

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

business: those countries where we observe the hump-shaped relationship between entry rate and size are those generally characterized by relatively costly entry processes.[29] This may stimulate firms to enter very small – and thus partly avoiding some of the entry costs that kicks 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, this 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 9 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 9 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.[30] 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, but also Mexico tend to have greater firm churning than in the OECD countries, on average.

The finding of important industry effects that hold across countries suggests a possible avenue for the difference-in-difference approach to shed light on the role of institutions in shaping firm dynamics. Some recent studies[31] have used the U.S. firm dynamic statistics as a benchmark arguing that most of the cross industry variation in the U.S. is induced by technological/cost factors. The working hypothesis that both papers use is that high turnover sectors in the U.S. should also be high turnover sectors in other countries unless institutional factors have been distorting the dynamics.

Another approach to removing the country-specific measurement error is to exploit the time variation within countries. If the measurement error in a country is time invariant, then the time dimension permits testing for possible changes in the process of creative destruction in countries affected by significant structural or policy-related changes.

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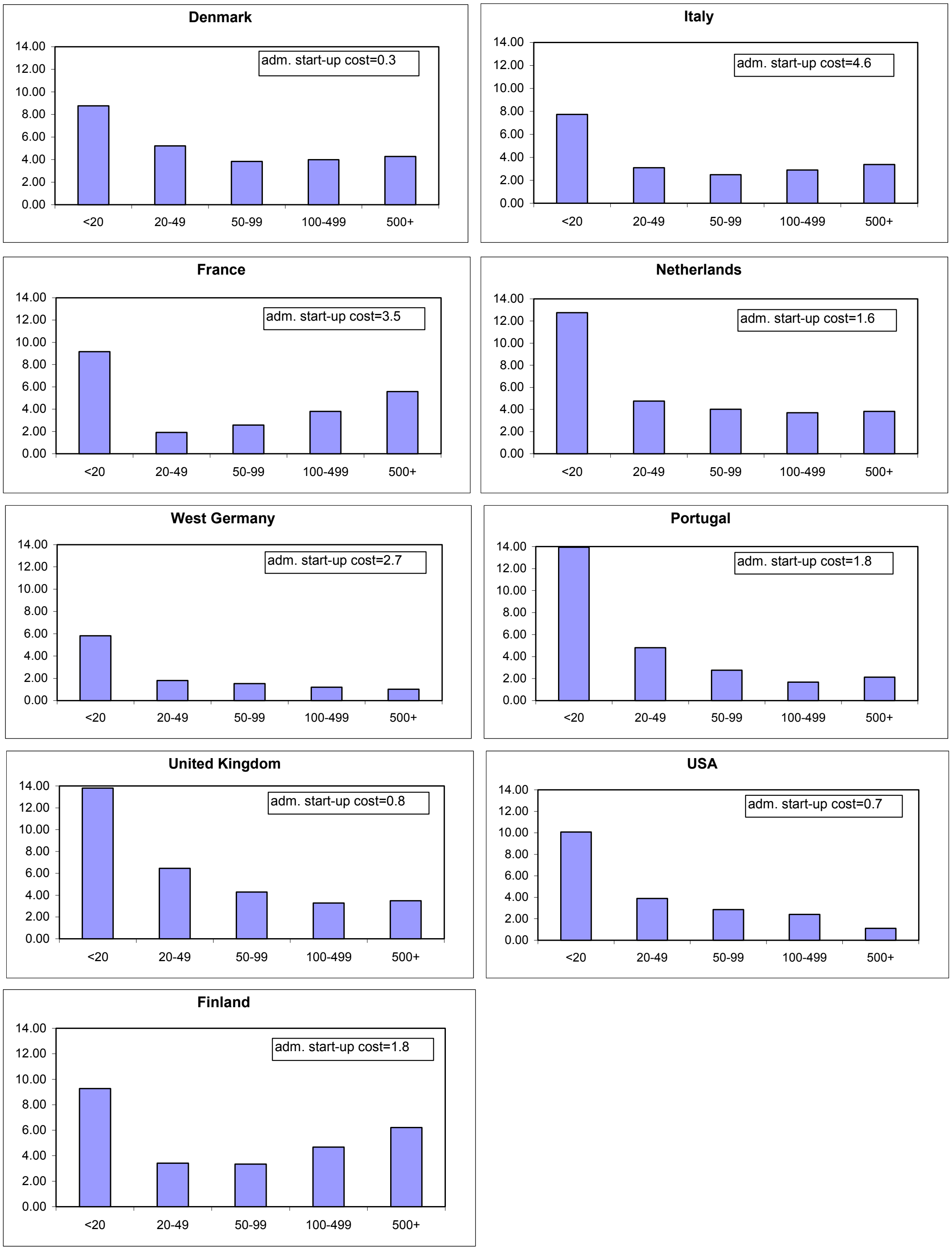
29. These data are from the World Bank "*Doing Business Database"*, (2005).

30. In Italy, however, there appears to be only small differences in churning between manufacturing and services. In the case of Italy 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.

