Employment Reallocation and Productivity Growth in Transition: An International Comparative Analysis

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Abstract

We analyze comprehensive manufacturing firm data to measure the contribution of inter-firm employment reallocation to aggregate productivity growth during the socialist and transition periods in Georgia, Hungary, Lithuania, Romania, Russia, and Ukraine. Reallocation rates and contributions to productivity growth are both very low under socialism, but they rise dramatically after reforms, with most countries' reallocation contributions greatly exceeding those observed in market economies. On average over the whole transition period, faster reform is associated with higher within-firm and overall productivity growth, but lower contributions from reallocation. Though the volumes of reallocation are higher in faster reforming Hungary and Romania, the slower reformers have wider productivity gaps and stronger correlations of reallocation with the gaps, resulting in much higher productivity gains for a given volume of reallocation. The continued presence of high productivity dispersion suggests that transition countries have the potential for significant reallocation-induced productivity gains well into the future.

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1. Introduction

Basic economics stresses the crucial role of resource allocation in achieving efficiency and, as a corollary, it implies the importance of flexible reallocation in fostering economic growth. Until recently, however, data constraints have prevented empirical research from quantifying the magnitudes and contributions of reallocation. Comprehensive panel data on business units are required, for example, to measure the extent to which aggregate productivity growth is driven by productivity improvements within firms as opposed to resource reallocation from less to more productive firms. Research on these questions is still in its early stages, but some of it has already documented substantial contributions of reallocation to aggregate productivity growth.[1]

This paper extends research on reallocation and productivity in several ways. We consider a set of formerly socialist economies that have been engaged in the transition from central planning for more than a decade, countries that have not received a great deal of attention but that we will argue provide particularly interesting cases for investigating reallocation. We assemble comparable annual panel data with long time series on the universe (or near-universe) of manufacturing firms in six of these economies – Georgia, Hungary, Lithuania, Romania, Russia, and Ukraine – and we apply the same data-cleaning and statistical procedures to each of them, in order to obtain genuinely comparable results. Following previous studies of productivity-enhancing reallocation, our measurement approach relies on decompositions of aggregate productivity growth (Haltiwanger, 1997; Foster et al., 2001); we extend this literature with a modified decomposition that we argue better reflects the contribution of entry, and we provide a formal link between productivity dispersion and the contribution of reallocation to productivity growth. We also follow most of the literature in measuring reallocation as employment changes at business reporting units, but in addition to the standard measures of job reallocation (Dunne, Roberts, and Samuelson, 1989; Davis and Haltiwanger, 1992), we also compute the standard deviation of employment share changes within industries. This measure is more closely tied to our method of decomposing productivity growth within industries, which also follows most previous research, and which is motivated by the difficulty of comparing productivity across industries.

We exploit the data's long time series – up to 20 years – to measure the pace of reallocation and its contribution to productivity growth under central planning, in the early reform years, as well as later reform years when the economies stabilized and growth resumed. Comparing these time periods provides an extreme example of the economic policy context within which productivity-enhancing reallocation takes place. The socialist economies were associated with poor innovation incentives and selection mechanisms, which suggest weaker processes of creative destruction than in well-functioning market economies. The collapse of Communist rule and the planning system were sudden and unanticipated, making it easier to identify the effects of liberalization during the subsequent transition. The six economies we study adopted very different transition policy strategies, and our data enable comparisons of their reallocation

[1] See for instance, Baily, Hulten, and Campbell (1992) and Foster, Haltiwanger, and Krizan (2001) for the US; Griliches and Regev (1995) for Israel; Aw, Chen, and Roberts (2001) for Taiwan; Disney, Haskel, and Heden (2003) for the UK; Eslava, Haltiwanger, Kugler, and Kugler (2004) for Colombia; and Bartelsman, Haltiwanger, and Scarpetta (2004) and Brown and Earle (2002, 2006) for some transition economies.

behavior, both before and after the transition began, to each other and to comparable figures for other economies that are available from previous research.

Why are some economies more effective in reallocating resources from lower- to higher-valued uses? Previous studies of the contributions of reallocation to aggregate productivity growth have usually focussed on single economies, but a logical next step is to use comparable microdata to try to understand cross-country differences.[2] Our paper goes beyond measuring the contribution in each country and time period to investigate the large variation that we find across countries and over time. To account for this variation, we propose and implement a method that decomposes the differences into three components: the dispersion of productivity, the pace of reallocation, and the correlation between reallocation and relative productivity across firms. This approach provides a useful framework for understanding the different patterns in the economies we study, and it is also general enough to be useful to researchers with access to data from other countries.

We find that the reallocation rates and contributions to aggregate productivity growth are quite different in our data on transition economies from the results that have been reported for other countries. They are different during the central planning years in that both the pace and contributions of reallocation in the economies we study are much lower than elsewhere. They are different after economic liberalization, as the contributions to productivity growth are generally much higher than elsewhere. The pace of reallocation also rises quickly, but only to the levels of developed market economies. Thus, transition economies achieve larger productivity results for roughly the same reallocation rates as exist elsewhere. These results demonstrate both the small role of reallocation in the centrally planned economies and the critical importance of the creative destruction unleashed by economic liberalization during the transition.

The productivity contributions from reallocation during transition differ considerably across the six economies we study. Hungary, generally considered the fastest reformer among the six in our sample (as well as close to the top among all transition economies) reallocation contribution rises earlier than elsewhere, but then declines to close to zero. Much higher reallocation contributions emerge later on in the slower reformers, and they continue through the most recent data (2006 in most cases). Somewhat surprisingly, the rank ordering across countries of the size of contributions of reallocation to productivity growth over the whole transition is inversely correlated with reform speed.

Our decomposition of the cross-country and over-time differences sheds light on these patterns. Reallocation led to no productivity growth in the centrally planned economies not only because so little reallocation occurred, but also due to a very low correlation between reallocation and relative productivity at the firm level, particularly in Soviet Russia: the direction of resource reallocation had little relationship with relative productivities. The rise in productivity-enhancing reallocation during the transition is

[2] Variation in data (collection methods, coverage, frequency, and definitions) and in decomposition methodologies usually make such comparisons difficult if not impossible, but our data are quite similar, and we apply consistent methods of analysis to the six countries. Bartelsman, Haltiwanger, and Scarpetta (2004) study the results from several countries that were produced by other researchers; they do not use the microdata directly to explore the underlying factors. In related research with a different focus, Aw, Chung and Roberts (2003) compare productivity and turnover patterns in Taiwan and Korea, but they do not measure the productivity growth attributable to reallocation.

proportionately greater than the rise in the pace of reallocation because of simultaneous rises in the dispersion of productivity and the correlation between reallocation and relative productivity. Productivity dispersion has increased more in the slower reformers, engendering large contributions of reallocation to productivity growth. A possible explanation for the negative relationship of reform and reallocation contribution is that slow-reforming government may have protected weaker firms rather than allowing them to exit early on. The larger gaps in the slower reformers could also help explain why reallocation is better targeted there, as it is more obvious which firms should expand vs. contract. Meanwhile, the faster reformers have had much better within-firm productivity growth, facilitated by the weeding out of less productive firms. It thus appears that a slow early pace of reallocation in the gradual reformers has led to lower within-firm productivity growth and higher growth via reallocation.

The rest of the paper proceeds with further motivation of a comparative analysis of productivity and reallocation under socialism and transition in Section 2, which provides a brief discussion of central planning, the different economic reform programs adopted in the six countries, and their potential implications for the magnitude and productivity contributions of resource reallocation. Section 3 discusses the data and methods for measuring productivity and decomposing productivity growth. Section 4 contains the results of our measurement of the magnitude of reallocation and its contribution to productivity growth. We also analyze the extent to which differences in the contribution of reallocation to productivity growth across time and countries are associated with the underlying factors of reallocation volume, productivity dispersion, and correlation between reallocation and productivity differentials. Section 5 contains a brief conclusion.

2. Central Planning, Market Reforms, and Productivity-Enhancing Reallocation

How would one expect reallocation and productivity patterns to look during the socialist period? Under central planning, most variables that we think of as business decisions—output, product variety, prices, technology, wages, investment, exit, and entry—were either specifically planned or indirectly controlled.[3] Enterprises had strong incentives to meet planned output targets, but little incentive to contain costs, to innovate, or to produce goods of value. There was no effective competition, and imports were tightly regulated. Worker mobility was restricted by a number of practices, and enterprises had little discretion in their decisions on employment.[4] Sometimes employment levels were fixed explicitly, but the central planners' usual method of constraining employment, particularly in the later socialist period, was to set a maximum fund available for an enterprise's total wage bill while specifying a wage grid based on just a few criteria, such as occupation, industry, and seniority. There were also constraints on the ability of enterprises to fire workers, although layoffs were not completely unknown. Thus, the usual factors that might be supposed to influence reallocation and productivity were largely absent.

[3] Kornai (1992) provides a comprehensive overview of the socialist system and early reforms. The term "centrally planned" is a partial misnomer, because not every economic decision was centralized, but it is a convenient label.

[4] For a discussion of labor allocation in the Soviet Union, see Granick (1987). Gregory and Collier (1988) discuss Soviet unemployment, which appears to have been very low (although non-zero).

Conceivably, omniscient planners might have effectively allocated and reallocated resources to fulfill the plan's output and efficiency goals. But planning and implementation could also be influenced by political objectives, among them rapid industrialization and large, prestigious projects. Moreover, even the most efficiency-minded planners were hindered by lack of information, which arose from inherent features of the system: fixed prices, ratchet effects, and other incentives that discouraged innovation and information revelation about productive capacities. Thus, while it seems unlikely that the planners would have been very successful in resource allocation and reallocation, how they actually performed is an empirical question—a very interesting one that we can address with our data.

The question is still more interesting in light of the variation in partial reforms adopted in the late socialist period. In Romania, no liberalization occurred until the Ceaucescus were overthrown at the end of 1989. By contrast, Hungary experienced a partial, gradual relaxation of the planning regime for the previous two decades under the rubric of "goulash communism," and decentralization of many economic decisions to the enterprise level accelerated from the mid-1980s. The Soviet Union began *perestroika* reforms in late 1988, although these were more tentative than the earlier ones in Hungary. Our data permit some analysis of the effects of these differences, particularly involving Hungary and Soviet Russia, on the pace of reallocation and its consequences for productivity growth.

After the adoption of wide-ranging reforms during the transition period, the factors affecting reallocation and productivity begin to be similar to those in market economies. Liberalization of decisions on prices, entry, exit, investment, employment, and scale of operation places these on the shoulders of enterprise owners and managers. These reforms together with privatization may increase incentives for productive reallocation through improved competition and corporate governance. The extent to which enterprises actually adjust in response to such changes, however, is likely to be a function of factors such as the macroeconomic environment and the history of central planning, which may affect the quality of price signals and firms' information on their productivity in a new economic system. The business environment may also play a crucial role, and observers have frequently suggested that, despite rapid liberalization, continued government intervention during the transition may stifle productivity-enhancing reallocation. Direct subsidization and other forms of support for weak and failing enterprises may impede exit, while discriminatory taxes, bureaucratic interference, poor contract enforcement, and uncertain property rights protection may hinder growth of more successful firms (e.g., Frye and Shleifer, 1997; Åslund, Boone, and Johnson, 1996). The transition economies could be subject to "sclerosis" (Caballero and Hammour, 1996), in which less productive resources remain employed due to market imperfections and government policies, while the creation of more productive matches of resources and enterprises is impeded.

The six countries we study in this paper cover the spectrum of transition policy strategies, at least as conventionally measured in evaluations of "progress" in reform and transition by international organizations such as the European Bank for Reconstruction and Development (EBRD) and the World Bank. The World Bank's (1996) four-group classification of 26 transition economies, for example, puts Hungary in the first group of leading reformers, Lithuania and Romania in the second group, Georgia and Russia in the

third, and Ukraine in the fourth. Similarly, the EBRD's annual indicators of "progress in transition" invariably place Hungary at or close to the top of all transition economies; its average score across the price liberalization, foreign exchange and trade liberalization, small-scale privatization, large-scale privatization, enterprise reform, competition policy, banking sector reform, and non-banking sector financial institutions indicators has been the highest or close to it among all transition economies since 1994. Georgia, Lithuania, Romania, Russia, and Ukraine started their reforms later, implemented them more gradually (it took them two to five years to reach the level Hungary achieved after one year), and they still have not bridged the gap with Hungary. Georgia and Ukraine started most slowly (Georgia's progress wasn't helped by its civil war in 1992-1994), but they rapidly converged with Romania and Russia in the second half of the 1990s. Success in macroeconomic stabilization followed a similar pattern, with Hungary experiencing the smallest cumulative output decline before recovering (15 percent), followed by Romania (21 percent), Russia (40 percent), Lithuania (44 percent), Ukraine (59 percent), and Georgia (78 percent).[5] Hungary never experienced annual inflation over 35 percent, while the other countries' inflation rates exceeded 100 percent in some years, and Georgia, Russia, and Ukraine's rates did not fall below that level until 1996.

Regardless of the exact figures, which are certainly subject to measurement errors and disputes, the clearly different patterns of policies in the six countries suggests an interesting set of comparative hypotheses. During the socialist period, Hungary's partial reforms may have stimulated a somewhat faster paced and more effective productivity-enhancing reallocation compared to Soviet Russia. During the transition, if a quicker and more effective implementation of reforms tends to stimulate productivity-enhancing reallocation, then Hungary's ambitious policy is likely to be reflected in the fastest increase in the contribution of reallocation to productivity growth. Although productive reallocation may be slowest to emerge in Georgia and Ukraine, it should tend to converge with that in Romania and Russia by the late 1990s. On the other hand, an alternative possibility is that more cautious, gradual policies are more successful at stimulating productive reallocation, and that overly rushed liberalization leads to unemployment rather than genuine reallocation, as in the "optimal speed of transition" (e.g., Aghion and Blanchard, 1994; Boeri and Terrell, 2002) or in Caballero and Hammour's (1996) discussion of "hyperkinesis." If valid, this could reverse the ordering of countries in the level and timing of the emergence of productive reallocation. Our empirical analysis provides evidence on these opposing hypotheses.

