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Employment Reallocation and Productivity Growth in Transition: A Comparative International Study

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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 Hungary, Romania, Russia, and Ukraine. Reallocation rates and contributions to productivity growth are both very low under socialism, but they rise dramatically after reforms, with the productivity contributions greatly exceeding those previously found for market economies. Reallocation is more productivity-enhancing in the early transition in Hungary and Romania, but Russia and Ukraine later achieve much larger productivity gains through reallocation. Faster reform is associated with higher within-firm and overall productivity growth, but less via reallocation. It appears that slower reform increases an economy's potential for cleansing, and once reform has progressed enough to produce high reallocation volumes, the reallocation becomes highly productivity-enhancing.

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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. Such research is still in its early stages, but it has frequently reported 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 four of these economies – Hungary, 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 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 and excess 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 narrowly defined manufacturing industries, which also follows most previous research, 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 during three periods: the central planning period, the years immediately after reforms were adopted, and the "late transition" period, after the economies stabilized and overall growth resumed. Comparing these time periods provides an extreme example of the economic policy context within which productivity-enhancing reallocation takes place. As we discuss, 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 four economies we study adopted very different transition policy strategies, however, and our data enable comparisons of their

[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, forthcoming) for some transition economies.

reallocation 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 pace of reallocation, the dispersion of productivity, 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 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 in that the contributions to productivity growth are generally much higher. The pace of reallocation also rises quickly, but only to the levels of developed market economies. Thus, the 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 effectiveness of the creative destruction unleashed by economic liberalization during the transition.

Although large in each case, the productivity contributions from reallocation during transition differ considerably across the four economies we study. Over the whole transition, the contributions are significantly higher (30-35 percent for labor productivity and 10-12 percent for multifactor productivity) in Hungary, Romania, and Ukraine compared to Russia. The pattern is different when we examine shorter periods, however: during the early-mid 1990s, the contributions are highest in Hungary followed by Romania, and these tend to converge towards the levels reported for non-transition economies later on, while in the late transition period the contributions are highest in Ukraine, followed by Russia. Interestingly, the rank order of countries in the productivity contributions of reallocation reverses; alphabetic in 1995, it becomes reverse alphabetic after 2000.

Our decomposition of the cross-country and over-time differences sheds light on these patterns. Productivity growth in the centrally planned economies did not benefit from reallocation not only because so little reallocation occurred, but also because of a very low correlation between reallocation and relative productivity at the firm level,

[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 four 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 attibutable to reallocation.

particularly in Soviet Russia: the direction of employment reallocation had little relationship with relative productivities. The rise in productivity-enhancing reallocation during the transition is 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. Economic liberalization seems not only to reduce the costs of adjustment, entry, and exit, but also to create better opportunities (larger productivity differentials) and better targeting (higher correlation with the differentials) of reallocation. Moreover, the data show not only a rise in productivity dispersion, but also a large change in the productivity rankings of firms within industries that takes place soon after liberalization. The primary factors driving the changing rank order of the four countries are continuously rising productivity dispersion and productivity-reallocation correlation in Russia and especially Ukraine, while the dispersion levels off and the correlation falls in Romania and especially Hungary. Overall, these results are consistent with the large role of reallocation under conditions of rapid institutional and structural change, and with cross-country differences in the inherited patterns of misallocation from the socialist period and in the timing of liberalization policies.

The rest of the paper proceeds with further motivation of a comparative analysis of productivity developments under socialism and transition in Section 2, which provides a brief discussion of central planning, the different economic reform programs adopted in the four countries, and their potential implications for the magnitude and productivity contributions of resource reallocation. Section 3 discusses the data and productivity measurement methods. Section 4 contains the analysis of magnitudes of productivity-enhancing reallocation. Throughout the discussion of these results, we provide separate measures of the pace and contributions of reallocation due to firm turnover, as opposed to reallocation among continuing firms. Section 5 uses the data to summarize the basic facts concerning entry and exit, reallocation rates, productivity dispersion, and correlations between reallocation and productivity differentials, and analyzes decompositions of differences across time and countries. Section 6 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

[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).

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.

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 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 four 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, Romania in the second group, 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. Romania, Russia, and Ukraine started their reforms later, implemented them more gradually (it took them two to four years to reach the level Hungary achieved after one year), and they still have not bridged the gap with Hungary. Ukraine started most slowly, but 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 least volatility of output growth and inflation, followed by Romania, Russia, and Ukraine – which reported inflation rates above 200 percent annually for most of the 1990s.

Regardless of the exact figures, which are certainly subject to measurement errors and disputes, the clearly different patterns of policies in the four countries suggests an interesting set of comparative hypotheses. During the socialist period, Hungary's partial reforms may have stimulated a higher paced and more productivity-enhancing reallocation compared to those in 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. Romania's should be second, followed by Russia and Ukraine. Although productive reallocation may be slowest to emerge in 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

The paper uses annual census-type data for manufacturing firms in each of the four countries.[5] Though the data sources and variables are similar, we have taken steps to make them sufficiently comparable to justify cross-country comparisons.

[5] 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 in this way in Russia: the 1993 registry contains a variable indicating the number of plants, which equals 1 in 99.91 percent of the 18,121

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.[6] 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 2003, and the Romanian data span 1992 to 2004. Table 1, panel A, shows that the database employment and output are similar to the yearbook numbers in both countries.

The Russian and Ukrainian sources are most similar, as their statistical methodologies and data collection mechanisms were inherited from the Soviet Union, and the national statistical offices (*Goskomstat* in Russia and *Derzhkomstat* in Ukraine) are the successors to the branches of the former Soviet State Committee. The main sources in each country are industrial enterprise registries, supplemented by balance sheet data. The data span every year between 1985-2004 for Russia, and 1989 and 1992-2004 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 1992-1998 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 1999-2004 registries. The pre-1992 Russian and 1989 Ukrainian data do not include firms in the military-industrial complex. As shown in Table 1, panel B, 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. Due to the fact that the Russian database covers the de novo sector less well than the other countries' databases, we have also calculated results including only old firms.[7]

Some truncation was necessary to make the samples comparable across countries. The data in all countries are limited to manufacturing (NACE 15-36). Because of noncomparability with the Russian and Ukrainian classification system, the recycling industry (NACE 37) is excluded. We also drop firms in the top and bottom one percent of either the labor productivity distribution or the annual labor productivity growth distribution, so that outliers don't drive the results.

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nonmissing cases. Note also that, to avoid double-counting, we have dropped the consolidated records of entities with subsidiaries from the analysis.

[6] Nevertheless, the coverage before 1992 in Hungary is still high (see Table 1A). Since the pre-1992 data are just a sample, we are unable to determine if firms entering and exiting the database during that period are true entrants and exiting firms, so we do not attempt to calculate entry and exit during that period.

[7] We define old firms as those meeting at least one of three criteria: existing prior to 1992 (1990 in Hungary) in the data, having any state ownership at first observation, or having over 100 employees in the first observation. The results, not reported here, show similar cross-country and cross-time patterns to the ones with all firms.

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 28 sectors, where all sectors have 14 or more firms on average per year in each country after dropping outliers. These sectors are 2-digit NACE, 3-digit NACE, or combinations of similar 3-digit NACE sectors. Tobacco (NACE 16) is not included in the 28, since it has a tiny number of firms in Hungary and Romania.

Summary statistics and definitions for employment, output, and labor productivity are reported for the first and last years in each country's data in Table 2. Average employment and output significantly decline in all four countries. The particularly sharp declines in Hungary, Romania, and Ukraine can be explained by small firm entry after liberalization.[8] Average labor productivity increases everywhere from the first to last year, although with a substantial drop in the early 1990s in all countries, as shown in Figure 1.

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 Hungary, 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. 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.[9]

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[8] 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.

[9] 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.

We compute two types of firm-level productivity measures: labor productivity (LP) is calculated as the log of gross output 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 28 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 reallocation volume, productivity dispersion, and the correlation between reallocation and productivity differentials.

Our method of decomposing aggregate productivity follows 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 sector level:

$$P_{it} = \sum_{e} S_{eit} P_{eit} \,, \tag{1}$$

where P_{it} is average productivity of 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.

Our preferred decomposition, FHK's "method I," expresses the change in aggregate sectoral productivity, ΔP_{it}, as follows:

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

The firm 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.[10]

[10] 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. This 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 we do not show OP results here.

4. Productivity Decomposition Results

We show FHK labor productivity (output per worker) and multifactor productivity decompositions for our four countries, plus the U.S. from Foster, et al. (2001) so as to provide a developed market economy benchmark. Tables 3A and 3B show that the within-firm effect is dominant in the U.S. The between-continuing firm contribution is small with labor productivity, and actually negative with multifactor productivity. The cross effect is negative with labor productivity and positive for multifactor productivity, which may reflect measurement error. The main reallocation contribution comes from net entry in the longer period.

Figures 2-5 show three-year labor productivity decompositions for the four transition economies, where each dot represents the particular effect for the three-year period ending in the year on the X axis.[11] The within contributions follow a "J-curve" pattern, similar to aggregate productivity in Figure 1. The between contribution is virtually zero in Russia in the late socialist period, rising to 5-8 percent during the transition. Hungary and Ukraine's between contributions also rise substantially at the beginning of the transition, and Ukraine's continues to rise through 2002. Romania's is near 10 percent throughout the transition.

Like in the U.S., Hungary and Romania's cross terms are negative, suggesting either productivity improvements via downsizing and/or measurement error. Early in the transition, firms gaining market share actually have smaller declines in productivity in Russia and Ukraine. Their cross terms become like Hungary and Romania's in the later transition. Little firm turnover occurs in Russia in the late socialist period, producing no net entry contribution to productivity growth. The net entry term is negative in the early transition in Hungary, Russia, and Ukraine. Hungary's net entry contribution becomes substantial in the mid-1990's before falling to nearly zero. The term rises significantly in Russia and Ukraine. Surprisingly, Romania's firm turnover usually has a small negative effect on productivity growth.

Figure 6 adds the between, net entry, and half the cross term[12] to get estimates of the total contribution of reallocation to productivity growth. Early in the transition, Hungary has the largest total reallocation contribution to productivity growth, followed by Romania, Russia, and Ukraine, consistent with the hypothesis that faster reform results in more productivity-enhancing reallocation. Later in the transition, however, the order reverses.

The five-year decompositions, shown in Tables 3A and B, are qualitatively similar to the three-year decompositions. The multifactor productivity results, shown in Table 3B (five-year) and in the appendix (three-year), are also similar to the labor productivity decompositions.

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[11] Since the Russian database covers de novo activity less well than those in the other countries, we have also calculated the decompositions using just old firms. The patterns are very similar to those for the full sample, with the main difference being that the Romanian reallocation effects are smaller with old firms alone, especially over longer periods. Even with just old firms, though, Romania's reallocation effect over longer periods is still larger than Russia's. It is thus unlikely that the different sample coverage in Russia is driving the cross-country differences.

[12] The extent to which the cross term is part of the within-firm vs. reallocation contribution is ambiguous. FHK's method 2, which employs weights that are the average of the beginning and end year, attributes half of the cross term to the within-firm contribution and half to reallocation.

The longer-run decompositions in Tables 3A and B present a somewhat different picture. The between terms tend to be smaller and the net entry terms larger. Hungary and Ukraine's net entry provide more than half of their productivity growth. Hungary's overall reallocation effect looks much larger than it is with any of the shorter-term decompositions, and Russia's is much smaller than that shown in the later-period shorter-term decompositions. The country reallocation effect rankings are thus quite sensitive to decomposition duration. We will take up this issue in the next section.

The cross-country patterns are puzzling. The rise in the reallocation contribution in the transition period relative to the socialist period and the higher reallocation contributions in the early transition in Hungary and Romania compared to Russia and Ukraine are consistent with the hypothesis that reform facilitates productivity-enhancing reallocation. Since Russia and Ukraine's reform progress approaches that of Romania, but not yet that of Hungary later in the transition, this hypothesis would predict that Russia and Ukraine's reallocation effects should catch up to Romania, but not to Hungary. We observe them rocketing past both countries, however. Do Russia and Ukraine's larger effects later in the transition come as a result of employment adjustments at a slower, more "optimal" speed? The next section will investigate the cross-country differences.

5. Analysis of Differences in Productivity-Enhancing Reallocation

We first look at what is behind the very different net entry terms in the shorter and longer decompositions. First note that the entry and exit terms are weighted by their employment shares, so the terms are potentially larger in absolute value when firm turnover is large. Many of the firms that are continuing in the shorter periods are entering or exiting in the longer decomposition, so what shows up as within, between, and cross effects in the shorter decompositions is attributed to entry and exit in longer ones. Below we will examine the employment shares of entrants and exitors.