31. See e.g. Micco and Pages (2004); and Haltiwanger, Scarpetta, Schweiger and Vodopivec (2005).

Figure 4 **Entry rates by firm size, manufacturing, 1989+**

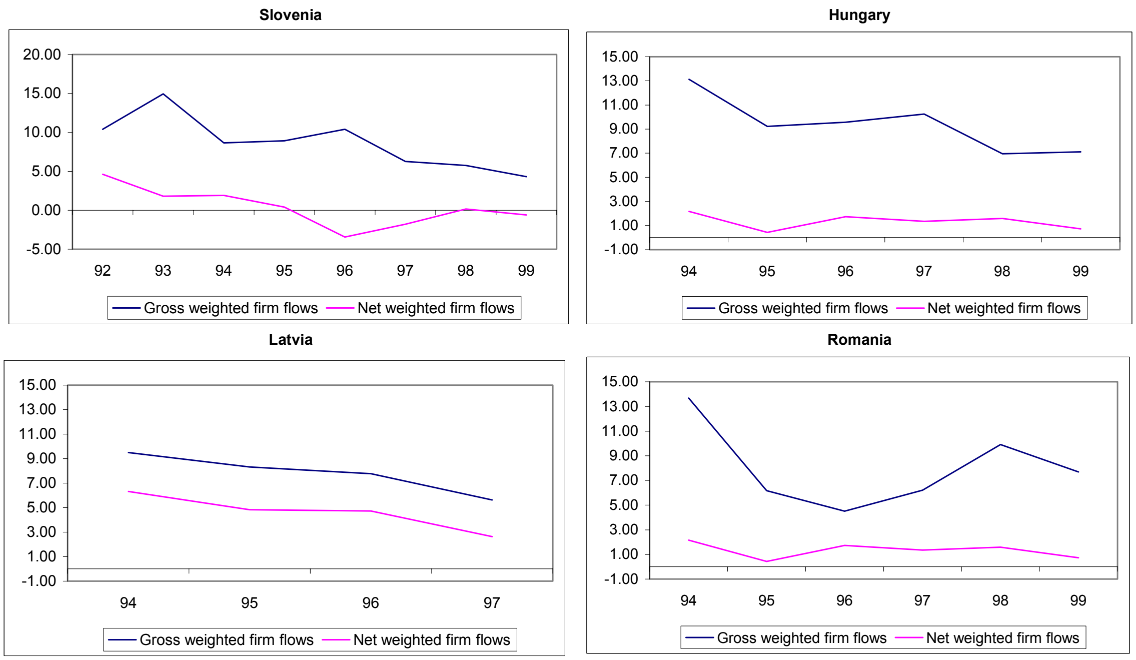


Data on the administrative burdens to start up a business are from Nicoletti, Scarpetta and Boylaud (1999). The indicators are normalized from 0 (least restrictive) to 6 (most restrictive). Data for Finland are from 1992 to 1998.

Within country variation over time in market institutions is clearly present in transition economies and thus examining the how the pace of firm dynamics changed within the transition economies is clearly of interest. At the beginning of their transition to a market economy in the early 1990s, both gross and net firm flows were large compared to industrial and other emerging economies (Figure 5): in some of the transition economies a large fraction of firms were closed down and replaced by new small ventures, and this process accounted for more than 10 percent of total employment. As the transition moved forward gross and especially net flows declined to reach, at the end of the 1990s, values fairly close to those observed in other countries.

Figure 5 The evolution of gross and net firm flows in transition economies, business sector

Panel A: Gross and net firm flows



Panel B: Employment-weighted firm flows

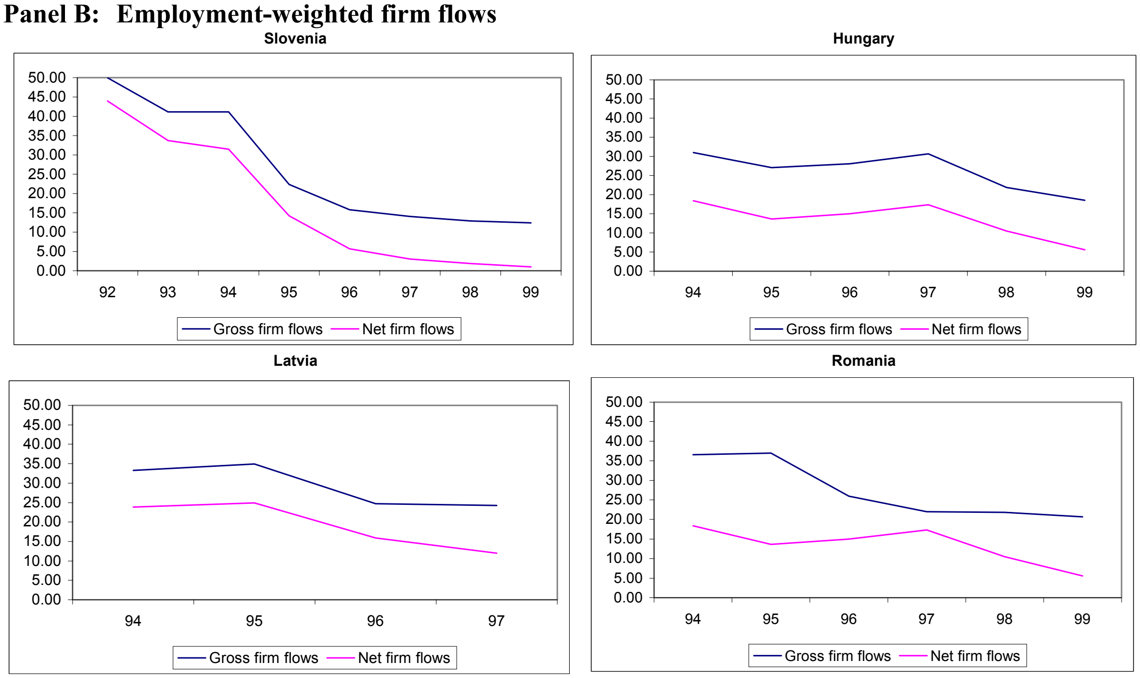


Table 9 Gross firm turnover across countries and sectors

(as a ratio of cross-country industry average)

	cross-country average	Industrial	Other countries	Denmark	France	Italy	Netherlands	Finland	West Germany	Portugal	UK	USA	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	
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**

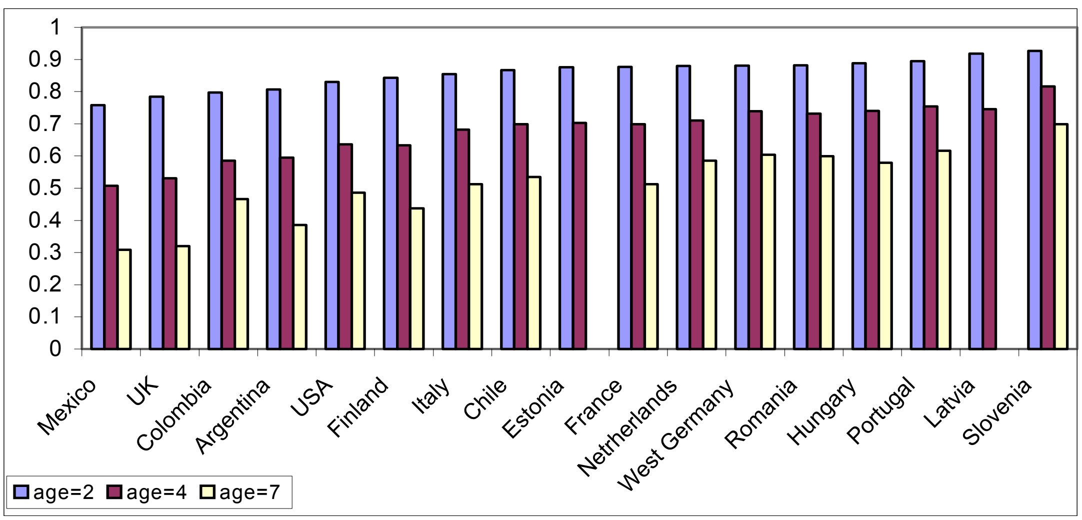
	cross-country average	Mexico	Slovenia	Hungary	Estonia	Brazil	Latvia	Romania	Argentina
total economy	**21.6**	**1.22**	**1.21**	**1.21**	0.81		**1.30**	**1.26**	0.75
Agriculture, Hunting, Forestry And Fishing	**19.8**	0.92	**1.27**	**1.00**	0.77			0.98	0.56
Mining And Quarrying	**18.9**	**1.27**	1.00	**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 post-entry performance of firms