3. Data and Basic Methods

3.1 Sources, Samples and Variables

The paper uses annual census-type data for manufacturing firms in each of the six countries.[6] Though the data sources and variables are similar, we have taken steps to make them sufficiently comparable to justify cross-country comparisons.

[5] See World Bank (2002).

[6] The units of observation in these data are firms, except for multi-plant entities where individual plants are listed as "subsidiaries" (*dochernye predpriyatiya* or "daughter companies") in the Russian registries. Apparently most but not all cases of multiple plants are treated individually in Russia: the 1993 registry contains a variable indicating the number of plants, which equals 1 in 99.91 percent of the 18,121 nonmissing cases. To avoid double-counting, we have dropped the consolidated records of entities with subsidiaries from the analysis.

The Georgian and Lithuanian data come from their respective national statistical offices and cover most firms outside the budgetary and financial sectors in 1995-2000 (Lithuania) or 2000-2004 (Georgia). The Georgian and Lithuanian databases include roughly three-fourths of total manufacturing employment reported in the yearbooks. We also use data from the 1989 Soviet industrial registry to get a measure of pre-transition productivity dispersion in the two republics. Unfortunately, we are unable to link these data with the later years, since our more recent data do not contain firm names or locations.

The basic sources for the Hungarian and Romanian data are balance sheets and income statements associated with tax reporting: to the National Tax Authority in Hungary and the Ministry of Finance in Romania. All legal entities engaged in double-sided bookkeeping report, with the exception of Hungary before 1992—when only a sample consisting of most firms with at least 20 employees and some smaller firms is available.[7] The Romanian data are supplemented by the National Institute for Statistics' enterprise registry and the State Ownership Fund's portfolio and transactions data. The Hungarian data are annual from 1986 to 2005, and the Romanian data span 1992 to 2006. The database employment is similar to statistical yearbook numbers in both countries.

The main sources in Russia and Ukraine are industrial enterprise registries from their national statistical offices, supplemented by balance sheet data. The data span 1985-2004 and 2006 for Russia, and 1989 and 1992-2006 for Ukraine. The Russian registries are supposed to include all industrial firms with over 100 employees as well as those that are more than 25 percent owned by the state and/or legal entities that are themselves included in the registry. In practice, it appears that once firms enter the registries, they continue to report even if these conditions no longer hold. The Russian data can therefore be taken as corresponding primarily to the "old" firm sector (and their successors) inherited from the Soviet period. The 1992-1996 Ukrainian registries contain all industrial firms producing at least one unit of output, where a unit is defined differently depending on the product. All legal entities outside the budgetary and financial sectors are included in the 1997-2006 registries. The pre-1992 Russian and 1989 Ukrainian data do not include firms in the military-industrial complex. The Ukrainian coverage is fairly complete except in 1989 (69 percent of employment). The Russian data cover nearly all activity through 1994; then the coverage declines to about 75 percent in more recent years as the de novo sector has grown.

Some truncation was necessary to make the samples comparable across countries. The data in all countries are limited to manufacturing (NACE 15-36). We exclude the tobacco industry (NACE 16) due to insufficient observations in four of the six countries and the recycling industry (NACE 37) because of noncomparability with the classification system used in Russia and Ukraine until recently. We also drop productivity outlier observations, so that they don't drive the results.[8]

[7] Nevertheless, the coverage before 1992 in Hungary is still very high (see Table 1B).

[8] We define outliers as firm-years with productivity in the first year that is less than 10 percent or greater than 10 times productivity in the following year, productivity in the last year that is less than 10 percent or greater than 10 times productivity in the previous year, productivity in interior years that is less than 20 percent of that in both adjacent years, or productivity greater than 5 times productivity in both adjacent years. Outliers defined on the basis of labor (multifactor) productivity are excluded from labor (multifactor) productivity exercises.

Ideally one would prefer to use sectors disaggregated to the level of product markets, so as to compare firms only to their competitors. On the other hand, since the productivity decompositions rely on deviations from the sectoral average, it is important to have sufficient numbers of firms in each sector to ensure reliable estimates. We have compromised by dividing manufacturing into 19 sectors. These sectors are 2-digit NACE categories, combining sector 23 with 24 and sector 30 with 32.

Summary statistics and definitions for employment, output, and capital stock are reported for the first and last years in each country's data in Table 1. Average employment and output or sales significantly decline everywhere except Georgia.[9] The particularly sharp declines in Hungary, Romania, and Ukraine can be explained by small firm entry after liberalization.[10]

These data have been extensively cleaned to remove inconsistencies and to improve missing longitudinal linkages due to change of firm identifier from one year to the next (associated with reorganizations and changes of legal form, for instance). The inconsistencies were evaluated using information from multiple sources (including not only separate data providers, but also previous year information available in Romanian balance sheets and Russian and Ukrainian registries). The longitudinal linkages were improved using all available information, including industry, region, size, multiple sources for the same financial variables, and some exact linking variables (e.g., firm names and addresses in all countries except Georgia, Hungary, and Lithuania, where this information was not available) to match firms that exited the data in a given year with those that entered in the following year. For Hungary we also used a database with direct information on longitudinal linkages: if a firm changed its identification number for some reason (and it appeared in the data as a new entry or an exit), the database indicated whether it had a predecessor or successor and, if so, that firm's identification number.

To eliminate spurious exit and entry, we eliminated employment changes associated with firms that exit and then re-enter, as well as firms with over 1,000 employees in their year of entry or exit. In Russia and Ukraine we also excluded firms in regions that are completely missing in the data in one of the two adjacent years, and those in industries with implausibly high entry or exit rates in that year (suggesting a change in sample coverage). Entry and exit associated with firms that were members of Soviet-era production associations or that belong to multi-establishment firms were also excluded in Russia.[11]

[9] The lack of a sharp decline in Georgia can be explained by the fact that the data start only in 2000. Georgia's average manufacturing employment in 1989 is much higher, at 302.

[10] Average employment and output decline among old firms (enterprises inherited from the socialist system) samples as well, but the Hungarian, Romanian, and Ukrainian declines are much smaller than they are when using full samples.

[11] The reason for excluding production association entry and exit during the Soviet period and multi-establishment firm entry and exit during the transition period is that many of these firms report inconsistently in the data. In one year a consolidated entity may appear, in the next each of the establishments may report separately, or vice versa. These exclusion rules result in a conservative bias. Of course some production associations may be starting new establishments or closing others down, and there may be some true entry and exit in industries with implausibly high rates and in regions that enter and exit the dataset.

3.2 Productivity Measures and Decompositions

We compute two types of firm-level productivity measures: labor productivity (LP) is calculated as the log of gross output or sales divided by number of employees, and multifactor productivity (MFP) is the residual from an industry-specific Cobb-Douglas production function in capital and labor (using 19 manufacturing sectors). In each case, the productivity values are aggregated into a constructed productivity index for each year and industry, and then the aggregates are decomposed using methods that have become standard in the literature. We then further decompose the effect of reallocation on productivity growth into productivity dispersion, reallocation volume, and the correlation between reallocation and productivity differentials.

The method of decomposing aggregate productivity growth employed here is a modified version of the proposal of Haltiwanger (1997) and Foster, Haltiwanger, and Krizan (2001), hereafter referred to as FHK. Construction of aggregate labor productivity measures involves summing firm-level measures to the aggregate level:

$$P_t = \sum_i S_{it} \sum_e S_{eit} P_{eit} \tag{1}$$

where P_t is aggregate productivity in year t, S_{it} is the employment share of industry/sector i in year t, S_{eit} is the employment share of firm e in industry i and year t, and P_{eit} is the productivity of enterprise e in sector i in year t.

FHK's "method I" decomposition expresses the change in aggregate sectoral productivity, ΔP_{it} (where $P_{it} = \sum_e S_{eit} P_{eit}$), as follows:

$$\Delta P_{it} = \sum_{e \in C} s_{et-1} \Delta p_{et} + \sum_{e \in C} (p_{et-1} - P_{it-1}) \Delta s_{et} + \sum_{e \in C} \Delta p_{et} \Delta s_{et} + \sum_{e \in N} s_{et} (p_{et} - P_{it-1}) - \sum_{e \in X} s_{et-1} (p_{et-1} - P_{it-1}) \tag{2}$$

The first term in (2) measures the average change in firm productivity holding composition constant at its previous year structure, in order to distinguish average productivity growth from composition effects. This term may reflect firm restructuring and deterioration as well as mismeasured price and quality changes. The second term measures the between-firm (within-sector) reallocation effect, the covariance of share changes with the previous year deviation of enterprise productivity from the industry mean. The third term measures the intrasectoral covariance of productivity and compositional changes, the "cross" effect, while the fourth and fifth represent the contributions of entry (N) and exit (X), respectively.[12] The fourth and fifth terms

[12] We have also examined an FHK method using average period weights, with similar qualitative conclusions, but we do not use the Olley and Pakes (1996) cross-sectional decomposition (OP) of aggregate productivity into unweighted average productivity and covariance of deviations of employment shares and productivity from sector means. The OP approach may attribute some activities to within effects that the FHK decompositions treat as reallocation effects and vice versa. If two firms with fixed shares switch ranks in the productivity distribution, OP reports a reallocation effect and FHK a within-firm effect from the change. When a firm above average size and productivity splits into two firms with the same productivity but below average size, this appears as a negative reallocation effect and positive within-firm effect with OP, but it has no effect in the FHK decompositions. OP treats exit of a firm below average in size and productivity as a positive within-firm and negative reallocation effect and entry by a similar firm as the opposite, while the FHK decompositions treat the exit as a positive and the entry as a negative reallocation effect. The FHK treatments accord more closely with intuition about reallocation, so OP results are not shown here.

combined are the net entry effect. The total reallocation contribution is thought to be the sum of the between and net entry effects plus part of the cross effect.

Notice, however, that the FHK net entry effect is not purely a reallocation effect. For instance, if exiting firms are just as productive on average as stayers in the initial period, and entrants are also equally productive as surviving incumbents in the final period, then the FHK net entry effect will simply be the entry share of activity multiplied by the change in sectoral productivity, i.e., its productivity growth contribution will be proportionate to its share of activity. This is not a very natural way to think of the entry contribution, and an alternative approach is to compare entrants with the productivity of incumbents in year *t* and to distinguish the aggregate productivity contribution of net entry due to above- or below-average productivity levels, relative to a benchmark in which exitors are like incumbents in the exit year and entrants are like incumbents in the entry year. This can be accomplished by decomposing FHK's entry term in the following way:

$$\sum_{e\in N} s_{et}\left(p_{et} - P_{it-1}\right) = \sum_{e\in N} s_{et}\left(P_{it} - P_{it-1}\right) + \sum_{e\in N} s_{et}\left(p_{et} - P_{it}\right). \qquad (3)$$

The first term is the change in average sector productivity over the period, weighted by entrants' share, which may be labeled the "proportionate entry" term. The second term is the weighted average of entrants' productivity compared to the sector average in year *t*, the "extraordinary entry" term. The entire decomposition becomes:

$$\Delta P_{it} = \sum_{e\in C} s_{et-1}\Delta p_{et} + \sum_{e\in C}\left(p_{et-1} - P_{it-1}\right)\Delta s_{et} + \sum_{e\in C}\Delta p_{et}\Delta s_{et} + \sum_{e\in N} s_{et}\left(P_{it} - P_{it-1}\right) + \sum_{e\in N} s_{et}\left(p_{et} - P_{it}\right)$$
$$- \sum_{e\in X} s_{et-1}\left(p_{et-1} - P_{it-1}\right). \qquad (4)$$

The combination of exit and extraordinary entry show whether firm turnover contributes disproportionately to aggregate productivity growth.[13] For comparison purposes when considering the results below, the FHK entry term can be recovered by simply adding the two entry terms in (4) together. [14]

We report the base-year employment-weighted average of the sector-level decompositions using equation (4).

[13] Although they do not calculate the contribution of extraordinary entry as we do, Foster et al. (2001) and Disney et al. (2003) implicitly adopt the same perspective when they run regressions comparing the productivity of entrants in the final year to the productivity levels of exitors in the initial year and continuers in the initial and final years.

[14] The equation (4) decomposition also has the advantage of shifting any measurement error for entering and exiting firms into the proportionate entry term. If firms' links in the data were broken randomly, leading some continuers to be counted as exits and subsequent entrants, their productivity growth would contribute to the FHK entry term. In our modified decomposition, random breaks of firm linkages would be incorporated into the proportionate entry term, but would not affect the exit and extraordinary entry terms. Also, since productivity of entering firms is compared with incumbents' productivity in the same year, the extraordinary entry term is not sensitive to mismeasured price deflators.

4. Results

4.1 Reallocation

Before presenting the reallocation contribution decomposition results, we first report calculations of the volume of job reallocation, the division of reallocation between changes among continuing firms versus firm turnover, and how these patterns vary across time and country in Tables 2A-F. Standard job flow measures are calculated using the methods of Davis and Haltiwanger (1992). Entry and exit rates in these tables are shown as percentages of total employment (the average of t-1 and t, for comparability with the overall reallocation figures). The entry (exit) share of total employment divided by the job creation (destruction) rate is the proportion of job creation (destruction) coming from entry (exit). The difference between job creation and destruction is net employment change. The net change is negative in the early transition years in all countries, reflecting the sharp decline in the manufacturing sector during that period.

The pace of gross flows under central planning, evidenced by the results from Hungary and Russia, are well below those typically found in market economies (which are typically 8-10 percent each for annual creation and destruction). However, the job flow rates during this period are significantly higher in Hungary than Russia. This is due to both higher creation and destruction by continuing firms and more firm turnover. Hungary experiences only a modest amount of firm turnover prior to the transition, but the Russian data show virtually none. These patterns may reflect greater pre-transition reform in Hungary. Once the transition starts, there is a marked increase in job flows both from continuing firms and firm turnover. The increase is much larger in Hungary, which implemented faster reform.

