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Economic Reforms and Productivity-Enhancing Reallocation in the Post-Soviet Transition

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How do economic reforms affect resource reallocation processes and their contributions to productivity growth? This paper studies the consequences of enterprise privatization and liberalization of product markets, labor markets, and imports in the former Soviet Republics of Russia and Ukraine. Analyzing interfirm reallocation of output, labor, capital, and an input index with annual industrial census data from 1985 to 2001, we find that Soviet Russia displayed low reallocation rates that bore little relationship to relative labor and multifactor productivity across firms. Since reforms began, resource flows have increased in both countries, and their contributions to aggregate productivity growth have become substantial both through increased flows from less productive to more productive continuing firms and through higher exits of less productive entities – i.e., through creative destruction. Among the policy-relevant factors that may explain firm-level variation, privatization is estimated to have positive effects on productivity-enhancing reallocation, but there is less evidence of such effects from domestic product market competition, labor market competition, or import penetration.

1. Introduction

Well-functioning market economies appear to exhibit rapid rates of resource reallocation across production units, a process with the potential to contribute significantly to economic growth. The empirical regularities of these processes have been extensively documented in studies of job reallocation, such as those by Dunne, Roberts, and Samuelson (1989a, 1989b) and Davis and Haltiwanger (1990, 1992, 1999). The relationship between reallocation and productivity has been analyzed by Baily, Hulten, and Campbell (1992), Bartelsman and Dhrymes (1998), and Foster, Haltiwanger, and Krizan (2001), among others.[1]

Whether the potential for productivity-enhancing reallocation is realized is likely to be a function of a number of factors. Existing theoretical models tend to emphasize frictions in product and factor markets (Caballero and Hammour, 1996, 2000), externalities associated with innovation (Aghion and Howitt, 1992), or the impact of international trade (Bernard et al., 2003; Melitz, 2003). An additional factor could be corporate governance that affects the responsiveness of a firm's reallocation decisions to its relative productivity. Addressing these issues empirically, however, has been impeded by difficulties in measuring such factors and by their limited variation in most data. Few studies have examined abrupt policy changes whose effects can be analyzed with pre- and post-policy data on the same set of business units.[2] Few studies have been able to measure the variation in policy-relevant variables at the firm level and to estimate their effects by relating the firm-level variation to aggregate growth.

This paper contributes to understanding the determinants of productivity-enhancing resource reallocation by analyzing microeconomic data from a remarkable quasi-experiment: the transition in the former Soviet Union. We study changes in the contributions of reallocation to productivity growth in Russia and Ukraine using consistent panel data from 1985 to 2001 that cover nearly the universe of industrial enterprises operating under Soviet socialism and their successor firms in the post-Soviet period. Although some of these enterprises have split up, spun off assets, exited, or merged with others, we are able to follow

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[1] Outside the U.S., job flow studies include Albaek and Sorensen (1998) on Denmark; Baldwin, Dunne, and Haltiwanger (1998) on Canada (in comparison with the U.S.); Levinsohn (1999) on Chile; and Roberts (1996) on Chile, Columbia, and Morocco. The effects of reallocation on productivity growth in countries other than the U.S. have been analyzed by Aw, Chen, and Roberts (2001) for Taiwan, Griliches and Regev (1995) for Israel, and Liu and Tybout (1996) for Chile and Columbia. Studies of transition economies are discussed below.

[2] The only exceptions appear to be Olley and Pakes (1996) on deregulation and productivity in the U.S. telecommunications equipment sector, and Tybout and Westbrook (1995) and Pavcnik (2002) on the effects of import liberalization on productivity growth in Mexico and Chile, respectively. The methods and results of these studies, which tend to find that liberalization raises productive reallocation, are discussed further below.

a set of producers that is quite consistent in composition and variable definitions across time and countries.

Our analysis exploits several sources of substantial variation in these data. First, the Soviet transition involved one of the most drastic shifts in economic policy during recorded history, as central planning and state control gave way to liberalized markets and private ownership within just a few years during the mid-1990s. Our 17 years of data permit us to compare behavior before and after these radical policy changes. How high were reallocation rates and how much did they contribute to productivity growth during the Soviet period? More recently, have the pace and productivity effects of reallocation become similar to those documented for mature market economies?

Secondly, the policy shifts took place at rather different rates in Russia and Ukraine, the two largest successor states of the Soviet Union. While sharing a common starting point in the Soviet period, Ukraine has by all accounts followed a more "gradualist" path of slower liberalization, privatization, and stabilization than its larger neighbor for most of the period since the end of 1991, when the Soviet Union split up. More recently, in the late 1990s, policy reforms in Ukraine appear to have been catching up, according to the aggregate statistics and the evaluations of international organizations. At the same time, the reform process in both countries has been heavily criticized. Do the different reform strategies result in differences in the pace of productivity-enhancing reallocation?

Thirdly, we analyze firm-level variation, within and across countries, in several policy-relevant variables: private ownership and competitive pressures from domestic product markets, labor markets, and imports from OECD, less developed, and CIS countries. Our motivation for examining privatization is the possibility of improved corporate governance leading to increased responsiveness of firms to their relative productivity levels, while increased competition in product and labor markets may either serve to discipline non-profit-maximizing managers or to induce reallocation among profit-maximizing firms operating in non-competitive markets (as in Bernard et al., 2003; or Melitz, 2003). Exploiting the considerable variation in the extent and timing of privatization and in the degree of import penetration and product and labor market concentration in our data, we develop procedures to relate the extent of productivity-enhancing reallocation to these firm- and industry-level variables, permitting an assessment of the interfirm reallocation patterns through which the policies of privatization and liberalization may affect aggregate productivity growth. Our analysis of privatization benefits from the fact that we observe firms for several years both before and after privatization took place, while our approach to

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the effects of liberalization involves an analysis of changes in the relationship between productivity-enhancing reallocation and the structure of product and labor markets. Have these economic reforms stimulated firms to engage in greater amounts of productive reallocation?

Finally, we consider all of these sources of variation simultaneously. The Soviet period provides a convenient baseline for considering the variation in microeconomic behavior, as we can assess any pre-privatization differences between firms that were later privatized and those that were to remain state-owned, and we can assess the extent to which product and labor market structure might have already been associated with productive reallocation under central planning. Considering the subsequent developments in Russia and Ukraine relative to this baseline, have privatization and liberalization had a bigger impact on the extent to which productivity growth is associated with resource reallocation in a country following a more rapid reform program? Or perhaps is it rather the gradualist strategy that makes private ownership and competitive markets function more effectively? These are the main questions considered in our analysis.

Our database is quite appropriate for addressing these questions. At the beginning of transition, in 1992, the data account for 90.5 percent of officially reported industrial employment in Russia and 94.1 percent in Ukraine. We have annual observations from 1985 to 2001 for the Russian firms and from 1992 to 2000 for those in Ukraine, permitting us to analyze the effects of reforms on a set of firms that we observe both before and after the policy changes. With respect to these firms, the data provide a nearly ideal setting for examining the effects of changes in economic institutions and policies on reallocation and productivity growth.[3] Not only are the data comparable across time, but also across countries. Both the scope and the variable definitions are essentially identical, as we have constructed the database from original data provided by the Russian and Ukrainian State Statistical Committees, which were branches of the same organization during the Soviet period and which still employ the same reporting methods as they did formerly. The data contain identical measurement concepts for employment, output, and industrial classification across the two countries, and they permit us to construct comparable measures of private ownership and product market and local labor market structure.[4] The earlier Russian data

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[3] The data are relatively weak in their ability to track small firms and exit and entry patterns. Comparing the pre- and post-transition periods also involves some measurement difficulties. Section 3 discusses these issues further and how we address them, together with a detailed description of the data sources and construction.

[4] Cross-country studies of job reallocation, for instance, are typically fraught with inconsistent definitions and measurement methods; see, e.g., the discussion of typical comparability problems and of the harmonization of

permit us to trace out longer-term changes from the pre-*perestroika* Soviet period into the transition; given that Ukraine was governed by the same economic and political regime as Russia, the 1985-92 behavior for Ukraine is unlikely to differ substantially from Russia's, although the earlier Ukrainian data are unavailable for study.

Our research builds on previous work for the U.S. and other developed and less developed market economies, particularly decomposition methods recently proposed by Foster, Haltiwanger, and Krizan (2001).[5] Our data, however, pertain to a situation displaying much more variation in the policy regime – both over time and across countries – than those in previous research, and we are able to characterize the impact of firm-level variables representing the effects of policy changes (privatization and liberalization) on the strength of the reallocation-productivity relationship. The paper is also relevant to the growing literature on the transition economies of Eastern Europe and the former Soviet Union. Studies of microeconomic productivity behavior in these countries have focused almost exclusively on the effect of various factors on firm-level productivity, and while the between-firm reallocation of jobs has also been investigated, there has been little attention to other forms of reallocation or to the possible productivity consequences.[6] In this paper, we examine the reallocation not only of jobs, but also of output, capital, and an input index, and we estimate the extent to which reallocation has contributed to productivity growth using large samples of firms observed before and after the policy reforms were implemented, focusing on the Soviet (1985-92) and transition (1993-1998) periods.[7]

To further motivate our comparative analysis of productivity developments in the Soviet Union and in transitional Russia and Ukraine, Section 2 provides a brief discussion of Soviet planning, the different economic reform programs adopted in the two successor 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 presents the results of our analysis, while Section 6 contains concluding remarks.

U.S. and Canadian data in Baldwin, Dunne, and Haltiwanger (1998). Our data have the unusual advantages not only of fully consistent coverage and definitions across countries and time, but also a common starting point that facilitates an analysis of the changes in behavior following the adoption of different reform programs.

[5] We also present the results of a method suggested by Olley and Pakes (1996), and we draw upon Liu and Tybout's (1996) suggestion of the input index as the appropriate weight in the decomposition. Other references within the literature on which we build are listed in footnotes 1 and 2 and are discussed further below.

[6] Djankov and Murrell (2002) review studies of firm-level restructuring in various transition economies. Acquisti and Lehmann (2000), Bilsen and Konings (1998), Brown and Earle (2002a, 2002b, 2003), Faggio and Konings (1999), Haltiwanger and Vodopivec (2003), Kapeliushnikov (1997), Konings, Lehmann, and Schaffer (1996), and Konings, Kupets, and Lehmann (2003) study job flows using firm or establishment-level data, and Haltiwanger and Vodopivec (2002) and Jurajda and Terrell (2000, 2003) analyze individual work histories.

[7] The years 1993-98 are used for the transition period, because we are unable to observe exit between 1992 and 1993 or entry between 1998 and 2000 in the Ukrainian data.

2. The Soviet Economy, Post-Soviet Reforms, and Implications for Productivity-Enhancing Reallocation

How would one expect reallocation and productivity patterns to look during the Soviet 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.[8] 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. 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.[9] Sometimes employment levels were fixed explicitly, but the central planners' usual method of constraining employment, particularly in the later Soviet 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

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[8] 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, 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.

[9] 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).

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. The degree to which planners were successful at productivity-enhancing reallocation may have been correlated with market structure if more dispersed structure provided greater information about production possibilities, but there was little effective competitive pressure in the usual market sense, and of course there was no private ownership. 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 and capital levels in principle, as liberalization more broadly permits 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 pace and design of such reforms after the break-up of the Soviet Union differed substantially between Russia and Ukraine, the two largest Soviet successor states. Although the policy changes in both were rapid and radical by the standards of most countries, Ukraine

by all accounts initially followed a more "gradualist" path than its larger neighbor in the early and mid 1990s, while by the end of the decade there appears to have been substantial convergence in policies. The World Bank (1996), for instance, ranked transition economies according to the "extent of economic liberalization," placing Russia almost at the top (just behind Kyrgyzstan) of the CIS countries, in front of Bulgaria, and well ahead of China and Vietnam. Ukraine's rank was considerably lower, placing it in the "least advanced" group of reformers together with Belarus and most of the Central Asian Republics.