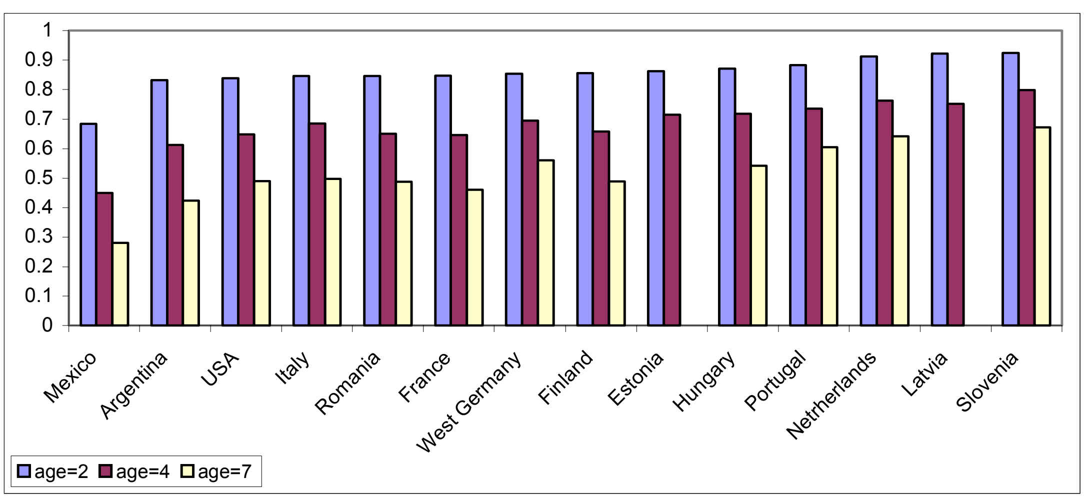
Another interesting metric to characterize firm dynamics is to examine post-entry performance of firms. Understanding the post-entry performance sheds light on the market selection process that separates successful entrant firms that survive and prosper from others that stagnate and eventually exit. In addition, post-entry performance is a measure that exploits variation that may be less subject to measurement error. Conditional on a sample or register capturing an entrant, there is a reasonable chance the sample or register will be able to follow that entrant over time. Moreover, even if there is spurious exit from a cohort of entrants, it may be that the degree of spurious exit is constant in any given year so that examining changes in survival and growth rates across ages for a given entering cohort may difference out such effects.

Figure 6 presents non-parametric (graphic) estimates of survivor rates for firms that entered the market in the late 1980s and1990s. 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 to minimize possible business cycle effects and possible measurement problems.

Figure 6 Firm survival at different lifetimes, 1990s
Panel A: Manufacturing



Panel B: Total business sector



Looking at cross-country differences in survivor rates, about 10 per cent (Slovenia) to more than 30 per cent (in Mexico) of entering firms fail within the first two years (Figure 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 per cent chance of surviving for five more years. Nevertheless, only about 30-50 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.[32]

For most countries, the rank ordering of survival is similar whether using a 2-year, 4-year or 7-year horizon suggesting that there is an important country effect that impacts the survival function. However, there are a few interesting exceptions. The U.S. has relatively low survival rates at the 2-year horizon but relatively higher survival rates at the 7-year horizon. This pattern might reflect the relatively rapid cleansing of poorly performing firms in the U.S.

Table 10 provides details on the survival rates at age four across industries and countries. The structure of the Table is similar to those presented above. Notably, the variation across countries is more systematic than that across industries. Across industries, between 60 and 80 percent of firms survive after 4 year, 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.

Each given cohort tends to increase in the initial years because failures are highly concentrated amongst 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.[33] This, however, may represent an over-correction as it eliminates employment growth in firms with positive employment at registration.

Figure 6 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[34] compared with the West European countries is partially 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 amongst young ventures in the US markets than in Europe. In turn, the smaller relative size of entrants can be taken to indicate a greater degree of

32. Survivor rates for firms with 20 or more employees at age one are similar to those observed in the newly compiled Eurostat firm-level database (Eurostat, 2004).

33. However, recent work by the US Census Bureau shows that even after correcting for the zero-employee problem, the size expansion of entrant firms in the U.S. 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.

34. The results for the United States are consistent with the evidence in Audretsch (1995). He found that the four-year employment growth amongst surviving firms was about 90 per cent.

experimentation, with firms starting small and, if successful, expanding rapidly to approach the minimum efficient scale.[35]

Table 10 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	UK	West Germany	Italy	Netherlands	Portugal	USA
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 And 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 non-agricultural business sector	0.65	1.02	0.99	1.00	0.99	0.82	1.05	1.04	1.16	1.13	0.97

(as a ratio to cross-country sectoral average)

	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
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 And 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 non-agricultural 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

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

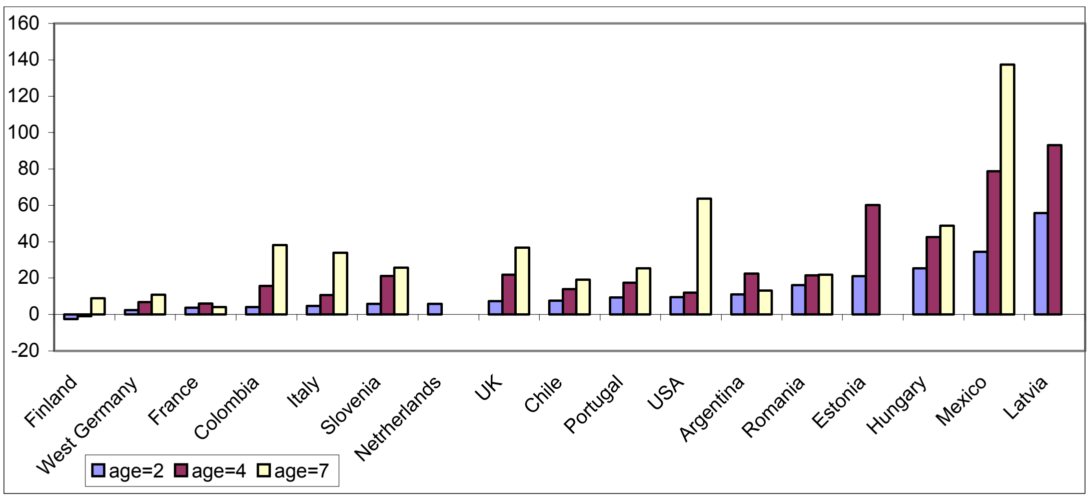
35. This greater experimentation of small firms in the US market may also contribute to explain the evidence of a lower than average productivity at entry, as discussed below.

