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Employment Reallocation, Productivity Growth, and Economic Systems: Evidence from Transition Economies in Comparative Perspective

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Abstract

This paper measures the contribution of employment reallocation to aggregate productivity growth using manufacturing census data in Hungary, Romania, Russia, and Ukraine. Between-firm reallocation provides a negligible contribution to productivity growth during the centrally planned period, but a substantial one after reform, much greater than in previous studies of the United States and United Kingdom. Firm turnover also makes a significant contribution to productivity growth. An increased volume of reallocation and greater productivity dispersion have contributed to the rise in the contribution of reallocation to productivity growth in all four countries. Increased correlation between reallocation and productivity differentials is also an important factor in Russia and Ukraine, but it has fallen in Hungary and Romania.

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1. Introduction

Standard economics principles textbooks lay great stress on the importance of resource allocation in explaining levels of economic performance and on the role of resource reallocation in accounting for cross-country differences in rates of economic growth. Until recently, however, data constraints have prevented researchers from empirically analyzing the contributions of resource allocation and reallocation. At the same time, theoretical models of the wealth of nations have traditionally taken a "representative agent" perspective, assuming the economy can be adequately represented as a single firm, which necessarily precludes any analysis of allocation and reallocation across firms within the economy. Perhaps as a consequence, public policy discussions have tended to emphasize the consequences of policies for the efficiency of an (imaginary) average firm, with little attention to the effects on the allocation of resources.

The growing availability of comprehensive microeconomic data creates an opportunity to analyze the importance of alternative sources of economic growth and to redress this imbalance in economic research and policy analysis. To what extent is aggregate productivity growth driven by improvements in productivity within firms as opposed to the reallocation of resources from less to more productive uses? How do different types of reallocation processes – entry, exit, and the movement of resources among incumbent, continuing firms – compare in their importance as sources of productivity growth? What factors tend to increase the productivity contributions coming from reallocation? Research on these questions is still in its early stages, but it has already measured the magnitude of productivity-enhancing reallocation in several economies, and in some instances it has examined the possibility that economic liberalization may increase both the pace and the productivity contributions of reallocation.[1] Typically, this literature finds substantial contributions of reallocation that tend to increase after reforms are implemented.

In this paper, we extend the current body of research in several ways. First, we consider a set of economies – those engaged in the transition from central planning – that have not received a great deal of attention but that might provide particularly interesting variation in the role played by reallocation. We assemble comparable panel data on manufacturing firms for four of these economies – Hungary, Romania, Russia, and Ukraine – and we apply the same data-cleaning and statistical procedures for each of them, in order to obtain genuinely comparable results. As in most previous studies of productivity-enhancing reallocation, our paper focuses on employment changes at business reporting units to measure the pace of reallocation, and it uses various productivity decomposition methods for measuring the contribution of reallocation. We also distinguish the separate contributions of reallocation between continuing producers and that given by firm turnover – exit and entry processes.

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[1] See Griliches and Regev (1995) for Israel, Olley and Pakes (1996) for the U.S. telecommunications equipment sector, Foster et al. (2001) for the US, Disney et al. (2003) for the UK, Tybout and Westbrook (1995) and Pavcnik (2002) for import liberalization and reallocation in Mexico and Chile, Eslava et al. (2004) for reforms and liberalization in Colombia, Aw et al. (2001, 2003) for Taiwan and Korea, and Bartelsman et al. (2004) and Brown and Earle (2002, forthcoming) for the effects of economic reforms on reallocation in transition economies.

Second, we exploit the long time series in our data to measure the pace of reallocation and its contribution to productivity growth during the central planning period as well as in the years immediately after reforms were adopted and later on, after the economies stabilized and overall growth resumed. The socialist economies were associated with low productivity and poor innovation incentives and selection mechanisms, which might imply 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 in our data adopted very different transition policy strategies, however, and we compare their reallocation behavior, both before and after the transition began, to each other and to comparable figures for the US, UK, and developing economies that are available from previous research.

Why do some economies allocate resources more efficiently (i.e., to higher-valued uses) and are more responsive in reallocating resources in response to changes in underlying conditions (e.g., relative scarcities) than are others? Our paper's final contribution is to investigate the large cross-country variation that we find in the contributions of reallocation to aggregate productivity growth. We decompose the differences into three components: the pace of reallocation, the dispersion of productivity, and the correlation of reallocation and relative productivity across firms. We show that all three of these components tended to rise after the transition began, but to differing extents in the four countries, with very different implications for the impact on aggregate productivity. This approach provides a useful framework for understanding the different patterns in the four economies we study, and it is also general enough to be useful to researchers with access to data from other countries.

To further motivate our comparative analysis of productivity developments under central planning and the transition to a market economy, Section 2 provides a brief discussion of central planning, the different economic reform programs adopted in the four countries, and their possible implications for the magnitude and productivity contributions of resource reallocation. Section 3 discusses the data and Section 4 the measurement methods. Section 5 contains the results of our analysis of the magnitude of productivity-enhancing reallocation in the four economies, with comparisons to the results in previous research for other economies, and Section 6 presents our method and results concerning the analyses of differences across time and countries. Section 7 concludes.

2. Central Planning, Market Reforms, and Implications for 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.[2] Enterprises had strong

[2] For a comprehensive overview of the socialist system and early partial reforms, see Kornai (1992). The term "centrally planned" is a partial misnomer, because not every economic decision was set centrally, but we use it as a convenient label. Also note that some decentralizing reforms were adopted under the rubric of *perestroika* from late 1988, complicating matters further, but these reforms were partial and tentative,

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. Thus, the usual factors that might be supposed to influence reallocation and productivity were largely absent.

The entry of new enterprises and shutdown of existing entities were determined solely by planners. For continuing enterprises, new capital investments and technologies were among the most tightly planned activities, both due to the priority placed on impressive projects and because of the need to stanch enterprises' perpetual "investment hunger" (Kornai, 1992). Concerning employment, worker mobility was restricted by a number of practices, and enterprises had rather little discretion in their decisions on employment.[3] 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 wage rates according to just a few criteria, such as occupation and industry. There were also constraints on the ability of enterprises to fire workers, although layoffs were not completely unknown. Arguably, however, the constraints on employment were due more to the planners' fear of excessive hiring than of unemployment, as a number of factors—including soft budget constraints, planned output targets, and unreliable input supplies—combined to produce excess demand for labor (Kornai, 1992).

How well did the socialist planners do in allocating resources across alternative uses? Frequently the objectives of the plan included political objectives, among them the prestige of rapid industrialization and of large, impressive projects, but the planners were also concerned with output and thus with productive efficiency. Besides having to overcome the political objectives and the whims of the Communist Party leaders, however, a major problem in implementing the efficiency objective was lack of information, itself due to inherent features of the system: fixed prices and wages, and perverse incentives discouraging innovation and revelation of information on productive capacities.

This discussion implies that the incentives and frictions of the socialist system might create very different patterns of reallocation and productivity compared to those that have been documented in developed market economies. Planners had many concerns other than efficiency, and even if they devoted some effort to reallocating resources from lower productivity to higher productivity enterprises, lack of information would have hindered them from doing so. Thus, while it seems unlikely that the planners would have been very successful, how they actually performed is an empirical question—a very interesting one that we can address with our data.

Turning to the transition, the factors affecting reallocation and productivity would seem to be quite different from those under central planning. New enterprises can be started up by entrepreneurs, and old ones can be shut down by their owners. The reduction of constraints on hiring, firing, and investment leaves enterprises free to choose their own employment levels in principle, as liberalization more broadly permits

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paling compared with the later transformation of policies; moreover our data suggest that the "Soviet period" of 1985-1991 was relatively homogeneous compared with the dramatic changes in behavior that occurred subsequently.

[3] 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).

enterprises—even those remaining in state ownership—to make most decisions autonomously and provides some incentives to do so. The extent to which enterprises actually adjust and improve productivity in response to changes in their environment, however, is likely to be a function of such factors as the strength of competitive pressures, the objectives of the state or new owners, the effectiveness of corporate governance by the owners, and the information conveyed by prices and wages. These factors in turn are influenced by the specific policies of liberalization, privatization, and stabilization that were adopted to initiate the transition to a market economy (e.g., Lipton and Sachs, 1990; Blanchard et al., 1991).

The four countries we study in this paper cover the spectrum of transition economies, 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, forex 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 highest among transition economies since 1994. As shown in Figure X, 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.

Regardless of the exact figures, which are certainly subject to measurement errors and disputes, the clearly different pattern of policy choices in the four countries suggests an interesting set of comparative hypotheses. If a quicker and more effective implementation of transitional policies tends to stimulate productivity-enhancing reallocation, then Hungary's ambitious policy is likely to be reflected in the fastest increase in the contribution of this factor to productivity growth. Ukraine's should be slowest to emerge, but it's reallocation effect should converge with that in Romania and Russia by the late 1990s.[4]

A final consideration concerns the institutional environment. Despite the rapid pace of liberalization in Romania, Russia, and Ukraine, many observers have noted continued government intervention that may slow productivity-enhancing reallocation. For instance, there have been frequent instances of direct subsidization and other forms of support for weak and failing enterprises, while discriminatory taxes, bureaucratic interference, poor contract enforcement, and uncertain property rights protection have impeded those that are more successful (e.g., Frye and Shleifer, 1997; Aslund, Boone, and Johnson, 1996). This suggests that these countries could be subject to "sclerosis" (Caballero and Hammour, 1996), in which less productive resources remain employed

[4] An alternative possibility is that more cautious, gradual policies are more successful at stimulating productive reallocation, and that overly rushed transitional programs lead to unemployment rather than genuine reallocation, as in the literature on the optimal speed of transition (see, e.g., Aghion and Blanchard, 1994; Boeri and Terrell, 2002), or in Caballero and Hammour's (1996) discussion of "hyperkinesis." We discuss the possibility that resource flows are either unassociated or negatively associated with productivity growth below.

due to market imperfections and government policies, while the creation of more productive matches of resources and enterprises is impeded.

3. Data

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.

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 1A 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 1B, the Ukrainian coverage is pretty 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

[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 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.

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 traditional 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.

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 sector average, it is important to have several 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 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. Only in Romania does firm heterogeneity in efficiency not rise.

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

[7] We define traditional firms as ones 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.

[8] Average employment and output decline in traditional firm samples as well, but the Hungarian, Romanian, and Ukrainian declines are much smaller than they are when using full samples.

Soviet-era production associations or that belong to multi-establishment firms were also excluded in Russia.[9]

4. Measurement Procedures

Our basic approach is to first compute firm-level labor (LP) productivity measures,[10] calculated as the log of gross output divided by number of employees. We aggregate them into a constructed aggregate productivity for each year and industry, and then decompose them using techniques developed by Foster, et al. (2001), hereafter referred to as FHK. We then further decompose the effect of reallocation on productivity growth into reallocation volume, productivity dispersion, and the correlation between reallocation and productivity differentials. This section lays out our procedures in detail.

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.

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

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

The 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.

FHK's method II decomposes aggregate sectoral productivity as follows:

$$\Delta P_{it} = \sum_{e \in C} \bar{s}_e \Delta p_{et} + \sum_{e \in C} (\bar{p}_e - \bar{P}_i) \Delta s_{et} + \sum_{e \in N} s_{et} (p_{et} - \bar{P}_i) - \sum_{e \in X} s_{et-1} (p_{et-1} - \bar{P}_i). \tag{3}$$

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[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.