The entry terms for all four countries (not reported here) are much larger in absolute value in the longer compared to shorter decompositions, while the difference in exit terms is not nearly so dramatic.[13] This is important because unlike the exit term, the entry term can be a misleading indicator of its value for overall productivity growth.[14] The entry term could be quite positive even if the gap between entrants' final year productivity and exitors' initial year productivity is lower than continuing firms' growth over the same period; it could be negative despite the entrant-exit gap being less negative than that of continuing firms. In the former case, the economy may be better off without entry, while it is likely to be useful in the latter case.[15] In contrast, a positive (negative)

[13] A reason for this could be that though the productivity of entering and exiting firms is compared to the same average productivity in the sector regardless of the time span of the decomposition (the initial period average), exiting firm productivity is always measured in the initial period, but entering firm productivity is measured in the last period, which changes with the time span.

[14] Here we consider firm turnover to be valuable for productivity growth if total productivity growth is higher than that when just considering the group of continuing firms.

[15] By itself, the relative productivity gap of entrants vs. exitors compared to that of continuing firms does not give a full indication for firm turnover's value to productivity growth, because relative shares of entrants and exitors are also important. If the entrant share is larger than the exit share, then sufficient conditions for firm turnover to contribute positively to productivity growth vs. a counterfactual of no turnover are that the entry-exit productivity gap is larger than that between continuing firms in the final vs.

exit term unambiguously suggests that exit contributes negatively (positively) to overall productivity growth.

Tables 4A and 4B show entry and exit employment shares and relative labor and multifactor productivity for five-year and longer-term periods. Entry and exit account for a significant proportion of activity in the longer periods, creating the potential to substantially influence productivity growth. Firm turnover is a much larger proportion of activity in Hungary than in any of the other countries. Romania has the lowest amount of exit and the U.S. the lowest entry. Despite the fact that the Russian database doesn't cover all de novo activity, we still observe substantial firm turnover there. The entry-exit productivity gap is larger than continuers' productivity growth when using both productivity measures in the U.S. and Ukraine, but only when using multifactor productivity for Hungary and Russia. The entrant-exitor gap is smaller in Romania. Romania's entrant share is much larger than its exit share, while entrant productivity is lower than that of continuers in the final year. Thus it is not surprising that Romania's productivity growth over the long periods is higher within the continuing firm group than when also including entrants and exitors (24.0 percent higher labor productivity growth and 4.7 percent higher multifactor productivity growth).[16] Productivity growth with firm turnover is higher in Hungary, Russia, and Ukraine than when just including continuing firms (1.5 percent for Hungarian LP, 5.0 percent for Hungarian MFP, 4.0 percent for Russian LP, 8.6 percent for Russian MFP, 7.0 percent for Ukrainian LP, and 10.0 percent for Ukrainian MFP).

The five-year period results in Tables 4A and 4B show the trends across time. Hungary's firm turnover and Romania's entry are high in both the early and later transition, while Russia's firm turnover and Ukraine's exit are much larger in the later period. The productivity gap between entrants and exitors in Romania is small in both periods and less than productivity growth among continuers. The entrant-exitor gap is actually negative in the earlier period when using multifactor productivity. The positive net entry term in the 1994-1999 Romanian multifactor productivity growth decomposition is thus a result of the fact that entrant productivity in 1999 is higher than that of continuers in 1994 and that the entrant share of employment is much higher than the exit share. The productivity differentials between entrants and exitors reverse across periods in Russia and Ukraine, initially showing higher exitor than entrant productivity, then dramatically higher entrant than exitor productivity. Note, however, that even in the earlier period, the difference in productivity between the exitors and the entrants is less negative than that of continuers, suggesting that without the firm turnover the productivity decline would be even more severe. These results suggest that the net entry terms in the productivity growth decompositions are quite misleading about the benefits of firm turnover – they appear to be overstated in Hungary and Romania for both shorter and longer decompositions and understated in Russia and Ukraine, particularly in the early transition. The decompositions are more misleading the longer the period.

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initial year and that entrants have higher productivity than continuing firms in the final year. The sufficient conditions for firm turnover to contribute positively when the exit share is higher are that the entry-exit productivity gap is larger than that between continuing firms in the final vs. initial year and that exitors have lower productivity than continuing firms in the initial year.

[16] To get these numbers, we calculate the difference between the total productivity growth when including only continuing firms and the total when including all firms.

To investigate whether productivity-enhancing reallocation is associated with a slower speed of reallocation, we decompose the sum of the FHK between and net entry terms into employment share change dispersion, productivity dispersion, and correlation between productivity differentials and reallocation contributions.[17] The sum of the between and net entry terms 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. The difference in the reallocation contribution between sectors *i* and *j* can be decomposed in the following way:

$$\sum_e (p_{et-k} - P_{it-k})\Delta s_{et} - \sum_f (p_{ft-k} - P_{jt-k})\Delta s_{ft} =$$

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

$$+$$

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

$$+ .5 \times \{N_i \sigma_{\Delta s_{et}} \sigma_{p_{et-k}-P_{it-k}} + N_j \sigma_{\Delta s_{ft}} \sigma_{p_{ft-k}-P_{jt-k}}\} \times \{Corr(\Delta s_{et}, p_{et-k} - P_{it-k}) - Corr(\Delta s_{ft}, p_{ft-k} - P_{jt-k})\} \quad (4)$$

The first term is the employment share change dispersion component. Ceteris paribus, the more reallocation occurs across firms, the more it can contribute to productivity growth. This can be thought of as reallocation intensity or volume. The productivity dispersion component is the second term. Gaps in productivity across firms create the potential for productivity-enhancing reallocation – without these gaps, reallocation has no effect. Productivity dispersion can thus be considered a measure of "cleansing potential". 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 toward more productive firms.[18] To get the average effects for countries, we weight sectors by the average of the sector employment shares of the two groups being compared (e.g., two countries or two different time periods for the same country).

Before presenting the reallocation contribution decomposition results, we first report standard job reallocation rates and the ingredients to the decomposition. Annual manufacturing job reallocation rates in developed market economies are typically between 15-25 percent.[19] In contrast, Russian job reallocation rates in the years prior to the transition are 3-6 percent, and Hungary's are 6-8 percent, as shown in Figure 7. Reallocation rates soar once reforms start, reaching similar levels to those in developed market economies and staying in that range throughout the transition. Hungary's average rate in 1990-2003 is 24.0 percent, Romania's in 1993-2004 is 20.8 percent, Russia's in 1992-2004 is 18.0 percent, and Ukraine's in 1993-2004 is 18.4 percent.

[17] We don't include the cross term here. We have also decomposed the between and net entry terms from FHK's Method II, which attributes half of the cross term to reallocation, and the results are similar to the ones reported here.

[18] The three components are likely to be interrelated. High productivity dispersion should facilitate the targeting of reallocation (entrepreneurs will have better information about whether they should increase or decrease market share) and should encourage a higher volume of reallocation, since reallocation gains are higher. Good targeting and high reallocation volume should 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.

[19] See, for example, OECD (1994) or Davis and Haltiwanger (1999).

We next show trends in the components of the reallocation contribution to productivity growth. Figure 8 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. Hungary experiences the greatest reallocation in the early transition; first Romania, then Russia and Ukraine converge on the Hungarian level.

Figure 9 presents productivity dispersion using initial year productivity (except for entrants, whose productivity is measured in the final year). Productivity dispersion is very similar across countries at the beginning of the transition. It increases substantially in Hungary, Russia, and Ukraine after the introduction of reform. Dispersion rises in the early transition, then levels off. Russia and Ukraine, the countries with the slowest reform, also experience the largest gains in heterogeneity.

To investigate whether the productivity dispersion increase is simply a widening of pre-existing gaps between firms, or whether firms change ranks, we calculate the correlation between the productivity ranks of continuing firms across year pairs. Figure 10 shows one minus this correlation. Prior to the transition, firm ranks change very little. 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 and Russia's lowest.

The employment share change-productivity correlation across three-year periods is displayed in Figure 11. The Russian and Ukrainian correlations are around zero prior to the transition, falls in the early transition, then shoot up in the mid-1990's as the economies stabilize. Hungary's correlation also falls in the early transition, but it never subsequently rises. Romania's correlation is at a similar low level to Hungary's.

We turn to the reallocation contribution decompositions in Figures 12-15. These break down the difference between the reallocation contribution of the respective country and that in 1985-1988 Russia into employment share dispersion, productivity dispersion, and employment share-productivity correlation effects.

All three components make non-negligible positive contributions to the reallocation effect in each country during the transition. The employment share-productivity correlation component is most important in Hungary, Russia, and Ukraine, while employment share change dispersion is the strongest component in Romania. Dramatic changes in the correlation contribution occur across time in Russia and Ukraine – they go from zero pre-transition, to negative in the early transition, to highly positive later in the transition. Starting in the mid-1990's, each component rises substantially in Russia and Ukraine. The strong positive relationship between the employment share dispersion component and the overall contribution of reallocation to productivity growth is inconsistent with the prediction of the optimal speed of transition hypothesis.

6. Conclusion

This paper measures the contribution of employment reallocation to aggregate productivity growth using manufacturing census data in Hungary, Romania, Russia, and Ukraine. Reallocation contributes almost nothing to productivity growth during the socialist period, but a substantial amount after reform, much greater than in the United States. The growth comes from both between continuing firm reallocation and firm turnover. Early in the transition the reallocation contribution to productivity growth is

higher in Hungary and Romania, but Russia and Ukraine later far surpass them. The productivity of reallocation has risen not just because reallocation volume has picked up during the transition, but also because productivity dispersion and the targeting precision of reallocation have increased.

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, the reallocation contribution is higher in the faster reformers early in the transition, and Russia and Ukraine's reallocation contribution has increased as more reform has been implemented. But the hypothesis doesn't explain why Russia and Ukraine's reallocation contributions have become so much higher than Hungary and Romania's. The results do not support the optimal speed of transition hypothesis either. Large-scale reallocation in the early transition in Hungary and Romania has produced significant productivity growth, and Russian and Ukrainian productivity growth has increased in reallocation volume. The marked increase in Russian and Ukrainian reallocation volume later in the transition appears not to have hurt the targeting of reallocation toward more productive firms.

What can explain why the reallocation contribution country ordering has reversed over the course of the transition? The striking productivity dispersion patterns may provide the beginnings of an explanation.[20] As reform is introduced, firms are placed in a new environment; some adapt to it better than others, creating productivity gaps. High inflation, lingering price controls, and state subsidies distort market signals, making it harder for the economy to channel reallocation toward more productive firms.[21] The longer an economy remains in the state of incomplete liberalization and stabilization, the more productivity dispersion rises, producing greater and greater potential for cleansing. Russia and Ukraine's slower reform may have led to the larger increase in productivity dispersion, resulting in more productive reallocation once Russia and Ukraine finally stabilize. Reallocation is much more productivity-enhancing in all these economies than in the U.S.: 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. Indeed, Hungary and Romania have experienced higher overall productivity growth during the transition than Russia and Ukraine, much of it through within-firm productivity growth. Under the circumstances, though, Russia and Ukraine would be much worse off without reallocation.

[20] Note that though the targeting and reallocation volume components of the reallocation contribution decompositions tend to be larger than the productivity dispersion component, it can be argued that in these transition economies, productivity dispersion has so far had a greater influence on reallocation volume and targeting than the latter have had on productivity dispersion. The expected direction of influence of targeting and reallocation volume on productivity dispersion is negative, but productivity dispersion has yet to decline.

[21] 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.