Mexico selection of small firms is stronger than in all other countries, but post-entry growth of successful firms is also very strong, pointing to a strong market selection process but also strong rewards to successful new firms.

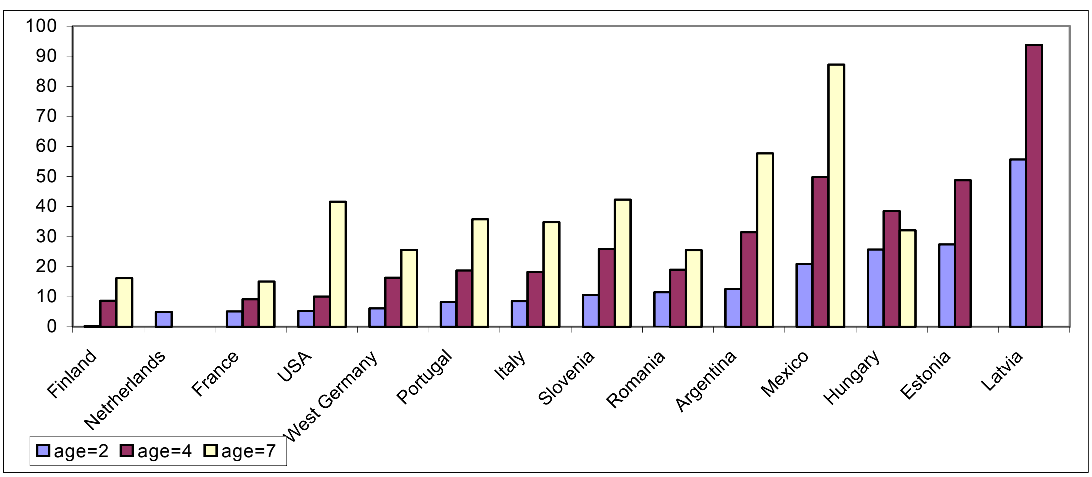
Transition economies show a different behavior from most other countries also on firm survival. They tend to show higher survivor rates and large post entry growth of successful firms which confirm the hypothesis that new firms enjoyed a period of relatively low market contestability especially in new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

Figure 7 Average firm size relative to entry, by age

Panel A: Manufacturing



Panel B: Total Business sector



5. The effects of creative destruction on productivity

Reallocation and Productivity: Growth vs. 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 amongst continuing businesses. However, such analysis of the contribution of reallocation to productivity growth across countries, 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 in this analysis and then in turn comparing such sectoral differences between countries. In addition, we explore a cross sectional decomposition of productivity that turns out to be simpler and more robust in terms of theoretical predictions and measurement.

Reallocation and Productivity Growth

Let's define the sector-wide productivity level in year t, P_t as:[36]

$$P_t = \sum_i \theta_{it} p_{it} \qquad 8$$

where θ_i is the input share of firm i and P_t and p_{it} are a productivity measure (which may be LPQ, LPV, TFP, or MFP). In principle, a measure of productivity based upon TFP or MFP is preferred but in practice the most readily available measures (and in some ways the most reliable measures) across countries is typically LPQ. In what follows, we focus on LPQ but make reference to results and issues for the other measures.

A number of different decompositions have been suggested in the literature to explore the relationship between productivity and reallocation. Some of the decompositions are dynamic that permit explicit accounting of the role of entry and exit while others are cross-sectional which permit measuring the extent of allocative efficiency at any point in time. In what follows, we explore both types of decompositions and discuss the relative merits of each with a focus on the use of these decompositions in a cross country setting.

The first decomposition we consider is that 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 follows:

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36. Besides the industry decompositions of productivity, data also are collected on aggregate industry productivity levels and growth rates, un-weighted average productivity of continuing firms, entrants and exiters, and on the standard deviation of the distribution of productivity of continuers, entrants and exiters.

$$\Delta P_t = \sum_{i\in C}\theta_{it-k}\Delta p_{it} + \sum_{i\in C}\Delta\theta_{it}(p_{it-k} - P_{t-k}) + \sum_{i\in C}\Delta\theta_{it}\Delta p_{it} + \sum_{i\in N}\theta_{it}(p_{it} - P_{t-k}) - \sum_{i\in X}\theta_{it-k}(p_{it-k} - P_{t-k}) \quad 9$$

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 ($t - k$).[37]

The components of the FHK (we will refer to above as FHK for shorthand in what follows) decomposition are defined as follows:

- The *within-firm effect* is within-firm productivity growth weighted by initial output shares.
- The *between-firm effect* captures the gains in aggregate productivity coming from the expanding market of high productivity firms, or from low-productivity firms' shrinking shares weighted by *initial* shares.
- The '*cross effect*' reflects gains in productivity from high-productivity *growth* firms' expanding shares or from low-productivity *growth* firms' shrinking shares.
- The *entry effect* is the sum of the differences between each entering firm's productivity and *initial* productivity in the industry, weighted by its market share.
- The *exit effect* is the sum of the differences between each exiting firm's productivity and *initial* productivity in the industry, weighted by its market share.

The FHK method uses the first year's values for a continuing firm's share (θit-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 a second approach proposed by Griliches and Regev (GR henceforth, 1995) which uses the time averages of the first and last years for them ($\overline{\theta}_i$, $\overline{p}_i$, and $\overline{P}$). As a result the 'cross-effect', or 'covariance' term, disappears from the decomposition.[38] The averaging of market shares in the GR method 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 resulting formula is:

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

38. Similarly, in case of total factor productivity decomposition using output shares, random measurement errors in output could yield a positive covariance between productivity changes and share changes, and hence, within effect could be spuriously low.

$$\Delta P_t = \sum_{i \in C} \overline{\theta_i} \Delta p_{it} + \sum_{i \in C} \Delta \theta_{it} (\overline{p_i} - \overline{P}) + \sum_{i \in N} \theta_{it} (p_{it} - \overline{P}) - \sum_{i \in X} \theta_{it-k} (p_{it-k} - \overline{P}) \quad 10$$

where a *bar* over a variable indicates the average of the variable over the first year ($t - k$) and the last year (t).[39] Thus, the components of the GR decomposition can be described as follows:

- The *within effect* describes the productivity growth within firms weighted by the *average* firm share over the time-interval of the calculation.
- The *between-firm effect* captures the gains in aggregate productivity which comes from high-productivity firms' expanding shares, or from low-productivity firms' shrinking shares weighted by *average* shares over the time interval of the calculation.
- The *entry effect* is the sum of the differences between each entering firm's productivity and *average* productivity in the industry, weighted by its market share.
- The *exit effect* is the sum of the differences between each exiting firm's productivity and *average* productivity in the industry, weighted by its market share.