[10] Though the datasets contain the book value of fixed assets, it is measured with considerable error.

Unlike method I, method II holds the share constant at the average of first and last year values in the within term, and productivity differentials are calculated using averages of first and last year productivity. There is no cross term. As Foster, et al. (2001) discuss, method I has the advantage of making a clearer distinction between the within and reallocation effects, since with time averaging the within term is influenced by changes in firm shares over time, and the reallocation terms is affected by changes in productivity over time. The correlation between changes in productivity and changes in employment share could be spurious in the presence of measurement error in employment shares and relative productivity levels in the base year, however. Since measurement error is a particular concern in the transition economy context, we display method II decompositions as well.

A third decomposition we have considered is the Olley and Pakes (1996) cross-sectional decomposition of productivity (OP), where aggregate productivity is divided into unweighted average productivity and the covariance of the difference between firms' employment shares and the sector average and the difference between firms' productivity and the sector average. By differencing the components of the decomposition over time, one can calculate within-firm and reallocation contributions to productivity growth. This approach is attractive in its simplicity, but it attributes some activities to within effects that the other decompositions treat as reallocation effects and vice versa. If two firms switch ranks in the productivity distribution, while keeping their employment shares the same, this is a reallocation effect in OP and a within-firm effect in the two FHK decompositions. When a larger than average firm with above-average productivity splits into two smaller than average firms with the same positive productivity differential the parent had, this shows up as a negative reallocation effect and positive within-firm effect with OP and as no effect in the FHK decompositions. OP treats exit by a smaller than average and below-average productivity firm 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. Since the FHK decompositions treat each of these cases in a more rational way, we have chosen not to show OP results here.

5. Productivity Decomposition Results

We begin by documenting aggregate industrial output and labor productivity trends in our four countries. As shown in Figure 2, output declines significantly at the start of market reform. It both falls most sharply and begins to recover more quickly in Hungary and Romania. Ukraine experiences the most gradual output fall. Only Romania has multiple cycles: its output declines a second time during its recession in the late 1990s. Figure 3 shows a similar picture for labor productivity growth, with the only difference being that productivity begins to recover sooner than output. Hungary achieves the largest productivity gains.

Annual manufacturing job reallocation rates in developed market economies are typically between 15-25 percent.[11] 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 4. Reallocation rates jump once reforms start, reaching similar levels to those in

[11] See, for example, OECD (1994).

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.

We next show trends in the components of the reallocation contribution to productivity growth. Figure 5 shows the standard deviation of employment share changes across two-year pairs, 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, and first Romania, then Russia and Ukraine converge on the Hungarian level.

Figure 6 presents productivity dispersion using average productivity across year pairs. 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, while Romania's rises only slightly. Dispersion rises during periods when output falls, then levels off as the economies recover. Russia and Ukraine, the countries with the longest periods of output decline, 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 7 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 year pairs is displayed in Figure 8. The Russian correlation is around zero prior to the transition, and then it jumps significantly in the first transition year. Though declining in the later period, the correlation generally remains more positive than prior to the transition. The distinction between Hungary's pre- vs. post-reform correlations is less clear, and it is close to zero after 1992. Romania experiences a large fall in correlation, while Ukraine's is high with little trend throughout the transition.

Table 3 focuses on the ingredients of the net entry component. Entry and exit account for a significant proportion of activity, creating the potential for the net entry 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. has the lowest entry. Despite the fact that the Russian database doesn't cover all de novo activity, we still observe quite a bit of firm turnover there. Except in Russia, entrants have markedly higher productivity than exitors, which should produce a positive net entry contribution to productivity growth. This differential is highest in Hungary, followed closely by Romania and Ukraine. Only in Ukraine is the productivity of entrants higher than that of continuers in the end year. The entry-exit gap is larger than stayers' productivity growth in the U.S., the U.K., and Ukraine, so we should expect a larger proportion of productivity growth to come from net entry than its share of activity in those countries. Survivors' productivity growth is bigger than the entrant-exit gap in Hungary and Romania, however, suggesting a less than proportionate contribution from net entry.

When considering the ingredients for productivity-enhancing reallocation together, it appears that the effect should be stronger post-reform than during the Socialist period in Russia. The effect could be either higher or lower in Hungary after reform, depending on whether the reallocation volume and productivity dispersion increases outweigh the drop in correlation or not. Russia and Ukraine have a strong combination of ingredients in the later transition, so we should expect particularly large reallocation effects there. To see if this is indeed the case, we now turn to the productivity growth decompositions.

We first show FHK method I and II labor productivity (output per worker) decompositions for the U.S. and U.K. from Foster, et al. (2001) and Disney, et al. (2003) so as to provide developed market economy benchmarks. Tables 4A and 4B show that the within-firm effect is dominant in the U.S., while reallocation is responsible for roughly half of productivity growth in the U.K. Nearly the entire reallocation effect comes from firm turnover, and this effect is quite volatile. It increases with the period covered, suggesting the presence of entrant selection (only the productive entrants survive) and/or learning (entrants' productivity grows over time). The method I between effect is less than three percent in both countries, and the method II between effect is less than one percent in the U.S. and negative in the U.K. The length of the time period doesn't have a systematic effect on the between term. The cross effect is always negative, indicating that downsizing firms are increasing productivity more.[12]

The between effect in Hungary's late Socialist period is on the high end of what we see in the U.S. and the U.K. It actually declines in the early transition, becoming negative in the method II decomposition (see Tables 4C and 4D). After 1992, when the economy starts to recover, the between effect becomes larger than in the U.S. or the U.K.[13] The cross term is negative like in the U.S. and U.K., except in the longest period decomposition. The net entry terms are very similar to those in the U.K.: volatile, larger in longer time periods, and of comparable magnitudes to the U.K. terms. Net entry accounts for 63 percent of productivity growth in 1990-2003. This is less than firm turnover's proportion of activity, though, as the Table 3 results suggested.[14]

Between-firm reallocation always provides a substantial productivity boost in Romania (Tables 4E and 4F), higher than in Hungary, the U.S., or the U.K., but the net entry effect is important only in the 1992-2004 decomposition. The cross term is always negative. There is no pronounced reallocation effect trend across time.

Russia's reallocation effect is virtually zero prior to the transition, but it becomes positive from the beginning of reform, driven by a sizeable between-firm reallocation term (Tables 4G and 4H). The net entry effect is negative in the early years and becomes increasingly positive, consistent with improved firm selection over time. It is actually negative in the 1992-2004 decomposition, however. The between-firm reallocation effect plateaus after the mid-1990's, and it is slightly lower than Romania's. Unlike in the countries discussed previously, the cross term is often positive.

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[12] Measurement error may also contribute to a negative cross effect.

[13] As a robustness check, we calculate post-1992 decompositions with just continuing firms, since we are unable to calculate the net entry effect prior to 1992. The between effect is of a similar magnitude, so the increase in the between effect post-reform is not due to inclusion of firm turnover in the later years.

[14] If there is a positive interaction effect between firm turnover and survivors' productivity growth, then the net entry effect could be understated, however. See Bartelsman, et al. (2004) for evidence of this.

Like in Russia, Ukraine's reallocation effect prior to the transition is tiny, and then it grows throughout the transition (see Tables 4I and 4J). Only the between effect contributes positively early on, but the net entry term rises sharply. As in the Russian decompositions, the cross term is often positive.

Hungary and Romania have larger reallocation effects during the early transition, while Russia and Ukraine have the bigger effects later on. When decomposing growth over the entire transition, we find that Hungary and Ukraine have similarly large reallocation effects, comparable to those in the U.K. in 1980-1992. Romania's reallocation effect is nearly as large. The Russian and U.S. effects are of about the same magnitude, only a fraction of the size of the others.[15] In the next section we investigate these differences in more detail.

6. Analysis of Reallocation Effect Differences Across Time and Countries

It would be useful to know the extent to which differences in the reallocation effect across time within sectors or between sectors or countries are due to differences in the correlation between productivity differentials and reallocation, reallocation volume, and productivity dispersion. The three terms in the FHK method II reallocation effect can be condensed into one, $\sum_e (\bar{p}_e - \bar{P}_i)\Delta s_{et}$, where entrants' productivity and change in share are their productivity and shares in the last year, and exitors' productivity and change in share are their productivity and the negative of their shares in the base year.[16] The difference in the reallocation effect between sector *i* and sector *j* can be decomposed in the following way:

$$\sum_e (\bar{p}_e - \bar{P}_i)\Delta s_{et} - \sum_f (\bar{p}_f - \bar{P}_j)\Delta s_{ft} =$$
$$.5\times\{Corr(\Delta s_{et}, \bar{p}_e - \bar{P}_i) + Corr(\Delta s_{ft}, \bar{p}_f - \bar{P}_j)\}\times[.5\times\{\sigma_{\bar{p}_e-\bar{P}_i} + \sigma_{\bar{p}_f-\bar{P}_j}\}\times\{N_i\sigma_{\Delta s_{et}} - N_j\sigma_{\Delta s_{ft}}\}] +$$
$$.5\times\{Corr(\Delta s_{et}, \bar{p}_e - \bar{P}_i) + Corr(\Delta s_{ft}, \bar{p}_f - \bar{P}_j)\}\times[.5\times\{N_i\sigma_{\Delta s_{et}} + N_j\sigma_{\Delta s_{ft}}\}\{\sigma_{\bar{p}_e-\bar{P}_i} - \sigma_{\bar{p}_f-\bar{P}_j}\}] +$$
$$.5\times\{N_i\sigma_{\Delta s_{et}}\sigma_{\bar{p}_e-\bar{P}_i} + N_j\sigma_{\Delta s_{ft}}\sigma_{\bar{p}_f-\bar{P}_j}\}\times\{Corr(\Delta s_{et}, \bar{p}_e - \bar{P}_i) - Corr(\Delta s_{ft}, \bar{p}_f - \bar{P}_j)\} \quad (4)$$

The first term is the reallocation volume effect, the second is the productivity dispersion effect, and the third is the reallocation-productivity correlation effect. 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). We also calculate the gap between the average reallocation effect difference between two groups using each group's own sector

[15] Since the Russian database covers de novo activity less well than those in the other countries, we have also calculated the decompositions using just traditional 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 traditional firms alone, especially over longer periods. Even with just traditional 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.

[16] Since the method I and II productivity growth decompositions yield similar results, we have chosen to decompose the reallocation effect of the simpler of the two methods.

employment shares and the average reallocation effect difference using the average of the sector employment shares, which we call the industry composition effect.

In one set of decompositions shown in Figures 9-12, we compare later periods to the earliest one for each country separately. A second set of decompositions in Figures 13-15 compares each country to Ukraine in 1992-1995, 1998-2001, and over the entire transition period.

The higher reallocation effect in Hungary in 1992-1995 and 1998-2001 relative to 1986-1989 is mainly due to greater reallocation volume, though increased productivity dispersion and change in industry composition also contribute. The fall in correlation between employment share change and productivity has a negative influence on the reallocation effect in each period relative to 1986-1989.

As in Hungary, Romania's employment share change-productivity correlation falls over time, which is why the reallocation effect is smaller in 1995-1998 and 1998-2001. This is despite an increase in reallocation volume and productivity dispersion.