Georgia experiences the largest creation and destruction rates on average during the transition.[15] Hungary, Lithuania, and Romania's rates are also quite high. Russia and Ukraine experience significantly less reallocation both from continuers and firm turnover.

Throughout the transition, these economies exhibit job destruction rates that are as high as or higher than in mature market economies. In Romania, Russia, and Ukraine, this is primarily a result of high continuing firm contraction, while exit also makes a large contribution in Hungary. In contrast to the destruction by continuers, their job creation is subdued in the first few years of the transition everywhere. The subsequent rise in continuer job creation occurs near the time of economic recovery, which arrives first in Hungary, then Romania, Lithuania, Georgia, Russia, and finally Ukraine.

4.2 Productivity Decompositions

To investigate the contribution of this reallocation to productivity growth, Tables 3A and 3B show five-year and longer-run modified FHK labor productivity (output per worker) and multifactor productivity growth decompositions for our six countries, plus the U.S. from Foster et al. (2001) so as to provide a developed market economy benchmark. Figures 1-7 (and Appendix Table 1) also show three-year labor productivity decompositions for the transition economies, where each dot represents the particular effect for the three-year period ending in the year on the X axis.

[15] It is not possible to clean the longitudinal links in the Georgian data as thoroughly as in the other countries, since the data do not contain name or location information. The high Georgian firm turnover rates could at least partly reflect spurious exit and entry. But the job creation and destruction rates among incumbents are also highest in Georgia, so incomplete longitudinal links cannot be the full explanation.

It is useful to start by reviewing FHK results for the U.S., as a benchmark. Based on labor productivity, the U.S. between-continuing firm contribution is small, and it is actually negative with multifactor productivity. The FHK net entry term is sizeable, particularly in the longer run, which has been interpreted to suggest that firm turnover is an important contributor to U.S. productivity growth. The proportionate entry effect accounts for nearly three-quarters of the FHK net entry term in the ten-year decomposition, however. In 1977-1987, for example, we calculate that exit and extraordinary entry contribute only 1.84 percentage points, or less than ten percent of aggregate labor productivity growth over the whole period. For multifactor productivity growth, the contribution is even smaller: 0.51 percentage points, or five percent of during that period. Foster et al. (2001) do not report five-year entry and exit shares, so we are unable to calculate five-year proportionate entry as distinguished from extraordinary entry and exit. Since total growth is positive, proportionate entry must also be positive, so the sum of extraordinary entry and exit must be lower than the FHK net entry term. These results suggest that productivity growth directly attributable to reallocation over 3-year and 5-year periods is in the 0-2 percentage point range in the U.S.[16]

Turning to the countries in our sample, the contributions of reallocation to productivity growth during the central planning period is virtually zero. [17] It contributes much more once the transition starts. Measured as the sum of the between, extraordinary entry, exit, and one-half the cross term, it rises from -4.4 in 1987-90 to 4.5 percentage points of growth in 1990-1993 in Hungary, -0.1 in 1989-92 to 6.5 in 1992-95 in Russia, and 1.4 in 1989-92 to 3.2 in 1992-95 in Ukraine. Nearly all the gain in Hungary's reallocation comes from much larger exit and extraordinary entry, while the bulk of the gain comes from continuing firm reallocation in Russia and Ukraine.

The Hungarian reallocation contribution to productivity growth peaks in 1990-93, when it is the highest among the countries observed that period. After 1994-97, the role of reallocation in Hungary never surpasses 2 percentage points and is in a similar range to that in the U.S. Though Hungary has healthily positive between and exit terms in most years, its total reallocation contribution is brought down by quite negative cross and extraordinary entry terms. Not only is the extraordinary entry contribution negative, but the sum of exit and extraordinary entry is also negative, which is surprising given previous studies' characterization of the new private sector as the engine for growth. These results also hold for Romania.

[16] Reallocation could also contribute indirectly, as entrants and expanding incumbents could discipline other incumbents to increase productivity or exit, but this factor is not taken into account by the FHK or other methods of decomposition.

[17] Here we discuss the three-year labor productivity growth decomposition results in Figures 1-7 and Appendix Table 1. Appendix Table 2 shows three-year multifactor productivity results, Table 3A and Appendix Table 3 show five-year labor productivity results, and Table 3B and Appendix Table 4 show five-year multifactor productivity results. The basic patterns are the same across these decompositions.

By the late 1990s, the reallocation contribution rises to double-digit levels in Russia and Ukraine. Continuing firm reallocation and exit contribute roughly equally to the rise in Russia, while more of it comes from continuing firm reallocation in Ukraine. Georgia has the highest reallocation contribution (41.8 percentage points in 2000-03), and its between and exit terms are both large. This shows that the productivity boom in these countries since Russia's 1998 financial crisis has not come simply from a restoration of incumbent firms' pre-transition production levels. Lithuania and Romania also show significant reallocation contributions, but only via continuing firm reallocation, and their levels are below those in Georgia, Russia, and Ukraine. The generally higher extraordinary entry terms and lower entry rates in Russia and especially Ukraine compared to Hungary Lithuania, and Romania are consistent with higher entry barriers in Russia and Ukraine (only the most productive entrepreneurs decide to bear the entry cost).

The within-firm contribution follows a "J-curve" pattern in each country with long time series.[18] Hungary's decline begins earlier than in Russia and Ukraine, but its trough is much shallower and the recovery begins several years earlier. In all countries the within-firm effect is usually significantly positive in the later years of transition. While it is the source of nearly all Hungary's productivity growth, it is important but not dominant elsewhere.

The cross term is nearly always negative in Hungary (as in the U.S.), suggesting either that firms with growing productivity are downsizing to a greater extent than other firms or that there is measurement error.[19] In the early transition the Russian and Ukrainian firms with growing productivity downsize less. In later years Russia and Ukraine (as well as Georgia and Romania) have negative cross terms.

The proportionate entry term (and the FHK entry term, which is proportionate plus extraordinary entry) is very large and negative, then large and positive in the early years of Hungary's transition. It is likely that these massive swings reflect a large volume of entry during a time when within-firm productivity growth is highly volatile rather than changes in the quality of entrepreneurship. The term is relatively unimportant in Hungary in later years and in the other countries, with the exception of Georgia and Ukraine in the 2000's, where it is significantly positive.

Some aspects of the cross-country patterns are puzzling. The rise in the reallocation contribution in the transition period relative to the socialist period is consistent with the hypothesis that market institutions facilitate productivity-enhancing reallocation, but the larger reallocation contributions in Georgia, Russia, and Ukraine compared to Lithuania, Romania, and especially Hungary and the U.S. is not. And the large firm turnover contributions in Georgia, Russia, and Ukraine and insignificant ones in Hungary, Lithuania, Romania, and the U.S. are inconsistent with previous characterization of the new private sector as the engine for growth in the more advanced

[18] The within, cross, and proportionate entry terms in this decomposition should be treated with caution, because any measurement error in price changes (associated for instance with quality differences or high and volatile inflation) is reflected directly in these components. During the socialist period, repressed inflation is not reflected in the figures, nor are improvements in the quality and availability of goods during the early transition; in the former case the within term is overstated, and in the latter it is understated. The reallocation terms do not suffer from the same measurement error problems to the extent that these errors are common across firms within an industry-period cell.

[19] See Foster et al. (2001) for a discussion of measurement error in the cross term.

reformers and developed market economies but not in the laggards. Do Georgia, Russia, and Ukraine's larger contributions come as a result of employment adjustments at a slower, more "optimal" speed? The next section investigates the cross-country differences.

4.3. Analyzing Differences in Productivity-Enhancing Reallocation

What factors lead to higher contributions of reallocation to productivity growth? We focus on three fundamental conditions: the volume of reallocation, the dispersion of productivity, and the correlation of reallocation and productivity differentials. We decompose the total contribution of reallocation, defined as the sum of the between, extraordinary entry, and exit terms in equation (4), into these three terms, measured as the standard deviation of employment share changes, the standard deviation of productivity, and correlation between share change and relative productivity.[20] The difference in the reallocation contribution between sectors (or countries or time periods) *i* and *j* can be decomposed in the following way:

$$\sum_e (p_{et-k} - P_{it-k})\Delta s_{et} - \sum_f (p_{ft-k} - P_{jt-k})\Delta s_{ft} =$$
$$.5 \times \{Corr(\Delta s_{et}, p_{et-k} - P_{it-k}) + Corr(\Delta s_{ft}, p_{ft-k} - P_{jt-k})\} \times [.5 \times \{N_i \sigma_{\Delta s_{et}} + N_j \sigma_{\Delta s_{ft}}\} \{\sigma_{p_{et-k}-P_{it-k}} - \sigma_{p_{ft-k}-P_{jt-k}}\}]$$
$$+$$
$$.5 \times \{Corr(\Delta s_{et}, p_{et-k} - P_{it-k}) + Corr(\Delta s_{ft}, p_{ft-k} - P_{jt-k})\} \times [.5 \times \{\sigma_{p_{et-k}-P_{it-k}} + \sigma_{p_{ft-k}-P_{jt-k}}\} \times \{N_i \sigma_{\Delta s_{et}} - N_j \sigma_{\Delta s_{ft}}\}]$$
$$+$$
$$.5 \times \{N_i \sigma_{\Delta s_{et}} \sigma_{p_{et-k}-P_{it-k}} + N_j \sigma_{\Delta s_{ft}} \sigma_{p_{ft-k}-P_{jt-k}}\} \times \{Corr(\Delta s_{et}, p_{et-k} - P_{it-k}) - Corr(\Delta s_{ft}, p_{ft-k} - P_{jt-k})\} \quad (5)$$

The first term in this equation is the productivity dispersion component. Gaps in productivity across firms create the potential for productivity-enhancing reallocation – without these gaps, reallocation can have no productivity effect. Productivity dispersion can thus be considered a measure of "cleansing potential." The employment share change dispersion component is the second term. Ceteris paribus, the more reallocation occurs across firms, the more it can affect productivity growth. This can be thought of as reallocation intensity or volume. The third term is the reallocation-productivity correlation component. A positive correlation is essential for reallocation to be productivity-enhancing. The stronger the correlation, the more precise is the targeting of reallocation from less productive toward more productive firms. We first analyze each of the components, focused on the case of three-year periods and labor productivity, and then we report the results from decomposition (5).

One would expect productivity dispersion to display an inverse-U shaped pattern as a function of market reform. An abrupt shift in prices and markets may be advantageous for some firms but disadvantageous for others. Firms are unlikely to adapt equally well to the new market environment. New firms will enter and experiment, some with high and others with low productivity; as they learn a selection process will tend to

[20] This sum is $\sum_e (p_{et-k} - P_{it-k})\Delta s_{et}$, where entrants' productivity and change in share are measured in the final year. We don't include the cross term here. The decomposition covers three-year periods using labor productivity.

make them more homogenous. Exit will also reduce heterogeneity, but weaker firms may be allowed to survive in countries implementing only partial reform, while they are pushed out with more complete reform. Together, these forces imply an inverse-U shaped profile. Figure 8 presents labor productivity dispersion using initial year productivity (except for entrants, whose productivity is measured in the final year (three years later in this three-year decomposition case)). Productivity dispersion is very similar across the five countries where we can measure it on the eve of the transition, as well as to the United Kingdom.[21] It rises by 60-240 percent after the introduction of reform, then plateaus. The fact that it plateaus suggests that cleansing of less productive firms is sufficient to prevent a further increase in dispersion, but not enough to bring it down to levels found in developed market economies. It both increases and plateaus earliest in Hungary and latest in Ukraine. In the later transition heterogeneity is highest in Ukraine, followed by Georgia, Russia, Romania, Hungary, and Lithuania, roughly in inverse order of reform progress in the early transition.

This massive productivity dispersion increase could simply be an uncovering of pre-existing gaps between firms that were hidden due to features of central planning such as fixed input and output prices and absence of competition. Alternatively, the physical and human capital needed to perform well in centrally planned and market systems may be very different. The former would suggest little change in firms' relative productivity rankings and the latter substantial change. To investigate this we calculate the correlation between the productivity ranks of continuing firms across three-year periods. Figure 9 shows one minus this correlation. Prior to the transition, firm ranks change very little, though more in Hungary than Russia (perhaps reflecting the partial reform process in Hungary). A large amount of rank change occurs at the beginning of the transition, then the pace falls somewhat. Romania's rank change is consistently highest, followed closely by Lithuania and Georgia, while Hungary and Russia's are lowest during the later years. The large increase in rank change coincides with the rise in productivity dispersion, suggesting that the greater dispersion is not just an uncovering of inherited gaps.

Labor and product market liberalization should lead to an increase in reallocation volume. Figure 10 displays the standard deviation of employment share changes across three-year periods, multiplied by the number of firms appearing in one or both years. Within-sector reallocation increases dramatically with reform in Hungary, but much more gradually in Russia and Ukraine. During the later years Romania and Hungary have the highest volume, followed by Georgia, Ukraine, Lithuania, and Russia.

Privatization and improved corporate governance should reorient firms toward profit maximization, implying that successful firms should strive to increase market share and unsuccessful ones should contract. Competition should also force the weaker firms to contract and exit. These factors would suggest that targeting of reallocation should improve with market reform. On the other hand, high reallocation volume sparked by reform could result in weaker average targetting. The employment share change-productivity correlation across three-year periods is displayed in Figure 11. The Russian and Hungarian correlations fall in the early transition compared to the late central planning period. Their correlations then rise, as does Ukraine's. Russia and Ukraine's improvements in targeting are much greater than Hungary's, however. Reallocation in

[21] Disney et al. (2003) report labor productivity dispersion of 0.67 in the United Kingdom manufacturing sector in 1992.