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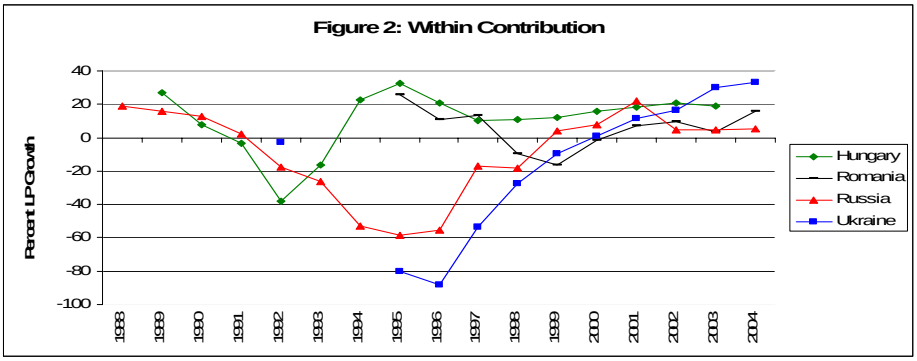
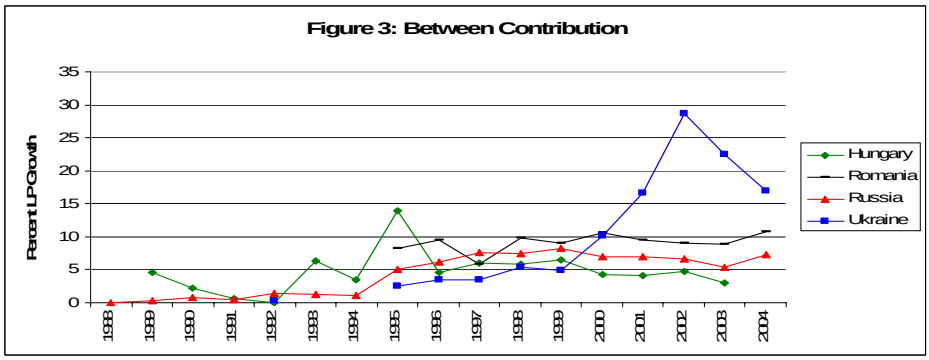
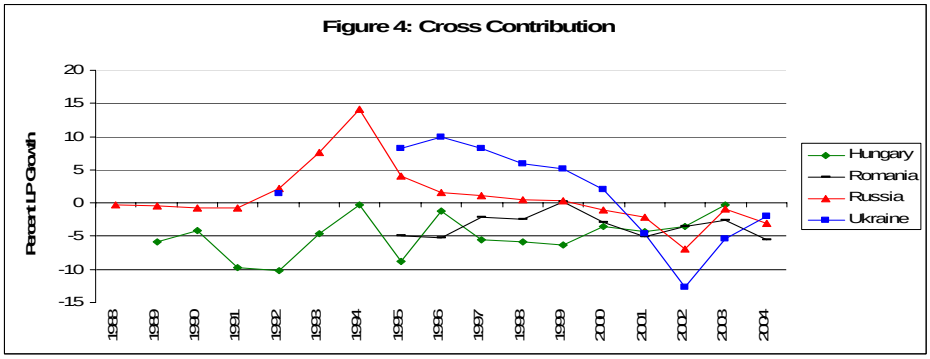
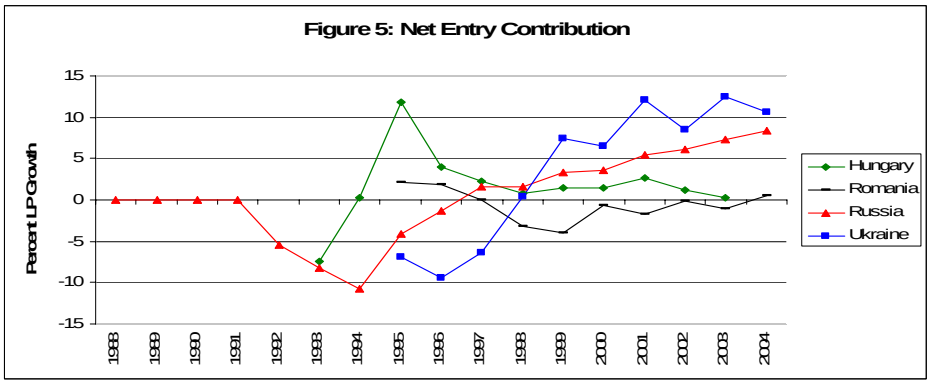
Figure 1: Industrial Labor Productivity
Labor Productivity (1989=100)
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
Hungary
Romania
Russia
Ukraine

Figures 2-5: Three-Year Labor Productivity Decompositions (Base-Year Weights)









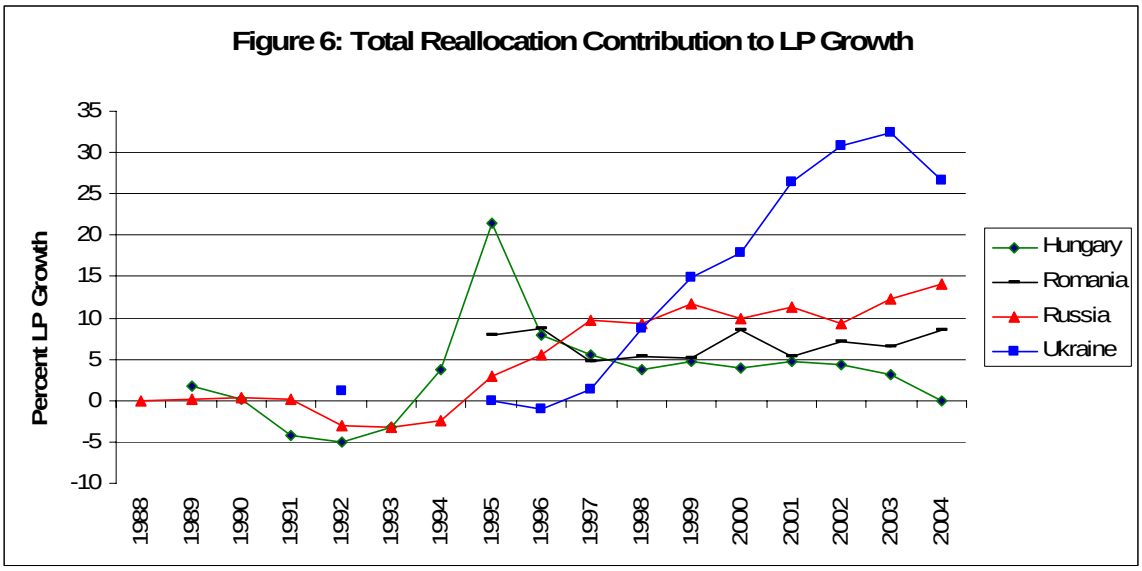


Figure 6: Total Reallocation Contribution to LP Growth
Percent LP Growth
35
30
25
20
15
10
5
0
-5
-10
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
Hungary
Romania
Russia
Ukraine

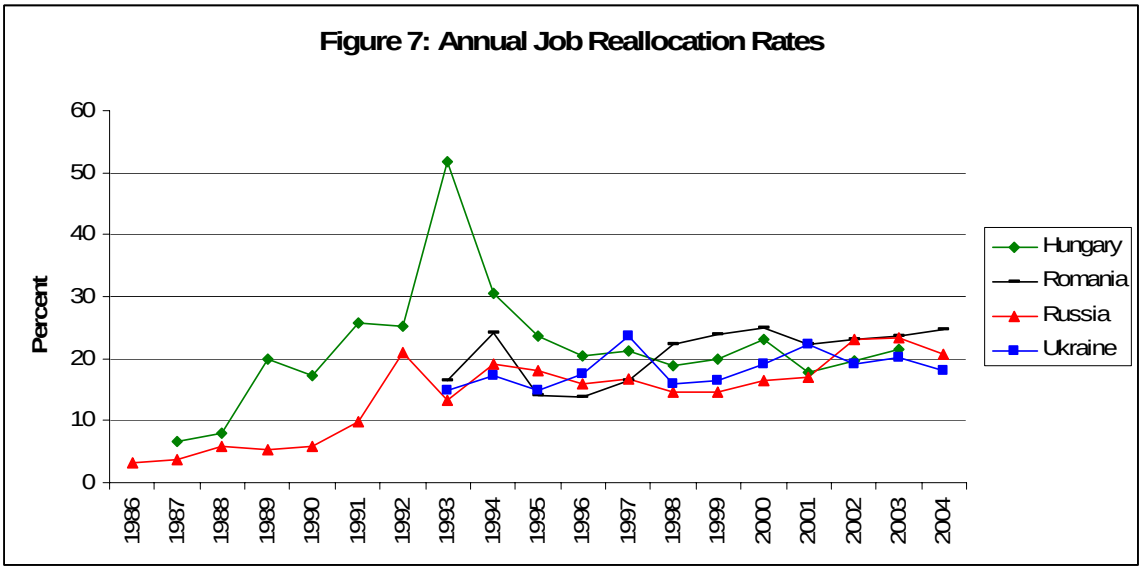
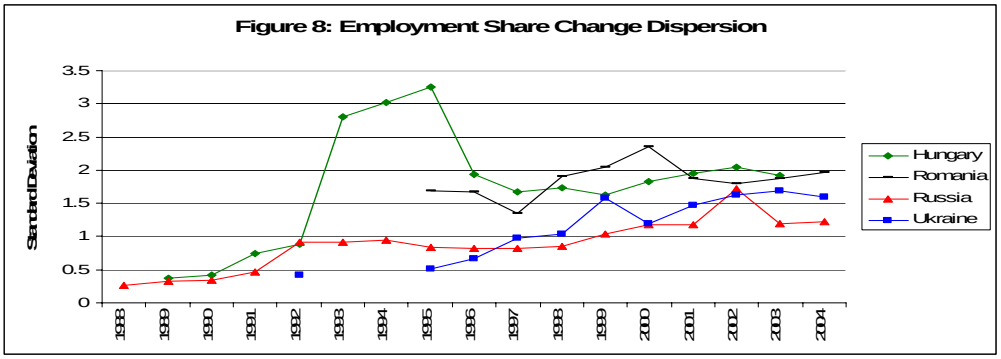
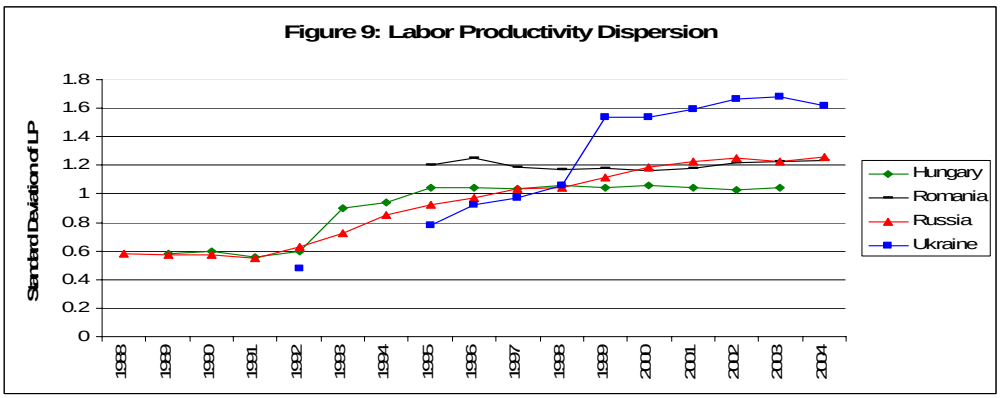
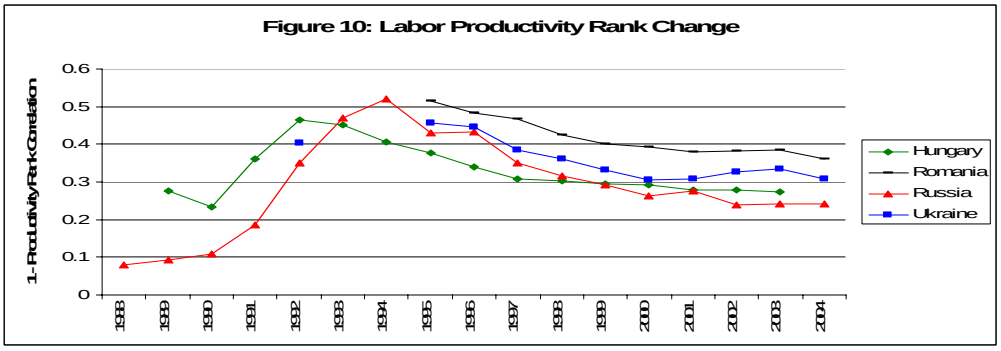
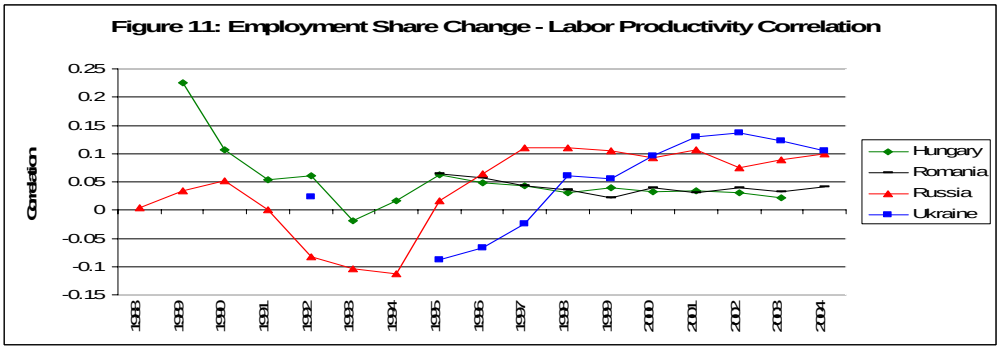