Certain aspects of the decomposition need to be borne in mind when interpreting the data:

- The FHK "within effect" reflects the pure contribution of continuing individual firms' productivity growth, as it is weighted by the *initial* shares. The "between effect" reflects the contribution of changes in market share changes given initial productivity level and the "cross effect" or "covariance term" reveals whether firms with increasing productivity also tend to increase market share or not.

- In contrast, in the GR method, the distinction between the within and between effects is somewhat blurred in the sense that 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.

- Although disadvantageous in some respects, it has been suggested that the GR method is less sensitive than the FHK method to annual fluctuations in the underlying data and, possibly, measurement errors. For example, firms with overestimated labor input in a given year will have spuriously low measured labor productivity and spuriously high measured employment share in that year, potentially producing negative covariance between productivity and share changes. In this case, within effect in the FHK method could be misleadingly high.[40]

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39. This version of the GR decomposition also includes a modest but important modification by FHK. The between term as well as the entry and exit terms are deviated from the overall average. Without this modification, it is possible that net entry can have a positive effect on productivity growth even if exiting plants are more productive than entering plants if the share of entering plants is greater than the share of exiting plants.

40. Similarly, in case of total factor productivity decomposition using output shares, random measurement errors in output could yield a positive covariance between productivity changes and share changes, and hence, within effect could be spuriously low.

The third method proposed by Baldwin and Gu (BG henceforth, 2003), 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.

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 3-5-year period with overall productivity at the beginning. Obviously, therefore, a positive entry component does not necessarily mean that productivity among entering firms is above average in relation to their contemporaries.

In our analysis we focus on the FHK method, but also use the other two methods for sensitivity analysis and to better qualify some of the key results. As part of sensitivity analysis, we also explore, for a sub-set of countries, productivity decompositions over different time horizons. The baseline analysis is based on 5-year rolling windows for all periods and industries for which data are available. However we also present results for a three-year rolling windows and test the hypothesis that the contribution from entry changes with the time horizon considered.

As we proceed through the cross country patterns that are observed in these decompositions, we focus on both the interpretation and measurement problems of these decompositions. Before presenting the results, we begin by noting some of the interpretation problems. The working hypothesis that poor market structure and institutions will distort the contribution of the creative destruction process turns out have 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 above 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.

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.[41]

In short, the gap between the productivity of entering and exiting businesses 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, 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 8 presents the decomposition of labor productivity growth in the total business sector and Figure 9 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 accounted 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. 5-year horizon) reallocation and, in particular, the entry component plays a stronger role to promote 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 combined with the covariance (or cross) term, which combined 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

41. FHK found large differences between five and ten year horizons in the U.S. and their subsequent analysis suggests that this is because entering cohorts in the U.S. 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 10-year horizon than a 5-year horizon. FHK show this holds even taking into account the inherently higher share of activity accounted for by entering and exiting businesses over a longer horizon. In what follows we only have decompositions over five year horizons for most countries and three year horizons for a smaller set of countries. While this comparison helps on this dimension it does so only to the extent that there are measurably different selection and learning effects between 3 and 5 years.

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 per cent and 50 per cent of total productivity growth. While 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, the entry contribution tend to be negative in most OECD countries and in the non-transition emerging economies. 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 positive, it is less than proportionate relative to the share of employment accounted for by firm turnover.

- *Gross firm entry* has variable effects on overall productivity growth across countries. For example, 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 and a stronger than average contribution tends to come from the exit of low productivity firms. Interpreting these findings without more information is difficult. The weak performance of entrants in the U.S. might reflect greater experimentation in the U.S. so that for each entering cohort of entrants there is more selection and potentially more learning by doing.[42]

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. These interpretation and measurement problems may interact and may be especially problematic for cross country comparisons of dynamics decompositions. Consider, for example, the problem of measurement error in firm turnover. Mis-measurement of firm turnover that yields too high a measure of firm turnover for a country because of say longitudinal linkage problems will have offsetting effects on the contribution of net entry to productivity growth. 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

42. 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 paper provides evidence of greater market experimentation in the U.S. relative to Germany. The latter shows that in the U.S. that as the horizon lengthens in the U.S., the contribution of net entry rises disproportionately. Moreover, Foster *et. al*. 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.

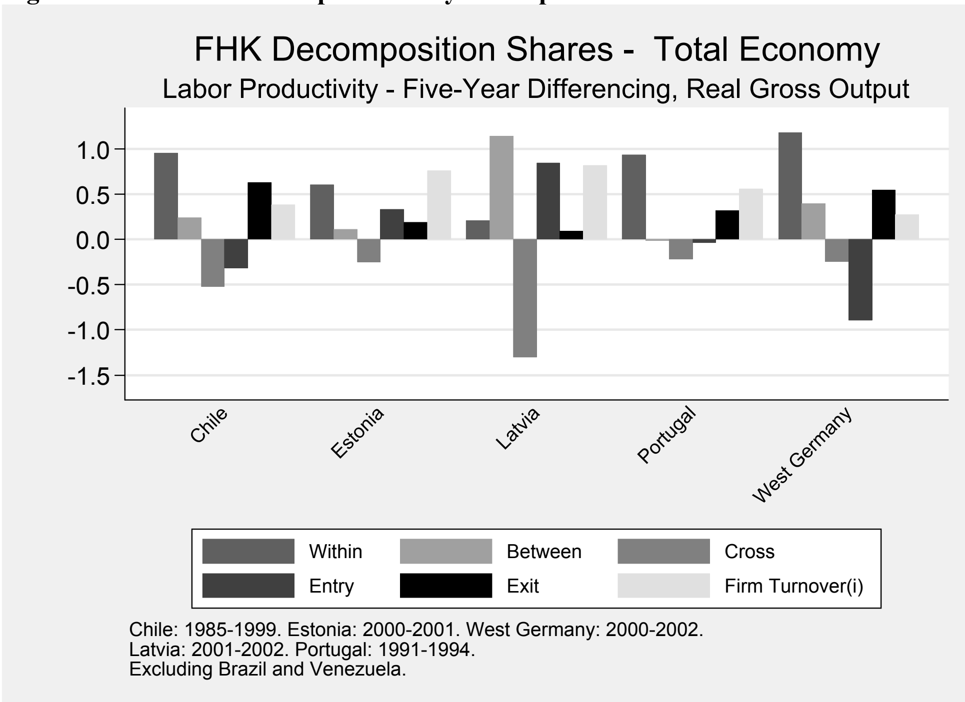
the gap and therefore decrease the contribution of net entry. For a country where entrants tend to be less productive than incumbents at entry perhaps due to market experimentation as in the U.S., spurious entry and exit will decrease the negative gap and therefore increase the contribution of net entry (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. 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 the transition 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 11 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, increasing 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 10 presents the productivity decompositions for two groups of industries in manufacturing: (i) the low technology industries; and (ii) the medium-high technology industries. The large negative cross-term discussed above, 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 interestingly, the contribution of new firms to productivity growth is modest in low-tech industries, and even largely negative in a few countries including the US. 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 opportunities. Given our focus on measurement issues in this paper, these findings provide another illustration why exploiting the cross industry variation within countries is a useful approach in cross country analysis.