The European Bank for Reconstruction and Development (EBRD) provides other ratings of "progress in transition" along several different dimensions and in a time series from 1992 to 2001. The scale for each dimension is from 1 (denoting "unreformed") to 4.3 (denoting a "market economy standard"). The 1992 scores given for both price liberalization and foreign exchange and trade liberalization were 3.0 for Russia and 1.0 for Ukraine. Only in 1995 did Ukraine's score rise to 3.0 (EBRD, 1998), converging with Russia's.[10]

Concerning privatization, both countries used some form of voucher privatization method with substantial preferences for employees, but Russia's pace was much faster. Most Russian industrial enterprises had been majority privatized firms by July 1994, while Ukraine proceeded much more gradually. Moreover, insider buyouts and collective worker ownership were still more important in Ukraine than in Russia.[11] Already in 1992, the EBRD (2001) awarded Russia a score of 2.0 for large privatization, while Ukraine received only 1.0. Russia's score reached 3.0 in 1993 and 3.3 in 1997 (the same as Poland, and ahead of Bulgaria, Latvia, Lithuania, and Romania), while Ukraine's was 2.3. In 2000, the Ukrainian privatization score rose to 2.7, just behind Russia's.

The EBRD (1998) also estimated that the private sector in 1993 already accounted for 40 percent of Russian GDP but only 15 percent of Ukraine's. In 1998, the figure was 70 percent in Russia, toward the top end of all transitional economies, and it had jumped to 55 percent in Ukraine. By 2000, the estimate for Ukraine reached 60 percent, again showing convergence toward Russia.

Concerning stabilization, while the reported price inflation in Russia reached high rates by any standards, it pales in comparison to Ukraine's hyperinflation during most of this

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[10] The EBRD does not provide ratings for labor market liberalization, but anecdotal evidence indicates that this process has also been somewhat uneven in the successor states, in particular as local governments have frequently attempted to interfere with mass layoffs and with inward migration through systems of permits (*propiski*). See Gimpelson and Lippoldt (2001) and Kapeliushnikov (2001) for detailed discussions of Russian labor market behavior and policies.
[11] See IMF (1999), Estrin and Rosevear (1999), or Pivovarsky (2001) for discussions of privatization in Ukraine, and Boycko, Shleifer, and Vishny (1993) or Earle and Estrin (1997) for Russia.

period: cumulating the annual CPI inflation reported in EBRD (2001) for the years 1992–2000 yields a total price increase of 9,442 percent in Russia and 108,664 percent in Ukraine.[12] By the late 1990s, however, official inflation rates were much more similar in the two countries (for instance, 14.8 percent in Russia and 15.9 percent in Ukraine in 1997).

Regardless of the exact figures, which are certainly subject to measurement errors and disputes, the clearly different pattern of policy choices in the two 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 Ukraine's gradualist policy is likely to be reflected in a slower increase in the contribution of this factor to productivity growth. The effects of private ownership and of product and labor market competition are also likely to be stronger in more rapidly reforming Russia, due to the greater levels of inside ownership and less rapid liberalization in Ukraine.[13]

A final consideration concerns the institutional environment in both Russia and Ukraine. Despite the rapid pace of liberalization in both countries, 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 both countries could be subject to "sclerosis" (Caballero and Hammour, 1996, 2000), 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. Unlike privatization and liberalization, these institutional factors cannot be measured at the enterprise level, but they may tend to attenuate the magnitude of reallocation and its contributions to productivity growth in both countries.

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[12] According to Fischer, Sahay, and Vegh (2002), Ukraine's experience meets the classic definition of hyperinflation from April 1991 to November 1994, the second longest period of hyperinflation in postwar history.

[13] 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.

3. Data

The basic sources for the firm panel data in this study are annual industrial registries provided by the State Committees for Statistics in Russia (the *Goskomstat*) and Ukraine (the *Derzhkomstat*).[14] During the Soviet period, these two statistical agencies were both parts of a single organization (also called the *Goskomstat*), and they have kept essentially identical reporting procedures for the industrial registries that they have continued to maintain. Thus, the data are not beset by the problems of comparability plaguing many cross-countries studies using micro-data. The definitions of employment, capital, output, and industrial classification (*OKONKh*) are identical in Russia and Ukraine, the same as they were in the Soviet Union.[15] One exception to this discussion concerns the definition of private ownership, but we are able to handle this by bringing in an additional data source for Ukraine. This procedure and the definitions of all variables are given in detail below.[16]

The coverages of the two countries' registries are also quite comparable. In Soviet Russia, the data include the universe of civilian industrial enterprises, while after 1991 the coverage is supposed to be all industrial firms with more than 100 employees plus those that are more than 25 percent owned by the state and/or by legal entities that are themselves included in the registry.[17] Because most industrial firms are large and nearly all of them were state-owned in 1992, the coverage is very high in 1992: the firms in the Russian registry accounted for 90.5 percent of officially reported total industrial employment, while the Ukrainian covered 94.1 percent in that year. The coverage rate in relation to official employment declined somewhat thereafter, falling by the year 2000 to 69.8 percent in Russia

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[14] The Russian industrial registries were also supplemented by information from registries compiled separately, including special registries on joint ventures, and the Ukrainian registries were supplemented by State Property Committee data on ownership.

[15] For the purpose of comparing our results with those from other studies, we should note that, similar to many other sources in East European economies, the employment concept in our data is an annual average rather than referring to a particular date or month, and it excludes "nonindustrial personnel" (chiefly, workers providing social benefits to employees).

[16] 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"). Apparently most but not all cases of multiple plants are treated in this way: the 1993 registry contains a variable indicating the number of plants, which equals 1 in 99.91 percent of the 18,121 nonmissing cases. Thus, our discussion refers to firms, plants, establishments, and business units interchangeably. Note also that, to avoid double-counting, we have dropped the consolidated records of entities with subsidiaries from the analysis.

[17] Enterprises subordinated to the State Committee for the Defense Industry are excluded prior to 1992 and after 1998. See Earle and Komarov (2001) for some discussion of this sector.

and 85.2 percent in Ukraine.[18] No doubt the decline is due partially to the entrance of new small firms owned by individuals, since the registries do not include such entities.[19]

The data are strongest, therefore, when used in a before-and-after analysis of the "old" firms inherited from the Soviet Union. All state-owned and privatized firms are included regardless of size and reorganization (split-ups and spin-offs), because the privatization process frequently resulted in legal entities (including the state) ending up with substantial shareholdings (Earle and Estrin, 1997). As there have been few cases of genuine shutdowns in these countries (those bankruptcies that have taken place typically involving transfers of control), our data cover nearly all the manufacturing assets inherited from the socialist system. At the same time, our analysis includes cases of entry and exit, probably due in most cases to reorganization rather than genuine startup or shutdown, but in fact all of these taken together account for a relatively minor fraction of total resource flows.[20]

Although the registries cover firms from all of the industrial sectors, we restrict the analysis in this paper to firms in manufacturing industries, eliminating electric utilities, mining and industrial services, in order to improve comparability with other studies. We also exclude firms classified as "public organizations," which include nonprofit firms and those belonging to the ministry of culture, the environment, health, or the interior (the databases contain a number of prison-based firms).

To eliminate implausible outliers, we excluded observations in the top and bottom one percent of the labor and multifactor productivity distributions, as these are likely to be related to problems in coding of data rather than to real changes. Finally, the sample is reduced due to missing values for employment, capital, and output, and those for the regressions on employer characteristics are reduced because of missing values in the latter set of variables. Table 1 shows the numbers of observations associated with each of these sample construction procedures.

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[18] The official figures on industrial employment should be taken with some caution, as they are compiled not only on the basis of the same registries that we study in this paper but also from a survey of nonregistry firms. If the latter results in an overstatement of nonregistry employment, for example, then our calculation of the coverage of the registries will be understated.

[19] A strong positive correlation of age and size is of course not surprising, and Richter and Schaffer (1996) provide evidence that new private Russian manufacturing firms in 1994 were much smaller than their state-owned and privatized counterparts: over half of the new firms in their sample had 50 or fewer employees and fewer than 10 percent had more than 200, the breakpoints provided in their analysis (p. 257). By contrast, fewer than 4 percent of old firms (and a trivial fraction of total employment) were in the smallest size category (<51). About ten percentage points of the decline in Russian coverage, however, is due to the exclusion of most military enterprises from the registry after 1998.

[20] The size and ownership selection criteria for the registry imply that observed entrants are more likely to represent reorganizations of existing assets than startups from scratch. The relatively small size of these firms implies, however, that they account for a small fraction of all flows.

Our data cleaning and preparation procedures paid a great deal of attention to longitudinal links across firms. All of our data sources included not only an identifying code for the firm, but also name and address, information which we used together with industry, region, and size to link firms that had exited the registry with firms that had entered in any given year. In order to eliminate spurious exits and entrances, we eliminated employment changes associated with firms that exit and then re-enter, those in regions that are completely missing in one of the two adjacent years, those in industries with implausibly high entry or exit rates in that year (suggesting a change in sample coverage), and those associated with firms that were members of Soviet-era production associations or that belong to multi-establishment firms.[21]

The data also have some important limitations, some of which are common to many empirical studies. The available measures of key variables, for example, are not always ideal: We do not measure value-added, but only gross output. Hours of work are unavailable, and only the contribution of part-time multiple job-holders is measured in full-time equivalents; other worker types are measured only by number of employees, and the data only include a single employment figure per firm in both countries.[22] The data include no measures of material or other costs. Still more problems arise in comparing the pre- and post-transition situations. During the central planning period, prices were set by planners, affecting both the output and the capital measures, while after liberalization market forces started to work. The farther the output from a final good, the more dubious its measure in value terms, so the capital measures may be especially dubious. The nature of physical output changed as planners' emphasis on quantity targets lost influence and consumer preferences regarding quality became more important. Reporting practices may also have changed, as managerial incentives tended to result in exaggerated output under planning, while tax avoidance leads to understatement during the transition.

These considerations suggest that productivity levels are in some sense incomparable between the planning and transition periods, but our method requires no such comparisons: we are concerned with the reallocation of resources within narrowly defined industries

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[21] 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.

[22] The Russian data include both production and nonproduction worker series (or concepts similar to these), but the Ukrainian do not.

conditional on relative productivity in the previous year. Our estimates of relative productivity also rely on within-year, within-industry estimates of production functions, and we maintain no assumptions about a constant form of the production function across years and industries. This approach also ameliorates some of the input measurement difficulties described above, as all we need assume is that certain ratios – of value-added to output, of hours to employment, of material inputs to other inputs, and of true capital and output to reported capital and output, respectively – are roughly constant across the firms operating within an industry in a given year. Finally, we examine alternative measures of productivity (labor productivity and multifactor productivity calculated using different methods) to examine the robustness of our finding with respect to a variety of specifications.