In contrast to Hungary and Romania, Russia's employment share change-productivity correlation rises considerably over time, and this is the most important factor behind the increasing reallocation effect. Greater reallocation volume and productivity dispersion also contribute.

Higher reallocation volume is the biggest effect in Ukraine, though the correlation and productivity dispersion effects are also sizeable.

Turning to the cross-country decompositions, Figure 13 indicates that Hungary and Russia's larger reallocation effects compared to Ukraine in 1992-1995 are due mainly to a larger amount of reallocation, whereas Romania's advantage is equally due to higher employment share change-productivity correlation. The main reason for Ukraine's move from having the lowest to highest reallocation effect is that its correlation effect rises considerably relative to the other countries. Ukrainian productivity dispersion becomes larger, and though Hungary and Romania continue to have more reallocation, those gaps are sharply reduced.

Over the transition period as a whole, Ukraine's much larger correlation is balanced by Hungary's massive reallocation. Note that if Ukraine had Hungary's industrial composition, it would have a higher reallocation effect than Hungary. The Romania-Ukraine comparison is similar to the Hungary-Ukraine one, though with smaller magnitudes of both the correlation and reallocation volume gaps. Russia has both much lower correlation and reallocation. Productivity dispersion plays little role in the entire period decomposition.

7. Conclusion

This paper measures the contribution of employment reallocation to aggregate productivity growth using manufacturing census data in Hungary, Romania, Russia, and Ukraine. Between-firm reallocation provides a negligible contribution to productivity growth during the centrally planned period, but a substantial one after reform, much greater than in previous studies of the United States and United Kingdom. Firm turnover also makes a significant contribution to productivity growth. An increased volume of reallocation and greater productivity dispersion have contributed to the rise in the contribution of reallocation to productivity growth in all four countries. Increased

correlation between reallocation and productivity differentials is also an important factor in Russia and Ukraine, but it has fallen in Hungary and Romania.

Hungary and Romania's higher reallocation rates, particularly from firm turnover, relative to Russia and Ukraine are not a surprise, given that they have undergone more reform. Their much lower and decreasing reallocation-productivity correlation presents a puzzle, however. This is an interesting topic for future research.

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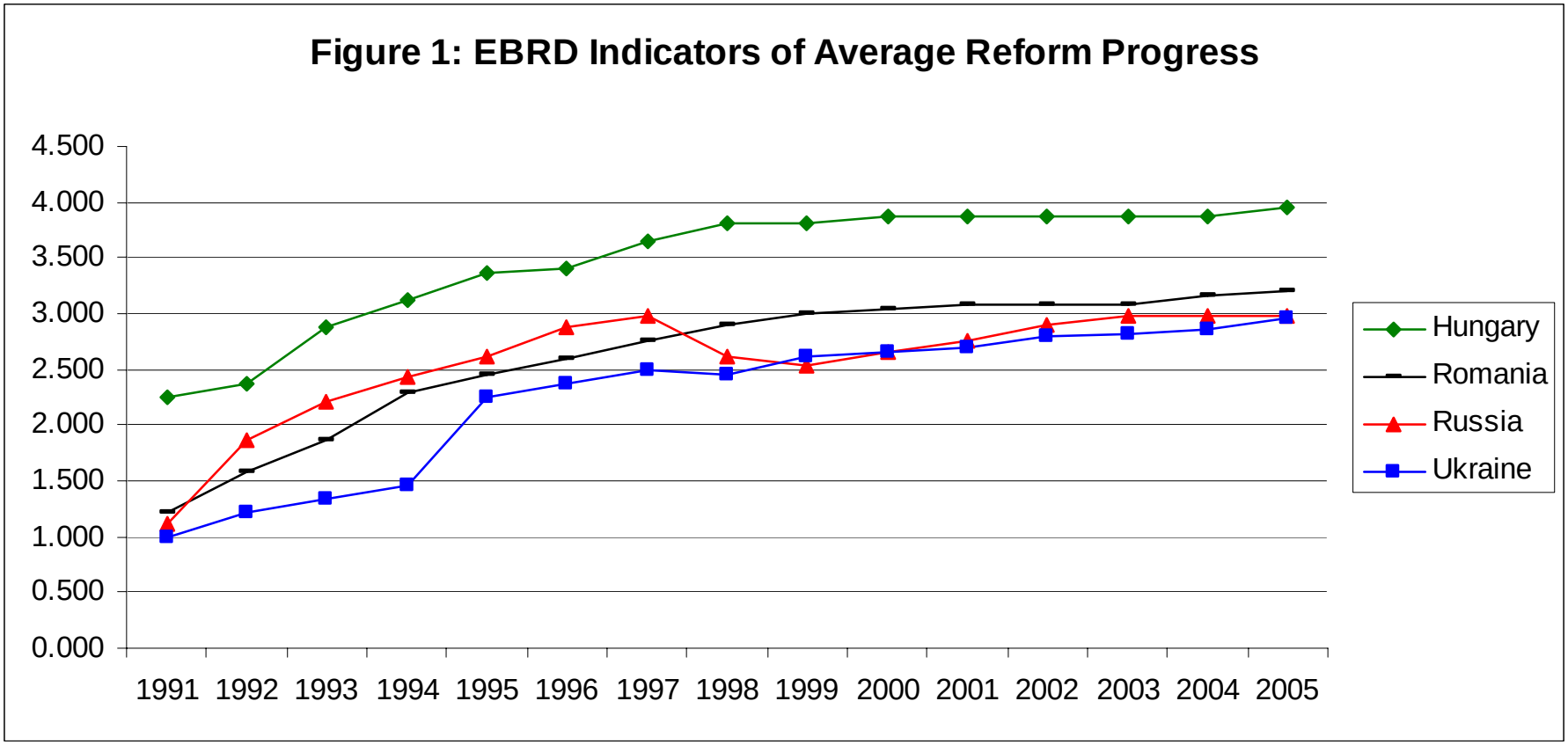
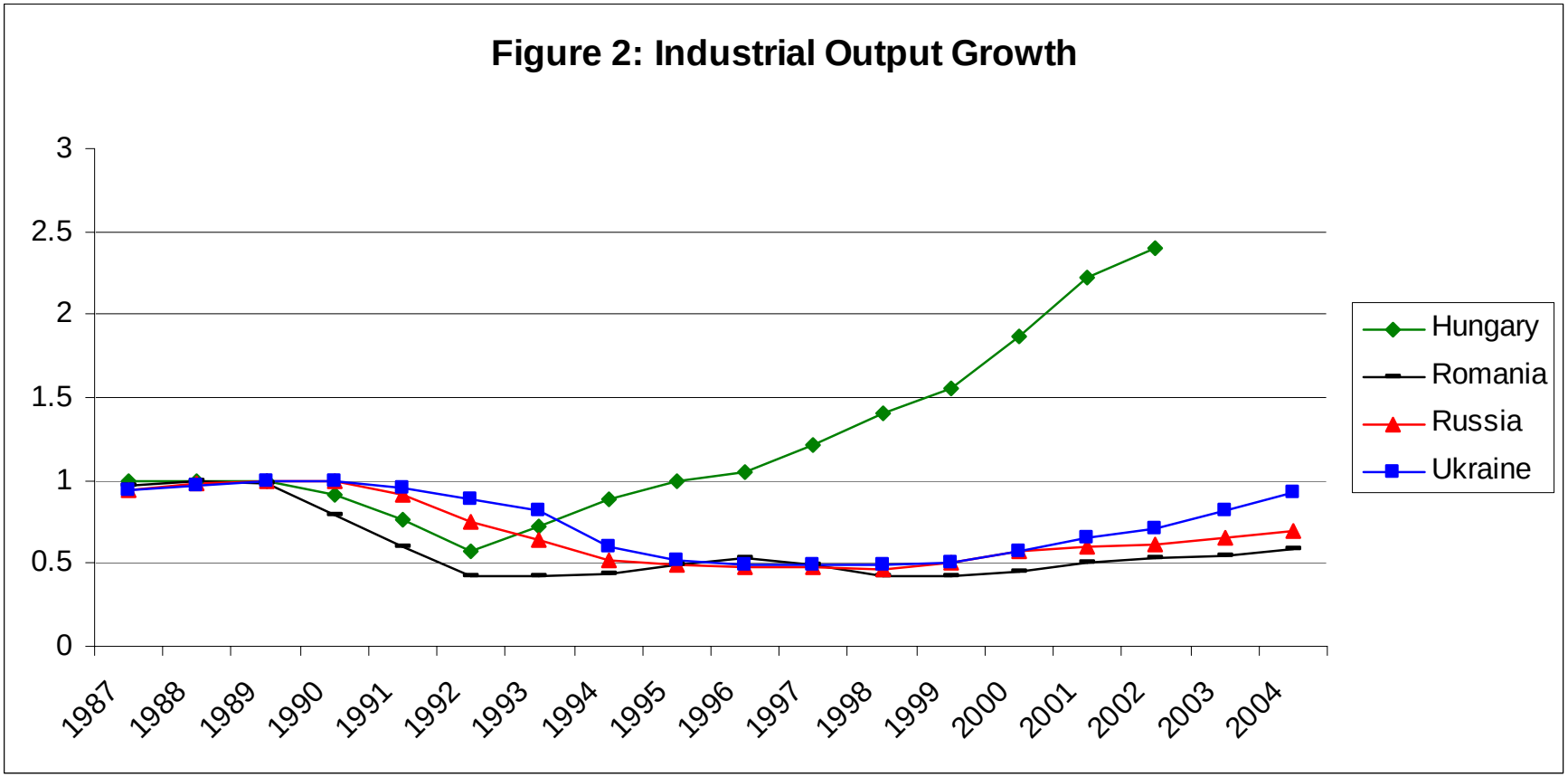


Figure 1: EBRD Indicators of Average Reform Progress
4.500
4.000
3.500
3.000
2.500
2.000
1.500
1.000
0.500
0.000
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
Hungary
Romania
Russia
Ukraine