Russia, Ukraine, and Georgia has been quite well targeted in recent years, and Lithuania and Romania's reallocation is also targeted more toward productive firms. In contrast, Hungary's reallocation-productivity correlation has hovered around zero.

We next analyze the extent to which the three components account for differences between the transition country reallocation contributions and those under central planning in Figures 12-14 and Appendix Table 6. These break down the difference between the reallocation contribution of the respective country and that in 1985-1988 Russia (representing a central planning benchmark) into employment share dispersion, productivity dispersion, and employment share-productivity correlation effects.

All three components make increasing contributions to the reallocation effect in the early years of transition in Hungary, Russia, and Ukraine, and the contributions are positive in the other countries as well. The ordering of countries for each component differs only slightly from the ordering for the overall reallocation effect. Russia's correlation component is higher than Romania's, while the productivity dispersion and employment change components are similar for the two countries. The correlation component is most important for Georgia, Lithuania, Russia, and Ukraine, while the employment share change component is the largest of the three in Hungary and Romania.

How is it possible that Hungary has a high reallocation volume, but its employment share change component in the reallocation effect decomposition is lower than elsewhere? As equation (5) shows, the employment dispersion component will be higher if a country's correlation and productivity dispersion are high. Hungary's productivity dispersion is similar to the other countries, but the employment share change-productivity correlation is close to zero, reducing both the productivity dispersion component and employment dispersion component.

The components of the reallocation effect may be interrelated. High productivity dispersion could facilitate the targeting of reallocation (entrepreneurs will have better information about whether they should increase or decrease market share) and may encourage a higher volume of reallocation, since reallocation gains are higher. Good targeting and high reallocation volume can lower productivity dispersion (the less productive firms exit), while imprecise targeting and/or low reallocation volume may increase dispersion. High reallocation volume may hinder targeting, as predicted by the optimal speed of transition hypothesis and hyperkinesis. It would be useful to explore these associations in future research.

5. Conclusion

This paper measures the contribution of employment reallocation to aggregate productivity growth using manufacturing census data in Georgia, Hungary, Lithuania, Romania, Russia, and Ukraine. Reallocation contributes almost nothing to productivity growth during the socialist period, but a substantial amount after reform in most of these countries, much greater than in the United States. The magnitude grows significantly higher as the transition progresses in Ukraine, Russia, and Georgia, somewhat less in Lithuania and Romania, but it falls back near zero in Hungary. Between continuing firm reallocation is strongly productivity-enhancing everywhere except Hungary, while firm turnover is productivity-enhancing only in Georgia, Russia, and Ukraine.

The results are only partly consistent with the hypothesis that reform facilitates productivity-enhancing reallocation. Reallocation has become more productivity-

enhancing since the transition began, and Russia and Ukraine's reallocation contribution has increased as more reform has been implemented. But the hypothesis doesn't explain why more gradually reforming Georgia, Russia, and Ukraine's reallocation contributions have become so much higher than faster reforming Hungary, Lithuania, and Romania's. The relationship between reform and productivity-enhancing reallocation thus appears to be inverse-U-shaped. The results do not support the optimal speed of transition hypothesis or the presence of hyperkinesis either, as Russian and Ukrainian reallocation volume and its contribution to productivity increase in tandem, and Georgia's reallocation volume is also both high and productivity-enhancing.

What then can explain why the reallocation contribution is higher in the slower reformers? As reform is introduced, firms face a new environment; some adapt better than others, creating productivity gaps. High inflation, lingering price controls, and state subsidies distort market signals, making it hard for the economy to channel reallocation toward more productive firms.[22] The longer an economy remains in a state of incomplete liberalization and stabilization, the more productivity dispersion rises, producing greater and greater potential for cleansing. Slower initial reallocation volume leads to a later high contribution to productivity not because slower reallocation creates better matches, but rather because the slow pace of reallocation allows productivity gaps to widen. In contrast to the transition economies, the U.S. economy has been continually swept clean of less productive firms, reducing the scope for reallocation to contribute to productivity growth.

Looked at from this point of view, productivity-enhancing reallocation is a second-best outcome. It would have been better if some firms had not had such difficulty adapting to the new market environment and experienced precipitous productivity drops, or if they had exited before falling so far behind. Indeed, the relationship between reform and the within-firm productivity contribution appears to be U-shaped – Hungary, for example, has experienced higher overall productivity growth during the transition than the other countries, and most of it was achieved through within-firm productivity growth.[23] Given that the productivity gaps have formed, though, the slower reformers would be much worse off if the reallocation they have experienced had been blocked. The continued presence of these gaps suggests that the potential exists for much more reallocation-induced productivity growth well into the future.

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[22] Inflation and price controls make it difficult for firms to sort out whether they will be more or less productive than their competitors as prices change. State subsidies encourage less productive firms to stay in the market.

[23] If firms with lower productivity growth or with less potential for future productivity growth exit, the firms that remain will have higher average within-firm productivity growth, which could help explain Hungary's superior within-firm productivity growth.

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Figures 1-7: Three-Year Labor Productivity Decompositions

Figure 1: Within Contribution

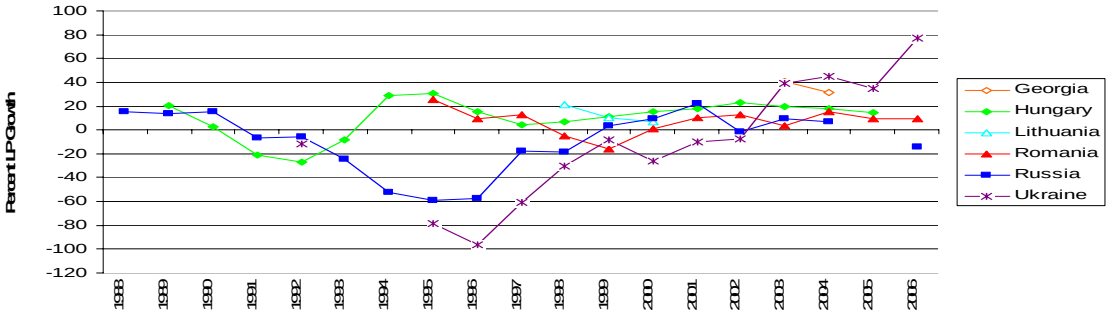


Figure 2: Between Contribution

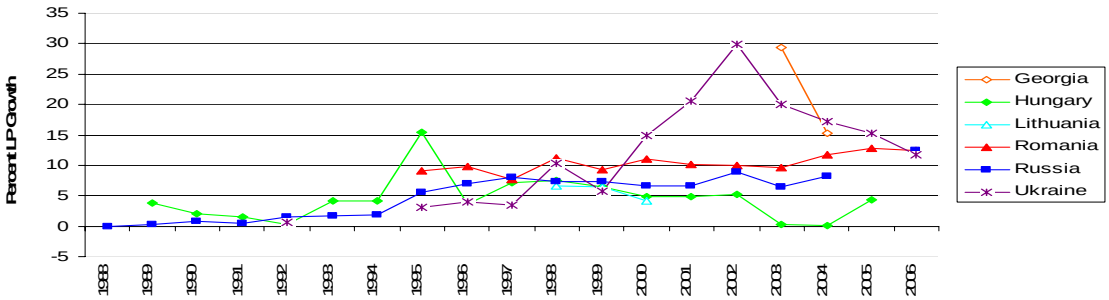


Figure 3: Cross Contribution

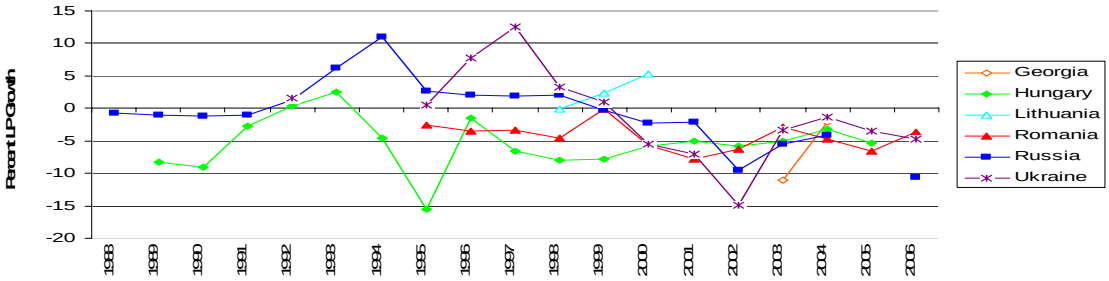


Figure 4: Proportionate Entry Contribution

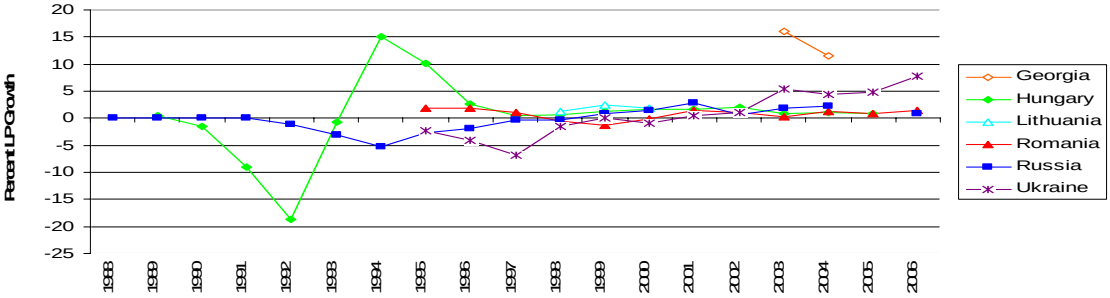


Figure 5: Extraordinary Entry Contribution

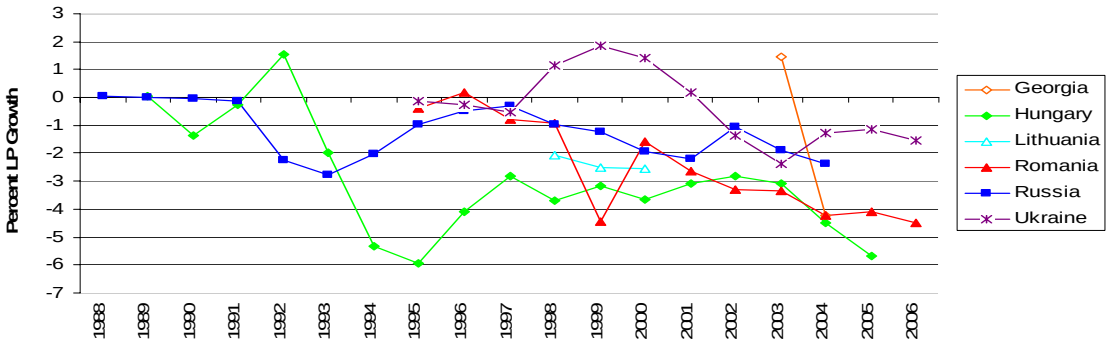


Figure 6: Exit Contribution

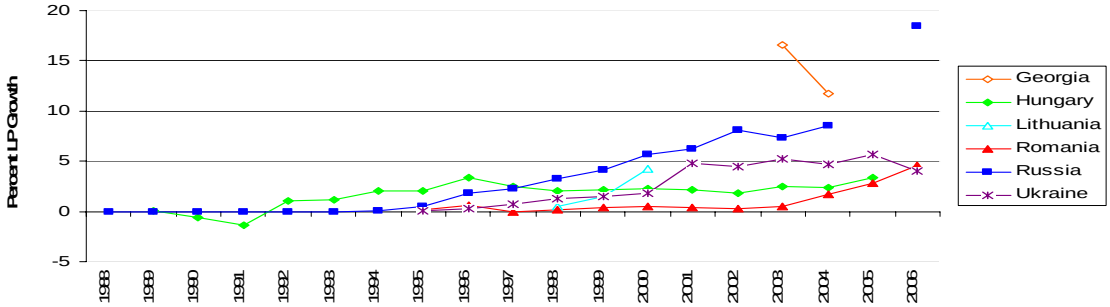
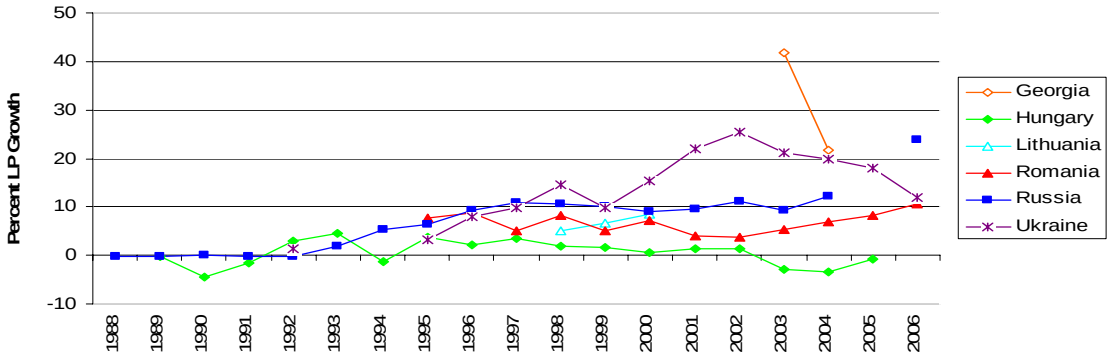


Figure 7: Total Intrasectoral Reallocation Contribution



Note: The numbers behind these figures are in Appendix Table 1. Total intrasectoral reallocation is defined as between + 0.5*(cross) + extraordinary entry + exit.