Figure 7: Annual Job Reallocation Rates
Percent
60
50
40
30
20
10
0
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
Hungary
Romania
Russia
Ukraine



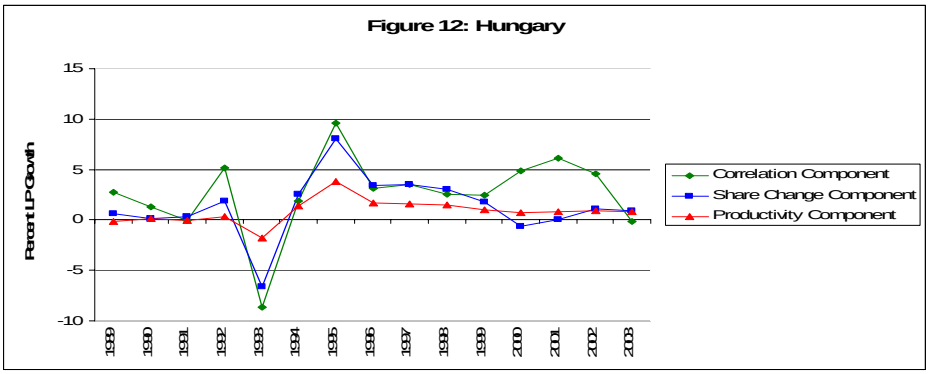


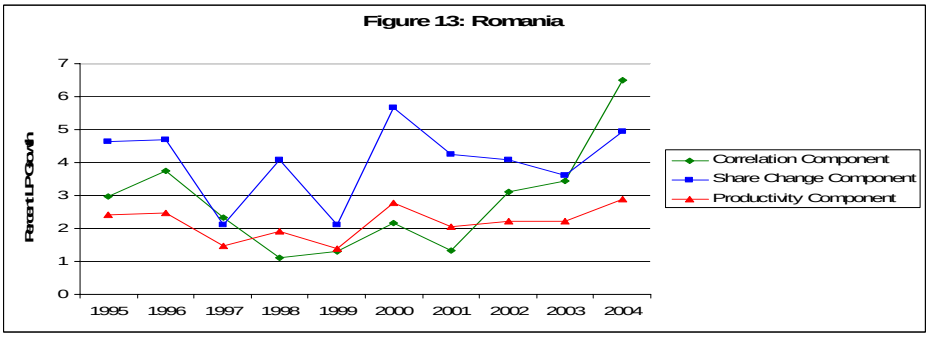


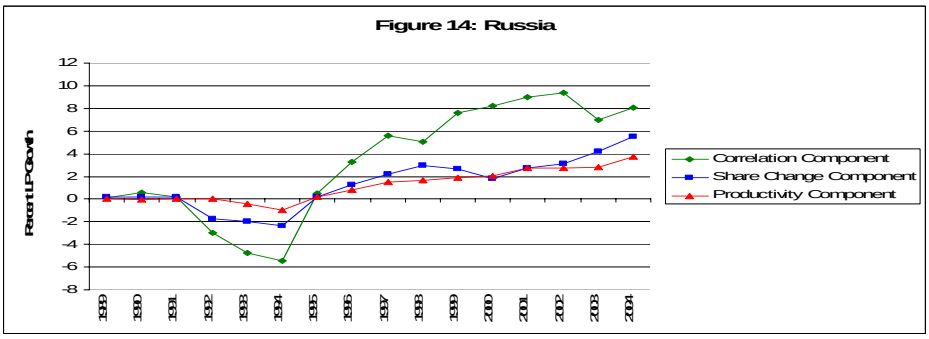


Note: These are three-year changes using the samples for the three-year labor productivity decompositions. The year on the x axis refers to the final year in the decomposition.

Figures 12-15: Three-Year Labor Productivity Reallocation Contribution Decomposition Compared to 1985-1988 Russia







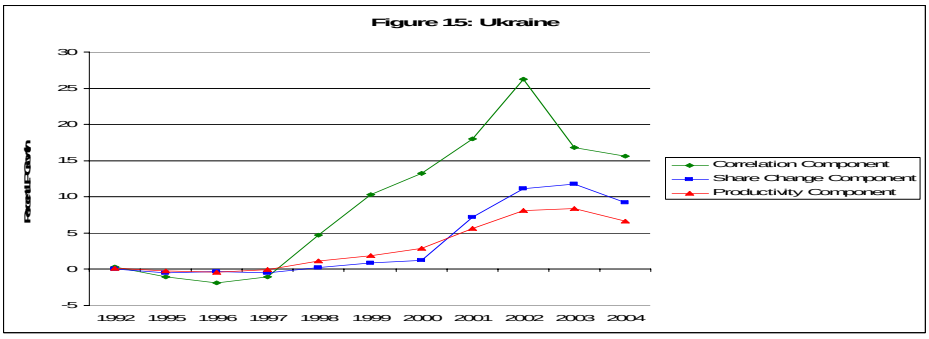


Table 1A: Hungarian and Romanian Sample Coverage

Year	Hungary				Romania			
	Yearbook Employment (thousands)	Database Employment (thousands)	Yearbook Sales (billion HUF)	Database Sales	Yearbook Employment (thousands)	Database Employment (thousands)	Yearbook Output (billion lei)	Database Sales (billion lei)
1986	1244	1232	1117	1016				
1987	1218	1205	1197	1077				
1988	1179	1156	1258	1119				
1989	1136	865	1461	1316				
1990	1074	1092	1585	1510				
1991	961	970	1745	1611				
1992	812	857	1422	1860	2865	2702	5484	4998
1993	713	737	1721	2080	2606	2529	15300	15322
1994	703	694	2134	2691	2456	2283	35247	30516
1995	690	689	2945	3775	2293	2234	48594	46544
1996	654	695	3827	4853	2302	2194	76188	72067
1997	652	725	5197	6508	2079	2217	171363	155500
1998	704	754	6616	8068	1964	1976	205445	187106
1999	717	752	7887	9392	1734	1799	292302	275999
2000	734	765	10525	11651	1691	1706	501554	418725
2001	724	770	11329	13732	1711	1730	769939	611488
2002	707	716	11442	13621	1835	1677	1001579	800197
2003	690	727	12430	15207	1797	1645	1235124	1021166
2004	676		13832		2051	1591	1483120	1326285

Note: The Hungarian yearbook employment numbers in 1986-1991 are the average number of persons employed in total industry, adjusted using the percentage of manufacturing employment in total industry in 1992. They come from the annual institutional labor statistics survey. The 1992-2004 yearbook numbers come from sub-annual institutional labor statistics surveys and are full-time employees in manufacturing. Yearbook employment covers firms with more than 20 employees in 1986-1993, more than ten employees in 1994-1999, and more than four employees in 2000-2003. Yearbook sales cover firms with more than 20 employees in 1986-1995, more than ten employees in 1996-1998, and more than five employees in 1999-2004. The Romanian yearbook numbers are for manufacturing industry.

Table 1B: Russian and Ukrainian Sample Coverage

Year	Russia				Ukraine			
	Yearbook Employment (thousands)	Database Employment (thousands)	Yearbook Output (million Rubles)	Database Output (million Rubles)	Yearbook Employment (thousands)	Database Employment (thousands)	Yearbook Output (thousand UAH)	Database Output (thousand UAH)
1985	16950	16019	0.430	0.344				
1986	16959	16283	0.449	0.353				
1987	16856	16504	0.465	0.380				
1988	16430	16015	0.482	0.392				
1989	15949	15165	0.490	0.392	7288	5044	162	98
1990	15411	14201	0.538	0.386				
1991	20117	19347	1.3	1.064				
1992	20020	19189	18.5	18.471	6515	5603	5800	5624
1993	18864	18706	129	129	6012	5642	160100	166045
1994	17440	17094	384	358	5477	5180	1203000	1222071
1995	16006	14314	1108	983	5035	4907	5882400	5276831
1996	14934	13064	1469	1254	4642	4421	73321000	67709114
1997	14009	11621	1626	1394	4273	4688	75061000	68344160
1998	13173	10792	1707	1374	4142	4571	82889000	77285833
1999	13077	9322	3150	2551	3932	4217	107537000	161005787
2000	13294	9703	4763	3762	4064	4396	144483000	186874508
2001	13282	9699	5881	4472	3811	4004	184276000	242849928
2002	12886	9955	6868	5166	3578	3853	202688000	267114228
2003	12384	9157	8498	6390	3416	3550	259502000	296736341
2004	11977	8765	11209	8596	3941	3478	400757100	416359631

Note: The numbers for both countries are for total industry. As the Russian database does not include military industry employment in 1985-1990, the Russian yearbook numbers for these years are adjusted using the percentage of civilian employment and output in the total in the database in 1992. The Ukrainian database does not include military employment in 1989 either, but we are unable to reliably identify military firms in the database in any year. The employment numbers do not include self employed persons, with the exception of 2004 in Ukraine. The Russian yearbook numbers include industrial divisions of non-industrial firms.

Table 2: Mean Output, Employment and Capital Stock in the First and Last Years of Analysis

	Employment		Output		Capital Stock	
	First year	Last year	First year	Last year	First year	Last year
Hungary	633.4	31.7	3,380.1	511.0	1131.6	162.9
	(862.5)	(176.7)	(8,526.1)	(7,660.5)	(3542.4)	(1733.4)
Romania	247.3	32.9	79,405.3	21,151.9	612181.9	10912.3
	(911.8)	(177.8)	(468690.1)	(323,498.0)	(2569150)	(193853.9)
Russia	815.0	372.8	403.4	249.6	285.9	638.2
	(2,301.1)	(1,478.4)	(1116.3)	(1,434.3)	(1,137.6)	(15,113.7)
Ukraine	796.5	86.0	44.1	6.5	15.1	3.8
	(1,882.2)	(753.3)	(236.0)	(118.4)	(68.7)	(67.5)

Note: The first year of analysis is 1985 in Russia, 1986 in Hungary, 1989 in Ukraine, and 1992 in Romania; the last year is 2003 in Hungary and Romania and 2004 in Russia and Ukraine. Labor productivity is measured as output over employment. Output and labor productivity are annual, expressed in constant 2003 prices (millions of HUF for Hungary, millions of ROL for Romania, millions of RUB for Russia, and millions UAH for Ukraine). Standard deviations are shown in parentheses.

Table 3A: Labor Productivity Growth Decompositions (Base-Year Weights)

Country	Year	Total	Within	Between	Cross	Net Entry
U.S.	1977-1982	2.54	3.10	2.16	-3.23	0.51
U.S.	1982-1987	18.67	15.50	2.43	-2.80	3.55
U.S.	1987-1992	7.17	6.74	2.37	-3.51	1.51
U.S.	1977-1987	23.02	17.03	1.84	-2.53	6.68
Hungary	1991-1996	33.29	25.74	2.36	2.03	3.16
Hungary	1998-2003	33.60	26.31	7.37	-4.80	4.71
Hungary	1990-2003	59.72	15.03	0.22	8.79	35.04
Romania	1992-1997	35.19	26.82	8.60	-5.23	4.99
Romania	1999-2004	31.59	22.30	12.41	-6.14	3.02
Romania	1992-2004	68.46	49.33	6.86	-15.84	28.11
Russia	1992-1997	-54.41	-64.19	6.17	6.50	-2.89
Russia	1999-2004	39.26	13.75	8.11	-1.01	18.41
Russia	1992-2004	-3.56	-11.76	6.61	2.09	-0.50
Ukraine	1992-1997	-93.60	-100.75	3.51	21.58	-17.93
Ukraine	1999-2004	89.62	39.66	33.25	-8.94	25.66
Ukraine	1992-2004	21.36	-18.80	6.86	17.76	15.54

Note: These are labor productivity growth decompositions weighted by 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 (2) in the text. 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).