Table 2 shows the characteristics of the sample that we focus on in this paper: ownership, domestic product market, concentration, labor market concentration, and import competition from the OECD, from the former Soviet Republics now in the Commonwealth of Independent States (CIS), and from Less Developed Countries (LDCs). The table also contains the mean employment, capital stock, output and input index, as well as their standard deviations. In Russia, information on ownership is available for each firm-year only in the form of a dummy variable for majority private ownership, *Private*; thus we define a similar dummy for Ukraine based on information concerning share ownership.[23] During the Soviet period, the mean of this variable is of course zero, but consistent with the evaluations of the international financial institutions, discussed in Section 2 above, a much larger fraction of Russian enterprises was majority private in the reform period: 67 percent of firm-year observations, compared with 35 percent in Ukraine. *Private* is included in the regression as the value for year *t-1* to explain flows from year *t-1* to year *t*.

To control for preprivatization behavior in the regressions, we also define a dummy variable *Ever Private* as equal to one if the firm is majority private by 2000, or by the last year it appears in the database. The mean of this variable is also shown in Table 2. Including *Ever Private* in the regressions implies that the *Private* effect is estimated by regression-adjusted difference-in-differences.[24]

Two dimensions of competitive pressure, domestic product market and local labor market, are measured as dispersion indices. Our measure of domestic product market dispersion follows Brown and Earle's (2001) method of using data at both the national and regional levels to account for different geographic market sizes across industries. The

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[23] See the Appendix for detailed definitions of the variables.
[24] The ownership status of firms in these data does not shift back from private to state ownership.

premise of the method is that the geographic scope of the market in an industry is reflected in the degree to which producers in the industry are located across different regions of the country. For instance, an industry with member firms in all regions is likely to have regional markets, and an industry with firms in only a few regions is likely to be a national market. To implement a mixed dispersion measure, we first calculate the opposite of the natural logarithm of the Herfindahl-Hirschman Index for each industry at the regional and national levels. These regional and national dispersion measures are then combined into a single index, *Product Market Dispersion*, by taking their weighted sum, where the weight on the regional dispersion measure is the proportion of regions with at least one firm in industry *j* in year *t*, and the weight on the national dispersion measure is one minus this proportion. To measure local *Labor Market Dispersion*, we similarly calculate the opposite of the natural logarithm of the Herfindahl-Hirschman Index for local industrial employment concentration in each municipality in Russia and Ukraine.

The three import measures pertain to import penetration from the OECD, LDC's, and CIS countries, respectively. These are measured as the natural logarithm of 1 plus import penetration, where the latter is 100*imports/(output+imports-exports) at the 5-digit *OKONKh* level.

Table 2 provides the means and standard deviations of these measures, showing somewhat lower product market dispersion, but higher import penetration in Ukraine than in Russia. The *Labor Market Dispersion* measures are similar in both countries. The product and labor market dispersion and import penetration indices from year *t-1* are included in the regressions to explain flows between years *t-1* and *t*. Further details on the variable sources and definitions are given in the Appendix.

4. Measurement Procedures

Our basic approach is to compute firm-level labor (LP) and multifactor (MFP) productivity measures,[25] aggregate them into a constructed aggregate productivity for each year and industry, and then estimate the effect of private ownership and product and labor market dispersion for components of the aggregation.[26] Labor productivity is calculated as the log of gross output divided by number of employees. Our measure of MFP is similar to

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[25] We employ both labor and multifactor productivity to check for robustness. Labor productivity has the disadvantage of ignoring capital inputs, while multifactor productivity suffers from the problem that capital is measured with considerable error.
[26] This approach focuses on the consequences for average industry productivity of within-industry reallocation of input and output shares, because productivity differentials across industries are very difficult to measure.

that used by Baily, Hulten, and Campbell (1992), our choice of weights for aggregating productivity follows Liu and Tybout (1996), and our decomposition methods are drawn from Foster, Haltiwanger, and Krizan (2001) and Olley and Pakes (1996).[27] Our estimation of the ownership and market structure effects makes use of regression methods we have developed for this purpose. This section lays out our procedures with respect to each of these parts of the analysis.

Concerning the multifactor productivity measure, we assume an industry-specific Cobb-Douglas relationship between output (X) and two inputs, capital (K) and labor (L):

$$X_{eit} = P_{ei\tau} K_{eit}{}^{\alpha_i} L_{eit}{}^{\beta_i} \tag{1}$$

where $P_{ei\tau}$ is the firm-specific Hicks-neutral MFP of firm e in industry i in year τ. In much of the analysis we consider two distinct periods for the analysis in this paper: 1985-1992 (Soviet) and 1993-1998 (reform). The function is estimated separately for each of 41 industries in two-year periods, using constant prices in the two years.

Construction of aggregate productivity measures involves summing firm-level measures to the industry level:

$$P_{it} = \sum_e S_{eit} P_{eit} , \tag{2}$$

where P_{it} is average productivity of sector i in year t, S_{eit} is the weight (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 construction of aggregate industry MFP follows Liu and Tybout (1996) in using the estimated input index, derived from equation (1):

$$P_{it} = \sum_e \left(\frac{K_{eit}{}^{\alpha_i} L_{eit}{}^{\beta_i}}{\sum_e K_{eit}{}^{\alpha_i} L_{eit}{}^{\beta_i}} \right) P_{eit} , \tag{3}$$

The basic decomposition, following Foster, Haltiwanger, and Krizan (2001), expresses the change in aggregate industry productivity, ΔP_{it}, as follows:

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

The firm term in (4) measures the average change in firm productivity holding composition constant at its previous year structure, in order to distinguish average productivity growth

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Brown and Earle (2002b) consider between-industry job reallocation and its consequences for aggregate labor productivity growth.
[27] We also investigated a decomposition developed by Griliches and Regev (1995), which produces results that are very similar to those reported here and are available on request.

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) reallocational 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.

We also employ an alternative productivity decomposition methodology, due to Olley and Pakes (1996). This approach involves a cross-sectional decomposition of labor productivity for each industry:

$$P_{it} = \overline{P}_{it} + \sum_e \left(S_{eit} - \overline{S}_{it} \right)\left(P_{eit} - \overline{P}_{it} \right), \tag{5}$$

where the overbar indicates the unweighted average across firms in the industry. The first term is the unweighted average of firm productivity, and the second term, "cross," reflects the extent to which activity is disproportionately located in high productivity firms (if the term is positive) or low productivity firms (if the term is negative). Changes in the ratio of the cross term to aggregate productivity reflect the extent to which the allocation of activity has become more or less productivity-enhancing over time. An advantage of this method compared to Equation (4) is that differences in productivity cross-sectionally are less affected by measurement error and transitory shocks.

How are firm-level variables related to policy changes associated with the strength of the reallocation-productivity relationship? We investigate this with respect to the total reallocation effect and then specifically to the exit effect. With respect to each, we propose a regression method for estimating the effects of private ownership and product and labor market competition.[28] To motivate our method, it is useful to express the between-firm effect in Equation (4) as a covariance, namely as

$$\sum_i S_{it-1} \sum_e \Delta S_{eit} \left(P_{eit-1} - P_{it-1} \right) = n \, \mathrm{cov}\left(S_{it-1} \Delta S_{eit}, P_{eit-1} - P_{it-1} \right) \tag{6}$$

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where *n* refers to the total number of sampled firms in all industries and the notation is otherwise the same as in Equation (4).[29] The effect may also be computed as $\hat{\beta}$ from the following OLS regression:

$$S_{it-1}\Delta S_{eit} = \hat{\alpha} + \hat{\beta}\left(\frac{P_{eit-1} - P_{it-1}}{n\,\mathrm{var}(P_{eit-1} - P_{it-1})}\right) + \hat{u}_{eit}, \qquad (7)$$

where $\hat{\alpha}$ is an estimated intercept and $\hat{u}_{eit}$ is an estimated residual. In this equation, $\hat{\beta}$ can be interpreted as the responsiveness of the firm's size adjustment to its relative performance within its industry, scaled so that the responsiveness is measured in terms of its contribution to aggregate productivity growth: if markets work well to reallocate resources across firms, then $\hat{\beta}$ will be high, while if the reallocation process is sclerotic, then $\hat{\beta}$ will be low.[30]

The usefulness of these expressions lies in the possibility to express $\hat{\beta}$ as a function of other variables, including country, time period, and firm characteristics, and thus to compute the impact of changes in those variables on the extent of productivity-enhancing reallocation. As a first exercise, we permit $\hat{\beta}$ to vary only across the three country-periods in our data (also including these three dummy variables into the intercept).

Our main interest concerns the effects of privatization and liberalization policies on productivity-enhancing reallocation within sectors. For this purpose, we permit $\hat{\beta}$ in Equation (7) to vary with the firm-level variables *Ever Private*, *Private*, *Product Market Dispersion*, *Labor Market Dispersion*, *OECD Import Penetration*, and *LDC Import Penetration*. These interaction effects are further permitted to vary by country and time period, so that we may assess any fluctuations over time in the relationships. The inclusion of the *Ever Private* variable controls for the possibility of selection bias in the privatization process, resulting in a regression-adjusted difference-in-differences estimator for the effect of private ownership on the extent to which reallocation is productivity-enhancing. These specifications permit an assessment of the effects of corporate governance and effective market competition in encouraging more productive firms to expand relative to less productive ones within each industry.

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[29] One difference is that entering and exiting firms are included here along with continuing firms, so as to estimate the total reallocation effect.

[30] This interpretation could also be motivated by models of industry dynamics and selection, such as those of Jovanovic (1982) and Ericson and Pakes (1995).

We also undertake a similar analysis of the effect of exit, based on the final term in Equation (4): $\sum_{e \in X} s_{et-1}(p_{et-1} - P_{it-1})$. Our procedure is to estimate the probability of exit, using a probit model, on the relative productivity of the firm interacted with our policy proxies of interest. We also control for firm size using log employment. Together with the analysis of the between-firm effect for continuing entities, this analysis sheds light on whether privatization and competition are associated with stronger productivity-enhancing effects of resource reallocation. The results of these investigations are described in the next section.

5. Results

We begin by providing basic information on the magnitudes of resource flows, reporting the creation (*C*), destruction (*D*), reallocation (*R*), net change (*NC*), and excess reallocation (*XR*) rates for employment, capital stock, input index, and output, separately for each variable by country and time period.[31] The calculations follow the methods of Davis and Haltiwanger (1990, 1992, 1999) for measuring job flows, except that we use regression procedures in order to calculate standard errors and to draw inferences concerning the statistical significance of Russia-Ukraine differences.[32] The results, shown in Table 3, demonstrate that there were very low reallocation rates for output, labor, capital, and the input index during the Soviet period. In the transition period, however, all of these rates increase greatly. Both the input and output rates tend to rise somewhat faster and reach higher levels in Russia than they do in Ukraine, though only the input rate difference is statistically significant.

As described above, our analysis of the productivity consequences of these resource flows focuses on changes in the industry shares of business units, thus on excess reallocation within industries. What fraction of excess reallocation is accounted for by within-industry flows? For this purpose, we rely on a methodology introduced by Davis and Haltiwanger (1992) to compute the fraction of excess reallocation that takes place within 5-digit industries. Previous research, summarized by Davis and Haltiwanger (1999) for a number of countries, has consistently found that the within-industry component predominates, in every case accounting for at least 80 percent of total excess reallocation. The figures for Russia and Ukraine in Table 4 imply a larger role for between-industry shifts; capital flows, particularly

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[31] Creation is defined as the change in growing firms, destruction as the absolute value of the change in declining firms, reallocation as the sum of creation and destruction, net change as the difference, and excess reallocation as reallocation minus the absolute value of net change.
[32] Our regression methods are described more fully in Brown and Earle (2002b). Foster, Haltiwanger, and Krizan (2001) report creation and destruction rates for output and capital.

in transition Russia, are estimated to be predominantly between rather than within. For job and output reallocation in both countries, and for the input index in Russia, within-industry flows predominate.