Figure 2: Industrial Output Growth



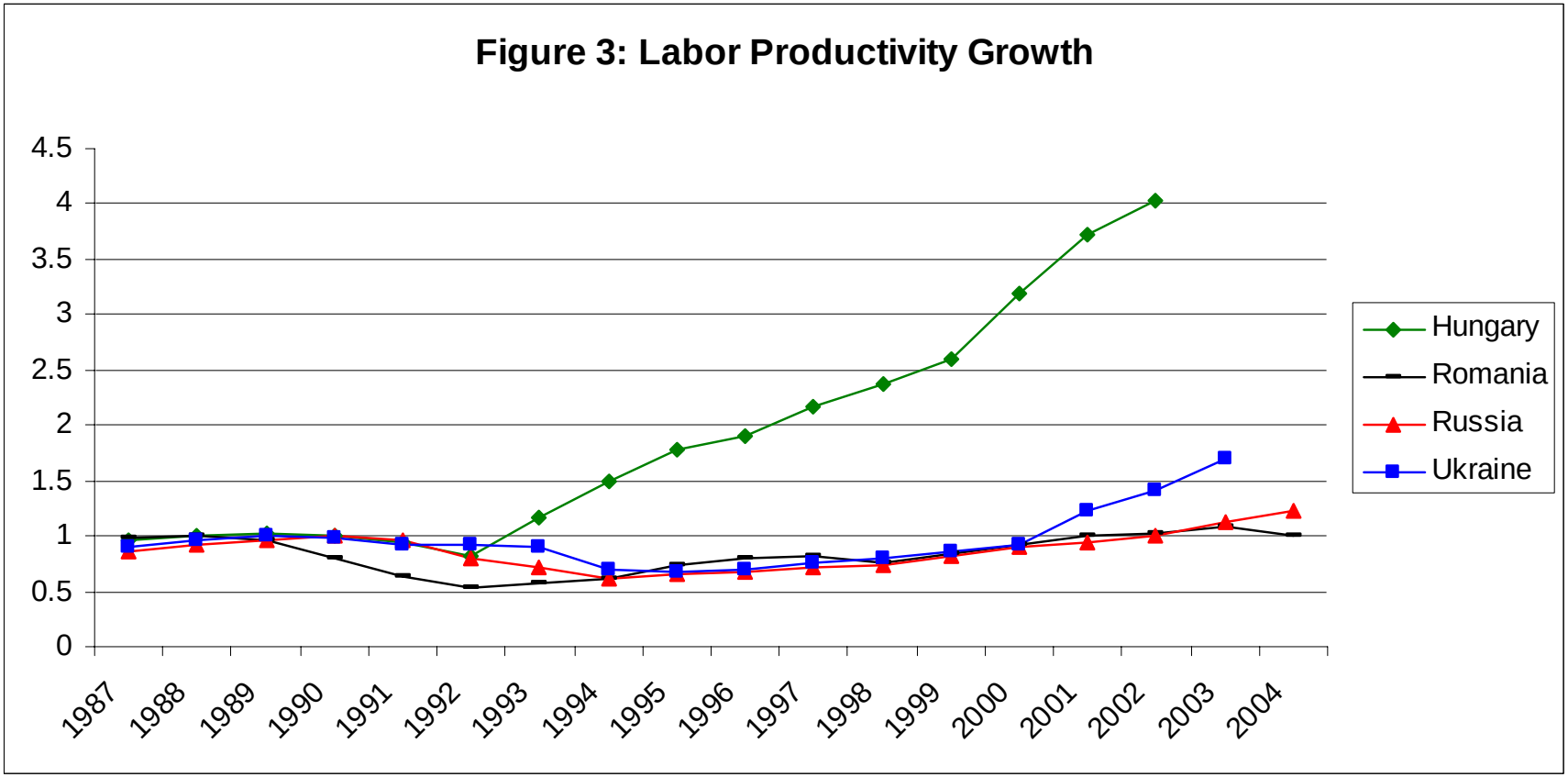


Figure 3: Labor Productivity Growth
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
Hungary
Romania
Russia
Ukraine

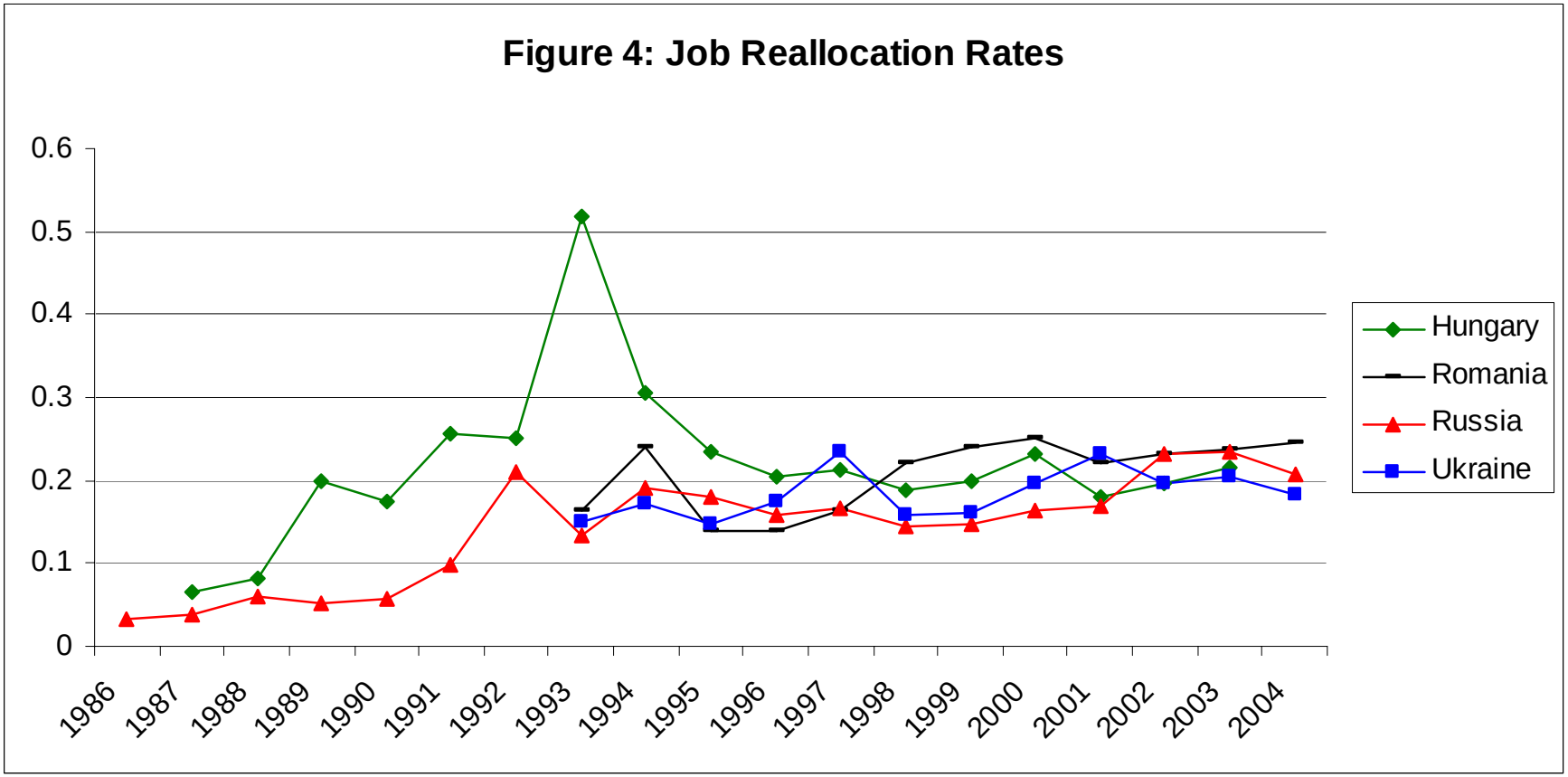
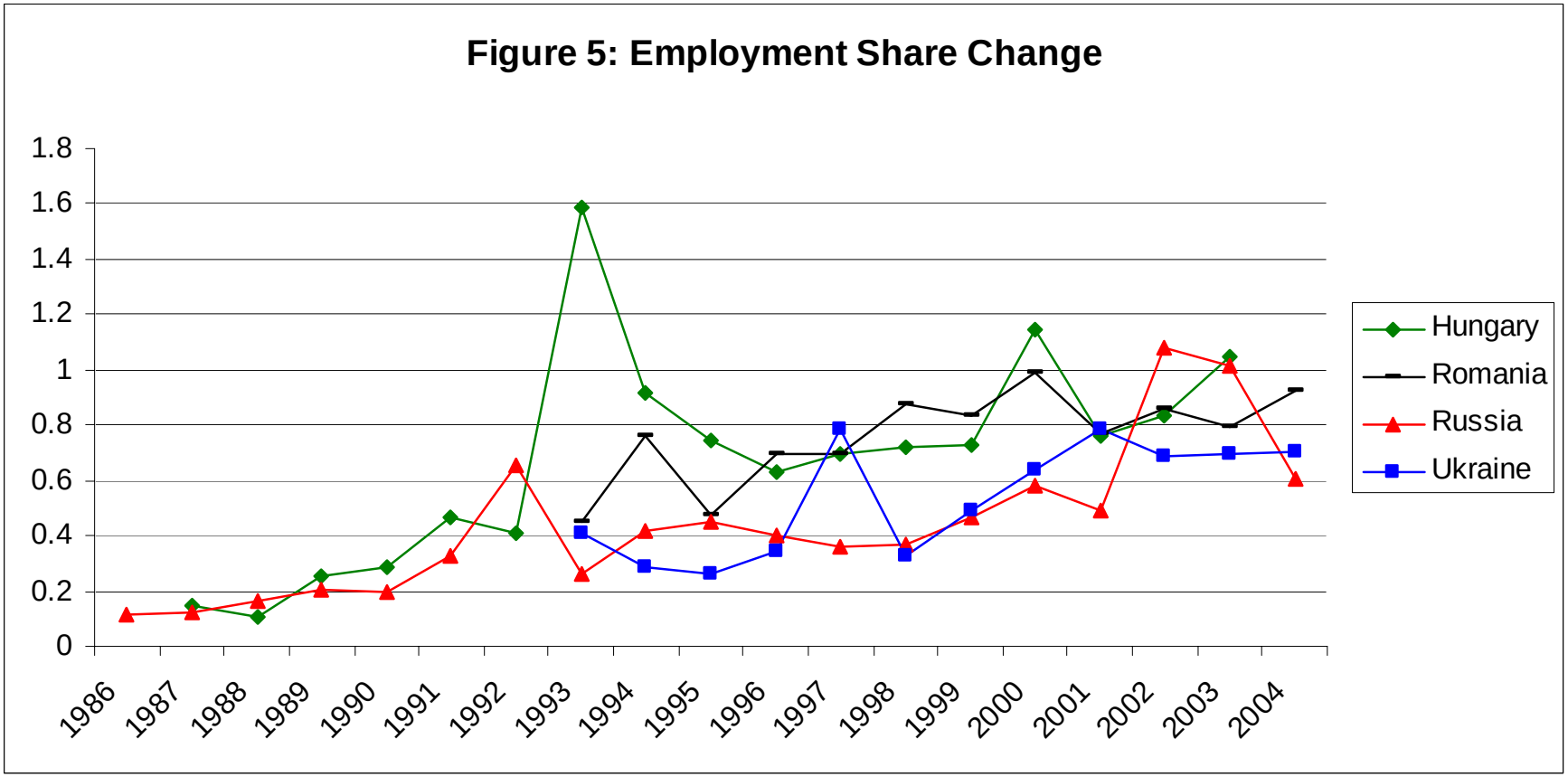


Figure 4: Job Reallocation Rates
0.6
0.5
0.4
0.3
0.2
0.1
0
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
Hungary
Romania
Russia
Ukraine