Table 3B: Multifactor Productivity Growth Decompositions (Base-Year Weights)

Country	Year	Total	Within	Between	Cross	Net Entry
U.S.	1977-1982	2.70	-0.24	-0.89	3.13	0.68
U.S.	1982-1987	7.32	3.81	-1.32	3.73	1.02
U.S.	1987-1992	3.30	-0.20	-1.29	3.63	1.16
U.S.	1977-1987	10.24	4.92	-0.82	3.48	2.66
Hungary	1991-1996	27.56	18.45	0.01	4.43	4.66
Hungary	1998-2003	16.93	16.33	3.10	-4.39	1.90
Hungary	1990-2003	32.39	7.02	-2.77	5.12	23.02
Romania	1992-1997	46.93	37.24	5.59	-2.75	6.85
Romania	1997-2002	4.47	-4.59	8.74	2.04	-1.72
Romania	1994-2002	42.75	28.00	8.23	-3.57	10.10
Russia	1992-1997	-48.29	-54.97	5.78	2.94	-2.04
Russia	1999-2004	35.41	13.79	5.84	-2.29	18.08
Russia	1992-2004	5.19	-4.93	6.09	-2.97	6.99
Ukraine	1992-1997	-83.02	-88.80	2.59	17.07	-13.88
Ukraine	1999-2004	81.21	32.75	26.87	-0.04	21.62
Ukraine	1992-2004	8.19	-33.97	6.57	26.88	8.71

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

Table 4A: Exit and Entry Shares and Relative Labor Productivity

		Employment Shares		Relative Labor Productivity			
Country	Year	Exitors (t-k)	Entrants (t)	Exitors (t-k)	Entrants (t)	Continuers (t-k)	Continuers (t)
U.S.	1977-1987	0.25	0.21	0.82	1.11	1.00	1.21
Hungary	1990-2003	0.68	0.75	0.86	1.53	1.00	1.69
Romania	1992-2004	0.12	0.54	0.88	1.49	1.00	1.69
Russia	1992-2004	0.44	0.34	0.84	0.78	1.00	0.94
Ukraine	1992-2004	0.27	0.39	0.90	1.22	1.00	1.09
Hungary	1993-1998	0.24	0.24	0.74	1.10	1.00	1.37
Romania	1992-1997	0.03	0.23	1.04	1.27	1.00	1.36
Russia	1992-1997	0.09	0.09	0.73	0.40	1.00	0.45
Ukraine	1992-1997	0.05	0.17	0.98	0.07	1.00	0.08
Hungary	1998-2003	0.20	0.17	0.90	1.18	1.00	1.36
Romania	1999-2004	0.08	0.22	0.65	1.02	1.00	1.32
Russia	1999-2004	0.25	0.22	0.34	1.12	1.00	1.26
Ukraine	1999-2004	0.18	0.13	0.11	1.83	1.00	1.70

Note: The relative labor productivity numbers are coefficients on the dummies for the respective categories (continuers in t-k being the omitted category) in employment-weighted OLS labor productivity regressions also including 28 sector dummies as controls. Labor productivity is measured as the log ratio of output per employee. The U.S. figures come from Foster, et al. (2001), who use establishment-level data for the manufacturing sector.

Table 4B: Exit and Entry Shares and Relative Multifactor Productivity

		Employment Shares		Relative Multifactor Productivity			
Country	Year	Exitors (t-k)	Entrants (t)	Exitors (t-k)	Entrants (t)	Continuers (t-k)	Continuers (t)
U.S.	1977-1987	0.22	0.21	0.96	1.09	1.00	1.10
Hungary	1990-2003	0.73	0.76	0.80	1.22	1.00	1.26
Romania	1994-2002	0.10	0.34	1.21	1.41	1.00	1.48
Russia	1992-2004	0.46	0.35	0.92	1.10	1.00	0.96
Ukraine	1992-2004	0.27	0.38	0.88	1.14	1.00	0.99
Hungary	1993-1998	0.23	0.24	0.80	1.21	1.00	1.39
Romania	1994-1999	0.03	0.19	1.21	1.19	1.00	1.28
Russia	1992-1997	0.08	0.09	0.96	0.71	1.00	0.49
Ukraine	1992-1997	0.05	0.17	0.83	0.20	1.00	0.16
Hungary	1998-2003	0.19	0.15	1.06	1.18	1.00	1.18
Romania	1997-2002	0.08	0.20	0.87	0.90	1.00	1.07
Russia	1999-2004	0.24	0.20	0.53	1.36	1.00	1.21
Ukraine	1999-2004	0.17	0.11	0.19	1.84	1.00	1.66

Note: The relative multifactor productivity numbers are coefficients on the dummies for the respective categories (continuers in t-k being the omitted category) in employment-weighted OLS regressions with multifactor productivity as the dependent variable and 28 sector dummies as controls. The U.S. figures come from Foster, et al. (2001), who use establishment-level data for the manufacturing sector.

Appendix Table 1: Three-Year Labor Productivity Growth Decompositions (Base-Year Weights)

Country	Year	Total	Within	Between	Cross	Net Entry
Hungary	1986-1989	25.77	27.04	4.64	-5.91	n.a.
	1987-1990	5.92	7.79	2.27	-4.13	n.a.
	1988-1991	-12.20	-3.15	0.63	-9.68	n.a.
	1989-1992	-47.88	-37.80	0.07	-10.15	n.a.
	1990-1993	-21.81	-16.25	6.41	-4.55	-7.42
	1991-1994	25.93	22.36	3.48	-0.22	0.31
	1992-1995	49.62	32.69	13.98	-8.87	11.83
	1993-1996	28.38	21.01	4.54	-1.16	4.00
	1994-1997	13.27	10.51	6.02	-5.48	2.21
	1995-1998	11.93	11.04	5.90	-5.84	0.82
	1996-1999	13.44	11.85	6.56	-6.39	1.43
	1997-2000	18.19	15.95	4.20	-3.48	1.52
	1998-2001	21.04	18.54	4.10	-4.30	2.70
	1999-2002	23.06	20.61	4.83	-3.57	1.20
	2000-2003	22.07	19.06	2.99	-0.27	0.30
Romania	1992-1995	31.05	25.59	8.22	-4.89	2.13
	1993-1996	17.19	11.16	9.47	-5.26	1.82
	1994-1997	16.95	13.32	5.80	-2.20	0.03
	1995-1998	-5.58	-9.69	9.75	-2.41	-3.23
	1996-1999	-11.38	-16.64	9.09	0.15	-3.98
	1997-2000	5.50	-1.60	10.69	-2.98	-0.61
	1998-2001	10.06	7.23	9.57	-5.03	-1.71
	1999-2002	15.26	9.84	9.07	-3.48	-0.17
	2000-2003	8.70	3.41	8.85	-2.54	-1.03
	2001-2004	21.67	15.91	10.72	-5.54	0.58
Russia	1985-1988	18.57	18.82	0.02	-0.31	0.05
	1986-1989	15.96	16.14	0.32	-0.51	0.00
	1987-1990	12.68	12.64	0.84	-0.82	0.02
	1988-1991	2.02	2.28	0.43	-0.70	0.00
	1989-1992	-19.62	-17.72	1.45	2.12	-5.46
	1990-1993	-25.95	-26.53	1.24	7.59	-8.25
	1991-1994	-48.43	-52.96	1.17	14.06	-10.71
	1992-1995	-53.75	-58.69	5.09	3.98	-4.14
	1993-1996	-49.23	-55.59	6.16	1.53	-1.33
	1994-1997	-6.96	-17.15	7.61	1.04	1.54
	1995-1998	-8.54	-18.03	7.49	0.44	1.57
	1996-1999	16.03	4.06	8.31	0.38	3.27
	1997-2000	17.10	7.64	6.92	-1.02	3.56
	1998-2001	32.58	22.30	6.92	-2.13	5.49
	1999-2002	10.24	4.52	6.59	-7.01	6.14
	2000-2003	16.78	4.80	5.46	-0.84	7.36
	2001-2004	17.98	5.37	7.35	-3.06	8.32
Ukraine	1989-1992	-1.17	-2.97	0.38	1.42	n.a.
	1992-1995	-76.14	-80.21	2.61	8.30	-6.86
	1993-1996	-84.43	-88.35	3.43	9.87	-9.38
	1994-1997	-48.27	-53.62	3.53	8.16	-6.34
	1995-1998	-15.86	-27.57	5.40	5.89	0.42
	1996-1999	7.76	-9.82	4.97	5.19	7.42
	1997-2000	19.53	0.70	10.21	2.04	8.40
	1998-2001	35.46	11.35	16.55	-4.57	12.12
	1999-2002	40.72	16.27	28.71	-12.71	8.44
	2000-2003	59.72	30.32	22.26	-5.33	12.47
	2001-2004	58.88	33.18	16.98	-1.92	10.64

Note: These are labor productivity growth decompositions weighted by employment.

Appendix Table 2: Three-Year Multifactor Productivity Growth Decompositions (Base-Year Weights)

Country	Year	Total	Within	Between	Cross	Net Entry
Hungary	1986-1989	16.85	17.67	2.47	-3.29	n.a.
	1987-1990	1.82	4.38	1.20	-3.76	n.a.
	1988-1991	-10.00	-6.98	-0.62	-2.40	n.a.
	1989-1992	-44.73	-45.97	-0.35	1.58	n.a.
	1990-1993	-36.13	-29.53	0.36	6.02	-12.98
	1991-1994	16.31	13.18	1.61	3.59	-2.07
	1992-1995	35.66	24.09	2.81	1.35	7.41
	1993-1996	32.04	23.63	2.88	0.76	4.77
	1994-1997	18.35	13.70	3.08	-1.21	2.78
	1995-1998	10.04	8.76	3.33	-2.88	0.83
	1996-1999	9.88	7.15	3.69	-2.89	1.93
	1997-2000	11.01	9.22	1.20	-0.25	0.84
	1998-2001	11.74	11.55	1.92	-2.16	0.42
	1999-2002	23.97	13.27	13.27	-0.94	-1.62
	2000-2003	17.23	9.74	9.74	-2.17	-0.09
Romania	1992-1995	24.42	15.65	5.76	-0.07	3.08
	1993-1996	15.27	9.91	4.98	-0.55	0.93
	1994-1997	36.05	32.04	4.61	-1.75	1.15
	1995-1998	11.27	6.03	7.25	-0.12	-1.89
	1996-1999	0.26	-8.07	7.48	2.84	-1.99
	1997-2000	0.67	-7.69	8.15	1.92	-1.70
	1998-2001	9.78	5.21	6.83	-0.92	-1.34
	1999-2002	15.07	9.67	6.22	-0.65	-0.18
Russia	1985-1988	11.03	11.41	0.23	-0.67	0.05
	1986-1989	11.99	12.46	0.40	-0.78	-0.09
	1987-1990	8.81	8.98	0.64	-0.84	0.03
	1988-1991	1.57	1.53	0.64	-0.65	0.05
	1989-1992	-23.47	-23.14	0.85	3.64	-4.83
	1990-1993	-29.43	-30.45	0.95	7.94	-7.87
	1991-1994	-66.10	-69.64	2.89	10.98	-10.34
	1992-1995	-49.09	-53.08	4.05	2.49	-2.55
	1993-1996	-45.06	-48.69	4.82	-0.17	-1.02
	1994-1997	-4.42	-11.58	6.55	-0.52	1.13
	1995-1998	-8.41	-14.99	6.74	-1.64	1.47
	1996-1999	16.13	6.80	6.09	-0.49	3.73
	1997-2000	16.39	9.88	6.42	-3.80	3.90
	1998-2001	30.73	24.64	6.65	-5.84	5.28
	1999-2002	5.71	5.20	6.04	-12.16	6.64
	2000-2003	16.50	7.85	5.56	-4.71	7.79
	2001-2004	14.67	5.12	6.32	-3.96	7.19
Ukraine	1989-1992	13.19	11.94	0.81	0.45	n.a.
	1992-1995	-75.34	-78.55	1.94	7.04	-5.77
	1993-1996	-80.84	-83.88	2.72	8.10	-7.75
	1994-1997	-46.67	-52.68	2.67	8.13	-4.80
	1995-1998	-12.76	-24.91	4.23	5.66	2.26
	1996-1999	2.10	-14.74	5.18	6.11	5.55
	1997-2000	15.26	-4.08	10.29	4.38	2.35
	1998-2001	29.18	5.12	15.40	-0.21	8.87
	1999-2002	35.37	9.81	23.19	-4.57	6.94
	2000-2003	53.60	23.85	19.87	-0.84	10.73
	2001-2004	54.29	30.50	15.75	-0.53	8.57

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

Appendix Table 3: Five-Year and Long-Run Labor Productivity Growth Decompositions (Base-Year Weights)