With this background on the magnitude of reallocation involved, we turn to the results from estimating the decompositions based on Equations (4) and (5), which appear in Table 5 and in the accompanying Figures 1a, 1b, 1c, 1d, 2a, and 2b. Reallocation was labor productivity-neutral, but slightly multifactor productivity-enhancing during the Soviet period.[33] Regardless of whether one uses labor or multifactor productivity, however, reallocation clearly became more productive in transition Russia. Reallocation is not productive until 1995 (multifactor productivity) or 1996 (labor productivity) in Ukraine. This could indicate that Ukraine's reallocation did not become productive until later in the transition compared to Russia, though one would need data from earlier years in Ukraine to be sure. But during the reform period overall, Ukraine's reallocation appears to be at least as productive as Russia's. The labor productivity results suggest that entry reduces and exit enhances labor productivity, with only a slight positive net entry effect in both countries in transition. Entry has basically no effect and exit has a slight positive effect on multifactor productivity. So the vast majority of the productive reallocation has come from changes in shares of continuing firms.[34] This may be changing over time, though, as the figures show an increasingly positive exit effect in both countries.

Figures 2a and 2b show results using the cross-sectional decomposition from equation (5). We display the differences between cross terms across year pairs, excluding spurious entry and exit during the two years. A larger cross term in one year compared to the previous year would suggest that resources are moving toward more productive firms. As with the previous decomposition, these results suggest that reallocation has been more productive in the reform period compared to the Soviet period, and that it has been similarly productive in Russia and Ukraine.

Since the Russian sample coverage changes across time, one may be concerned about the degree to which the differences in results across the Soviet and post-Soviet periods are being driven by these changes. Table 6 addresses this issue. In the table, "2-period" refers to firms present in the data in the 2 periods under consideration, while "1-period" refers to firms

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[33] The cross term (covariance between resource share change and within-firm productivity change) is only partly a reallocation effect. The cross term is subsumed into the reallocation and within-firm effects in roughly equal proportions in the Griliches and Regev (1995) decomposition.

[34] Note that this decomposition measures only the immediate effect of entry, which is frequently negative in market economies. We will examine longer-term effects below.

present in only one of the two periods – thus, to changes in the sample. The increase in the productivity of reallocation between continuing firms appears to be driven primarily by changes in the behavior of firms that continue for both periods.

These results provide strong evidence that the change of economic system had major implications for the pace of productivity-enhancing reallocation. Can the large increase be associated with any particular reform policies, such as privatization and liberalization of imports and of domestic product and labor markets? To provide some evidence on this question, we turn to the estimated results from the random coefficient equation (7), displayed in Table 7.[35] Starting with privatization, we first note that the estimated coefficient on the control variable *Ever Private*, which is a group effect that takes into account any fixed differences between firms that become privatized and those that do not, suggests that firms that would later be privatized have an only slightly greater tendency than those that would remain state-owned to reallocate inputs within their sector productively; thus there is little difference in preprivatization behavior. After the Russian firms were privatized, however, the labor productivity results imply that productivity growth is raised by about 3.5 percentage points relative to firms not yet privatized. In Ukraine, by contrast, privatization is estimated to have an insignificant effect.

Turning to *Product Market Dispersion*, we find a negative relationship with the productivity of intrasectoral reallocation in Ukraine and an insignificant relationship in Russia. Concerning *Labor Market Dispersion*, the relationship with productivity appears to be positive in each period when using MFP and insignificant when using LP. No systematic effects are found from being exposed to more international competition, regardless of the source.

Taken together, these results provide mixed evidence that the extent to which resource reallocation enhances productivity growth may indeed be a function of the economic policy and institutional environment. In the Soviet period, firms to be privatized exhibited little difference (in this sense) from those destined to remain state-owned. After privatization took place, there was a sharp jump in the contribution of privatized firms to productivity-enhancing reallocation in Russia, but no such effect can be detected in Ukraine, where privatization was carried out much more gradually and with a stronger bias towards insider giveaways. In contrast, the regressions provide little evidence that liberalizing reforms have stimulated more productive reallocation.

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[35] The results are very similar when including only continuing firms.

We now take a closer look at exit, which appeared in the decomposition results above to provide an increasingly important contribution to productivity growth across time. One may be concerned that the measured effect is due to a phenomenon analogous to an "Ashenfelter dip," where productivity suddenly falls once the firm knows it will exit. To check this, in Figures 3a and 3b we compare the productivity of exiting firms for five years prior to exit with a consistent panel of survivors. Though there is a dip in productivity in the last year, productivity was already lower in firms that would later exit well before the exit year, so exit appears to be providing a real contribution to aggregate productivity.

Table 8 focuses on how policies may affect the productivity of exit. The table shows estimated exit probits, where the coefficient on relative productivity is again permitted to vary with the set of firm characteristics representing measurable policies of interest. Privatization is associated with exit of less productive enterprises in both countries. No association between product market dispersion and the exit-productivity relationship is found. The relationship with labor market dispersion is unexpectedly positive in both countries, however, which taken at face value would imply that operating in a more competitive labor market would raise the probability that firms with above-average productivity would exit. LDC and CIS imports also have an unexpected positive sign in Ukraine. So, as with the earlier regressions, we find evidence that privatization (this time in both countries) has contributed to more productive reallocation, but not liberalization.

The final step in our analysis focuses on the selection and learning processes of entrants relative to incumbents during the transition period. For this purpose, Table 9 compares the levels of LP and MFP for entrants and incumbents in the year of entry, differentiating between entrants and incumbents that would exit and those that would still be producing three years later. Surviving incumbents is the omitted category. Nonsurviving incumbents exhibit statistically significantly lower productivity than surviving incumbents in all specifications except MP in Ukraine. Nonsurviving entrants have lower labor productivity than surviving incumbents, but no statistically significant difference is found when using MP. Surviving entrants also show lower LP, but not MP, than surviving incumbents. The differences in the LP and MP results may be explained by lower capital intensity among entrants, possibly due to credit constraints. When comparing nonsurviving to surviving entrants, we find that Russian nonsurviving entrants have statistically significantly (at the 5% level) lower LP than surviving entrants, but not MP. Strangely, nonsurviving Ukrainian entrants are found to have statistically significantly (at the 5% level) MP. Table 9 also reports regressions dividing nonsurviving entrants and incumbents by exit year. One might expect

relative productivity to be less negative for those exiting further in the future, but the results show no systematic pattern.

We then test for whether learning takes place among surviving entrants.[36] Table 10 shows the results from regressions comparing the productivity of surviving entrants and surviving incumbents three years after the entrance year. Entrants have now caught up to incumbents in LP and have surpassed them in MP in both countries. The results from tables 9 and 10 suggest that efficient selection is taking place among incumbents, but the evidence is weaker regarding selection among entrants. Russia exhibits more consistent selection effects than Ukraine. Strong evidence of learning by entrants is found in both countries, so the longer-run effect of entry on aggregate productivity appears to be positive.

6. Conclusion

Research on microeconomic productivity developments in the transition economies has focused almost entirely on the effect of various factors, most prominently privatization, on the average firm's productivity level (or growth). This body of research on the "within-firm effect" is large and has already achieved a status meriting lengthy review articles (e.g., Megginson and Netter, 2001; Djankov and Murrell, 2002). While this is no doubt an important area for continued work, there has been a relative neglect of other microeconomic mechanisms that affect aggregate productivity outcomes. Our research takes a very different perspective, emphasizing instead the contribution to aggregate productivity growth of reallocation across business units that display differential levels of productivity.

To describe the difference between these approaches in another way, the standard literature has focused on the possibility for learning and restructuring to improve the efficiency of firms. But what if such learning mechanisms are weak, for instance because of inertia due to sunk organizational and physical capital? In the extreme case, managers may have little chance to increase productivity, and as Nickell (1996) expressed it, the whole body of research (on the effects of product market competition on firm-level productivity, in his case) may have been "barking up the wrong tree." An alternative point of view, the one we adopt in this paper, takes such inertia as given and focuses on processes of selection rather than learning. Even if within-firm productivity is immutable, an effective selection mechanism across firms may lead to productivity-enhancing entry, exit, and reallocation across continuing firms. Managers may not be able to affect the productivity of their firms,

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[36] It may take time for entrants to discover their optimal factor mix, for example.

but they may be able to perceive their relative efficiency levels, and, if they are responsive to the associated market signals, they may downsize or expand appropriately. We have examined the role of privatization and liberalization policies in increasing this responsiveness, thus in increasing the intensity of productivity-enhancing reallocation.

The microeconomic database we have assembled provides useful material for investigating these questions. The data include nearly the universe of "old" industrial firms inherited from the Soviet period, and the time series is long enough to include seven years of data for Soviet Russia, ten years for post-Soviet Russia, and nine for Ukraine; we observe privatized firms for several years before and after their change in ownership. A further, unusual advantage of the data is that we face none of the vexing comparability issues plaguing most cross-country studies of these issues or any involving enterprise behavior. The sources for nearly all of our data originate in a single Soviet organization that was subsequently split up after the collapse of the Soviet Union, and the sample coverage and variable definitions are essentially identical in the two successor states. Our approach has not been to provide a complete description of job and other resource flow patterns in these economies, a task which is beyond the scope of our data, but rather to exploit the quasi-experimental situation of institutional and policy change and to focus on the set of enterprises that experiences these changes. For this purpose, our manufacturing census data for the inherited sector of medium and large enterprises from 1985–2001 are well suited.

Our analysis finds extremely low rates of interfirm reallocation in Soviet Russia and a negligible contribution of reallocation to aggregate productivity growth. These results contribute in an important way to our understanding of the poor performance of the Soviet system, as they support an evolutionary view of the system's drawbacks: while central planning may have functioned adequately in a static environment requiring little active reallocation of resources, it was much less effective in dynamic responsiveness to shocks requiring learning and selection—weeding out less efficient activities and promoting those that have become more productive.[37]

We also find that liberalizing reforms in the two largest Soviet successor states have brought substantial increases in resource reallocation and in the productivity-enhancing consequences of the reallocation process. The overall patterns are quite similar for the two countries, despite the differences in their reform policies. Our examination of the effects of privatization and competitive pressures from product and labor markets on the overall

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[37] Schumpeter (1942) was perhaps the first to emphasize the role of factor reallocation in capitalist growth. See Murrell (1992) on the evolutionary view of central planning and reform.

productivity-enhancing effect of resource reallocation shows a contribution by privatization in Russia, but not in Ukraine, and little contribution from competitive pressure is found in either economy, except possibly from local labor markets. Privatization in both countries is found to encourage less productive firms to exit.

Ukraine's transitional policies have frequently been labeled "gradualist," compared to Russia's "shock therapy," yet reforms in both countries have come in for severe criticism and their macroeconomic performance records have shown rather similar patterns. Aggregate output, for instance, displayed a similarly dismal trend for most of the 1990s, leading some observers to question the value of privatization and liberalization. The microeconomic evidence presented here, however, is consistent with the view that reforms have stimulated enterprise-level restructuring and reallocation in both countries, and that the reallocation process has become productivity-enhancing. In the early transition, the reallocation effects served to reduce the magnitude of productivity decline, and more recently they have accounted for a major fraction of productivity growth.

Appendix: Variable Definitions and Construction

Capital$_t$ is the average book value of fixed assets used in the main activity of the enterprise by employment in year *t*. Capital stock is adjusted for revaluations, which take place at the end of some years, using information on the end-of-year and beginning-of-year values. The rank of capital intensity is expressed in a range from 0 to 1, where 1 is the most capital-intensive.