Figures 8-11: Reallocation and Labor Productivity Descriptive Statistics

Figure 8: Labor Productivity Dispersion

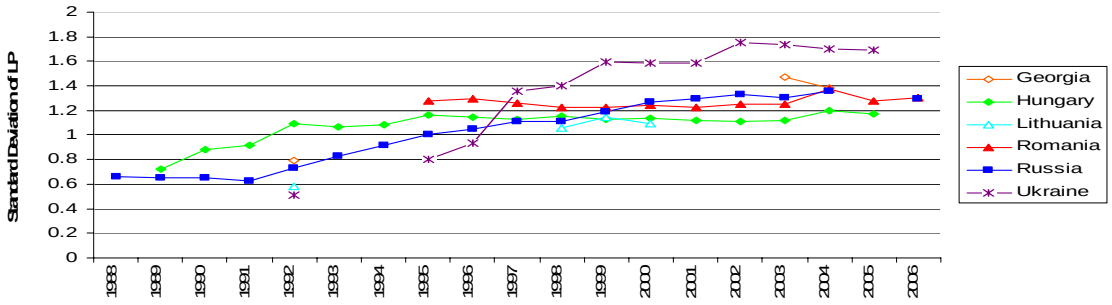


Figure 9: Labor Productivity Rank Change

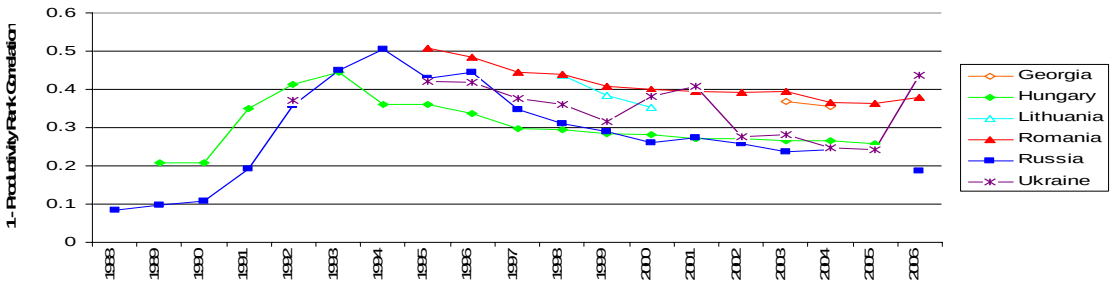


Figure 10: Employment Share Change Dispersion

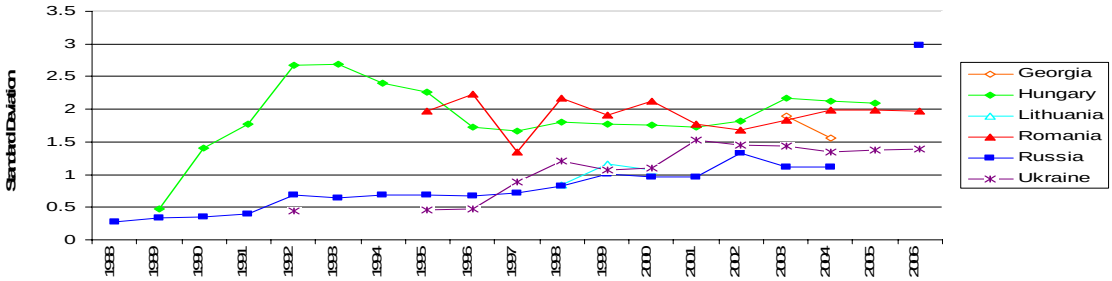
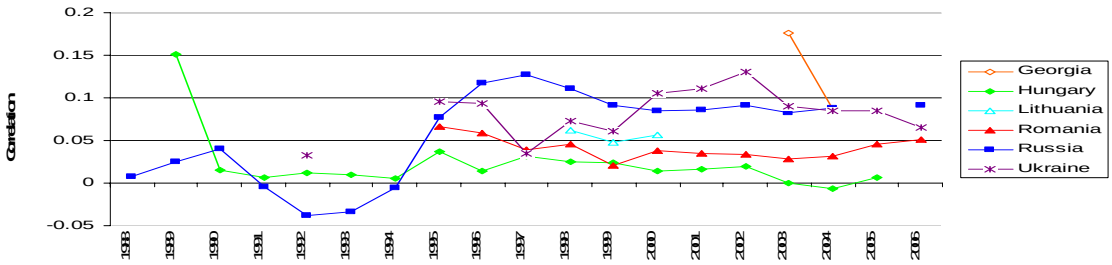


Figure 11: Employment Share Change - Productivity Correlation



Note: These are three-year changes using the samples for the three-year labor productivity decompositions. The year on the x axis refers to the final year in the decomposition. The numbers for these figures are shown in Appendix Table 5.

Figures 12-14: Decomposition of Reallocation Contribution Difference with 1985-1988 Russia

Figure 12: Productivity Dispersion Component

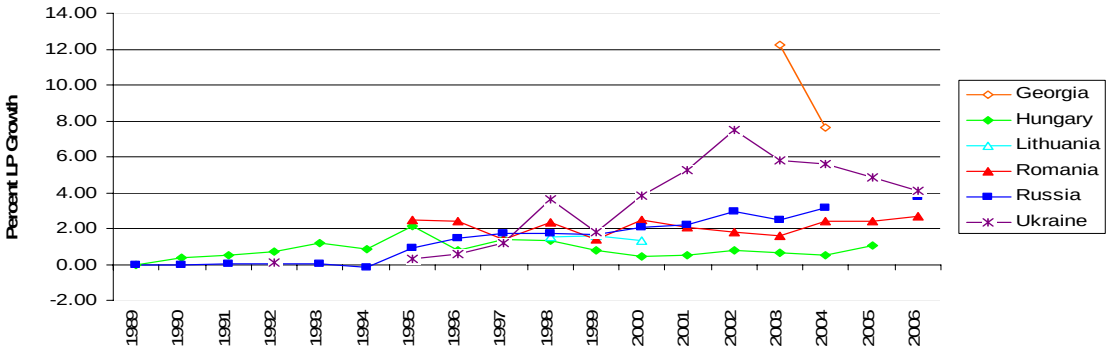


Figure 13: Employment Share Change Component

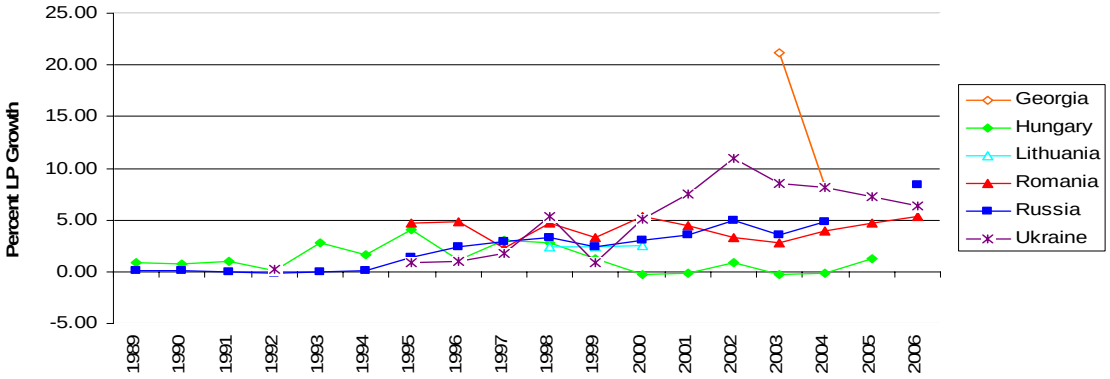
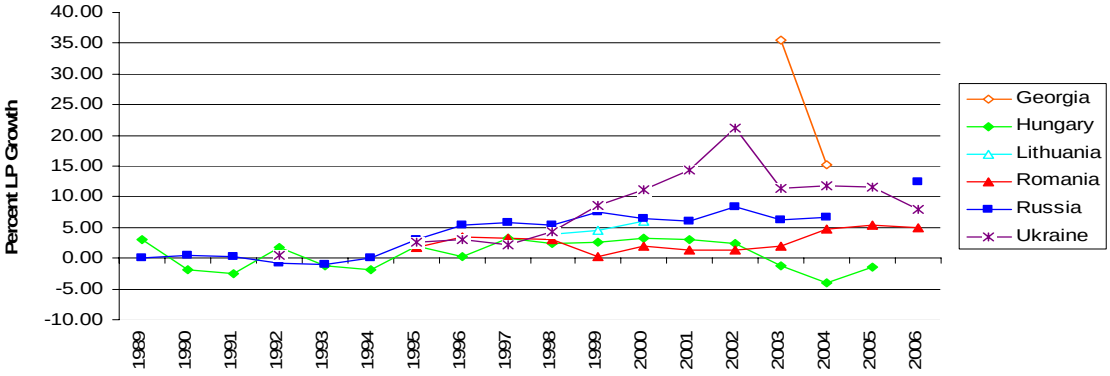


Figure 14: Correlation Component



Note: These are decompositions of the contribution of intrasectoral reallocation to three-year labor productivity growth compared to intrasectoral reallocation in 1985-1988 Russia, applying equation (5).

Table 1: Mean Output, Employment and Capital Stock in the First and Last Years of Analysis

	Employment		Output or Sales		Capital Stock	
	First year	Last year	First year	Last year	First year	Last year
Georgia	30.4	24.4	347.0	566.5	532.2	373.0
	(119.8)	(89.2)	(1,787.3)	(3,395.6)	(3999.4)	(2,159.4)
Hungary	751.6	24.3	6,999.7	624.9	2,320.0	197.5
	(1,429.3)	(159.3)	(21,678.4)	(14,664.6)	(8,974.4)	(3,654.2)
Lithuania	175.0	70.6	10,317.2	6,508.4	5,782.7	3,801.3
	(404.8)	(210.5)	(60,946.2)	(83,998.2)	(35,762.5)	(38,848.0)
Romania	206.0	32.1	84,871.3	35,189.0	827,648.3	22,438.7
	(955.9)	(172.2)	(563,970.9)	(569,901.3)	(3,320,922.0)	(310,311.6)
Russia	781.9	438.8	395.9	460.1	226.8	569.1
	(2,560.7)	(1,621.3)	(1,166.0)	(7,540.8)	(934.5)	(12,884.5)
Ukraine	783.0	73.1	57.0	12.5	39.3	12.5
	(1,853.1)	(676.5)	(179.0)	(134.6)	(177.4)	(153.6)

Note: The first year of analysis is 1985 in Russia, 1986 in Hungary, 1989 in Ukraine, 1992 in Romania, 1996 in Lithuania, and 2000 in Georgia; the last year is 2000 in Lithuania, 2004 in Georgia and for Russian capital stock, 2005 for Hungary, and 2006 for Romania and Ukraine. Employment is the average annual number of registered employees, except in Russia, where it excludes personnel working in non-industrial divisions. Output or sales is annual. It is sales in Georgia, Hungary, Lithuania, Romania, and post-2003 Ukraine, and it is value of production in Russia and pre-2004 Ukraine. Capital stock is the book value of fixed assets. Output or sales and capital stock are expressed in constant final-year prices (thousands of 2004 GEL for Georgia, millions of 2005 HUF for Hungary, thousands of 2000 LTL for Lithuania, millions of 2006 ROL for Romania, millions of 2006 RUB for Russia (except capital stock, which is millions of 2004 RUB, since 2006 capital stock is not available), and millions 2006 UAH for Ukraine). Standard deviations are shown in parentheses.

Table 2A: Job Flows in Georgian Manufacturing

	Job Creation	Job Destruction	Job Reallocation	Excess Job Realloc.	Within-Sector Excess Job Realloc.	Entry Share of Emp.	Exit Share of Emp.
2000-01	15.48	28.50	43.98	30.96	29.09	9.04	10.45
2001-02	12.87	22.91	35.78	25.73	21.88	5.96	6.83
2002-03	12.14	16.76	28.90	24.28	22.05	4.01	6.90
2003-04	20.05	19.17	39.22	38.35	26.67	8.81	11.70

Table 2B: Job Flows in Hungarian Manufacturing

	Job Creation	Job Destruction	Job Reallocation	Excess Job Realloc.	Within-Sector Excess Job Realloc.	Entry Share of Emp.	Exit Share of Emp.
1986-87	2.09	4.51	6.60	4.18	3.44	0.73	0.16
1987-88	3.82	7.16	10.98	7.63	7.47	2.02	0.48
1988-89	1.33	14.72	16.06	2.67	2.66	0.52	0.33
1989-90	14.48	11.91	26.38	23.82	18.44	9.21	1.14
1990-91	12.04	23.28	35.33	24.09	22.28	9.16	4.81
1991-92	20.62	27.92	48.55	41.25	38.85	17.43	11.82
1992-93	17.97	25.70	43.68	35.95	35.16	12.28	12.87
1993-94	11.52	16.46	27.98	23.03	22.36	5.49	6.40
1994-95	10.17	12.08	22.25	20.34	18.80	3.06	4.08
1995-96	9.97	10.66	20.63	19.94	16.60	2.79	3.06
1996-97	12.24	9.41	21.64	18.81	16.49	3.16	2.90
1997-98	11.60	8.09	19.69	16.18	15.17	2.24	2.12
1998-99	9.80	10.30	20.10	19.60	15.70	2.16	2.34
1999-00	11.33	10.42	21.75	20.84	14.99	2.42	3.47
2000-01	9.05	8.42	17.47	16.85	14.70	2.13	2.25
2001-02	8.25	10.94	19.19	16.50	15.73	2.23	2.47
2002-03	10.56	11.70	22.26	21.11	18.50	1.81	3.50
2003-04	11.29	11.81	23.10	22.58	17.41	4.12	3.08
2004-05	8.20	12.22	20.43	16.40	16.04	1.72	4.59

Table 2C: Job Flows in Lithuanian Manufacturing

	Job Creation	Job Destruction	Job Reallocation	Excess Job Realloc.	Within-Sector Excess Job Realloc.	Entry Share of Emp.	Exit Share of Emp.
1995-96	3.95	13.00	16.95	7.90	7.56		
1996-97	11.87	12.99	24.87	23.75	17.13	5.70	1.55
1997-98	8.08	11.89	19.97	16.16	13.33	2.57	1.42
1998-99	10.35	11.26	21.62	20.71	16.54	6.40	0.77
1999-00	9.66	20.10	29.76	19.32	19.23	1.60	10.54