Figure 8 Firm-level labor productivity decomposition for Total Business Sector



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

Figure 9 Firm-level labor productivity decomposition for Manufacturing

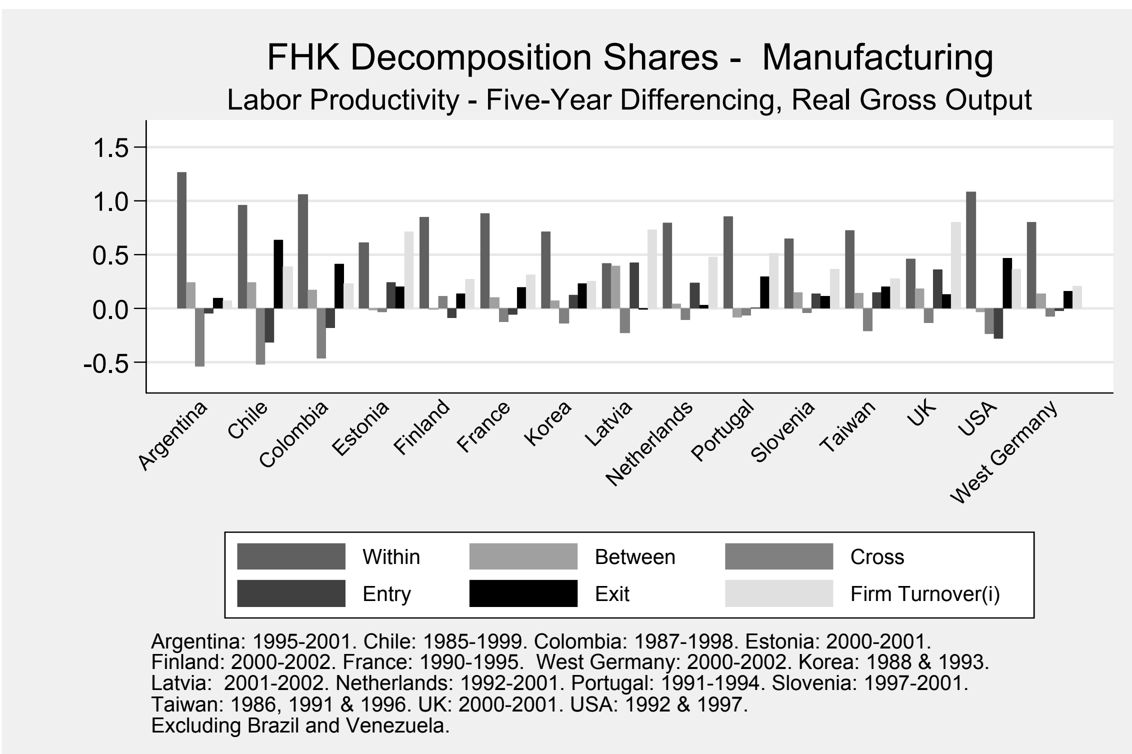


Table 11 **Time horizon Differences**			
Difference in Component from 5 to 3 Years			
Country	Net Entry	Between	Within
Argentina	0.001	-0.001	0.028
Chile	0.002	-0.005	-0.007
Colombia	0.001	-0.005	-0.004
Estonia	0.028	-0.006	-0.007
Latvia	0.019	-0.009	0.027
Slovenia	0.007	-0.001	0.001

One methodological issue that turns out not to be especially important in most cases is the form of the decomposition used for this analysis. To investigate the sensitivity to the decomposition methodology used, Table 12 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 base from which to deviate the entering and exiting plants productivity while BG use the exiters productivity. FHK 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. BG 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.[43] For most countries the difference is small and for virtually all the difference is positive. There are a couple of countries where the difference is large and positive (Korea, Slovenia and Taiwan (China)).

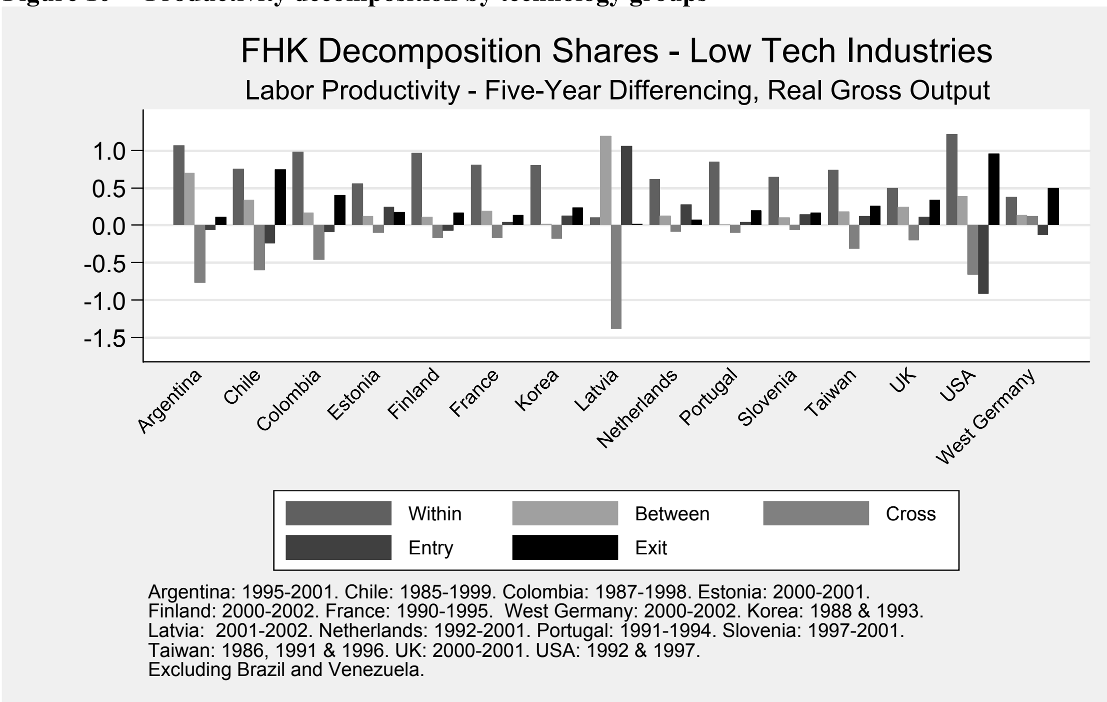
It is intuitive that the effects should in general be small because for both methods the net entry term depends critically on the difference between average productivity of entering and exiting businesses. Put differently, both the entry and the exit term subtract off whatever base is used, so at first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

$$FHK - BG = (\sum_{i \in X} \theta_{it-k} - \sum_{i \in N} \theta_{it})(P_{t-k} - P_{t-k}^{X}) \qquad 11$$