CIS Import Penetration$_t$ is imports from CIS countries divided by (domestic output plus total imports minus total exports) in year *t* in the five-digit *OKONKh* industry. The Russian trade data come from Goskomstat except in 1997, when they come from the State Customs Committee. The Ukrainian data come from Derzhkomstat.

Employment$_t$ is the average number of "registered industrial production personnel" (including both production and non-production workers, but excluding "nonindustrial personnel" chiefly involved in providing employee benefits) in year *t*. The concept includes the full-time equivalent number of part-time workers registered at another firm ("*sovmestiteli*").

Ever Private$_t$ is a dummy = 1 if the firm is over 50 percent privately owned in the year 2000 (or by the last year it appears in the data), 0 otherwise.

Labor Market Dispersion$_t$ = –ln(Herfindahl-Hirschman index of employment concentration in the municipality in Russia and county [*raion*] in Ukraine) in year *t*, calculated using the industrial registries. Our database includes firms in 3,655 municipalities in Russia and 642 *raions* in Ukraine.

Labor Productivity$_t$ = ln(*Output$_t$*/*Employment$_t$*).

LDC Import Penetration$_t$ is imports from non-CIS, non-OECD countries divided by (domestic output plus total imports minus total exports) in year *t* in the five-digit *OKONKh* industry. The Russian trade data come from Goskomstat, except in 1997, when they come from the State Customs Committee. The Ukrainian data come from Derzhkomstat.

OECD Import Penetration$_t$ is imports from OECD countries (not including East European countries) divided by (domestic output plus total imports minus total exports) in year *t* in the five-digit *OKONKh* industry. The Russian trade data come from Goskomstat, except in 1997, when they come from the State Customs Committee. The Ukrainian data come from Derzhkomstat.

Output$_t$ is the value of gross output produced in year *t*, net of VAT and excise taxes, expressed in constant prices in both countries. The nominal values were deflated using implicit deflators calculated by dividing the growth in nominal output at the three-digit *OKONKh* (ten-sector) level by a growth in physical volume index for Russia (Ukraine).[38]

Private$_t$ is a dummy = 1 if the firm is over 50 percent privately owned in year *t*, and = 0 otherwise The ownership data upon which this is based for Russia are annual ownership codes in the registries. For Ukraine we use annual State Property Committee data on the percentage of shares in private hands. If a firm is not found in those data, we include it as a state firm in all years if it has a state ownership code in the 2000 registry. Otherwise it is excluded from this part of the analysis, since we do not know the percentage of shares that are private. Note that the nature of the registry data (described above) implies that *Private* refers to privatized, formerly state-owned entities.

Product Market Dispersion$_t$ is the product market dispersion measure in year *t*. Dispersion indices at the regional (*oblast*) and national levels are obtained as –ln (Herfindahl-Hirschman index of product market concentration in the five-digit *OKONKh* industry) at the regional (*oblast*) and national level, respectively. A weighted average of these is constructed using the proportion of regions with at least one enterprise in the five-digit industry in year *t* to weight the national dispersion, and one minus this proportion to weight the regional dispersion measure. Russia and Ukraine use the same industrial classification system throughout the period. In Russia, there are 260 five-digit industries represented in the data while in Ukraine there are 241. There are 82 Russian and 28 Ukrainian *oblasts* represented in the data. The Russian figure is smaller than the total of 89 regions ("subjects of the Russian Federation") because several smaller districts (*okrugi*) are grouped together with surrounding regions, and the database does not cover Chechnya and Ingushetia.

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[38] We also performed the analysis using producer price indices, although we feel these are less reliable than the implicit deflators. In any event, the qualitative conclusions regarding the effects of job reallocation on productivity growth differed little across these two methods of deflation.

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Table 1
Numbers of Firm-Year Observations

	Soviet Russia (1985-1992)	Reform Russia (1993-1998)	Reform Ukraine (1993-1998)
Total sample	122,761	111,372	39,066
Sample for job flow analysis	106,159	111,879	39,032
Sample for capital flow analysis	120,670	78,249	35,402
Sample for input index flow analysis	97,536	72,779	33,182
Sample for output flow analysis	120,542	103,556	35,718
Sample for labor productivity decomp.	97,132	97,987	34,374
Sample for MFP decomposition	97,539	72,658	33,175
Sample for between LP regs.	79,346	72,171	20,210
Sample for exit LP regressions	—	74,004	25,650

Note: The total sample includes all manufacturing, nonpublic organization firm-years in the database, regardless of missing values for any variables. The samples for the job, capital, input index, and output flow calculations, and those for the productivity decomposition and regressions, exclude missing values and a small number of outliers, as described in the text.

Table 2
Firm Characteristics

	Soviet Russia	Reform Russia	Reform Ukraine
Ever Private (dummy)	0.774	0.801	0.688
Private (dummy)	0.000	0.667	0.349
Product Market Dispersion	2.058 (0.697)	1.865 (0.693)	1.650 (0.812)
Labor Market Dispersion	1.869 (1.278)	2.008 (1.330)	2.086 (0.928)
OECD Import Penetration	—	0.501 (0.833)	1.360 (1.458)
LDC Import Penetration	—	0.380 (0.804)	0.765 (1.054)
CIS Import Penetration	—	0.314 (0.654)	0.856 (1.264)
Employment	677 (2,287)	474 (1,781)	439 (1,267)
Capital	11,873 (53,026)	37,709 (2,012,849)	8,524 (54,502)
Input Index	4,838 (23,310)	5,738 (53,300)	8,706 (77,512)
Output	20,416 (70,893)	2,340,000 (22,300,000)	81,310 (577,276)

Note: Means are shown for all variables, and standard deviations (in parentheses) are shown for continuous variables. Definitions of all variables are described in the text, and the precise sources and computations are reported in the Appendix. The means for the first seven variables are for the sample in Table 7 for labor productivity, and the means for the latter four variables are from the samples in Table 3.

Table 3
Reallocation in Soviet and Post-Soviet Russia and Ukraine

	Russia						Ukraine					
	C	*D*	*R*	*NC*	*XR*	*N*	*C*	*D*	*R*	*NC*	*XR*	*N*
Average Annual Job Flow Rates, By Period												
Soviet	3.29	6.10	9.38	-2.81	6.58	106,159	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
(1985–92)	(0.22)	(0.15)	(0.29)	(0.24)	(0.44)							
Reform	4.63	17.04	21.68	-12.41	9.27	111,879	6.30*	13.57*	19.87	-7.28*	12.59*	39,032
(1993–98)	(0.21)	(0.37)	(0.44)	(0.40)	(0.41)		(0.41)	(0.41)	(0.65)	(0.52)	(0.84)	
Average Annual Capital Flow Rates, By Period												
Soviet	10.32	4.72	15.04	5.60	9.44	120,670	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
(1985–92)	(0.83)	(0.32)	(1.00)	(0.75)	(0.63)							
Reform	27.32	39.12	66.43	-11.80	54.63	78,249	12.29	3.71*	16.00*	8.58	7.42	35,402
(1993–98)	(10.89)	(7.67)	(15.08)	(11.29)	(21.78)		(1.49)	(0.52)	(1.50)	(1.64)	(1.04)	
Average Annual Input Index Flow Rates, By Period												
Soviet	5.79	7.70	13.49	-1.91	11.58	97,536	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
(1985–92)	(0.43)	(0.33)	(0.53)	(-3.46)	(0.86)							
Reform	7.00	12.03	19.03	-5.03	14.00	72,779	6.95	8.31*	15.26*	-1.35	13.91	33,182
(1993–98)	(0.65)	(0.52)	(0.71)	(0.93)	(1.29)		(0.59)	(1.11)	(1.22)	(1.29)	(1.17)	
Average Annual Output Flow Rates, By Period												
Soviet	13.82	13.61	27.43	0.21	27.22	120,542	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
(1985–92)	(0.85)	(0.37)	(0.87)	(0.22)	(0.74)							
Reform	11.80	26.22	38.02	-14.41	23.61	103,556	12.15	21.70	33.86	-9.55	24.31	35,718
(1993–98)	(0.97)	(2.45)	(2.77)	(2.50)	(1.94)		(0.99)	(1.84)	(1.66)	(2.45)	(1.98)	

Note: The star (*) signifies that the Ukrainian rate is statistically significantly different from the Russian rate at the one percent level.

Table 4
Proportion of Excess Reallocation Within Industries

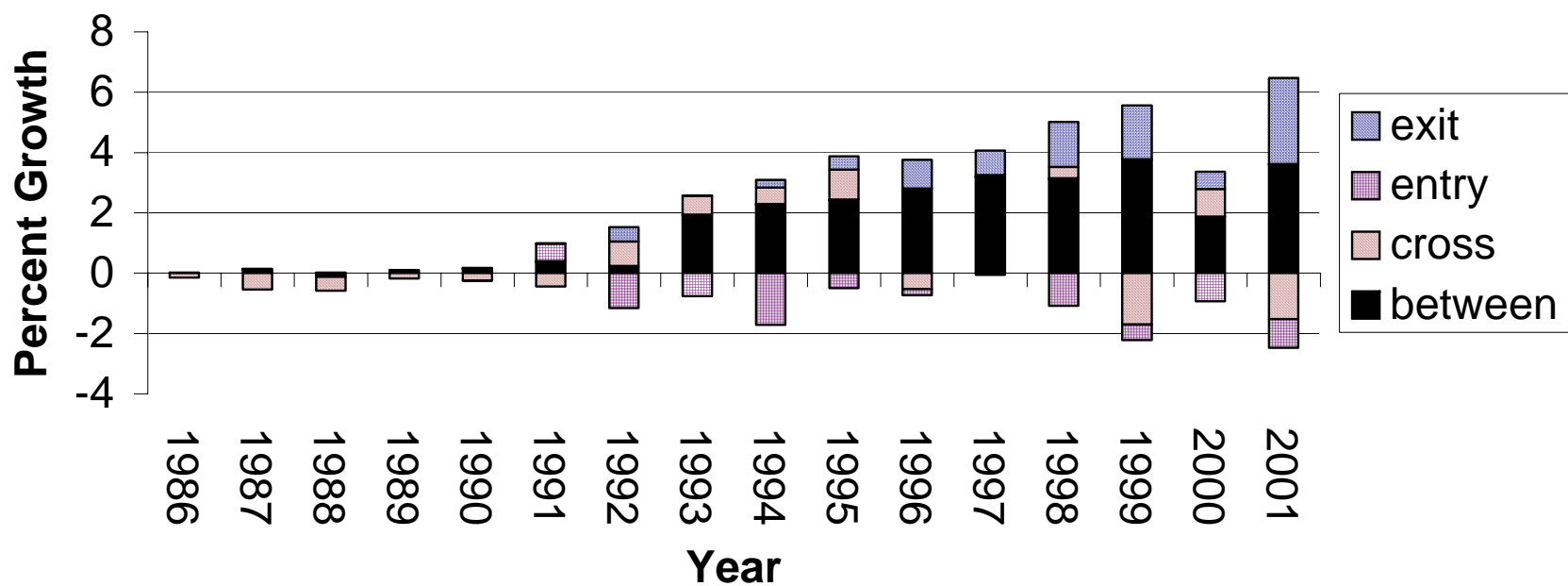|	Russia				Ukraine			
	Total Proportion	**Proportion due to:**			**Total Proportion**	**Proportion due to:**		
		Continuing Firms	**Entering Firms**	**Exiting Firms**		**Continuing Firms**	**Entering Firms**	**Exiting Firms**
Job Flows								
Soviet (1985–92)	0.7556	0.6307	0.1114	0.0135				
Reform (1993–98)	0.8680	0.4679	0.3798	0.0203	0.6895	0.3205	0.3416	0.0274
Capital Flows								
Soviet (1985–92)	0.6331	0.5821	0.0170	0.0340				
Reform (1993–98)	0.3675	0.3147	0.0357	0.0170	0.5919	0.3113	0.0706	0.2099
Input Index Flows								
Soviet (1985–92)	0.7690	0.6892	0.0667	0.0131				
Reform (1993–98)	0.5959	0.4704	0.0976	0.0280	0.4549	0.3896	0.0488	0.0165
Output Flows								
Soviet (1985–92)	0.5965	0.5604	0.0315	0.0045				
Reform (1993–98)	0.6348	0.5100	0.0818	0.0430	0.6093	0.5225	0.0717	0.0151

Note: These are proportions of total excess reallocation occurring within five-digit industries. When an industry is declining, the total excess reallocation is divided between continuing and entering firms' contributions based on their proportions of creation in the sector. The total is divided between continuing and exiting firms' contributions based on their proportions of destruction in the sector when the industry is expanding.