Table 2D: Job Flows in Romanian Manufacturing

	Job Creation	Job Destruction	Job Reallocation	Excess Job Realloc.	Within-Sector Excess Job Realloc.	Entry Share of Emp.	Exit Share of Emp.
1992-93	4.14	11.75	15.89	8.28	7.97	2.32	0.19
1993-94	3.10	14.09	17.19	6.19	6.19	1.59	0.15
1994-95	3.90	9.41	13.31	7.81	7.75	1.14	0.13
1995-96	6.15	6.73	12.89	12.31	9.53	0.77	0.25
1996-97	5.36	9.28	14.63	10.71	9.09	1.14	0.15
1997-98	5.88	18.10	23.97	11.76	10.30	1.29	0.31
1998-99	6.48	16.80	23.28	12.96	11.84	1.75	0.45
1999-00	9.34	14.30	23.64	18.68	15.89	1.62	0.48
2000-01	11.48	10.79	22.27	21.57	18.07	2.22	0.67
2001-02	10.01	12.23	22.24	20.03	18.25	2.13	0.54
2002-03	10.17	13.25	23.42	20.34	18.40	2.29	0.69
2003-04	10.13	14.26	24.39	20.26	19.22	2.32	0.78
2004-05	10.62	14.56	25.17	21.23	18.55	1.98	1.87
2005-06	9.88	14.73	24.61	19.76	18.78	1.90	2.28

Table 2E: Job Flows in Russian Manufacturing

	Job Creation	Job Destruction	Job Reallocation	Excess Job Realloc.	Within-Sector Excess Job Realloc.	Entry Share of Emp.	Exit Share of Emp.
1985-86	1.53	1.88	3.41	3.06	2.21	0.00	0.00
1986-87	1.36	2.51	3.87	2.73	2.66	0.00	0.00
1987-88	1.39	4.82	6.22	2.79	2.78	0.01	0.00
1988-89	1.12	4.25	5.37	2.24	2.22	0.02	0.00
1989-90	0.83	4.86	5.68	1.65	1.65	0.15	0.00
1990-91	2.02	6.49	8.51	4.05	4.05	0.84	0.00
1991-92	7.66	8.03	15.70	15.32	12.10	4.00	0.00
1992-93	2.97	9.36	12.33	5.94	5.66	1.30	0.02
1993-94	2.71	15.11	17.83	5.43	5.43	1.26	0.53
1994-95	3.70	12.39	16.09	7.40	7.40	1.00	0.91
1995-96	3.76	12.12	15.88	7.53	6.17	0.26	1.63
1996-97	2.21	14.12	16.33	4.41	4.41	0.34	0.79
1997-98	3.04	10.54	13.58	6.09	6.09	0.53	1.52
1998-99	6.40	8.36	14.76	12.80	12.28	0.85	1.06
1999-00	8.28	6.05	14.33	12.09	11.98	1.50	1.31
2000-01	7.79	8.84	16.64	15.59	14.28	1.96	1.47
2001-02	11.35	9.74	21.09	19.48	16.05	3.06	1.52
2002-03	9.12	16.06	25.19	18.25	17.89	3.01	1.45
2003-04	8.94	10.70	19.64	17.89	15.55	2.71	1.49

Table 2F: Job Flows in Ukrainian Manufacturing

	Job Creation	Job Destruction	Job Reallocation	Excess Job Realloc.	Within-Sector Excess Job Realloc.	Entry Share of Emp.	Exit Share of Emp.
1992-93	2.40	7.92	10.32	4.79	4.79	1.41	0.00
1993-94	2.31	12.10	14.41	4.61	4.61	1.35	0.49
1994-95	3.06	10.72	13.78	6.11	5.04	0.97	0.49
1995-96	3.82	11.73	15.55	7.64	7.20	2.02	0.69
1996-97	10.95	11.60	22.55	21.90	15.85	9.58	0.81
1997-98	6.01	10.90	16.92	12.03	11.20	3.52	0.87
1998-99	4.05	11.77	15.82	8.10	8.10	0.79	1.23
1999-00	11.46	8.26	19.73	16.53	13.01	1.06	0.19
2000-01	7.17	14.09	21.26	14.34	13.72	1.87	1.68
2001-02	7.06	11.91	18.96	14.11	14.09	1.90	0.29
2002-03	7.76	12.02	19.79	15.53	15.11	2.08	1.22
2003-04	8.04	8.35	16.39	16.09	14.12	0.73	0.39
2004-05	9.91	8.30	18.21	16.60	15.01	4.45	0.96
2005-06	6.97	9.01	15.98	13.94	12.67	1.25	0.13

Table 3A: Labor Productivity Growth Decompositions

	Total	Within	Between	Cross	Prop. Entry	Extra. Entry	Exit
U.S.							
1977-1982	2.54	3.10	2.16	-3.23		0.51*	
1982-1987	18.67	15.50	2.43	-2.80		3.55*	
1987-1992	7.17	6.74	2.37	-3.51		1.51*	
1977-1987	23.02	17.03	1.84	-2.53	4.83	1.84**	
Georgia							
2000-2004	114.22	45.46	30.26	-7.45	29.47	-3.59	20.07
Hungary							
1986-1991	-27.39	-15.40	2.42	-5.07	-8.21	0.24	-1.36
1990-1995	16.74	4.43	2.31	0.72	10.38	-2.64	1.55
1995-2000	14.57	15.62	9.18	-11.21	3.30	-5.67	3.35
2000-2005	31.07	30.22	4.91	-5.75	3.98	-6.42	4.12
1990-2005	57.57	29.68	-1.54	-15.07	46.41	-3.63	1.73
Lithuania							
1995-2000	40.87	18.93	7.89	7.92	5.07	-2.00	3.06
Romania							
1992-1997	39.25	25.66	9.00	-0.45	4.21	0.26	0.57
1996-2001	-1.16	-3.90	12.79	-5.96	-0.57	-4.04	0.52
2001-2006	31.60	17.86	14.89	-5.27	4.06	-4.87	4.93
1992-2006	84.82	48.48	7.29	-11.79	41.30	-3.30	2.85
Russia							
1985-1990	20.18	21.11	0.24	-1.18	0.04	-0.02	0.00
1992-1997	-53.83	-66.09	7.51	7.11	-3.78	-0.66	2.08
1996-2001	36.33	17.32	7.78	0.71	4.86	-2.18	7.84
2001-2006	4.53	-9.80	11.13	-7.69	0.87	-2.35	12.37
1992-2006	-10.43	-14.17	8.82	-7.85	-3.83	0.50	6.11
Ukraine							
1989-1994	-57.41	-61.46	1.31	5.87	-2.23	-0.91	0.01
1992-1997	-100.12	-111.68	3.59	23.19	-14.86	-0.80	0.45
1996-2001	10.18	-18.76	13.35	4.48	1.71	4.17	5.23
2001-2006	136.26	97.29	17.05	-5.60	19.80	-1.22	8.93
1992-2006	72.44	23.58	6.79	8.11	27.89	3.08	2.99

Note: These are labor productivity growth decompositions weighted by base-year employment. Labor productivity is the log of the ratio of real gross output divided by number of employees or manhours (U.S.). They apply Equation (4) in the text. The exit term here is $-\sum_{e \in X} s_{et-1}\left(p_{et-1} - P_{it-1}\right)$, so a positive exit term value means a positive contribution to productivity growth. The U.S. data are at the establishment level. The U.S. numbers are our calculations based on U.S. results in Foster, et al. (2001). *The U.S. five-year single-starred numbers are proportional entry plus extraordinary entry plus exit. **The U.S. ten-year two-starred number is extraordinary entry plus exit.

Table 3B: Multifactor Productivity Growth Decompositions

	Total	Within	Between	Cross	Prop. Entry	Extra. Entry	Exit
U.S.							
1977-1982	2.70	-0.24	-0.89	3.13		0.68*	
1982-1987	7.32	3.81	-1.32	3.73		1.02*	
1987-1992	3.30	-0.20	-1.29	3.63		1.16*	
1977-1987	10.24	4.92	-0.82	3.48	2.15	0.51**	
Georgia							
2000-2004	127.85	51.37	44.56	-7.56	26.40	0.29	12.79
Hungary							
1986-1991	-23.23	-14.45	1.54	-2.54	-7.37	0.90	-1.31
1990-1995	1.63	-7.05	-2.69	10.07	1.64	-3.49	3.16
1995-2000	14.05	10.54	5.87	-3.71	2.84	-3.39	1.92
2000-2005	25.49	22.15	3.30	-2.90	3.14	-1.81	1.61
1990-2005	44.04	17.05	-3.77	-3.92	35.48	-1.68	0.88
Lithuania							
1995-2000	44.74	13.39	10.73	9.21	5.32	2.96	3.12
Romania							
1992-1997	49.81	37.13	6.64	2.73	4.89	-1.14	-0.44
1996-2001	12.39	4.77	11.89	-2.25	2.04	-4.04	-0.02
2001-2006	26.80	7.78	10.83	0.55	3.41	0.22	4.01
1992-2006	97.95	47.88	4.83	-5.05	47.81	-1.00	3.48
Russia							
1985-1990	14.19	15.22	0.67	-1.72	0.03	0.00	0.00
1992-1997	-49.80	-61.13	8.40	3.95	-3.37	1.22	1.13
1996-2001	37.91	19.76	9.43	-4.75	5.83	1.60	6.04
1999-2004	41.89	11.85	12.50	-3.93	6.72	2.79	11.96
1992-2004	8.44	-5.30	7.53	-2.74	0.75	3.41	4.80
Ukraine							
1989-1994	-42.39	-45.85	1.58	2.38	-0.46	-0.02	-0.02
1992-1997	-95.91	-105.83	3.26	14.09	-8.75	1.16	0.16
1996-2001	5.94	-25.22	14.71	5.42	1.46	4.23	5.34
2001-2006	135.08	81.44	22.76	-2.29	19.09	2.41	11.68
1992-2006	63.91	-1.04	8.89	22.07	23.48	5.56	4.94

Note: These are multifactor productivity growth decompositions weighted by base-year employment. The exit term here is $-\sum_{e \in X} s_{et-1}\left(p_{et-1} - P_{it-1}\right)$, so a positive exit term value means a positive contribution to productivity growth. *The U.S. five-year single-starred numbers are proportional entry plus extraordinary entry plus exit. **The U.S. ten-year two-starred number is extraordinary entry plus exit.

Appendix Table 1: Three-Year Labor Productivity Growth Decompositions

	Total	Within	Between	Cross	Prop. Entry	Extra. Entry	Exit
Georgia							
2000-2003	98.24	41.18	29.31	-11.06	16.12	1.44	16.62
2001-2004	68.15	31.54	15.24	-2.11	11.48	-4.22	11.75
Hungary							
1986-1989	16.68	20.42	3.88	-8.24	0.48	0.05	0.09
1987-1990	-8.11	2.44	2.05	-9.10	-1.57	-1.34	-0.60
1988-1991	-32.81	-20.92	1.56	-2.80	-9.00	-0.27	-1.39
1989-1992	-42.18	-26.59	0.20	0.35	-18.74	1.56	1.03
1990-1993	-3.52	-8.52	4.09	2.47	-0.72	-1.98	1.14
1991-1994	39.95	28.51	4.24	-4.52	15.01	-5.34	2.04
1992-1995	37.02	30.89	15.44	-15.51	10.12	-5.96	2.03
1993-1996	19.76	15.69	3.62	-1.54	2.71	-4.08	3.36
1994-1997	5.13	4.46	7.09	-6.59	0.51	-2.82	2.48
1995-1998	4.99	6.61	7.51	-8.05	0.57	-3.69	2.03
1996-1999	10.37	11.37	6.41	-7.81	1.35	-3.15	2.21
1997-2000	14.71	15.53	4.79	-5.78	1.57	-3.65	2.25
1998-2001	18.21	17.84	4.78	-5.09	1.61	-3.07	2.15
1999-2002	23.20	22.61	5.23	-5.77	2.09	-2.83	1.87
2000-2003	15.10	19.59	0.20	-5.00	0.89	-3.07	2.48
2001-2004	13.91	17.97	0.17	-3.18	1.03	-4.50	2.42
2002-2005	12.29	14.69	4.31	-5.36	0.94	-5.69	3.40
Lithuania							
1995-1998	27.66	21.39	6.56	-0.11	1.35	-2.08	0.55
1996-1999	20.70	10.48	6.38	2.33	2.48	-2.49	1.51
1997-2000	20.19	7.15	4.20	5.27	1.86	-2.57	4.28
Romania							
1992-1995	33.27	25.17	9.11	-2.61	1.78	-0.40	0.23
1993-1996	18.15	9.10	9.76	-3.43	1.93	0.20	0.60
1994-1997	17.04	12.43	7.67	-3.42	1.13	-0.78	0.01
1995-1998	0.36	-5.07	11.16	-4.51	-0.46	-0.92	0.17
1996-1999	-11.93	-15.67	9.32	-0.18	-1.31	-4.45	0.37
1997-2000	5.27	1.22	10.96	-5.72	-0.16	-1.56	0.53
1998-2001	12.29	10.60	10.22	-7.75	1.44	-2.64	0.42
1999-2002	14.21	12.43	10.02	-6.21	1.03	-3.30	0.23
2000-2003	7.33	3.14	9.54	-2.84	0.28	-3.34	0.55
2001-2004	21.08	15.30	11.73	-4.73	1.26	-4.23	1.76
2002-2005	14.80	9.14	12.71	-6.57	0.83	-4.09	2.77
2003-2006	19.57	9.27	12.47	-3.60	1.38	-4.48	4.54