Figure 5: Employment Share Change



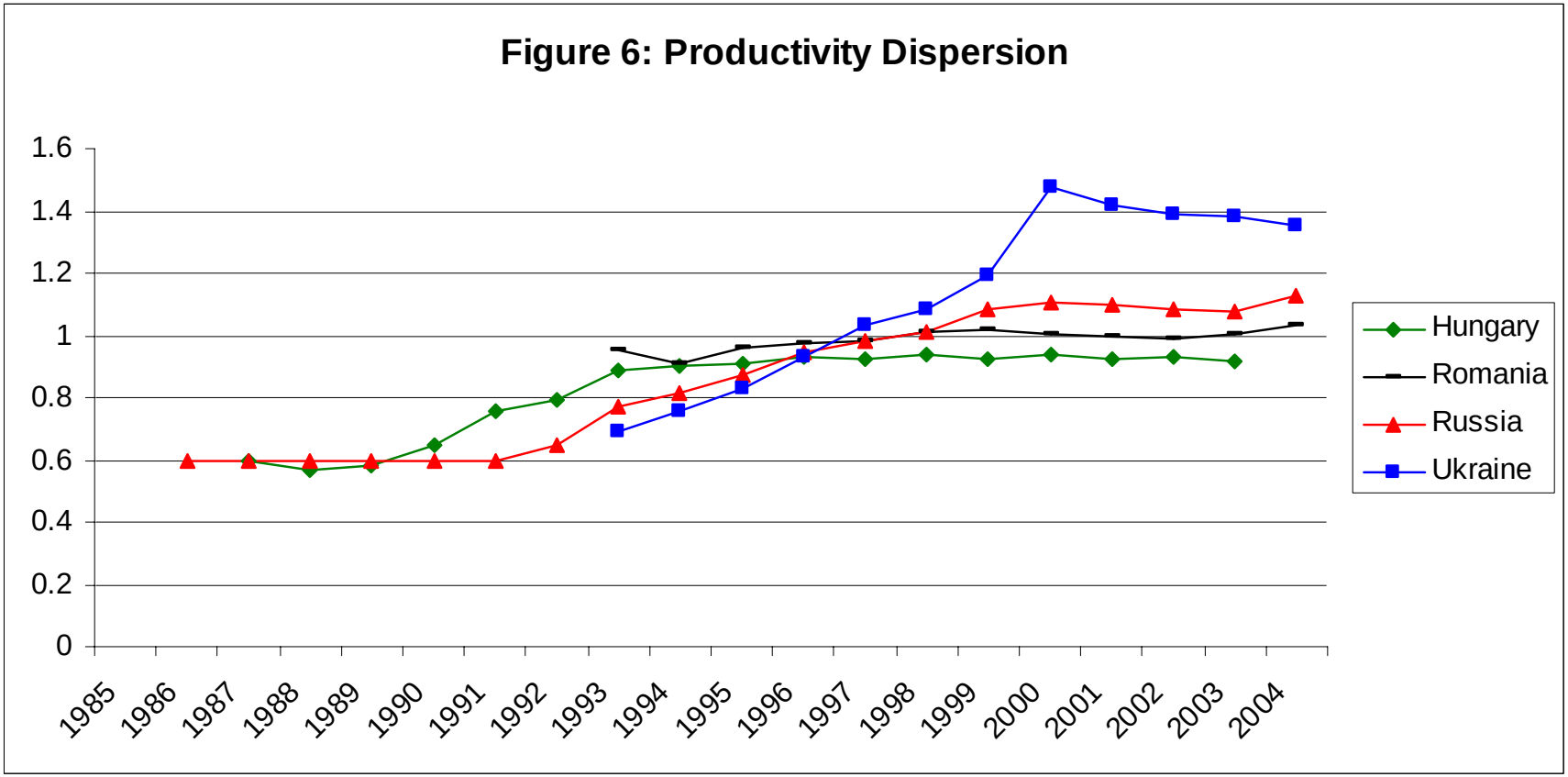


Figure 6: Productivity Dispersion
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
Hungary
Romania
Russia
Ukraine

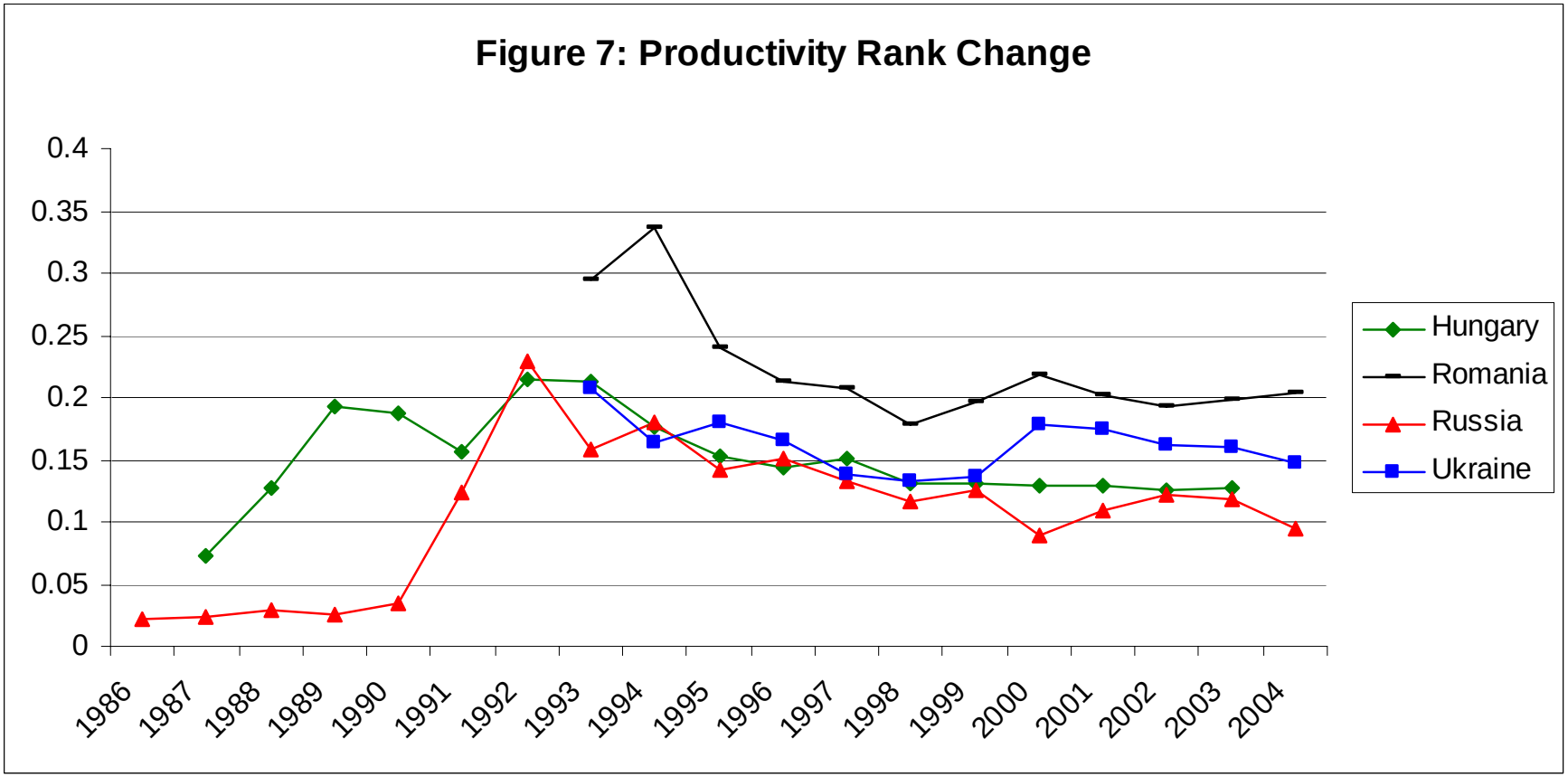


Figure 7: Productivity Rank Change
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
Hungary
Romania
Russia
Ukraine