Country	Year	Total	Within	Between	Cross	Net Entry
Hungary	1986-1991	-4.55	4.38	1.99	-10.91	n.a.
	1987-1992	-26.20	-18.49	2.38	-10.10	n.a.
	1988-1993	-42.62	-23.80	-4.18	-4.94	-9.71
	1989-1994	-37.63	-22.25	-3.68	-0.26	-11.43
	1990-1995	13.52	2.90	5.12	5.49	0.01
	1991-1996	33.29	25.74	2.36	2.03	3.16
	1992-1997	55.85	34.09	10.49	-5.62	16.90
	1993-1998	35.73	26.29	4.11	-2.45	7.78
	1994-1999	21.14	16.07	7.81	-7.88	5.13
	1995-2000	23.91	19.89	7.37	-8.43	5.07
	1996-2001	27.62	23.16	6.23	-7.77	6.00
	1997-2002	31.21	24.57	6.02	-5.42	6.04
	1998-2003	33.60	26.31	7.37	-4.80	4.71
	1990-2003	59.72	15.03	0.22	8.79	35.68
Romania	1992-1997	35.19	26.82	8.60	-5.23	4.99
	1993-1998	6.59	-4.10	10.30	-0.47	0.86
	1994-1999	11.27	2.99	9.79	-1.02	-0.49
	1995-2000	7.80	-0.94	12.61	-4.16	0.28
	1996-2001	-3.04	-7.72	12.07	-2.46	-4.93
	1997-2002	9.26	-0.60	11.52	-0.81	-0.85
	1998-2003	20.37	9.47	11.19	-3.48	3.18
	1999-2004	31.59	22.30	12.41	-6.14	3.02
	1992-2004	68.46	49.33	6.86	-15.84	28.11
Russia	1985-1990	23.20	23.51	0.47	-0.85	0.06
	1986-1991	12.33	13.03	0.28	-1.25	0.26
	1987-1992	-7.48	-5.73	1.47	0.25	-3.47
	1988-1993	-21.19	-21.78	1.91	5.70	-7.01
	1989-1994	-59.38	-61.89	2.27	15.67	-15.44
	1990-1995	-66.45	-71.11	1.83	21.58	-18.75
	1991-1996	-66.85	-73.53	0.98	18.14	-12.45
	1992-1997	-54.41	-64.19	6.17	6.50	-2.89
	1993-1998	-46.46	-55.02	7.13	4.43	-3.00
	1994-1999	-1.60	-16.82	7.90	4.36	2.97
	1995-2000	12.15	-1.58	6.58	2.67	4.48
	1996-2001	35.08	18.22	7.85	0.27	8.72
	1997-2002	18.73	7.73	8.17	-7.04	9.86
	1998-2003	45.38	24.36	6.32	-1.23	15.93
	1999-2004	39.26	13.75	8.11	-1.01	18.41
	1992-2004	-3.56	-11.76	6.61	2.09	-0.50
Ukraine	1989-1994	-48.85	-51.59	1.11	7.10	-5.47
	1992-1997	-93.60	-100.75	3.51	21.58	-17.93
	1993-1998	-81.59	-88.76	4.65	19.48	-16.96
	1994-1999	-33.34	-50.65	4.74	16.07	-3.51
	1995-2000	12.96	-13.29	12.59	5.16	8.50
	1996-2001	41.50	6.61	11.18	2.07	21.63
	1997-2002	56.51	19.54	17.86	-2.95	22.06
	1998-2003	83.08	38.11	21.44	-2.97	26.51
	1999-2004	89.62	39.66	33.25	-8.94	25.66
	1992-2004	21.36	-18.80	6.86	17.76	15.54
United States	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	6.68

Note: These are labor productivity growth decompositions weighted by employment.

Appendix Table 4: Five-Year and Long-Run Multifactor Productivity Growth Decompositions (Base-Year Weights)

Country	Year	Total	Within	Between	Cross	Net Entry
Hungary	1986-1991	-4.38	-2.01	0.99	-3.36	n.a.
	1987-1992	-30.80	-34.90	0.38	3.72	n.a.
	1988-1993	-52.07	-42.67	-0.21	9.91	-19.10
	1989-1994	-40.30	-30.43	0.32	9.01	-19.20
	1990-1995	1.97	-6.82	-0.08	11.66	-2.78
	1991-1996	27.56	18.45	0.01	4.43	4.66
	1992-1997	45.09	28.51	2.88	-0.19	13.89
	1993-1998	39.33	28.95	2.83	-1.92	9.48
	1994-1999	21.39	14.46	3.93	-3.11	6.11
	1995-2000	20.41	14.88	4.62	-3.63	4.54
	1996-2001	19.28	15.64	3.55	-3.81	3.90
	1997-2002	16.35	13.24	1.84	-1.03	2.29
	1998-2003	16.93	16.33	3.10	-4.39	1.90
	1990-2003	32.39	7.01	-2.77	5.12	23.02
Romania	1992-1997	46.93	37.24	5.59	-2.75	6.85
	1993-1998	19.22	8.32	5.62	3.34	1.94
	1994-1999	25.39	14.02	8.32	0.26	2.79
	1995-2000	20.86	9.82	9.60	0.02	1.42
	1996-2001	10.01	1.43	10.12	0.28	-1.81
	1997-2002	4.47	-4.59	8.74	2.04	-1.72
	1994-2002	42.75	28.00	8.23	-3.57	10.10
Russia	1985-1990	13.76	14.16	0.57	-1.04	0.07
	1986-1991	10.22	10.58	0.81	-1.47	0.30
	1987-1992	-12.99	-12.78	0.74	2.17	-3.14
	1988-1993	-24.07	-24.82	1.10	6.20	-6.55
	1989-1994	-58.50	-60.89	1.65	14.46	-13.72
	1990-1995	-61.92	-65.73	2.13	16.91	-15.22
	1991-1996	-80.36	-83.97	3.49	10.12	-9.99
	1992-1997	-48.29	-54.97	5.78	2.94	-2.04
	1993-1998	-39.97	-45.08	7.08	-0.46	-1.51
	1994-1999	4.28	-8.41	7.57	0.81	4.31
	1995-2000	15.26	4.19	7.02	-0.80	4.85
	1996-2001	38.49	22.72	6.05	-3.11	12.83
	1997-2002	14.55	9.14	8.58	-16.35	13.17
	1998-2003	43.76	27.10	7.12	-6.73	16.27
	1999-2004	35.42	13.79	5.84	-2.29	18.08
	1992-2004	5.19	-4.93	6.09	-2.97	6.99
Ukraine	1989-1994	-38.47	-42.12	1.55	3.40	-1.68
	1992-1997	-83.02	-88.80	2.59	17.07	-13.88
	1993-1998	-70.74	-78.19	3.54	16.46	-12.55
	1994-1999	-34.91	-54.99	4.32	18.68	-2.92
	1995-2000	1.50	-24.84	8.09	13.41	4.85
	1996-2001	31.43	-2.30	10.65	6.34	16.73
	1997-2002	46.35	7.92	16.52	4.21	17.70
	1998-2003	73.88	28.54	19.96	3.08	22.30
	1999-2004	81.21	32.75	26.87	-0.04	21.62
	1992-2004	8.19	-33.97	6.57	26.88	8.71
United States	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	2.66

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

Appendix Table 5: Three-Year Labor Productivity Growth Decompositions (Average-Year Weights)

Country	Year	Total	Within	Between	Net Entry
Hungary	1986-1989	25.39	23.67	1.73	n.a.
	1987-1990	6.05	5.77	0.29	n.a.
	1988-1991	-11.51	-7.87	-3.64	n.a.
	1989-1992	-46.92	-42.99	-3.94	n.a.
	1990-1993	-20.70	-16.62	6.03	-10.11
	1991-1994	28.56	24.19	4.59	-0.21
	1992-1995	50.75	28.79	8.79	13.18
	1993-1996	28.65	20.687	3.71	4.26
	1994-1997	13.77	7.97	3.46	2.33
	1995-1998	12.63	8.73	3.10	0.80
	1996-1999	14.45	9.26	3.70	1.49
	1997-2000	18.96	14.83	2.57	1.56
	1998-2001	21.69	16.95	1.90	2.84
	1999-2002	23.24	19.01	2.67	1.55
	2000-2003	21.83	18.77	2.14	0.92
Romania	1992-1995	30.61	23.02	7.01	0.58
	1993-1996	16.80	8.30	7.60	0.90
	1994-1997	16.81	12.09	5.45	-0.72
	1995-1998	-6.02	-11.38	8.34	-2.98
	1996-1999	-11.60	-16.69	8.56	-3.47
	1997-2000	4.30	-3.98	8.78	-0.50
	1998-2001	10.65	5.21	7.51	-2.07
	1999-2002	14.82	7.77	7.57	-0.52
	2000-2003	7.96	1.63	7.39	-1.06
	2001-2004	19.76	11.67	8.02	0.07
Russia	1985-1988	18.09	18.18	-0.13	0.04
	1986-1989	15.96	15.89	0.08	-0.01
	1987-1990	12.66	12.21	0.48	-0.02
	1988-1991	1.98	1.91	0.17	-0.09
	1989-1992	-19.75	-16.66	1.07	-4.15
	1990-1993	-26.09	-22.62	2.47	-5.94
	1991-1994	-47.24	-44.72	4.02	-6.55
	1992-1995	-53.22	-56.19	6.38	-3.41
	1993-1996	-47.88	-53.64	7.43	-1.67
	1994-1997	-6.34	-15.96	8.24	1.38
	1995-1998	-8.54	-17.74	7.76	1.44
	1996-1999	15.79	4.13	8.30	3.35
	1997-2000	16.99	6.90	6.43	3.66
	1998-2001	32.73	21.19	6.08	5.45
	1999-2002	10.07	0.77	3.22	6.07
	2000-2003	16.73	4.45	5.14	7.14
	2001-2004	17.82	3.79	5.88	8.14
Ukraine	1989-1992	-1.24	-2.34	1.09	n.a.
	1992-1995	-75.45	-75.55	3.74	-3.64
	1993-1996	-82.50	-81.87	5.49	-6.12
	1994-1997	-46.46	-48.25	6.08	-4.29
	1995-1998	-15.46	-24.20	7.66	1.07
	1996-1999	7.05	-7.90	8.03	6.92
	1997-2000	18.21	0.61	12.08	5.52
	1998-2001	33.32	7.45	13.94	11.93
	1999-2002	38.81	8.68	22.00	8.14
	2000-2003	58.72	27.22	18.96	12.53
	2001-2004	58.64	32.37	15.49	10.78

Note: These are labor productivity growth decompositions weighted by employment.

Appendix Table 6: Three-Year Multifactor Productivity Growth Decompositions (Average-Year Weights)

Country	Year	Total	Within	Between	Net Entry
Hungary	1986-1989	16.85	16.02	0.83	n.a.
	1987-1990	1.82	2.50	-0.68	n.a.
	1988-1991	-10.00	-8.18	-1.82	n.a.
	1989-1992	-44.73	-45.18	0.44	n.a.
	1990-1993	-36.13	-26.52	4.06	-13.67
	1991-1994	16.31	14.98	3.97	-2.64
	1992-1995	35.66	24.77	3.18	7.71
	1993-1996	32.04	24.01	3.13	4.90
	1994-1997	18.35	13.10	2.54	2.71
	1995-1998	10.04	7.32	1.90	0.83
	1996-1999	9.88	5.71	2.51	1.66
	1997-2000	11.01	9.09	1.10	0.82
	1998-2001	11.74	10.47	0.69	0.57
	1999-2002	12.30	12.80	1.00	-1.50
	2000-2003	8.88	8.66	0.15	0.07
Romania	1992-1995	24.42	15.62	7.18	1.63
	1993-1996	15.27	9.64	5.56	0.07
	1994-1997	36.05	31.16	4.92	-0.04
	1995-1998	11.27	5.97	7.47	-2.17
	1996-1999	0.26	-6.65	8.93	-2.02
	1997-2000	0.67	-6.73	8.90	-1.49
	1998-2001	9.78	4.75	6.86	-1.83
	1999-2002	15.07	9.34	6.17	-0.44
Russia	1985-1988	11.03	11.08	-0.10	0.05
	1986-1989	11.99	12.07	0.02	-0.10
	1987-1990	8.81	8.56	0.25	0.01
	1988-1991	1.57	1.21	0.38	-0.02
	1989-1992	-23.47	-21.32	0.96	-3.12
	1990-1993	-29.43	-26.48	1.85	-4.80
	1991-1994	-66.10	-64.14	3.65	-5.61
	1992-1995	-49.09	-51.83	4.66	-1.91
	1993-1996	-45.06	-48.77	5.54	-1.82
	1994-1997	-4.42	-11.84	6.42	1.00
	1995-1998	-8.41	-15.81	5.98	1.41
	1996-1999	16.13	6.56	5.85	3.73
	1997-2000	16.39	7.98	4.68	3.74
	1998-2001	30.73	21.72	4.10	4.91
	1999-2002	5.71	-0.88	0.17	6.43
	2000-2003	16.50	5.50	3.35	7.65
	2001-2004	14.67	3.14	4.44	7.09
Ukraine	1989-1992	13.19	12.17	1.03	n.a.
	1992-1995	-75.34	-75.03	2.53	-2.84
	1993-1996	-80.84	-79.83	4.03	-5.04
	1994-1997	-46.67	-48.62	4.72	-2.78
	1995-1998	-12.76	-22.08	6.32	3.01
	1996-1999	2.10	-11.69	8.53	5.25
	1997-2000	15.26	-1.89	13.13	4.02
	1998-2001	29.18	5.02	15.65	8.51
	1999-2002	35.37	7.53	20.83	7.02
	2000-2003	53.60	23.42	18.97	11.21
	2001-2004	54.29	30.24	15.15	8.90