Table 5
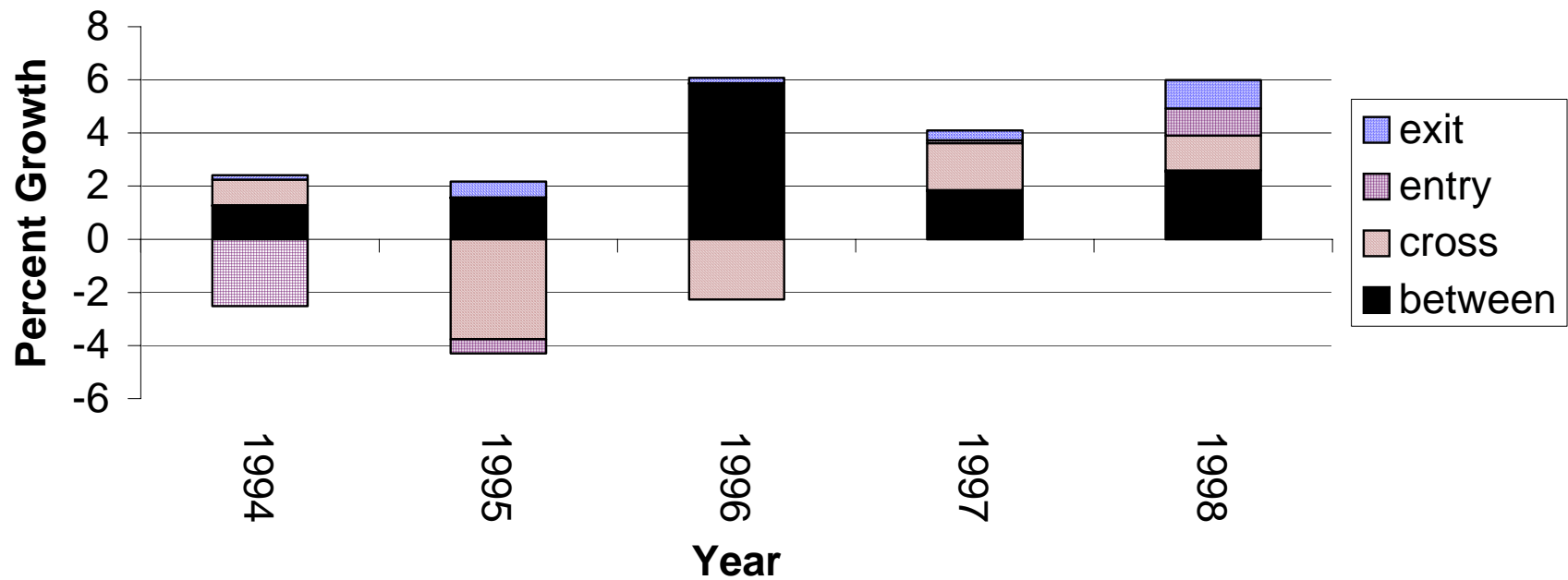**Contribution of Reallocation to Productivity Growth**

	$\sum_{e\in C} \Delta S_{eit}\left(P_{eit-1} - P_{it-1}\right)$	$\sum_{e\in C} \Delta P_{eit}\Delta S_{eit}$	$\sum_{e\in N} S_{eit}\left(P_{eit} - P_{it-1}\right)$	$-\sum_{e\in X} S_{eit-1}\left(P_{eit-1} - P_{it-1}\right)$	Reallocation Effect with Cross Term	Reallocation Effect without Cross Term
			Labor Productivity			
Soviet Russia (1985-92)	0.14	-0.17	-0.08	0.07	-0.04	0.13
Reform Russia (1993-98)	2.78	0.29	-0.71	0.79	3.15	2.86
Reform Ukraine (1993-98)	2.63	-0.40	-0.38	0.48	2.33	2.73
			Multifactor Productivity			
Soviet Russia (1985-92)	1.83	-2.04	0.03	0.13	-0.05	2.00
Reform Russia (1993-98)	3.04	-2.16	-0.09	0.15	0.94	3.10
Reform Ukraine (1993-98)	2.57	-0.78	0.02	0.35	2.16	2.94

Note: The multifactor productivity figures show the results from applying Equation (4) in the text to firms in 41 industries, by country and time period. The industry-level results are aggregated using annual average output weights.
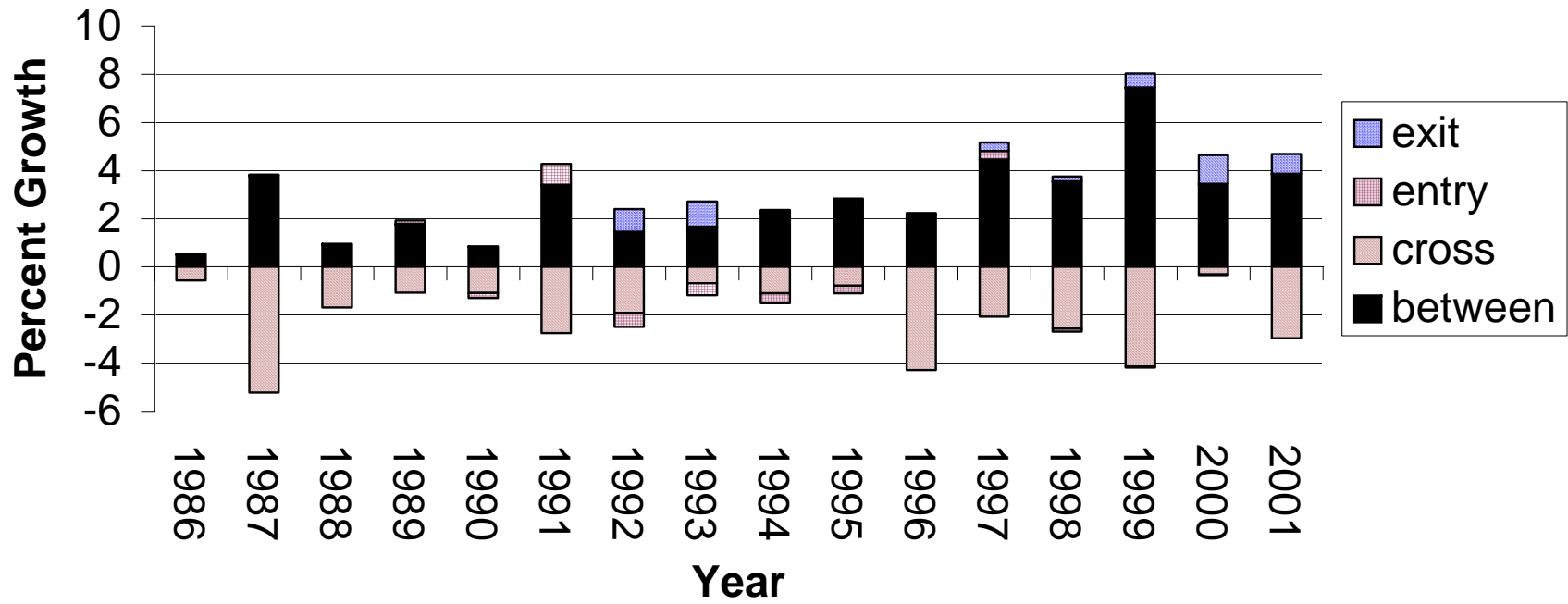
Figure 1a
Contribution of Reallocation to Russian Labor Productivity Growth
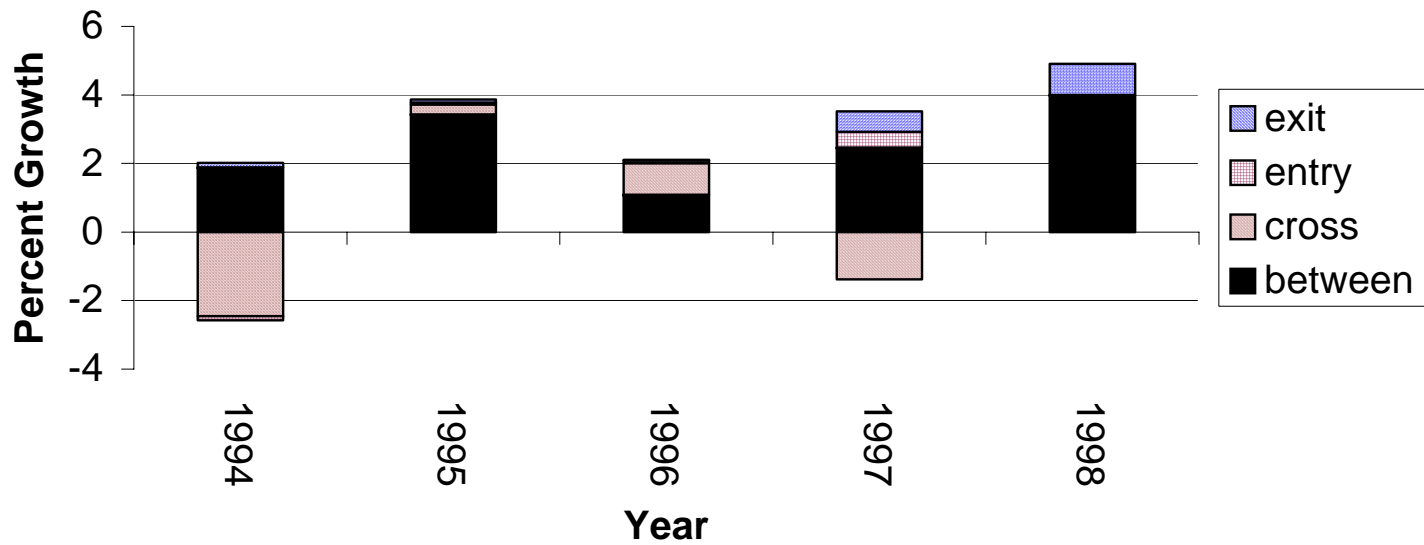
Figure 1b
Contribution of Reallocation to Ukrainian Labor Productivity Growth
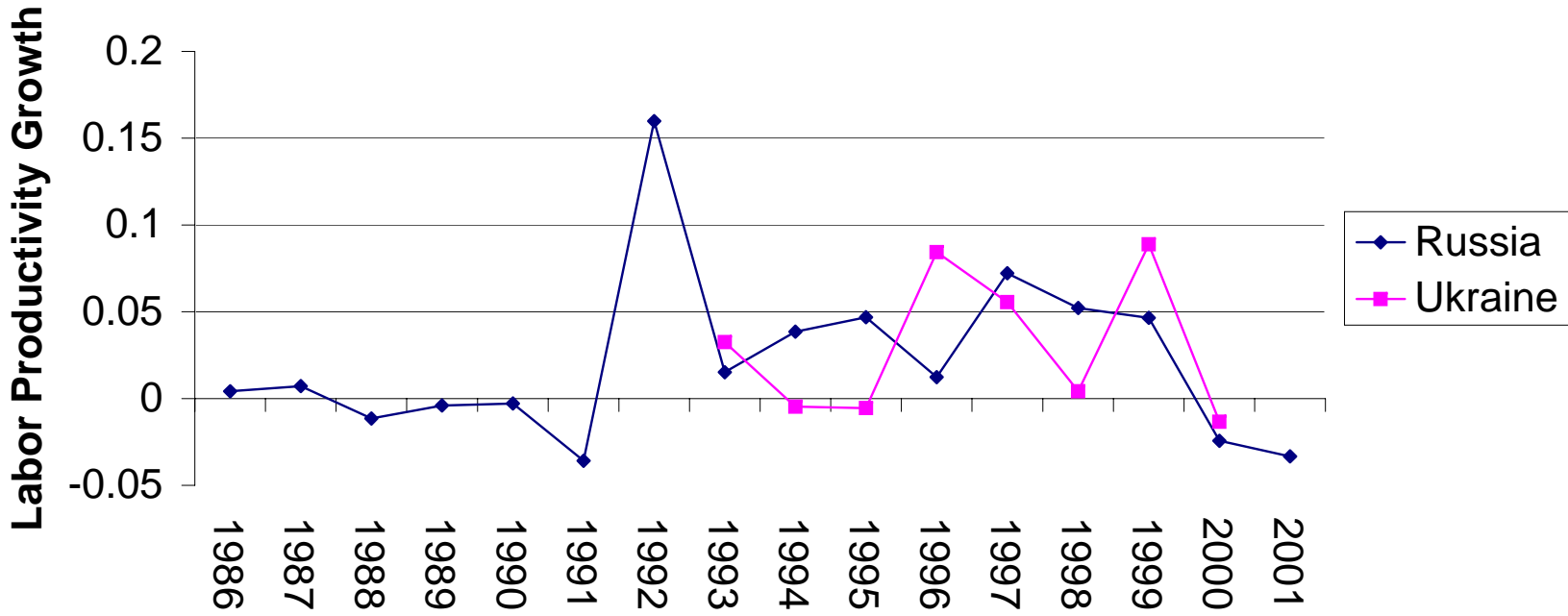
Figure 1c
Contribution of Reallocation to Russian
Multifactor Productivity Growth