Figure 8: Employment Share Change-Productivity Correlation

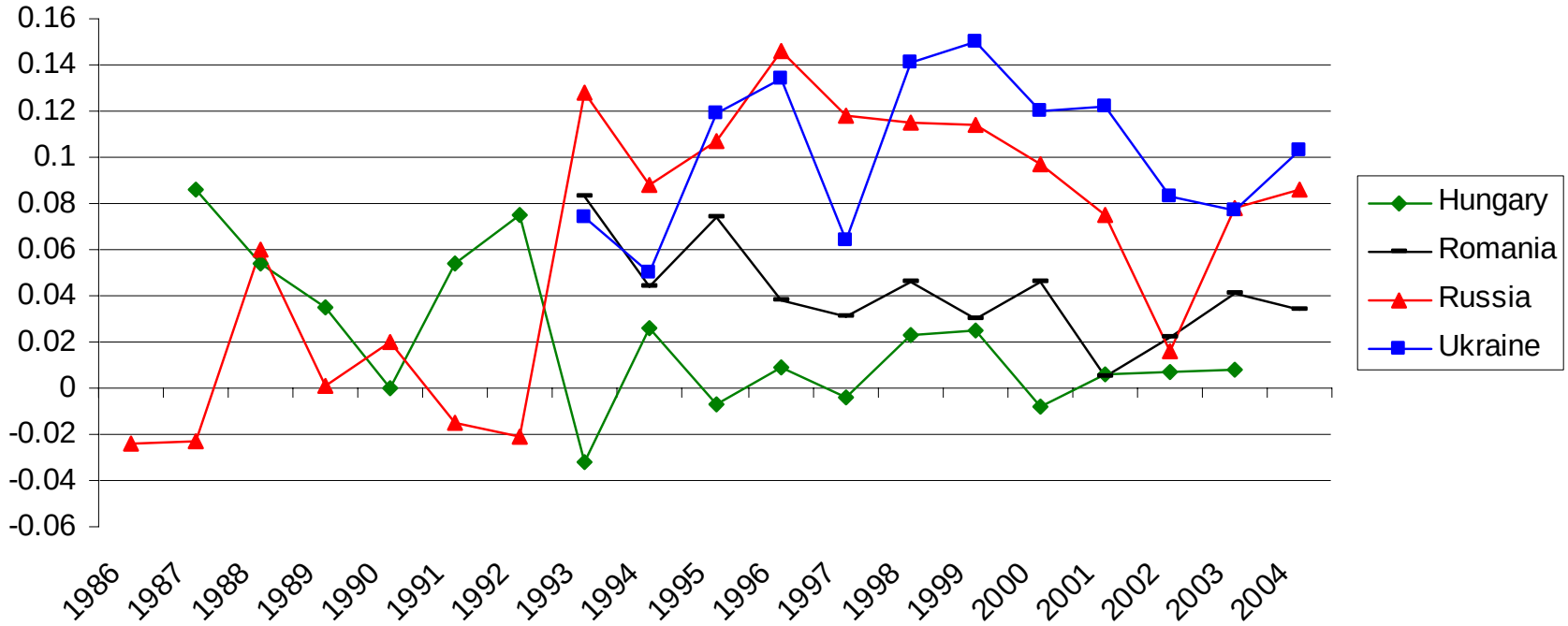


Figure 9: Hungarian Reallocation Effect Relative to 1986-1989 Decomposition

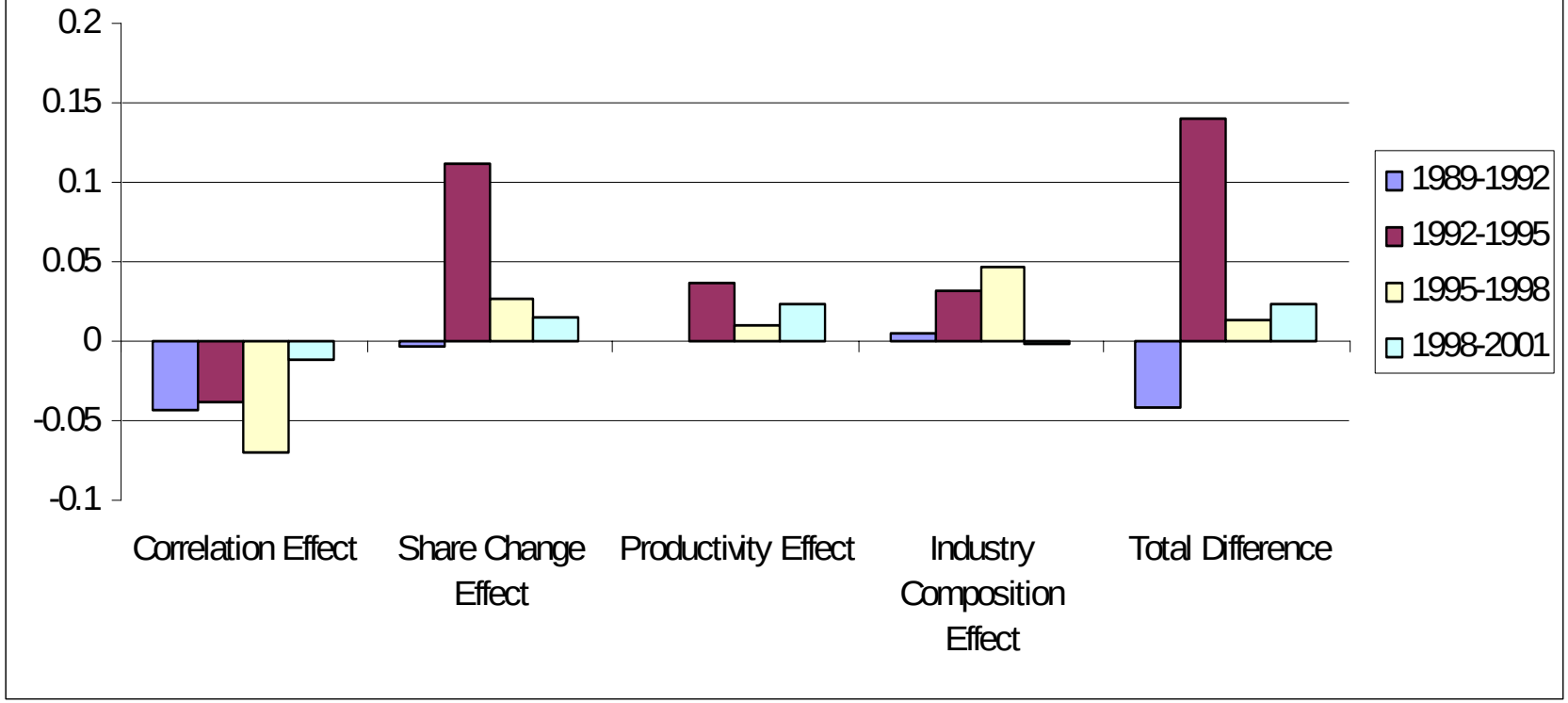


Figure 10: Romanian Reallocation Effect Relative to 1992-1995 Decomposition

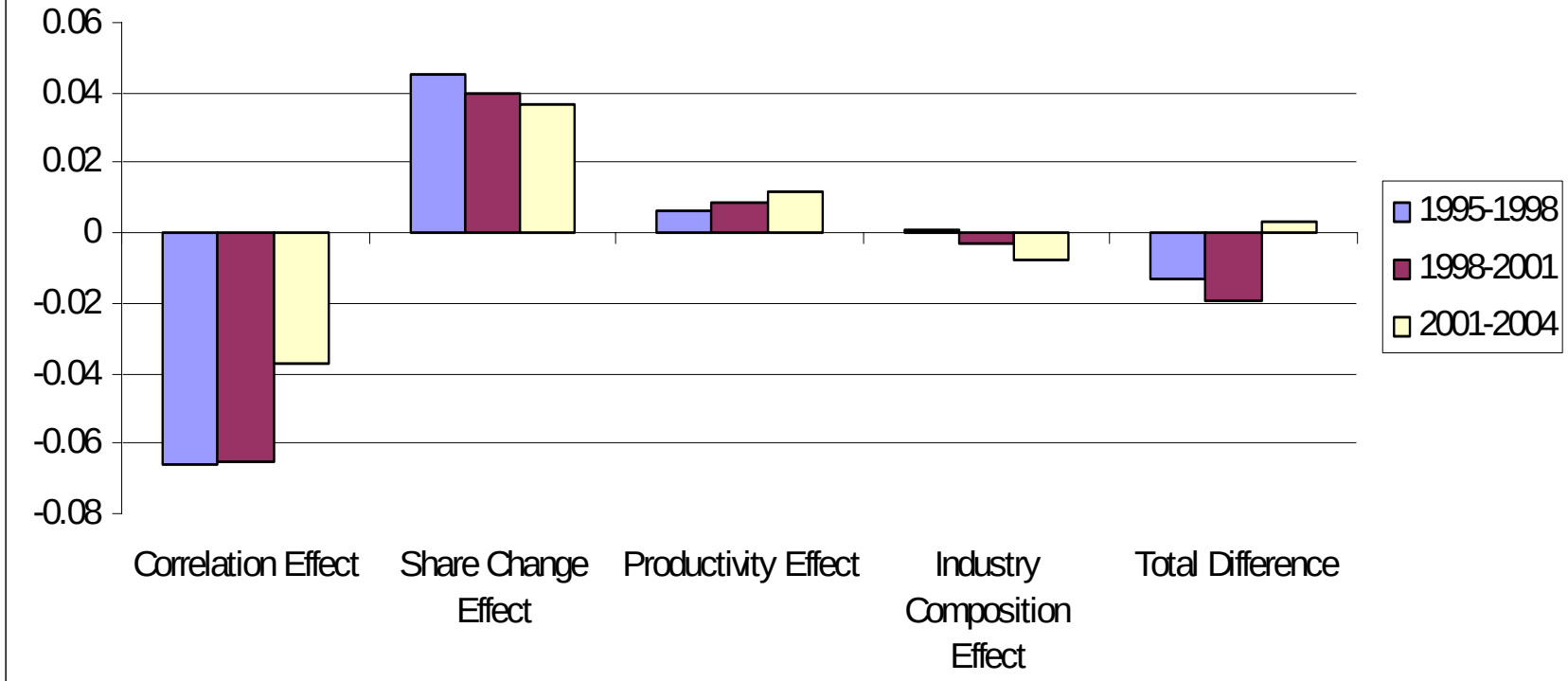


Figure 11: Russian Reallocation Effect Relative to 1986-1989 Decomposition

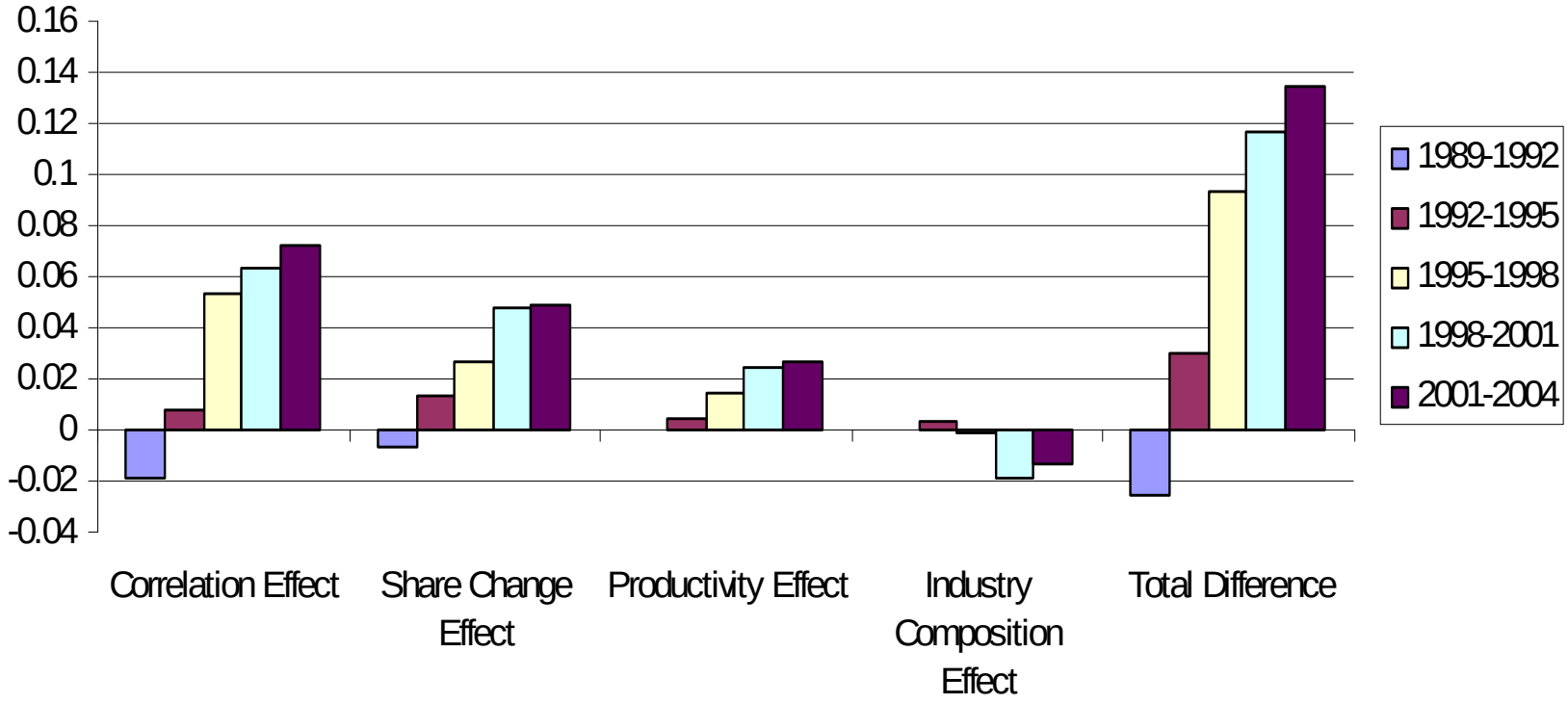


Figure 12: Ukrainian Reallocation Effect Relative to 1989-1992 Decomposition