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

Appendix Table 7: Five-Year and Long-Run Labor Productivity Growth Decompositions (Average-Year Weights)

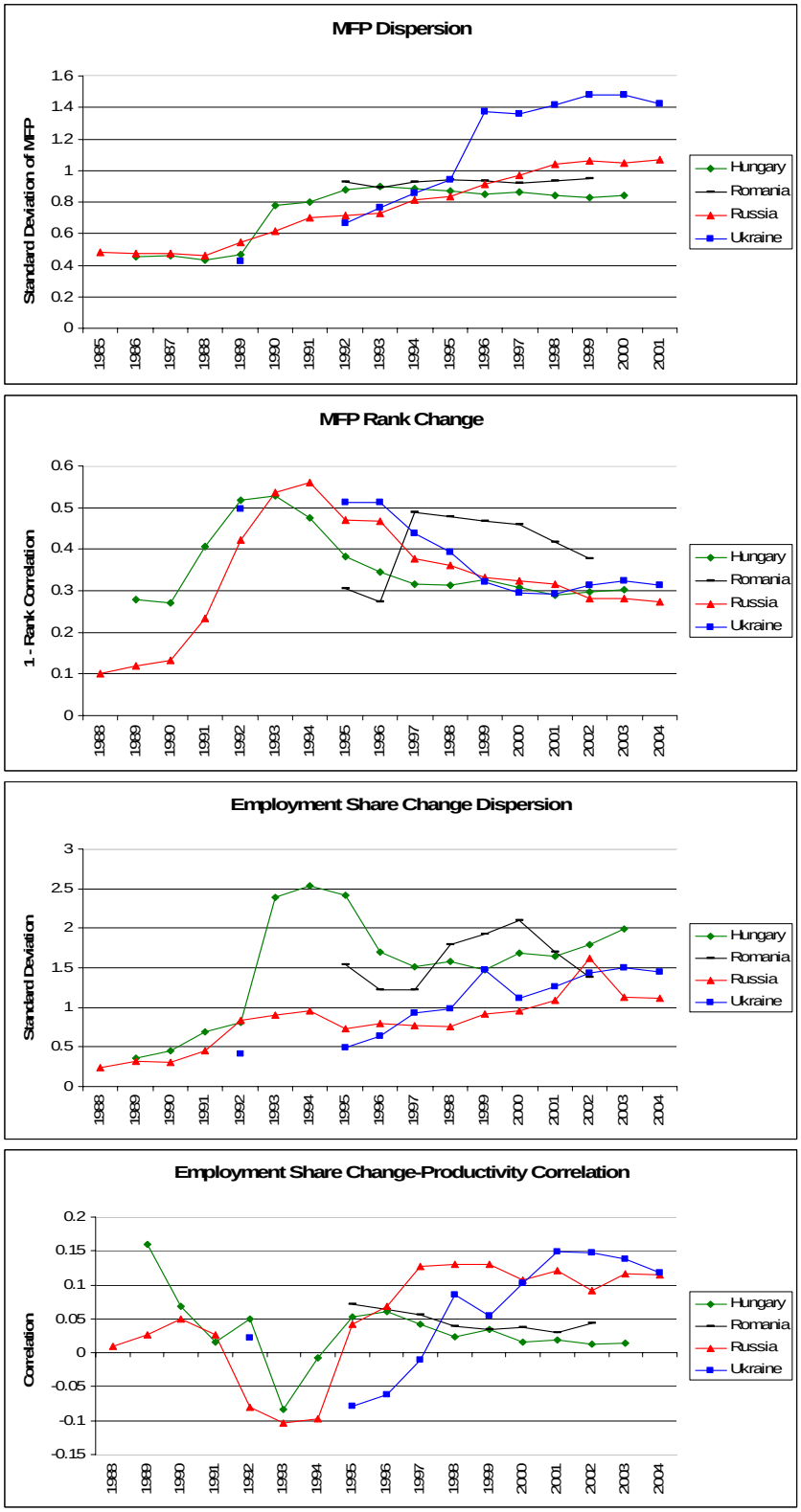
Country	Year	Total	Within	Between	Net Entry
Hungary	1986-1991	-4.19	-1.46	-2.73	n.a.
	1987-1992	-24.45	-22.87	-1.58	n.a.
	1988-1993	-43.01	-26.70	-2.63	-13.68
	1989-1994	-35.60	-22.53	1.07	-14.14
	1990-1995	13.59	5.59	7.31	0.69
	1991-1996	36.58	27.64	4.55	4.38
	1992-1997	57.74	31.33	7.60	18.81
	1993-1998	37.08	25.80	2.94	8.34
	1994-1999	22.85	12.96	4.38	5.51
	1995-2000	26.10	17.15	3.63	5.33
	1996-2001	29.77	20.85	3.04	5.88
	1997-2002	32.89	22.75	3.70	6.43
	1998-2003	34.99	24.97	4.63	5.40
	1990-2003	61.86	17.94	2.05	41.87
Romania	1992-1997	34.04	23.31	8.24	2.50
	1993-1998	5.62	-5.00	10.15	0.48
	1994-1999	10.65	1.93	10.09	-1.37
	1995-2000	7.28	-3.53	10.89	-0.08
	1996-2001	-3.42	-9.19	10.09	-4.32
	1997-2002	7.70	-2.41	11.18	-1.07
	1998-2003	19.86	7.31	10.56	1.98
	1999-2004	29.00	17.10	10.24	1.67
	1992-2004	60.63	34.94	9.61	16.09
Russia	1985-1990	23.29	23.18	0.10	0.01
	1986-1991	12.30	12.39	-0.14	0.05
	1987-1992	-7.58	-5.62	1.16	-3.13
	1988-1993	-21.20	-18.75	2.80	-5.25
	1989-1994	-58.73	-53.00	4.15	-9.89
	1990-1995	-65.09	-58.52	5.45	-12.02
	1991-1996	-63.31	-61.07	6.42	-8.66
	1992-1997	-53.24	-59.94	9.38	-2.68
	1993-1998	-44.87	-51.40	9.91	-3.38
	1994-1999	-1.35	-14.50	10.02	3.14
	1995-2000	11.40	-0.72	7.56	4.55
	1996-2001	34.50	18.13	7.47	8.90
	1997-2002	17.88	3.69	4.09	10.10
	1998-2003	44.90	23.29	5.56	16.05
	1999-2004	38.92	13.20	6.97	18.75
	1992-2004	-4.13	-10.90	7.57	-0.80
Ukraine	1989-1994	-48.86	-48.16	3.14	-3.85
	1992-1997	-92.05	-89.15	7.59	-10.49
	1993-1998	-79.25	-77.56	9.33	-11.03
	1994-1999	-32.57	-42.55	10.54	-0.56
	1995-2000	10.82	-12.09	16.31	6.61
	1996-2001	37.61	5.06	14.12	18.43
	1997-2002	52.24	15.35	18.43	18.46
	1998-2003	79.57	34.52	19.34	25.71
	1999-2004	79.57	34.23	25.84	27.04
	1992-2004	17.94	-11.30	17.69	11.56
United States	1977-1982	2.54	1.50	0.53	0.51
	1982-1987	18.67	14.00	0.56	3.92
	1987-1992	7.17	5.02	0.57	1.58
	1977-1987	23.02	15.88	0.23	6.91

Note: These are labor productivity growth decompositions weighted by employment.

Appendix Table 8: Five-Year and Long-Run Multifactor Productivity Growth Decompositions (Average-Year Weights)

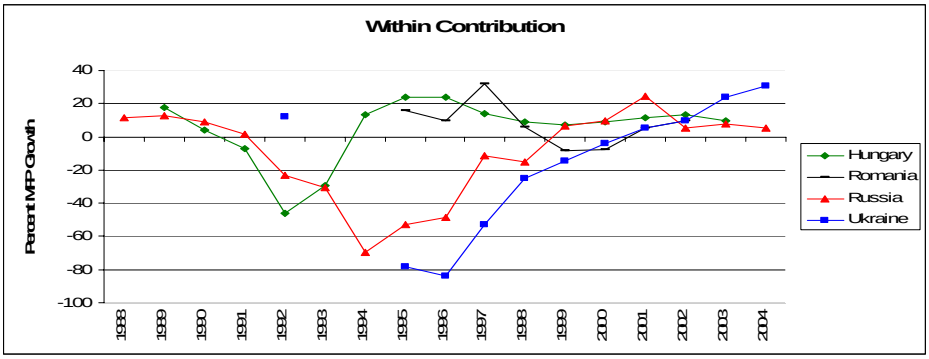
Country	Year	Total	Within	Between	Net Entry
Hungary	1986-1991	-4.38	-3.69	-0.69	n.a.
	1987-1992	-30.80	-33.04	2.24	n.a.
	1988-1993	-52.07	-37.71	2.74	-17.10
	1989-1994	-40.30	-25.93	3.27	-17.64
	1990-1995	1.97	-0.99	5.35	-2.38
	1991-1996	27.56	20.67	3.30	3.59
	1992-1997	45.09	28.41	3.13	13.54
	1993-1998	39.33	27.99	2.31	9.03
	1994-1999	21.39	12.91	2.92	5.56
	1995-2000	20.41	13.07	3.32	4.02
	1996-2001	19.28	13.74	1.90	3.65
	1997-2002	16.35	12.73	1.33	2.29
	1998-2003	16.93	14.13	0.88	1.92
	1990-2003	32.39	9.58	0.13	22.68
Romania	1992-1997	46.93	35.87	7.92	3.15
	1993-1998	19.22	9.99	8.87	0.36
	1994-1999	25.39	14.15	10.34	0.89
	1995-2000	20.86	9.83	11.04	-0.01
	1996-2001	10.01	1.57	10.75	-2.30
	1997-2002	4.47	-3.57	9.74	-1.70
	1994-2002	42.84	26.60	11.03	5.21
Russia	1985-1990	13.76	13.64	0.08	0.04
	1986-1991	10.22	9.85	0.25	0.12
	1987-1992	-12.99	-11.69	0.97	-2.28
	1988-1993	-24.07	-21.72	1.88	-4.23
	1989-1994	-58.50	-53.66	2.96	-7.80
	1990-1995	-61.92	-57.28	4.10	-8.74
	1991-1996	-80.36	-78.91	6.22	-7.67
	1992-1997	-48.29	-53.50	7.29	-2/08
	1993-1998	-39.97	-45.31	7.58	-2.24
	1994-1999	4.28	-8.01	7.83	4.46
	1995-2000	15.26	3.79	6.29	5.19
	1996-2001	38.49	21.17	4.86	12.46
	1997-2002	14.55	0.97	0.57	13.01
	1998-2003	43.76	23.74	3.96	16.06
	1999-2004	35.42	12.64	4.08	18.69
	1992-2004	5.19	-6.41	4.88	6.72
Ukraine	1989-1994	-38.47	-40.42	2.49	-0.70
	1992-1997	-83.02	-80.27	5.16	-7.91
	1993-1998	-70.74	-69.96	7.16	-7.93
	1994-1999	-34.91	-45.65	10.56	0.18
	1995-2000	1.50	-18.14	15.06	4.58
	1996-2001	31.43	0.87	15.66	14.90
	1997-2002	46.35	10.03	20.60	15.73
	1998-2003	73.88	30.08	21.85	21.95
	1999-2004	81.21	32.73	24.68	23.79
	1992-2004	8.19	-20.53	20.57	8.15
United States	1977-1982	2.70	1.32	0.70	0.68
	1982-1987	7.32	5.71	0.59	1.02
	1987-1992	3.30	1.62	0.56	1.12
	1977-1987	10.24	6.66	1.02	2.56

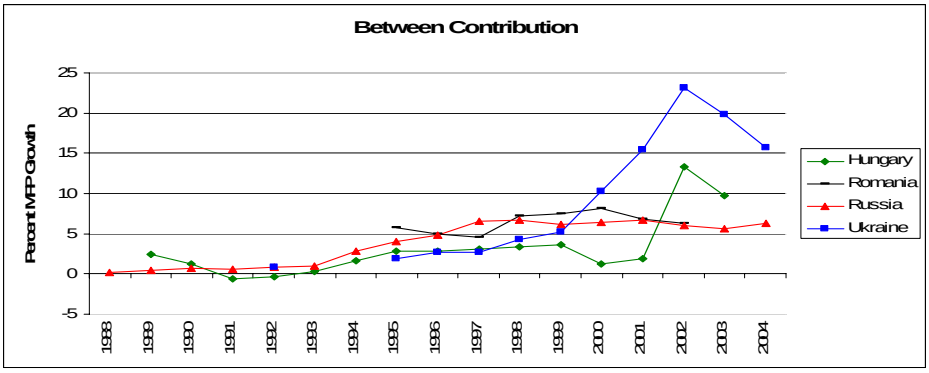
Note: These are multifactor productivity growth decompositions weighted by employment.