Figure 1d
Contribution of Reallocation to Ukrainian Multifactor Productivity Growth

Figure 2a
Contribution of Reallocation to Labor Productivity Growth (Cross-Sectional Method)

Note: These are differences between the cross-terms (the second term in equation 5) in year *t* and *t-1*. Firms disappearing in year *t* or appearing in year *t*, but which are not exiting or entering according to the definitions used in this paper, are excluded so that data coverage changes do not drive the results.
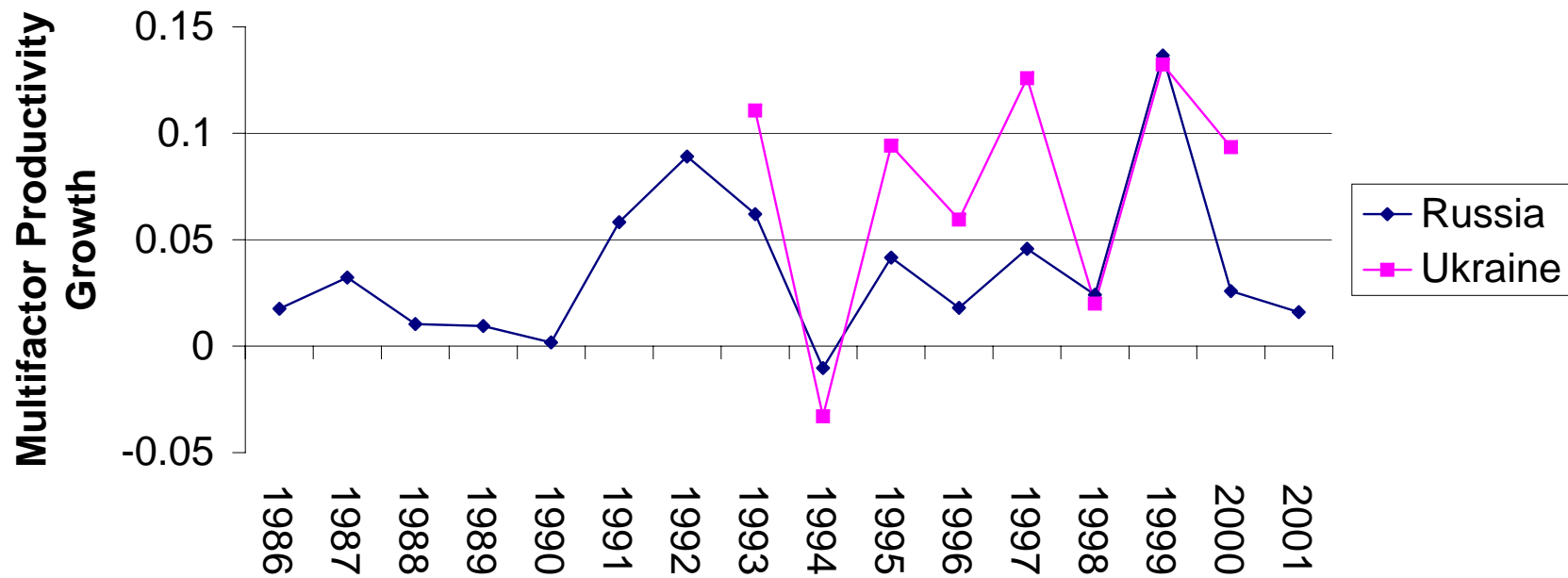
Figure 2b
Contribution of Reallocation to Multifactor Productivity Growth (Cross-Sectional Method)

Note: These are differences between the cross-terms (the second term in equation 5) in year *t* and *t-1*. Firms disappearing in year *t* or appearing in year *t*, but which are not exiting or entering according to the definitions used in this paper, are excluded so that data coverage changes do not drive the results.

Table 6
Breakdown of Productivity Terms into Contributions by Russian Firms Present in One vs. Both Periods

|	2-Period Between Firm	1-Period Between Firm	2-Period Covariance	1-Period Covariance
Labor Productivity				
Soviet Russia	0.15	-0.01	-0.03	-0.14
Reform Russia	1.63	1.14	0.21	0.08
Multifactor Productivity				
Soviet Russia	0.84	0.99	-0.74	-1.30
Reform Russia	2.01	1.03	-1.41	-0.75

Note: "2-period" refers to the contribution to the respective productivity growth term made by firms that appear in both of the periods being compared, and "1-period" is the contribution made by firms appearing in just one of the two periods being compared.

Table 7
The Effects of Private Ownership and Market Competition
on Productivity-Enhancing Resource Reallocation:
**Between-Firm (within-industry) Regressions**

	Labor Productivity	MFP
PD*SovietRussia	0.002 (0.69)	-0.010 (-1.24)
PD*ReformRussia	0.032 (2.41)	0.008 (0.69)
PD*ReformUkraine	0.074 (2.01)	0.023 (1.54)
PD*EverPrivate*SovietRussia	0.005 (2.49)	0.008 (1.55)
PD*EverPrivate*ReformRussia	-0.013 (-1.15)	0.010 (0.89)
PD*EverPrivate*ReformUkraine	-0.024 (-1.67)	0.013 (1.30)
PD*Private*ReformRussia	0.035 (3.49)	0.027 (2.10)
PD*Private*ReformUkraine	0.002 (0.34)	-0.011 (-1.11)
PD*ProdDisp.*SovietRussia	-0.001 (-0.46)	0.003 (0.78)
PD*ProdDisp.*ReformRussia	-0.002 (-0.30)	-0.005 (-0.58)
PD*ProdDisp.*ReformUkraine	-0.010 (-2.00)	-0.014 (-1.81)
PD*LaborDisp.*SovietRussia	-0.001 (-1.01)	0.006 (2.78)
PD*LaborDisp.*ReformRussia	-0.001 (-0.38)	0.007 (1.41)
PD*LaborDisp.*ReformUkraine	0.000 (0.00)	0.010 (1.68)
PD*OECDImp*ReformRussia	-0.001 (-0.13)	-0.002 (-0.50)
PD*OECDImp*ReformUkraine	-0.002 (-0.49)	-0.001 (-0.42)
PD*LDCImp*ReformRussia	0.002 (0.60)	0.001 (0.34)
PD*LDCImp*ReformUkraine	-0.006 (-2.01)	0.002 (0.56)
PD*CISImp*ReformRussia	-0.001 (-0.19)	-0.005 (-1.60)
PD*CISImp*ReformUkraine	0.002 (0.71)	-0.001 (-0.35)
Adjusted R^2	0.007	0.002
N	171,727	155,261

Note: These are OLS regressions with t statistics, adjusted for firm clustering, reported in parentheses. The specifications also include country-year effects, main effects for all the variables, and all two-way interactions. In the first column of results (based on Equation (10) in the text with β permitted to vary by country, time period, ownership and market structure), PD is the lagged deviation of the firm's productivity from the industry average ($P_{eit-1} - P_{it-1}$) divided by n_{t-1}*Var($P_{eit-1} - P_{it-1}$), where n_{t-1} is the number of firms in year $t-1$. Soviet Russia refers to 1985-92 and reform to 1993-98. Variable definitions are given briefly in the text and in detail in the Data Appendix.