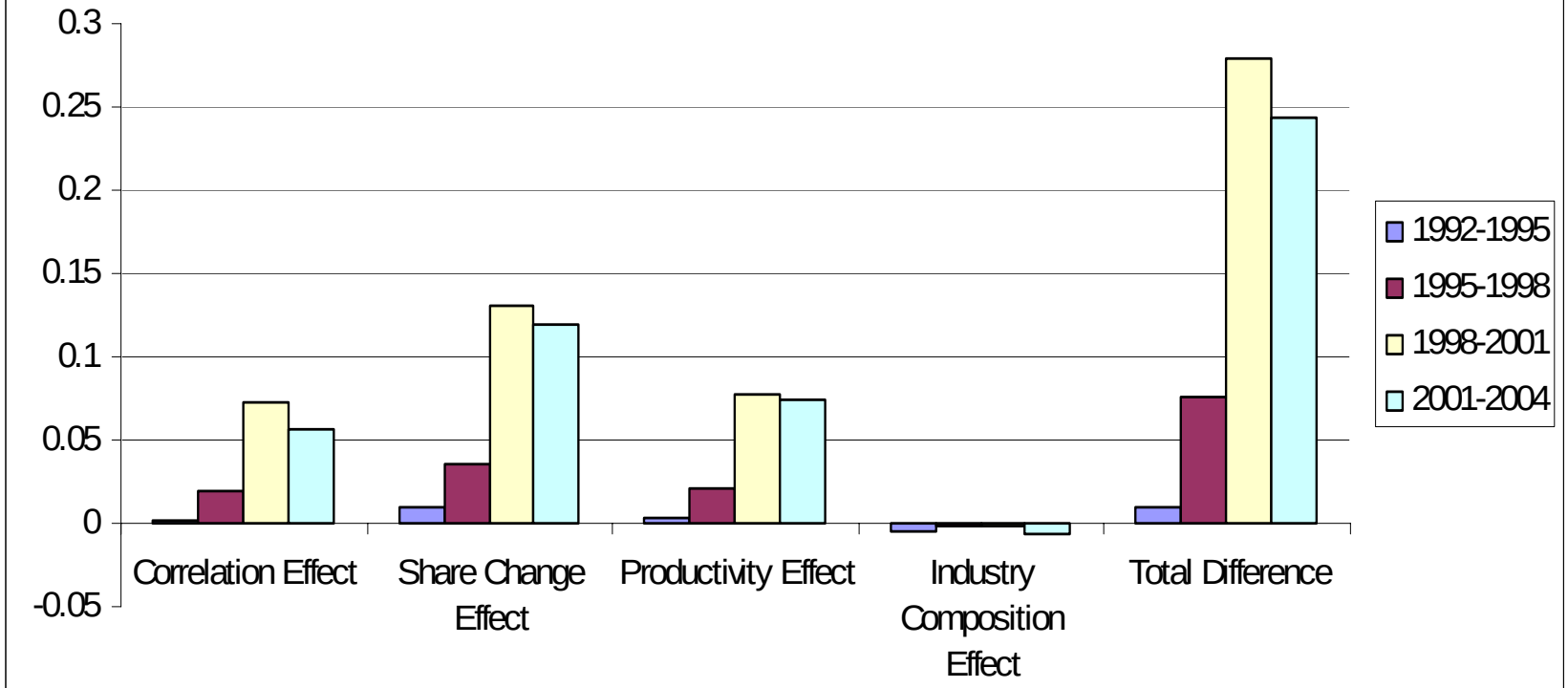


Figure 13: Reallocation Effect Decomposition in Ukraine Compared to Hungary, Romania, and Russia in 1992-1995

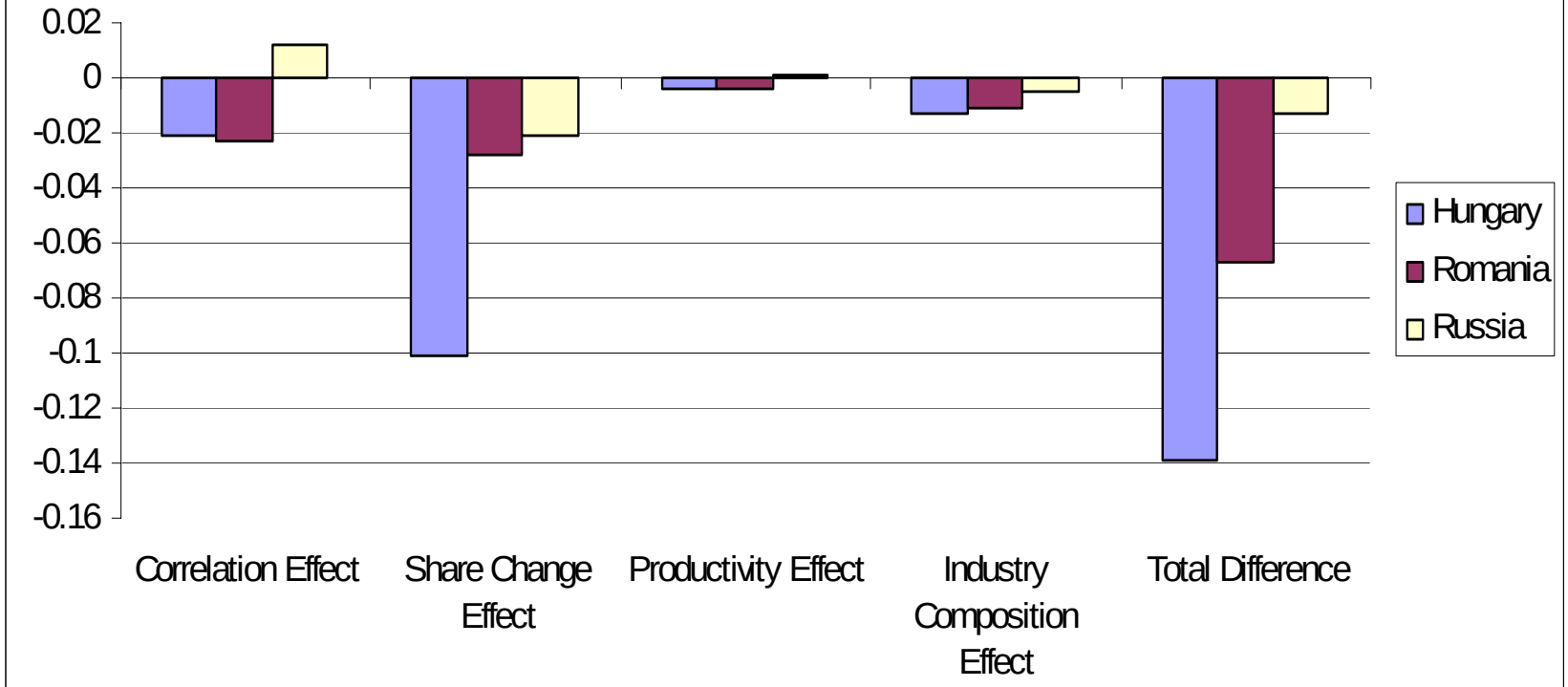


Figure 14: Reallocation Effect Decomposition in Ukraine in 1998-2001 Compared to Hungary, Romania, and Russia

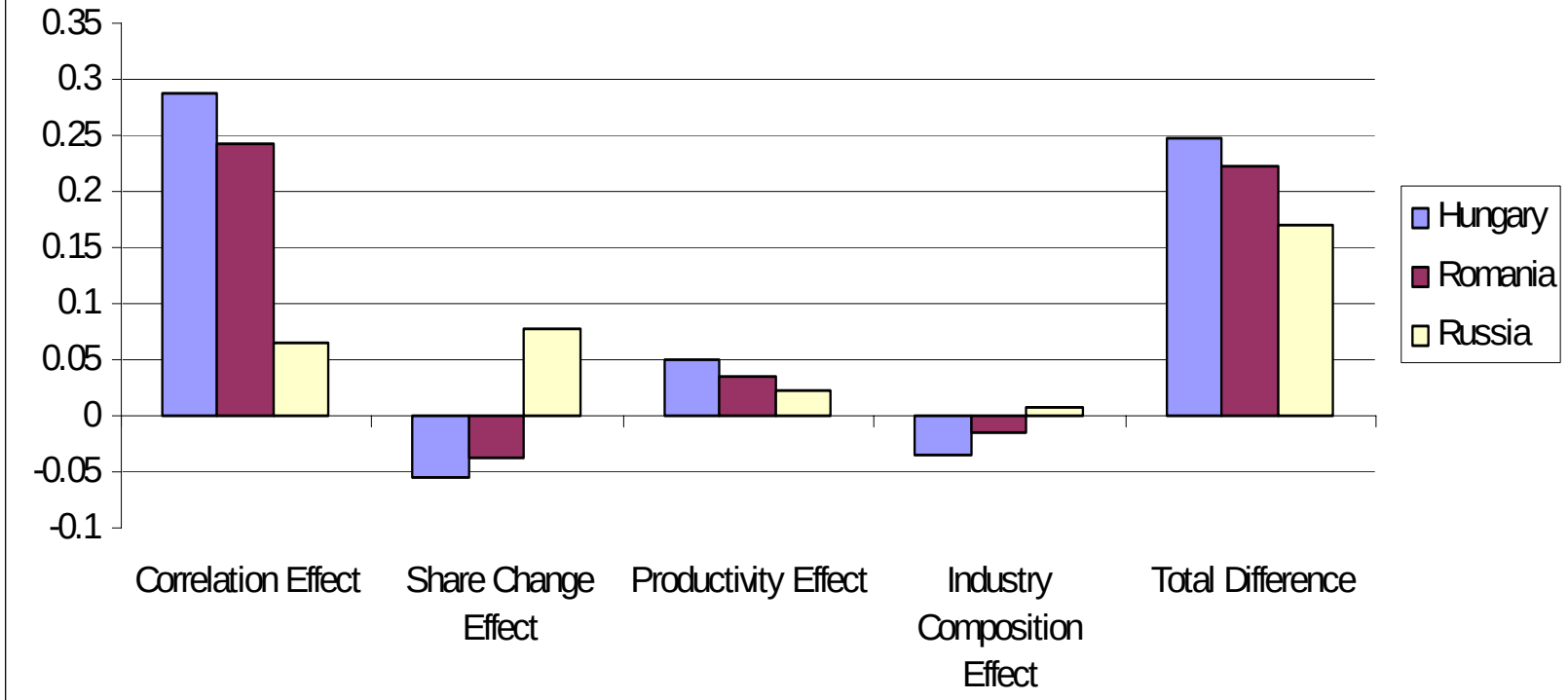


Figure 15: Reallocation Effect Decomposition Over the Entire Transition in Hungary Compared to Romania, Russia, and Ukraine