	Total	Within	Between	Cross	Prop. Entry	Extra. Entry	Exit
Russia							
1985-1988	14.98	15.62	-0.01	-0.68	0.01	0.04	0.00
1986-1989	13.18	13.86	0.29	-0.97	0.00	-0.01	0.00
1987-1990	14.57	14.97	0.75	-1.11	0.02	-0.05	0.00
1988-1991	-7.51	-6.77	0.38	-1.04	0.05	-0.13	0.00
1989-1992	-6.03	-5.36	1.50	1.27	-1.18	-2.26	0.00
1990-1993	-21.98	-23.99	1.69	6.17	-3.10	-2.75	0.00
1991-1994	-47.00	-52.67	1.90	10.92	-5.17	-2.04	0.07
1992-1995	-54.02	-59.24	5.61	2.69	-2.63	-0.96	0.51
1993-1996	-48.58	-57.20	7.05	2.08	-1.81	-0.50	1.80
1994-1997	-5.84	-17.37	7.96	1.91	-0.36	-0.29	2.31
1995-1998	-7.27	-18.52	7.33	2.03	-0.40	-0.96	3.25
1996-1999	14.81	3.95	7.40	-0.33	0.86	-1.21	4.14
1997-2000	18.57	9.24	6.56	-2.31	1.37	-1.93	5.65
1998-2001	33.36	21.97	6.63	-2.16	2.83	-2.20	6.28
1999-2002	5.66	-1.50	8.88	-9.51	0.74	-1.07	8.11
2000-2003	17.44	9.15	6.48	-5.53	1.85	-1.90	7.39
2001-2004	19.57	7.14	8.13	-4.06	2.15	-2.37	8.57
2003-2006	5.16	-14.34	12.37	-10.60	0.88	-1.61	18.45
Ukraine							
1989-1992	-9.46	-11.63	0.57	1.60	n.a.	n.a.	n.a.
1992-1995	-77.50	-78.65	3.07	0.57	-2.37	-0.14	0.02
1993-1996	-88.80	-96.46	3.95	7.68	-4.06	-0.24	0.34
1994-1997	-51.80	-61.10	3.50	12.50	-6.85	-0.54	0.69
1995-1998	-15.82	-30.43	10.40	3.35	-1.61	1.16	1.32
1996-1999	1.79	-8.40	5.82	1.01	-0.03	1.86	1.52
1997-2000	-13.85	-25.68	14.94	-5.44	-0.90	1.41	1.81
1998-2001	9.17	-9.68	20.52	-7.12	0.46	0.18	4.81
1999-2002	11.61	-7.48	29.95	-14.95	1.01	-1.37	4.44
2000-2003	63.67	38.70	20.05	-3.37	5.45	-2.36	5.21
2001-2004	69.10	45.31	17.23	-1.37	4.50	-1.28	4.71
2002-2005	55.61	34.50	15.23	-3.48	4.79	-1.15	5.72
2003-2006	94.40	76.94	11.80	-4.73	7.84	-1.52	4.08

Note: These are labor productivity growth decompositions weighted by base-year employment. Labor productivity is the log of the ratio of real gross output divided by number of employees. They apply Equation (4) in the text. The exit term here is $-\sum_{e \in X} s_{et-1}\left(p_{et-1} - P_{it-1}\right)$, so a positive exit term value means a positive contribution to productivity growth.

Appendix Table 2: Three-Year Multifactor Productivity Growth Decompositions

	Total	Within	Between	Cross	Prop. Entry	Extra. Entry	Exit
Georgia							
2000-2003	83.57	41.12	29.48	-16.32	15.34	2.44	11.50
2001-2004	79.94	29.75	32.48	-1.50	10.83	0.06	8.31
Hungary							
1986-1989	11.83	13.52	2.24	-4.14	0.25	0.08	-0.13
1987-1990	-6.59	-1.99	1.81	-5.50	-1.33	1.24	-0.82
1988-1991	-27.69	-17.93	0.94	-1.15	-8.19	0.36	-1.72
1989-1992	-49.82	-33.71	-0.30	6.73	-23.67	-0.01	1.14
1990-1993	-25.22	-22.35	-0.37	10.75	-10.72	-5.12	2.59
1991-1994	20.46	14.50	1.11	1.89	7.32	-7.66	3.29
1992-1995	35.22	26.21	8.24	-5.66	9.30	-6.03	3.17
1993-1996	26.50	18.32	1.15	3.31	3.68	-3.03	3.07
1994-1997	13.20	9.77	3.96	-1.80	1.35	-1.83	1.75
1995-1998	7.64	6.46	4.27	-2.69	0.69	-2.30	1.21
1996-1999	8.81	7.39	5.24	-4.36	1.13	-1.85	1.25
1997-2000	8.60	7.47	1.91	-0.24	0.84	-2.10	0.72
1998-2001	13.94	11.75	3.44	-1.44	1.14	-1.48	0.52
1999-2002	18.13	15.31	2.74	-0.73	1.41	-0.56	-0.04
2000-2003	14.66	13.32	0.40	0.67	0.75	-0.76	0.28
2001-2004	12.14	12.59	0.69	-1.17	0.88	-0.99	0.14
2002-2005	10.45	8.94	3.99	-3.31	0.86	-1.72	1.69
Lithuania							
1995-1998	26.57	17.00	6.59	0.95	1.20	0.13	0.70
1996-1999	25.00	8.21	8.42	1.77	4.02	1.43	1.15
1997-2000	21.27	4.51	8.09	2.56	1.80	1.03	3.27
Romania							
1992-1995	24.36	16.41	6.92	1.80	0.67	-0.97	-0.47
1993-1996	-1.86	-7.48	5.82	1.60	-0.73	0.27	-1.34
1994-1997	39.69	35.75	4.73	-2.05	2.32	-1.02	-0.04
1995-1998	15.70	7.70	8.74	-0.07	0.46	-1.08	-0.05
1996-1999	1.19	-5.63	9.17	2.75	-0.31	-4.88	0.08
1997-2000	3.34	-6.09	9.30	1.82	-0.22	-1.61	0.13
1998-2001	11.65	7.39	7.53	-1.47	1.04	-2.93	0.08
1999-2002	13.44	8.04	7.91	-1.01	0.96	-2.32	-0.15
2000-2003	5.33	-1.13	6.33	1.62	0.19	-1.78	0.10
2001-2004	15.28	7.86	7.75	0.06	0.83	-1.83	0.62
2002-2005	11.14	1.42	10.41	-1.73	0.50	-0.75	1.30
2003-2006	18.34	2.65	10.86	1.18	1.19	-0.61	3.06

	Total	Within	Between	Cross	Prop. Entry	Extra. Entry	Exit
Russia							
1985-1988	12.63	13.59	0.29	-1.30	0.01	0.04	0.00
1986-1989	9.42	10.26	0.55	-1.38	0.00	-0.01	0.00
1987-1990	10.31	10.75	0.49	-0.91	0.02	-0.04	0.00
1988-1991	-11.62	-11.40	0.94	-1.33	0.03	0.15	0.00
1989-1992	-10.68	-12.12	0.79	2.51	-1.29	-0.58	0.00
1990-1993	-43.29	-48.90	1.62	8.90	-4.27	-0.61	-0.04
1991-1994	-49.53	-55.52	5.82	1.84	-1.92	0.10	0.14
1992-1995	-46.27	-52.32	7.09	-0.34	-1.59	0.41	0.48
1993-1996	-3.56	-14.34	9.27	0.03	-0.22	0.76	0.94
1994-1997	-7.88	-17.76	8.05	0.09	-0.31	0.49	1.56
1995-1998	14.41	5.32	9.26	-4.46	0.86	1.09	2.34
1996-1999	19.02	12.38	8.33	-6.50	1.41	-0.36	3.76
1997-2000	32.62	23.35	8.54	-6.30	2.51	-0.04	4.56
1998-2001	1.24	-2.22	8.63	-14.07	0.22	2.12	6.56
1999-2002	17.35	7.91	8.14	-7.19	1.56	1.31	5.61
2000-2003	17.68	3.66	9.24	-4.14	1.70	1.29	5.94
2001-2004	17.68	3.66	9.24	-4.14	1.70	1.29	5.94
Ukraine							
1989-1992	9.89	8.61	0.57	0.71	n.a.	n.a.	n.a.
1992-1995	-80.48	-82.03	3.02	0.52	-2.50	0.48	0.02
1993-1996	-90.92	-97.24	3.50	6.37	-4.24	0.68	0.01
1994-1997	-56.59	-66.39	3.40	9.28	-4.30	1.18	0.25
1995-1998	-21.85	-35.99	5.90	7.07	-2.07	2.19	1.05
1996-1999	0.12	-11.46	6.71	1.03	0.00	2.40	1.43
1997-2000	-18.03	-30.56	14.39	-4.66	-1.24	2.39	1.65
1998-2001	4.82	-14.10	19.38	-6.00	0.14	1.08	4.33
1999-2002	11.79	-11.67	31.57	-13.17	0.82	0.10	4.13
2000-2003	64.33	36.11	21.57	-2.84	4.50	0.14	4.85
2001-2004	68.31	43.93	18.91	-2.37	3.64	0.31	3.88
2002-2005	52.88	31.63	17.04	-5.66	4.23	1.17	4.47
2003-2006	82.25	61.49	14.29	-6.01	6.03	1.36	5.08

Note: These are multifactor productivity growth decompositions weighted by base-year employment.

Appendix Table 3: Five-Year Labor Productivity Growth Decompositions

	Total	Within	Between	Cross	Prop. Entry	Extra. Entry	Exit
Hungary							
1986-1991	-27.39	-15.40	2.42	-5.07	-8.21	0.24	-1.36
1987-1992	-23.26	-11.82	1.74	-5.02	-9.91	2.60	-0.84
1988-1993	-15.72	-16.25	1.34	6.15	-8.04	2.04	-0.95
1989-1994	-15.43	-17.87	-0.44	9.11	-9.22	0.91	2.08
1990-1995	16.74	4.43	2.31	0.72	10.38	-2.64	1.55
1991-1996	40.28	26.68	3.70	-6.12	18.31	-4.27	1.98
1992-1997	38.60	30.01	13.51	-14.91	14.19	-5.60	1.40
1993-1998	25.74	21.73	4.21	-5.84	6.42	-4.74	3.96
1994-1999	9.55	8.73	8.31	-9.35	2.22	-3.96	3.60
1995-2000	14.57	15.62	9.18	-11.21	3.30	-5.67	3.35
1996-2001	23.97	23.25	7.25	-9.39	4.68	-5.07	3.25
1997-2002	28.14	25.39	5.91	-7.45	4.79	-4.06	3.57
1998-2003	23.48	26.95	4.51	-11.09	3.86	-3.54	2.78
1999-2004	28.29	29.53	4.08	-8.52	4.93	-4.66	2.93
2000-2005	31.07	30.22	4.91	-5.75	3.98	-6.42	4.12
Lithuania							
1995-2000	40.87	18.93	7.89	7.92	5.07	-2.00	3.06
Romania							
1992-1997	39.25	25.66	9.00	-0.45	4.21	0.26	0.57
1993-1998	8.57	-4.40	10.42	-0.05	0.75	1.10	0.76
1994-1999	10.94	3.36	10.44	-0.66	1.73	-4.01	0.08
1995-2000	8.58	2.29	12.87	-6.60	0.81	-1.14	0.35
1996-2001	-1.16	-3.90	12.79	-5.96	-0.57	-4.04	0.52
1997-2002	9.24	2.31	13.03	-2.94	0.56	-4.30	0.59
1998-2003	20.97	8.02	12.68	-1.03	3.72	-3.16	0.74
1999-2004	31.31	23.27	13.97	-6.35	3.96	-5.06	1.51
2000-2005	20.71	11.86	12.75	-4.79	2.22	-4.40	3.07
2001-2006	31.60	17.86	14.89	-5.27	4.06	-4.87	4.93

	Total	Within	Between	Cross	Prop. Entry	Extra. Entry	Exit
Russia							
1985-1990	20.18	21.11	0.24	-1.18	0.04	-0.02	0.00
1986-1991	1.71	2.90	0.01	-1.22	0.13	-0.12	0.00
1987-1992	6.59	6.82	1.81	0.30	-0.12	-2.23	0.00
1988-1993	-17.66	-19.35	2.21	4.53	-2.36	-2.69	0.00
1989-1994	-55.99	-59.63	2.64	12.18	-7.75	-3.44	0.00
1990-1995	-63.12	-69.26	2.44	17.88	-10.75	-3.91	0.47
1991-1996	-65.65	-75.84	2.72	15.46	-8.26	-1.15	1.42
1992-1997	-53.83	-66.09	7.51	7.11	-3.78	-0.66	2.08
1993-1998	-44.81	-57.76	7.58	7.25	-3.93	-0.99	3.04
1994-1999	-1.46	-17.92	7.44	5.33	-0.45	-1.20	5.34
1995-2000	15.43	-0.98	6.37	3.60	1.75	-1.72	6.41
1996-2001	36.33	17.32	7.78	0.71	4.86	-2.18	7.84
1997-2002	14.30	0.64	7.38	-4.15	2.32	-2.22	10.33
1998-2003	46.76	27.06	5.62	-2.84	7.73	-2.24	11.42
1999-2004	42.80	15.79	9.81	-2.77	7.82	-2.12	14.27
2001-2006	4.53	-9.80	11.13	-7.69	0.87	-2.35	12.37
Ukraine							
1989-1994	-57.41	-61.46	1.31	5.87	-2.23	-0.91	0.01
1992-1997	-100.12	-111.68	3.59	23.19	-14.86	-0.80	0.45
1993-1998	-86.35	-102.59	5.23	22.90	-14.20	1.13	1.18
1994-1999	-42.44	-58.58	5.11	15.29	-7.83	1.92	1.65
1995-2000	-29.18	-46.94	13.86	2.63	-4.37	3.53	2.10
1996-2001	10.18	-18.76	13.35	4.48	1.71	4.17	5.23
1997-2002	26.68	-5.05	22.92	-2.06	4.25	0.84	5.78
1998-2003	52.04	13.94	26.86	-3.71	7.76	-1.18	8.38
1999-2004	70.31	30.66	33.32	-12.32	9.93	-1.01	9.72
2000-2005	93.75	52.12	22.66	-2.78	14.56	-1.20	8.39
2001-2006	136.26	97.29	17.05	-5.60	19.80	-1.22	8.93

Note: These are labor productivity growth decompositions weighted by base-year employment. Labor productivity is the log of the ratio of real gross output divided by number of employees. They apply Equation (4) in the text. The exit term here is $-\sum_{e \in X} s_{et-1}\left(p_{et-1} - P_{it-1}\right)$, so a positive exit term value means a positive contribution to productivity growth.