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 4, for most countries the share of activity accounted for by entry is about the same as that for exit with the latter typically 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 -- hence the sensitivity for these countries. This difference yields an especially big effect in Korea given that the gap between incumbents and exiting businesses is also large.

43. One technical limitation of this alternative is that this implies in turn that the between component uses the exiters as the base for that component and this is difficult to motivate.

Figure 10 Productivity decomposition by technology groups



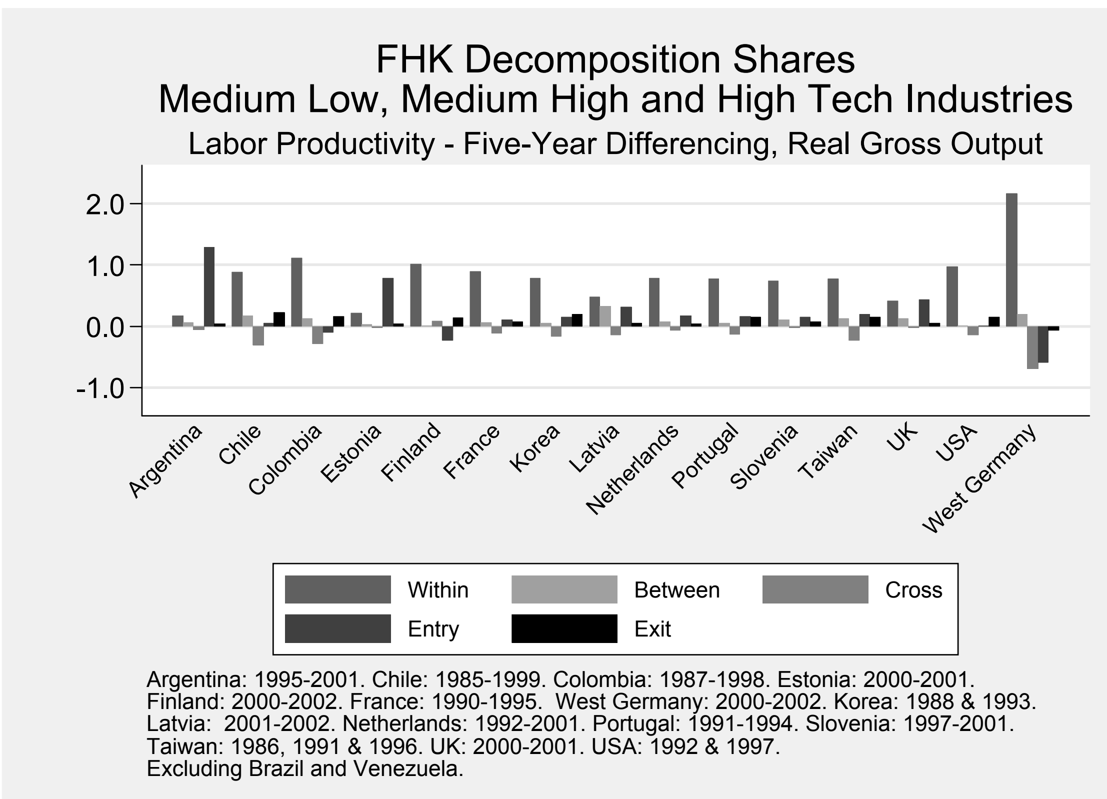


Table 12 Accounting for the differences between FHK and BG decompositions

	Net Entry Difference	Exit/ Entry Share Difference	Incumbent/Exit Productivity Difference
Argentina	0.006	-0.012	0.098
Chile	-0.015	-0.022	0.432
Colombia	0.005	0.008	0.627
Estonia	-0.008	-0.031	0.28
Finland	-0.003	-0.013	0.251
France	0.004	0.034	0.107
Korea, Rep.	-0.06	-0.122	0.495
Latvia	0.01	-0.001	-0.037
Netherlands	0.003	0.028	0.025
Portugal	-0.016	-0.039	0.394
Slovenia	0.014	0.059	0.252
Taiwan (China)	-0.019	-0.077	0.264
UK	0.008	0.148	0.051
USA	0.004	0.012	0.299
West Germany	0	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).

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). These problems should not be interpreted as suggesting there is no value to cross country comparisons of dynamic decompositions – indeed, some of the patterns we noted across the countries appear to reflect rich actual differences in the firm dynamics that could only be detected with these decompositions. Our message instead is largely one of caution. Moreover, our message is to look for decompositions that are less subject to the concerns we have raised here. We now turn to a decomposition approach that we regard as especially promising in a cross country context.

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 above at some length, measurement and interpretation problems raise questions about the comparisons of dynamic decompositions across countries. An alternative simpler and more robust approach 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:

$$P_t = (1/N_t)\sum_i P_{it} + \sum_i \Delta\theta_{it}\Delta P_{it} \qquad 12$$

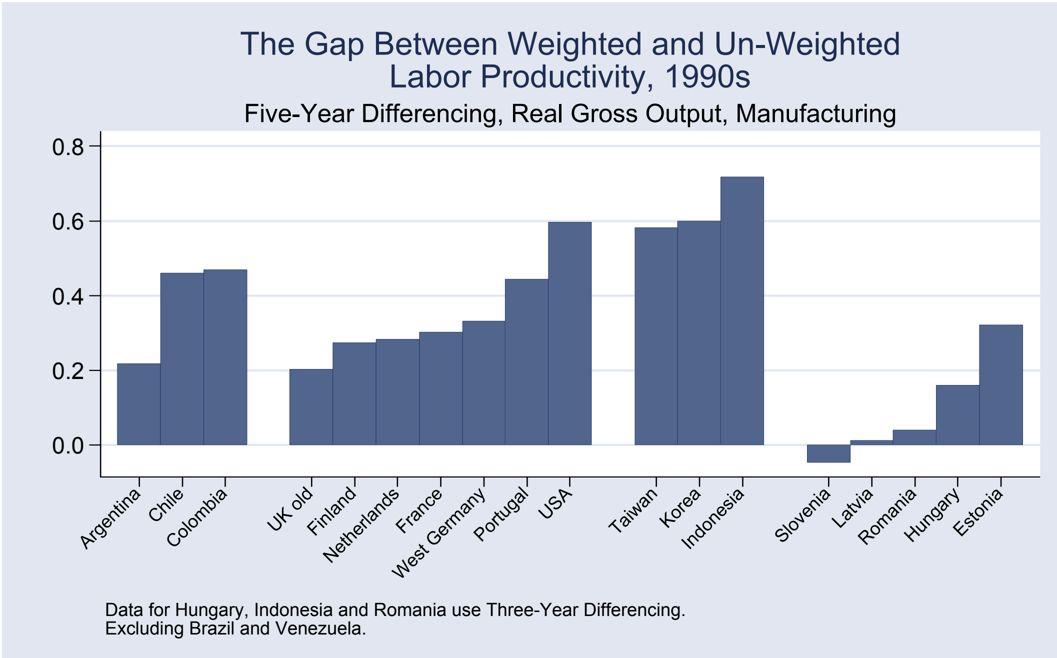
where N is the number of businesses in the sector and Δ is the operator that represents the cross sectional deviation of the firm-level measure from the industry simple average. The simple interpretation of this decomposition is that aggregate productivity can be decomposed into two terms involving the un-weighted 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 un-weighted 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 un-weighted productivity (or equivalently the cross term) should be smaller.

With these remarks in mind, Figure 11 the measure of the gap between weighted and un-weighted average productivity for a sample of countries. For virtually all countries, the gap is positive suggesting that resources are allocated to more productive businesses in these countries. The South East Asian economies are on top, followed by the U.S., 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 U.S., the allocative efficiency term accounts for more than 50 percent of productivity. In the EU, the productivity boost is smaller but roughly around 25 percent.

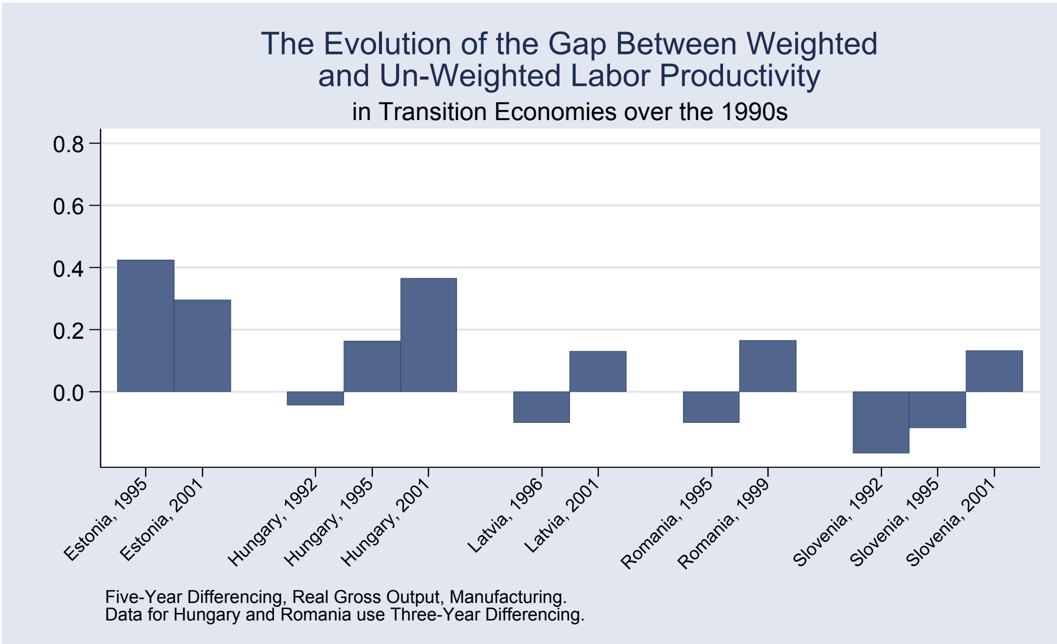
Figure 12 presents the evolution over the 1990s in the transition economies. As may be seen, the transition economies all start out at very low and sometimes negative allocation effects. A negative effect means that allocation was worse than that resulting from a toss of the dice: for some reason resources were disproportionately allocated towards poor productivity firms. However, the transition countries generally exhibit a rapid increase of this ratio over time consistent with the view that allocative efficiency improved substantially in the transition economies over this time period.

Figure 11 The gap between weighted and un-weighted labor productivity, 1990s



The findings in Figure 11 and Figure 12 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 specific industries and/or other classifications of firms suggesting that a pooled country, firm-type dataset 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.

Figure 12 The evolution of the gap between weighted and un-weighted productivity in transition economies over the 1990s



6. Concluding remarks

In this paper we assess the measurement and analytic challenges for studying firm dynamics within and across countries. We use recently collected measures of firm dynamics for a sample of more than 20 countries. Our cross-country dataset has been assembled paying great care to the harmonization of key concepts. Such harmonization is essential to conduct meaningful comparisons, but we also argue that our effort so far should probably be extened as there remain significant measurement problems. While simple comparisons of firm dynamics across countries remain difficult to interpret, considerable progress can be made by examining multiple indicators and, by carefully considering the nature of the measurement error. Since much of the measurement error is country-specific, in some cases, using some form of difference-in-difference approach which eliminates overall country-specific effects reduces measurement error problems

Bearing in mind the significant 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 measures,* taken at face value, are large: gross firm turnover involves 10-20 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 5-10 per cent 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 and many small new comers fails before reaching the efficient scale of production. There are significant measurement and interpretation issues related to firm turnover data. Nevertheless, we argue that exploring the variation in firm turnover across sectors and firms of different sizes sheds some light on the different nature of creative destruction.

- *Market selection is pretty harsh*: about 20 to 40 per cent 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 40-50 per cent of total entering firms in a given cohort survive beyond the seventh year. Again, however, rank ordering of these measures is clouded by measurement and interpretation problems.

- *Successful entrants expand rapidly.* Surviving firms are not only relatively larger but also tend to grow rapidly. The combined effect of exits being concentrated amongst the smallest units and the growth of survivors makes the average size of a given cohort to increase rapidly towards the efficient scale. Measuring the post-entry performance within countries appears to be a somewhat more robust statistic since this statistic reflects 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, 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. In addition, changes over time in this measure also make sense. For example, for transition economies, allocative efficiency is low but has increased significantly over the course of the 1990s.

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