Figure 3a
Pre-Exit Labor Productivity
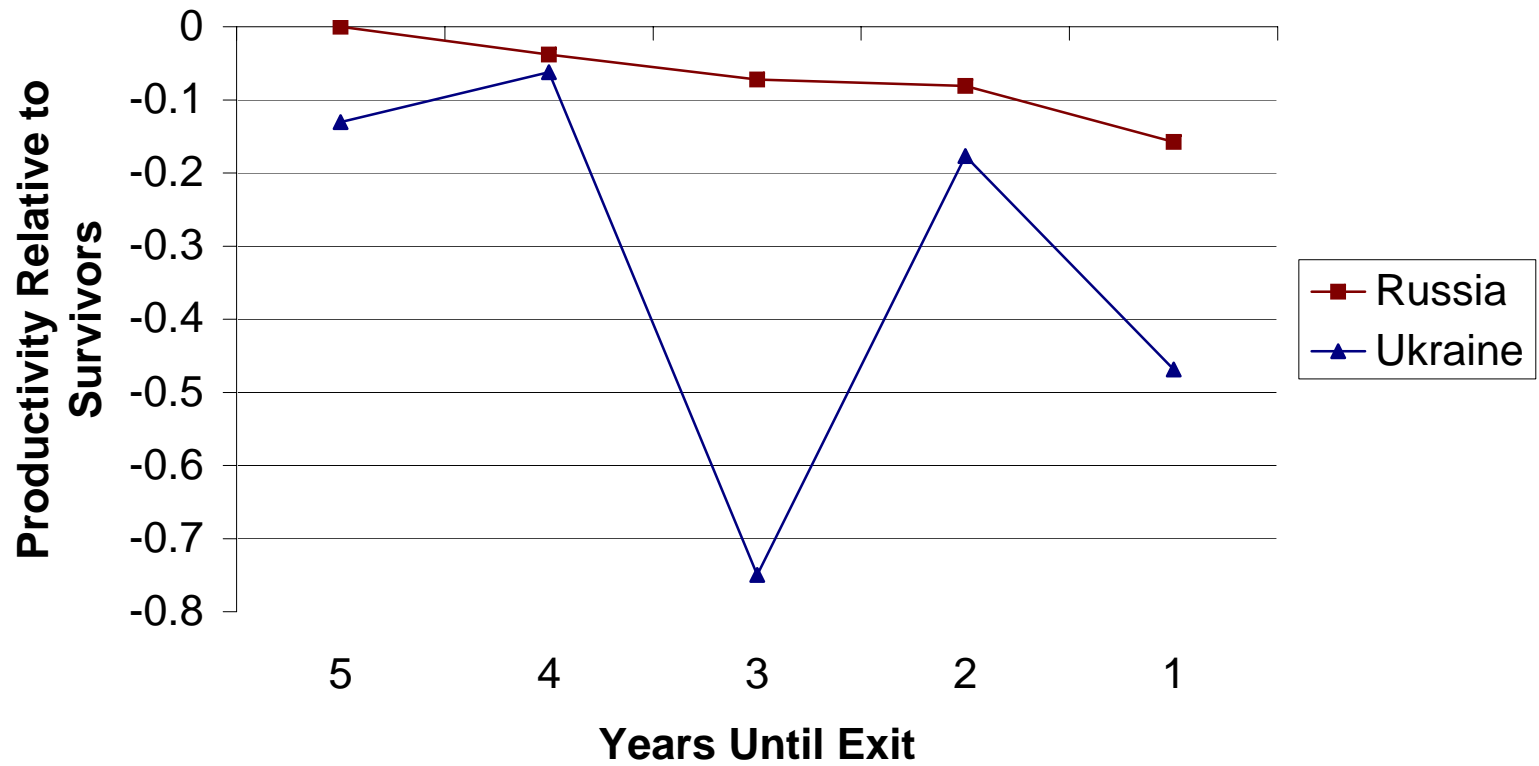
Figure 3b
Pre-Exit Multifactor Productivity
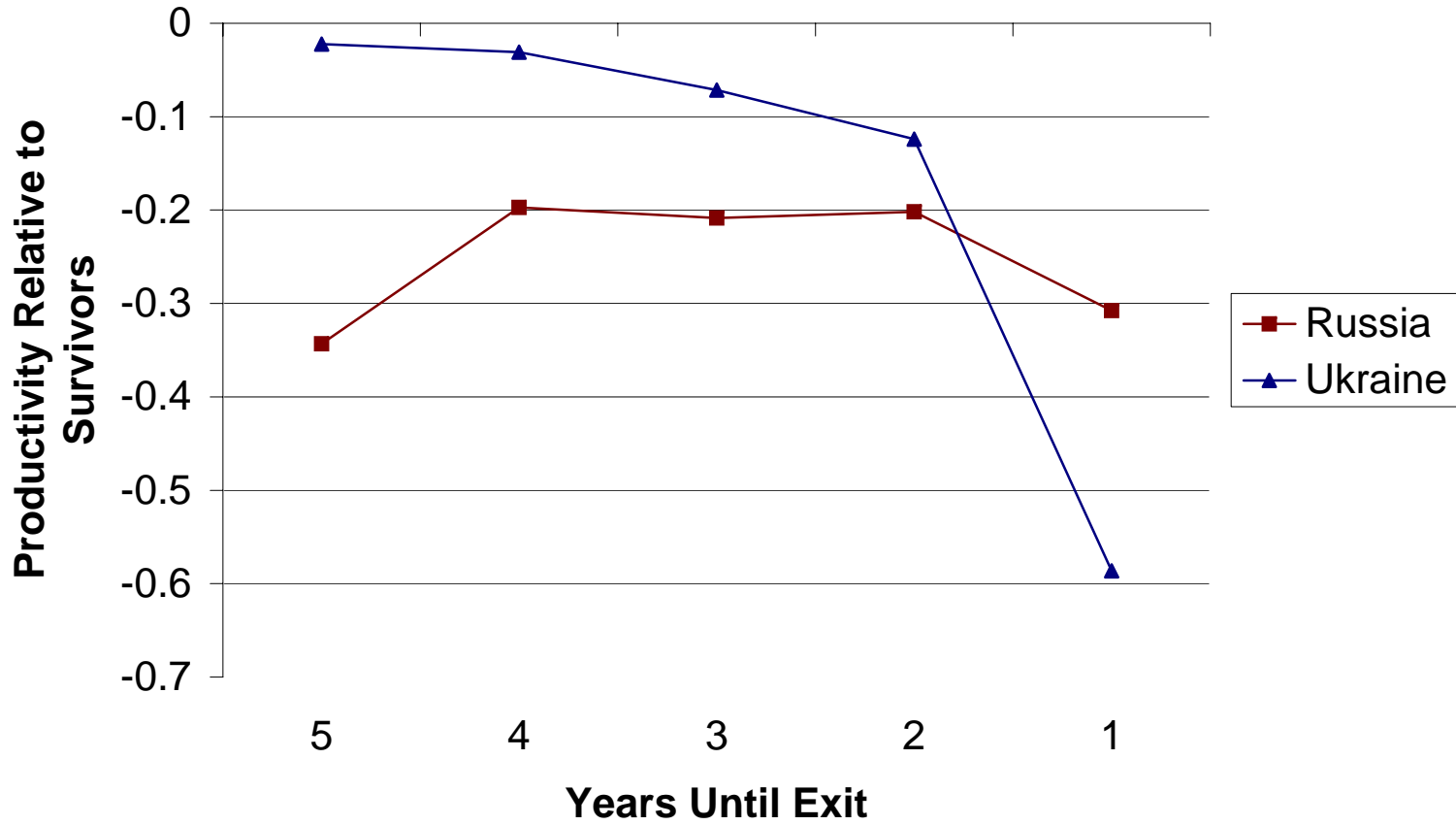
Table 8

Table 8
The Effects of Private Ownership and Market Competition on Productivity-Enhancing Resource Reallocation: Exit Probability Regressions (Probits)

	LP		MFP	
PD*Russia	-0.335	(-3.12)	0.026	(0.11)
PD*Ukraine	-0.254	(-1.43)	-0.148	(-0.39)
PD*Private*Russia	-0.103	(-1.78)	-0.235	(-2.44)
PD*Private*Ukraine	-0.157	(-2.27)	-0.669	(-3.27)
PD*ProdDisp.*Russia	0.021	(0.46)	-0.042	(-0.51)
PD*ProdDisp.*Ukraine	0.003	(0.05)	0.092	(0.57)
PD*LaborDisp.*Russia	0.088	(4.37)	0.032	(0.68)
PD*LaborDisp.*Ukraine	0.074	(1.18)	0.046	(0.44)
PD*OECDImp*Russia	-0.049	(-1.31)	-0.046	(-0.50)
PD*OECDImp*Ukraine	-0.107	(-2.10)	-0.156	(-1.72)
PD*LDCImp*Russia	0.029	(1.09)	-0.052	(-0.60)
PD*LDCImp*Ukraine	0.132	(2.00)	0.170	(1.23)
PD*CISImp*Russia	0.066	(0.95)	0.082	(1.11)
PD*CISImp*Ukraine	0.099	(1.92)	0.035	(0.42)
Private*Russia	-0.804	(-11.68)	-1.230	(-12.53)
Private*Ukraine	-1.518	(-8.80)	-1.669	(-5.82)
ProdDisp.*Russia	-0.668	(-12.88)	-0.513	(-7.75)
ProdDisp.*Ukraine	-0.206	(-2.48)	-0.044	(-0.36)
LaborDisp.*Russia	0.169	(5.75)	0.061	(1.53)
LaborDisp.*Ukraine	0.029	(0.51)	0.069	(0.66)
OECDImp*Russia	-0.046	(-1.28)	-0.004	(-0.06)
OECDImp*Ukraine	0.101	(2.34)	0.134	(1.49)
LDCImp*Russia	0.000	(0.01)	-0.042	(-0.52)
LDCImp*Ukraine	-0.059	(-1.24)	0.013	(0.12)
CISImp*Russia	-0.159	(-3.38)	-0.166	(-2.22)
CISImp*Ukraine	0.003	(0.06)	-0.115	(-1.68)
LogEmployment*Russia	-0.075	(-1.77)	-0.060	(-0.87)
LogEmployment*Ukraine	0.016	(0.27)	0.138	(0.89)
Pseudo R^2	0.167		0.247	
N	99,654		79,843	

Note: These are probit regressions for 1993-98, weighted by employment (LP) or the input index (MP). PD is the difference between the firm's productivity and the productivity of its 5-digit industry. *T*-statistics, shown in parentheses, are based on the Huber/White/sandwich estimator of variance. Country-year effects are also included.

Table 9
Comparison of Surviving and Non-Surviving Incumbents and
Entrants in Year of Entry

	Russia				Ukraine			
	LP		MP		LP		MP	
Nonsurviving	-0.318		-0.271		-0.469		-0.090	
Incumbents	(-9.38)		(-7.28)		(-5.25)		(-1.08)	
Exit$_{t+1}$		-0.365		-0.147		-0.409		-0.108
		(-7.02)		(-2.80)		(-3.61)		(-1.31)
Exit$_{t+2}$		-0.434		-0.314		-0.409		-0.031
		(-12.22)		(-6.82)		(-3.49)		(-0.34)
Exit$_{t+3}$		-0.197		-0.310		-0.563		-0.130
		(-2.54)		(-6.57)		(-5.02)		(-1.14)
Nonsurviving	-0.433		-0.205		-0.836		0.336	
Entrants	(-7.30)		(-1.31)		(-3.14)		(1.19)	
Exit$_{t+1}$		-0.442		-0.010		-0.920		-0.506
		(-4.98)		(-0.09)		(-2.95)		(-2.88)
Exit$_{t+2}$		-0.479		-0.003		-0.031		1.331
		(-5.62)		(-0.02)		(-0.11)		(2.35)
Exit$_{t+3}$		-0.353		-0.305		-1.003		0.581
		(-2.97)		(-1.64)		(-1.67)		(2.49)
Surviving	-0.174	-0.175	-0.007	-0.006	-0.436	-0.433	-0.255	-0.282
Entrants	(-3.36)	(-3.39)	(-0.06)	(-0.06)	(-3.18)	(-3.14)	(-1.44)	(-1.58)
Number of Surviving Entrants	1,975		1,143		329		268	
Number of Non-surviving Entrants	1,440		892		139		97	
Number of Surviving Incumbents	49,481		30,547		20,230		19,998	
Number of Non-surviving Incumbents	15,689		12,559		3,149		2,993	

Note: These are OLS regressions in 1994-97 with *t* statistics, adjusted for firm clustering, reported in parentheses. Productivity is regressed on the incumbent and entrant dummies (surviving incumbents is the omitted category), controlling for industry and year effects. The regressions are weighted by employment (LP) or the input index (MP). Incumbents are defined as existing since year *t*-1 or before.

Table 10
Comparison of Surviving Incumbents and
Entrants Three Years after Entry

	Russia		Ukraine	
	LP	MP	LP	MP
New Entrants$_{t-3}$	0.031 (0.48)	0.297 (2.71)	0.129 (0.88)	0.013 (0.05)
Number of Entrants	2,057	1,143	971	265
Number of Incumbents	51,021	30,556	20,804	20,034

Note: These are OLS regressions in 1997-2000 with t statistics, adjusted for firm clustering, reported in parentheses. Productivity is regressed on the entrant dummy, controlling for industry and year effects. The omitted category is incumbents, defined as firms existing since year t-4 or before. The regressions are weighted by employment (LP) or the input index (MP).