Appendix Table 4: Five-Year Multifactor Productivity Growth Decompositions

	Total	Within	Between	Cross	Prop. Entry	Extra. Entry	Exit
Hungary							
1986-1991	-23.23	-14.45	1.54	-2.54	-7.37	0.90	-1.31
1987-1992	-40.90	-23.46	0.55	2.16	-21.37	2.59	-1.37
1988-1993	-37.30	-26.46	0.37	11.62	-22.43	0.72	-1.13
1989-1994	-28.32	-28.93	-1.01	16.89	-18.06	0.18	2.61
1990-1995	1.63	-7.05	-2.69	10.07	1.64	-3.49	3.16
1991-1996	30.68	18.22	0.67	0.40	13.12	-4.35	2.63
1992-1997	41.37	27.81	7.14	-6.35	15.26	-4.73	2.24
1993-1998	34.15	24.18	1.43	-0.16	8.27	-3.05	3.48
1994-1999	15.40	11.09	5.13	-4.28	3.22	-2.52	2.75
1995-2000	14.05	10.54	5.87	-3.71	2.84	-3.39	1.92
1996-2001	20.31	15.51	5.64	-3.61	3.71	-2.59	1.65
1997-2002	18.96	13.30	3.78	-0.88	3.13	-1.43	1.05
1998-2003	21.07	16.98	4.05	-2.10	3.16	-1.20	0.18
1999-2004	23.47	20.69	2.95	-3.75	4.03	-0.51	0.07
2000-2005	25.49	22.15	3.30	-2.90	3.14	-1.81	1.61
Lithuania							
1995-2000	44.74	13.39	10.73	9.21	5.32	2.96	3.12
Romania							
1992-1997	49.81	37.13	6.64	2.73	4.89	-1.14	-0.44
1993-1998	5.09	-10.45	7.25	8.75	-1.05	1.65	-1.06
1994-1999	31.31	20.61	6.93	1.84	5.17	-3.13	-0.12
1995-2000	24.80	12.25	11.80	-0.68	2.84	-1.38	-0.03
1996-2001	12.39	4.77	11.89	-2.25	2.04	-4.04	-0.02
1997-2002	6.66	-5.98	11.68	3.81	0.21	-3.16	0.09
1998-2003	17.43	-0.64	10.71	5.35	3.10	-1.29	0.20
1999-2004	27.44	14.10	12.31	-1.45	3.61	-1.96	0.83
2000-2005	17.78	4.56	8.92	-0.18	1.93	-0.27	2.82
2001-2006	26.80	7.78	10.83	0.55	3.41	0.22	4.01

	Total	Within	Between	Cross	Prop. Entry	Extra. Entry	Exit
Russia							
1985-1990	14.19	15.22	0.67	-1.72	0.03	0.00	0.00
1986-1991	-3.64	-2.99	0.59	-1.52	0.11	0.17	0.00
1987-1992	0.09	-1.14	1.41	0.75	-0.35	-0.58	0.00
1988-1993	-19.01	-22.58	1.33	4.67	-1.89	-0.53	0.00
1989-1994	-52.54	-57.57	2.08	10.39	-6.22	-1.32	0.09
1990-1995	-55.43	-63.34	2.23	14.87	-8.35	-1.18	0.35
1991-1996	-64.59	-72.90	2.78	11.04	-6.90	0.93	0.46
1992-1997	-49.80	-61.13	8.40	3.95	-3.37	1.22	1.13
1993-1998	-39.98	-51.33	8.99	3.19	-3.28	1.41	1.03
1994-1999	2.98	-11.81	8.81	1.65	0.11	1.38	2.83
1995-2000	17.72	3.83	7.90	-0.58	1.83	0.89	3.84
1996-2001	37.91	19.76	9.43	-4.75	5.83	1.60	6.04
1997-2002	11.32	0.23	9.98	-13.17	2.05	3.82	8.41
1998-2003	46.89	27.36	8.29	-6.78	6.85	1.69	9.48
1999-2004	41.89	11.85	12.50	-3.93	6.72	2.79	11.96
Ukraine							
1989-1994	-42.39	-45.85	1.58	2.38	-0.46	-0.02	-0.02
1992-1997	-95.91	-105.83	3.26	14.09	-8.75	1.16	0.16
1993-1998	-86.05	-100.35	4.41	17.62	-10.73	2.32	0.68
1994-1999	-42.04	-57.95	5.41	14.19	-7.86	2.80	1.37
1995-2000	-31.98	-51.39	14.53	3.32	-4.45	4.08	1.92
1996-2001	5.94	-25.22	14.71	5.42	1.46	4.23	5.34
1997-2002	23.34	-11.50	22.32	-0.44	3.96	2.97	6.03
1998-2003	49.35	9.85	25.13	-2.99	7.29	1.75	8.31
1999-2004	68.68	25.24	36.32	-12.27	9.06	0.82	9.52
2000-2005	93.05	48.02	25.60	-3.06	13.38	1.39	7.71
2001-2006	135.08	81.44	22.76	-2.29	19.09	2.41	11.68

Note: These are multifactor productivity growth decompositions weighted by base-year employment.

Appendix Table 5: Reallocation and Labor Productivity Descriptive Statistics

	Productivity Dispersion	Productivity Rank Change	Employment Share Change	Employment Share Change-Productivity Correlation
Georgia				
2000-2003	1.47	0.37	1.90	0.18
2001-2004	1.38	0.35	1.56	0.09
Hungary				
1986-1989	0.72	0.21	0.47	0.15
1987-1990	0.88	0.21	1.41	0.02
1988-1991	0.92	0.35	1.77	0.01
1989-1992	1.09	0.41	2.67	0.01
1990-1993	1.07	0.44	2.68	0.01
1991-1994	1.09	0.36	2.40	0.01
1992-1995	1.16	0.36	2.26	0.04
1993-1996	1.14	0.34	1.73	0.01
1994-1997	1.13	0.30	1.67	0.03
1995-1998	1.15	0.29	1.80	0.02
1996-1999	1.13	0.29	1.77	0.02
1997-2000	1.13	0.28	1.75	0.01
1998-2001	1.12	0.27	1.73	0.02
1999-2002	1.11	0.27	1.82	0.02
2000-2003	1.12	0.27	2.17	0.00
2001-2004	1.20	0.26	2.12	-0.01
2002-2005	1.17	0.26	2.09	0.01
Lithuania				
1995-1998	1.06	0.44	0.83	0.06
1996-1999	1.14	0.38	1.15	0.05
1997-2000	1.09	0.35	1.07	0.06
Romania				
1992-1995	1.27	0.51	1.98	0.07
1993-1996	1.30	0.48	2.24	0.06
1994-1997	1.26	0.44	1.35	0.04
1995-1998	1.22	0.44	2.16	0.05
1996-1999	1.23	0.41	1.91	0.02
1997-2000	1.25	0.40	2.12	0.04
1998-2001	1.22	0.40	1.77	0.03
1999-2002	1.25	0.39	1.68	0.03
2000-2003	1.25	0.39	1.84	0.03
2001-2004	1.37	0.37	1.98	0.03
2002-2005	1.28	0.36	1.98	0.05
2003-2006	1.30	0.38	1.97	0.05

	Productivity Dispersion	Productivity Rank Change	Employment Share Change	Employment Share Change-Productivity Correlation
Russia				
1985-1988	0.66	0.08	0.28	0.01
1986-1989	0.65	0.10	0.34	0.02
1987-1990	0.65	0.11	0.35	0.04
1988-1991	0.62	0.19	0.40	0.00
1989-1992	0.73	0.36	0.69	-0.04
1990-1993	0.82	0.45	0.65	-0.03
1991-1994	0.92	0.50	0.68	-0.01
1992-1995	1.00	0.43	0.68	0.08
1993-1996	1.05	0.44	0.68	0.12
1994-1997	1.11	0.35	0.72	0.13
1995-1998	1.11	0.31	0.83	0.11
1996-1999	1.19	0.29	1.01	0.09
1997-2000	1.27	0.26	0.96	0.08
1998-2001	1.29	0.27	0.96	0.09
1999-2002	1.33	0.26	1.33	0.09
2000-2003	1.30	0.24	1.12	0.08
2001-2004	1.35	0.24	1.11	0.09
2003-2006	1.29	0.19	2.99	0.09
Ukraine				
1989-1992	0.51	0.37	0.44	0.03
1992-1995	0.80	0.42	0.47	0.10
1993-1996	0.93	0.42	0.47	0.09
1994-1997	1.35	0.38	0.88	0.03
1995-1998	1.40	0.36	1.20	0.07
1996-1999	1.60	0.31	1.06	0.06
1997-2000	1.58	0.38	1.10	0.11
1998-2001	1.59	0.41	1.53	0.11
1999-2002	1.75	0.28	1.46	0.13
2000-2003	1.74	0.28	1.44	0.09
2001-2004	1.70	0.25	1.35	0.09
2002-2005	1.69	0.24	1.37	0.08
2003-2006	1.62	0.44	1.40	0.06

Note: Productivity dispersion is the standard deviation of labor productivity in the first year of the three-year period. Productivity rank change is 1 minus the correlation in labor productivity rankings in the first and last years of the three-year periods. Employment share change is the standard deviation of employment share change in the three-year period. Employment share change-productivity correlation is the correlation between a firm's deviation from average labor productivity in the sector and its employment share change.

Appendix Table 6: Decomposition of Reallocation Contribution Difference with 1985-1988 Russia

	Productivity Component	Employment Share Change Component	Correlation Component	Total Difference in Reallocation Contribution
Georgia				
2000-2003	12.21	21.18	35.57	68.96
2001-2004	7.66	8.30	15.23	31.19
Hungary				
1986-1989	-0.05	0.89	3.10	3.95
1987-1990	0.35	0.79	-1.80	-0.66
1988-1991	0.51	0.96	-2.45	-0.97
1989-1992	0.69	0.15	1.83	2.67
1990-1993	1.19	2.78	-1.19	2.78
1991-1994	0.82	1.60	-1.93	0.50
1992-1995	2.14	4.03	1.95	8.11
1993-1996	0.80	1.12	0.18	2.10
1994-1997	1.40	3.02	3.21	7.63
1995-1998	1.33	2.73	2.48	6.54
1996-1999	0.77	1.20	2.61	4.59
1997-2000	0.47	-0.31	3.29	3.45
1998-2001	0.48	-0.16	3.12	3.45
1999-2002	0.78	0.84	2.38	3.99
2000-2003	0.67	-0.25	-1.27	-0.85
2001-2004	0.48	-0.10	-3.98	-3.59
2002-2005	1.02	1.30	-1.43	0.90
Lithuania				
1995-1998	1.56	2.39	3.88	7.83
1996-1999	1.57	2.46	4.59	8.63
1997-2000	1.33	2.55	6.12	10.00
Romania				
1992-1995	2.46	4.76	1.71	8.93
1993-1996	2.44	4.83	3.53	10.80
1994-1997	1.42	2.24	3.28	6.95
1995-1998	2.34	4.74	3.06	10.15
1996-1999	1.39	3.24	0.16	4.78
1997-2000	2.47	5.40	1.97	9.84
1998-2001	2.09	4.49	1.43	8.01
1999-2002	1.82	3.31	1.37	6.49
2000-2003	1.57	2.73	1.91	6.22
2001-2004	2.38	3.96	4.71	11.04
2002-2005	2.44	4.65	5.31	12.40
2003-2006	2.67	5.35	4.99	13.02

	Productivity Component	Employment Share Change Component	Correlation Component	Total Difference in Reallocation Contribution
Russia				
1986-1989	0.00	0.08	0.14	0.22
1987-1990	-0.01	0.11	0.56	0.66
1988-1991	0.03	-0.04	0.24	0.23
1989-1992	0.01	-0.16	-0.80	-0.96
1990-1993	0.03	0.00	-1.12	-1.08
1991-1994	-0.14	0.08	0.07	0.01
1992-1995	0.89	1.42	2.95	5.26
1993-1996	1.45	2.44	5.31	9.21
1994-1997	1.70	2.89	5.83	10.42
1995-1998	1.74	3.25	5.42	10.41
1996-1999	1.67	2.44	7.42	11.53
1997-2000	2.03	3.02	6.43	11.49
1998-2001	2.20	3.61	6.05	11.86
1999-2002	2.96	4.96	8.29	16.21
2000-2003	2.47	3.55	6.34	12.37
2001-2004	3.19	4.89	6.77	14.84
2003-2006	3.78	8.37	12.33	24.49
Ukraine				
1989-1992	0.08	0.19	0.44	0.70
1992-1995	0.32	0.85	2.56	3.73
1993-1996	0.58	1.05	2.94	4.58
1994-1997	1.20	1.74	2.15	5.09
1995-1998	3.61	5.30	4.22	13.13
1996-1999	1.80	0.85	8.51	11.16
1997-2000	3.86	5.04	11.22	20.13
1998-2001	5.24	7.53	14.42	27.19
1999-2002	7.49	10.94	21.11	39.54
2000-2003	5.80	8.58	11.35	25.73
2001-2004	5.57	8.11	11.89	25.58
2002-2005	4.84	7.24	11.53	23.60
2003-2006	4.08	6.42	7.99	18.48

Note: These are decompositions of the contribution of intrasectoral reallocation to three-year labor productivity growth compared to intrasectoral reallocation in 1985-1988 Russia, applying equation (5).