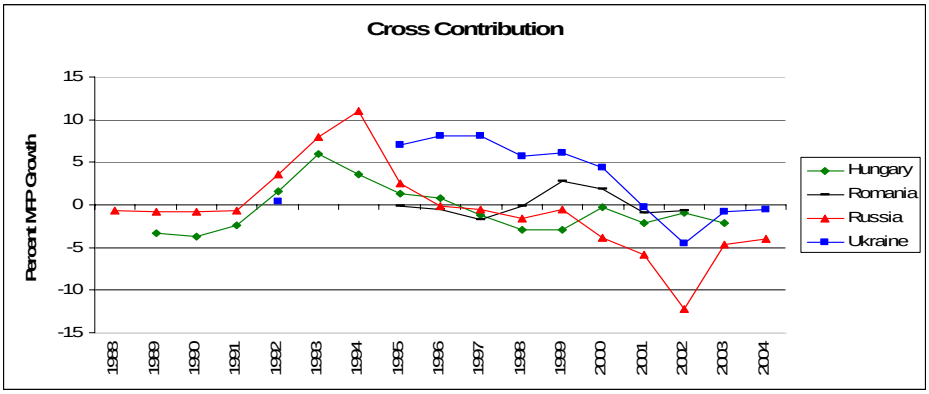


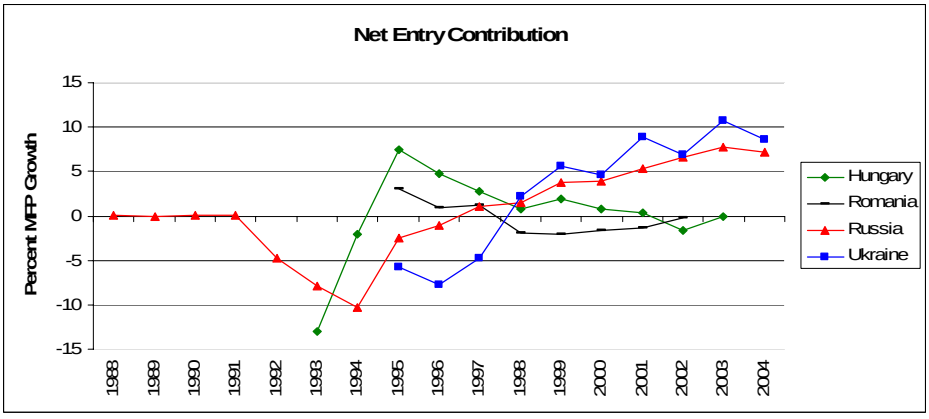
Note: These are three-year changes using the samples for the three-year multifactor productivity decompositions.

Three-Year Multifactor Productivity Decompositions
(Base-Year Weights)

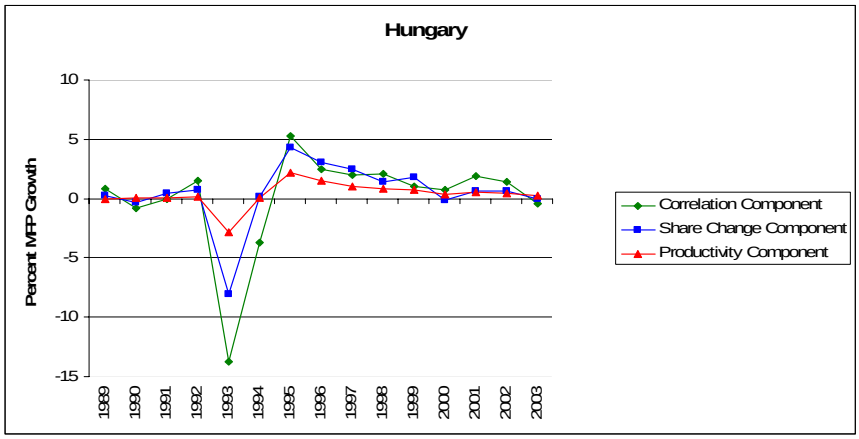


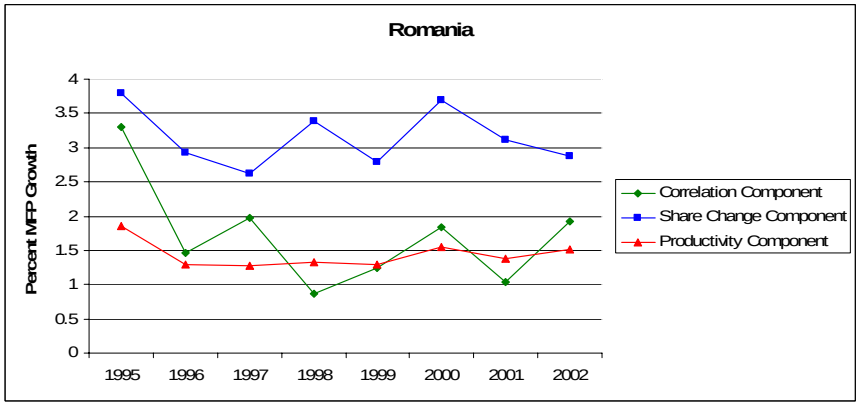


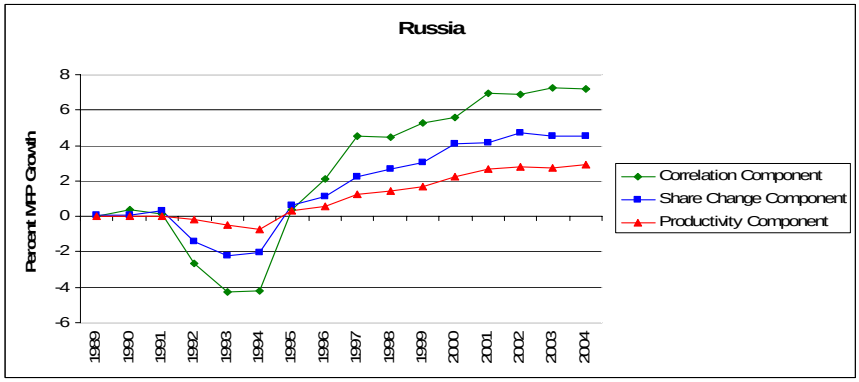


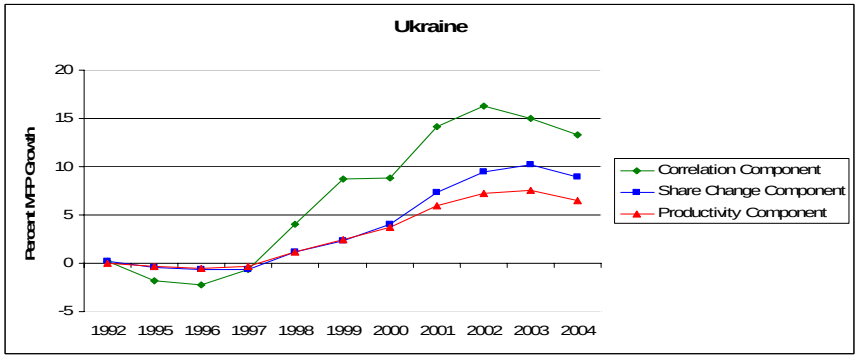


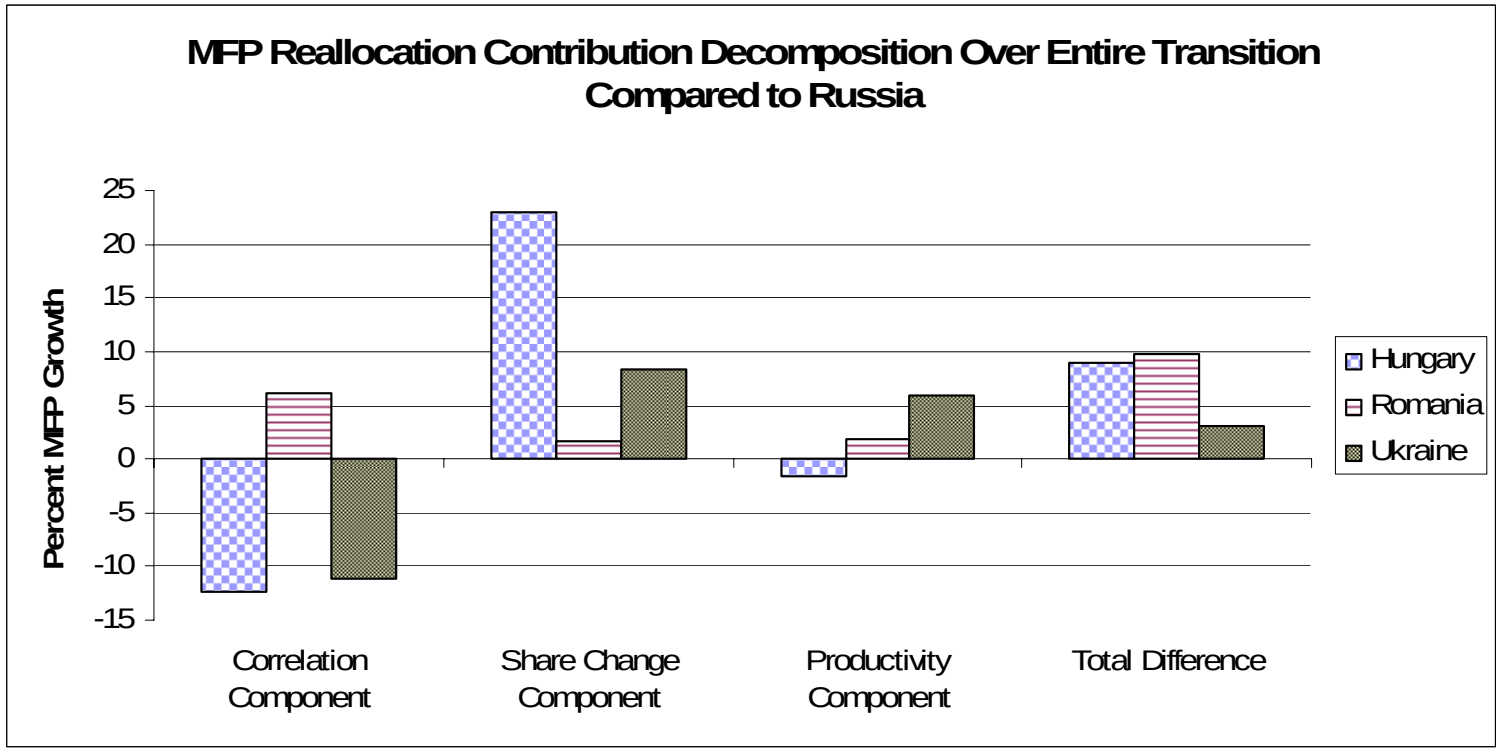
Three-Year Multifactor Productivity Reallocation Contribution Decomposition Compared to 1985-1988 Russia










MFP Reallocation Contribution Decomposition Over Entire Transition Compared to Russia
Percent MFP Growth
25
20
15
10
5
0
-5
-10
-15
Correlation Component
Share Change Component
Productivity Component
Total Difference
Hungary
Romania
Ukraine