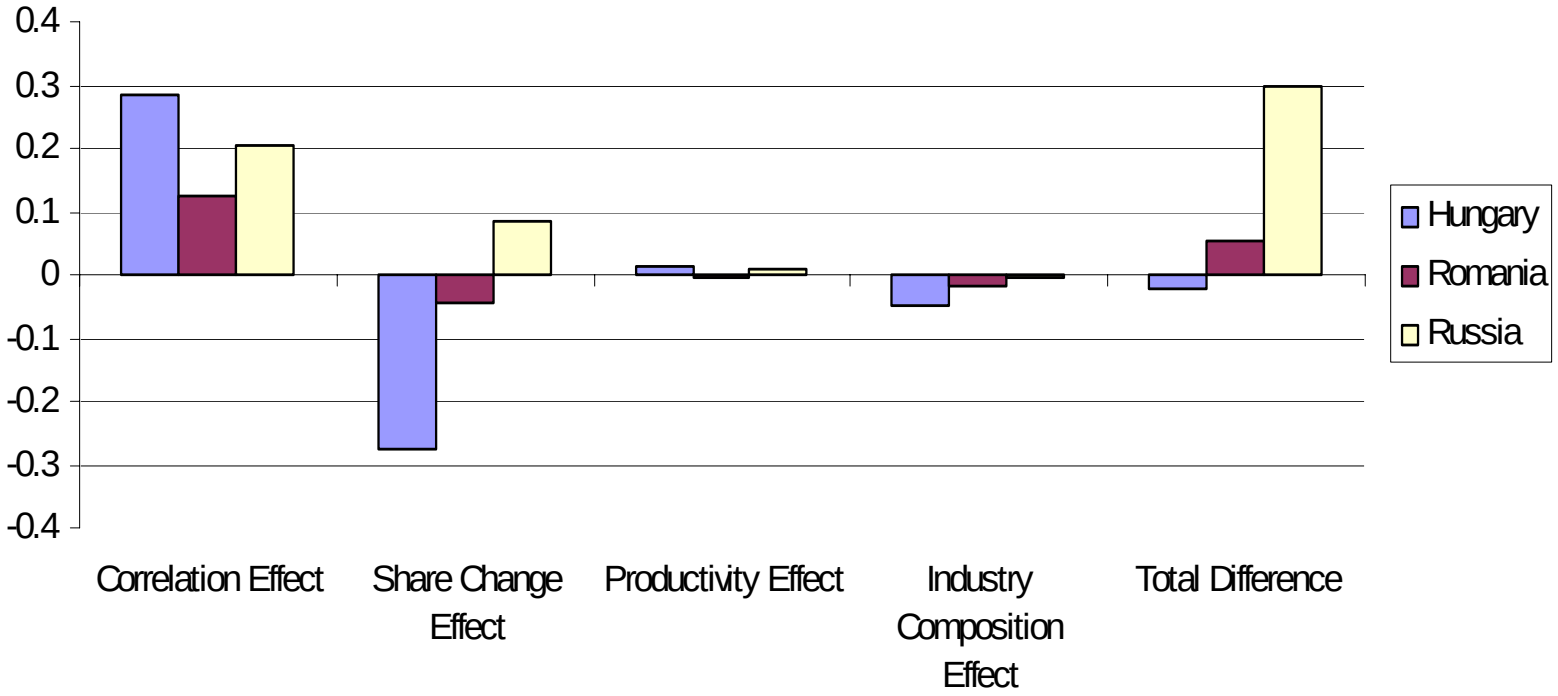


Table 1A: Hungarian and Romanian Sample Coverage

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 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. The 1992-2004 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 data cover 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 Labor Productivity in the First and Last Years of Analysis

	Employment		Output		Labor Productivity	
	First year	Last year	First year	Last year	First year	Last year
Hungary	586.7	29.5	3021.5	435.9	4.05	10.47
	(937.8)	(170.9)	(7936.3)	(6955.1)	(3.71)	(13.68)
Romania	236.0	41.4	87298.2	26955.1	485.8	526.9
	(1026.0)	(200.3)	(741739.1)	(451939.6)	(855.2)	(809.3)
Russia	786.3	368.8	392.9	246.8	0.49	0.51
	(2262.3)	(1454.9)	(1126.1)	(1412.1)	(0.49)	(0.89)
Ukraine	787.5	89.8	42.0	9.0	0.050	0.093
	(1870.6)	(750.9)	(132.6)	(93.5)	(0.054)	(0.208)

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, and millions of ROL for Romania, millions of RUB for Russia, and millions UAH for Ukraine). Standard deviations are shown in parentheses.

Table 3: Exit and Entry

		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
U.K.	1980-1992	0.50	0.42	0.89	1.28	1.00	1.32
Hungary	1990-2003	0.66	0.81	0.86	1.53	1.00	1.69
Romania	1992-2004	0.14	0.49	0.88	1.49	1.00	1.69
Russia	1992-2004	0.44	0.35	0.84	0.78	1.00	0.94
Ukraine	1992-2004	0.20	0.44	0.92	1.42	1.00	1.37

Note: The U.S. figures come from Foster, et al. (2001), and the U.K. results are from Disney, et al. (2003). The U.S. and U.K. numbers are based on establishment-level data for the manufacturing sector. Labor productivity is measured as the log ratio of output per employee, and the averages are employment-weighted.

Table 4A: U.S. and U.K. FHK Method 1 Decompositions

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
U.K.	1982-1989	38.38	24.56	0.00	-2.69	16.50
U.K.	1989-1992	7.25	4.42	0.36	-0.65	3.12
U.K.	1980-1992	70.17	33.68	2.81	-0.70	34.38

Note: These are labor productivity decompositions weighted by employment, where labor is measured by number of employees. They apply Equation (2) in the text. These are establishment-level data for the manufacturing sector. The numbers are our calculations based on U.S. results in Foster, et al. (2001) and U.K. results in Disney, et al. (2003).

Table 4B: U.S. and U.K. FHK Method 2 Decompositions

Country	Year	Total	Within	Between	Net Entry
U.S.	1977-1982	2.54	1.50	0.53	0.51
U.S.	1982-1987	18.67	14.00	0.56	3.92
U.S.	1987-1992	7.17	5.02	0.57	1.58
U.S.	1977-1987	23.02	15.88	0.23	6.91
U.K.	1982-1989	38.38	23.03	-1.54	16.50
U.K.	1989-1992	7.25	4.13	-0.29	3.48
U.K.	1980-1992	70.17	32.98	-0.70	37.19

Note: These are labor productivity decompositions weighted by employment, where labor is measured by number of employees. They apply Equation (2) in the text. These are establishment-level data for the manufacturing sector. The numbers are our calculations based on U.S. results in Foster, et al. (2001) and U.K. results in Disney, et al. (2003).

Table 4C: Hungarian FHK Method I Productivity Growth Decomposition

Year	Total	Within	Between	Cross	Net Entry
1986-1989	0.227	0.232	0.042	-0.048	n.a.
1989-1992	-0.429	-0.367	0.015	-0.077	n.a.
1992-1995	0.435	0.343	0.131	-0.134	0.095
1995-1998	0.109	0.107	0.061	-0.058	-0.001
1998-2001	0.222	0.202	0.045	-0.044	0.019
1986-1991	-0.043	0.005	0.034	-0.082	n.a.
1992-1997	0.510	0.389	0.112	-0.125	0.134
1998-2003	0.395	0.307	0.086	-0.042	0.045
1990-2003	0.583	0.169	-0.017	0.058	0.374

Note: The labor productivity figures show the results from applying Equation (2) in the text to firms in 28 industries by time period. The industry-level results are aggregated using annual average employment weights.

Table 4D: Hungarian FHK Method II Productivity Growth Decomposition

Year	Total	Within	Between	Net Entry
1986-1989	0.227	0.208	0.019	n.a.
1989-1992	-0.429	-0.406	-0.023	n.a.
1992-1995	0.435	0.277	0.070	0.089
1995-1998	0.109	0.078	0.032	-0.001
1998-2001	0.222	0.180	0.020	0.042
1986-1991	-0.043	-0.036	-0.007	n.a.
1992-1997	0.510	0.327	0.056	0.128
1998-2003	0.395	0.286	0.059	0.050
1990-2003	0.583	0.198	0.018	0.368

Note: The labor productivity figures show the results from applying Equation (3) in the text to firms in 28 industries by time period. The industry-level results are aggregated using annual average employment weights.

Table 4E: Romanian FHK Method II Productivity Growth Decomposition

Year	Total	Within	Between	Cross	Net Entry
1992-1995	0.296	0.224	0.086	-0.027	0.013
1995-1998	-0.046	-0.110	0.104	-0.018	-0.023
1998-2001	0.064	0.020	0.108	-0.044	-0.020
2001-2004	0.297	0.238	0.107	-0.060	0.013
1992-1997	0.275	0.173	0.088	-0.020	0.034
1999-2004	0.371	0.276	0.143	-0.079	0.030
1992-2004	0.702	0.450	0.086	-0.113	0.280

Note: The labor productivity figures show the results from applying Equation (2) in the text to firms in 28 industries by time period. The industry-level results are aggregated using annual average employment weights.

Table 4F: Romanian FHK Method II Productivity Growth Decomposition

Year	Total	Within	Between	Net Entry
1992-1995	0.296	0.220	0.082	0.004
1995-1998	-0.046	-0.119	0.096	-0.023
1998-2001	0.064	-0.002	0.090	-0.024
2001-2004	0.297	0.208	0.081	0.008
1992-1997	0.275	0.163	0.093	0.019
1999-2004	0.371	0.237	0.116	0.017
1992-2004	0.702	0.393	0.145	0.164

Note: The labor productivity figures show the results from applying Equation (3) in the text to firms in 28 industries by time period. The industry-level results are aggregated using annual average employment weights.

Table 4G: Russian FHK Method I Productivity Growth Decomposition

Year	Total	Within	Between	Cross	Net Entry
1986-1989	0.145	0.146	0.006	-0.006	-0.001
1989-1992	-0.213	-0.197	0.022	0.013	-0.051
1992-1995	-0.523	-0.575	0.055	0.039	-0.043
1995-1998	-0.099	-0.199	0.076	0.008	0.016
1998-2001	0.304	0.193	0.065	-0.016	0.062
2001-2004	0.189	0.067	0.068	-0.029	0.082
1985-1990	0.211	0.213	0.010	-0.012	0.000
1992-1997	-0.546	-0.651	0.071	0.059	-0.025
1999-2004	0.384	0.130	0.086	-0.015	0.184
1992-2004	-0.041	-0.112	0.072	0.014	-0.015

Note: The labor productivity figures show the results from applying Equation (2) in the text to firms in 28 industries by time period. The industry-level results are aggregated using annual average employment weights.

Table 4H: Russian FHK Method II Productivity Growth Decomposition

Year	Total	Within	Between	Net Entry
1986-1989	0.145	0.143	0.003	-0.001
1989-1992	-0.213	-0.190	0.015	-0.038
1992-1995	-0.523	-0.555	0.070	-0.038
1995-1998	-0.099	-0.195	0.081	0.015
1998-2001	0.304	0.185	0.061	0.058
2001-2004	0.189	0.053	0.055	0.081
1985-1990	0.211	0.207	0.005	-0.000
1992-1997	-0.546	-0.622	0.101	-0.026
1999-2004	0.384	0.122	0.073	0.189
1992-2004	-0.041	-0.105	0.081	-0.016

Note: The labor productivity figures show the results from applying Equation (3) in the text to firms in 28 industries by time period. The industry-level results are aggregated using annual average employment weights.

Table 4I: Ukrainian FHK Method I Productivity Growth Decomposition

Year	Total	Within	Between	Cross	Net Entry
1989-1992	-0.046	-0.060	0.005	0.010	n.a.
1992-1995	-0.725	-0.781	0.034	0.073	-0.052
1995-1998	-0.167	-0.282	0.056	0.060	-0.002
1998-2001	0.704	0.425	0.152	-0.020	0.147
2001-2004	0.463	0.218	0.174	-0.016	0.087
1992-1997	-0.906	-1.010	0.045	0.202	-0.143
1999-2004	1.128	0.593	0.344	-0.089	0.280
1992-2004	0.389	-0.058	0.066	0.170	0.211

Note: The labor productivity figures show the results from applying Equation (2) in the text to firms in 28 industries by time period. The industry-level results are aggregated using annual average employment weights.

Table 4J: Ukrainian FHK Method II Productivity Growth Decomposition

Year	Total	Within	Between	Net Entry
1989-1992	-0.046	-0.055	0.010	n.a.
1992-1995	-0.725	-0.744	0.047	-0.027
1995-1998	-0.167	-0.252	0.079	0.006
1998-2001	0.704	0.415	0.150	0.139
2001-2004	0.463	0.210	0.166	0.087
1992-1997	-0.906	-0.909	0.087	-0.083
1999-2004	1.128	0.549	0.284	0.295
1992-2004	0.389	0.027	0.189	0.173

Note: The labor productivity figures show the results from applying Equation (3) in the text to firms in 28 industries by time period. The industry-level results are aggregated using annual average employment weights.