
PRODUCER TURNOVER AND PRODUCTIVITY GROWTH IN DEVELOPING COUNTRIES

Mark J. Roberts
James R. Tybout

The reallocation of resources, either across sectors or across producers within a sector, can serve as a potential source of productivity growth. New research findings exploit comprehensive microeconomic data on the manufacturing sectors of Chile, Colombia, and Morocco to document resource shifts as producers enter, expand, contract, and exit operation. The micro-level adjustment is substantial; between 25 and 30 percent of the total number of manufacturing jobs turn over each year. In the short run, the productivity effects of this turnover are modest because the new plants that come on line are only slightly more productive than the ones they replace—and both are typically small. In the longer term, however, the turnover generates more substantial increases in productivity because the new firms that survive record substantial productivity gains in their early years. Moreover, firms that exit are typically on a downward productivity spiral and would probably have dragged down sectoral efficiency farther if they had continued in operation.

Many developing countries in the process of structural transformation are struggling to catch up technologically, and their labor markets face the formidable task of moving workers among diverse occupations. At the same time, various frictions inhibit factor mobility in the industrial sector; these include severance laws that prevent firms from firing workers and regulations that limit the establishment of new firms and the termination of old ones. The movement of capital and labor is further constrained by credit-market imperfections, noncompetitive markets, and limited information about technological advances. Many resources might earn higher social returns if they were redeployed in different activities, and structural changes that work to this end might generate large efficiency gains. Similarly, if rates of productivity growth differ across sectors, resource shifts

from low- to high-productivity sectors might significantly improve productivity growth throughout the economy.

This notion that growth can be generated by reallocating resources more efficiently has long interested development economists. It is well documented that broad shifts in the composition of output take place as the development process unfolds, typically shifting production away from natural resource-based products and toward manufacturing and service sectors (Chenery 1979; Chenery, Robinson, and Syrquin 1986; and Syrquin 1988). Several studies have found that this structural change is often associated with substantial gains in productivity, but little is known about the resource reallocations that occur *within* sectors as producers enter and exit and their respective market shares change. As Kuznets (1979) and Syrquin (1984) note, if these processes move resources from less efficient to more efficient plants within the same sector, the gains in productivity may be substantial, but the source of these gains is impossible to identify using aggregate data.¹

This paper summarizes recent research on the magnitude and implications of this micro-level reallocation of resources in semi-industrial countries. A common theme of this research is that individual producers within the same industry differ in efficiency and thus the reallocation of resources from less-efficient to more-efficient producers offers the potential for improved economic performance. The research is based on panel data that cover virtually all the manufacturers with at least ten workers in three countries: Chile, Colombia, and Morocco. (Other, more limited data from Mexico, Turkey, and Venezuela are also used.) These data make it possible to track individual producers as they enter, expand or contract production, and exit. Differences in productivity can be measured, and the effect of micro-level resource reallocations on aggregate productivity can be quantified.

Several robust patterns of resource reallocation exist. First, a tremendous amount of adjustment at the micro level is completely masked in aggregate or sectoral data. Each year the entry of new manufacturing plants and the growth of existing plants create new jobs that average between 13 and 19 percent of total employment in the manufacturing sector. At the same time the contraction and closing of other plants are responsible for the simultaneous loss of between 12 and 14 percent of total employment. This high rate of employment reallocation among manufacturing plants is present in all the countries studied and persists in each year throughout the business cycle, reflecting a vigorous process of micro-level adjustment.

Second, the patterns of plant turnover partly reflect differences in productivity across plants. On average, exiting plants are less productive than surviving ones, and entering plants are less productive than more experienced incumbents. As new plants mature, however, their average productivity tends to increase for several years until they reach industry norms. Overall, the empirical results reveal a continual process of resource reallocation that moves resources from less-efficient to more-efficient producers within the same industry and that contributes to long-run improvements in economic performance.

In this article we first review the empirical evidence on patterns of producer turnover, describing the creation and destruction of jobs and the entry, growth, and exit patterns of manufacturing plants. We then summarize the evidence on differences in productivity among plants and the implications of turnover for productivity growth. Finally, we address some of the reasons for the differences in efficiency across producers.

Producer Turnover and Employment Flows

It is useful to think of the reallocation of resources as arising from three different forces. The first source, which has received the most attention in the literature on development, is long-run structural shifts in technology, endowments, and demand. These forces generate an expansion of output and attract new producers in some sectors, while inducing a contraction in output and net exit by producers in other sectors. Typically, industrial sectors in developing countries gradually shift out of assembling low-technology manufactured goods and move into more sophisticated products that are relatively intensive in human and physical capital.

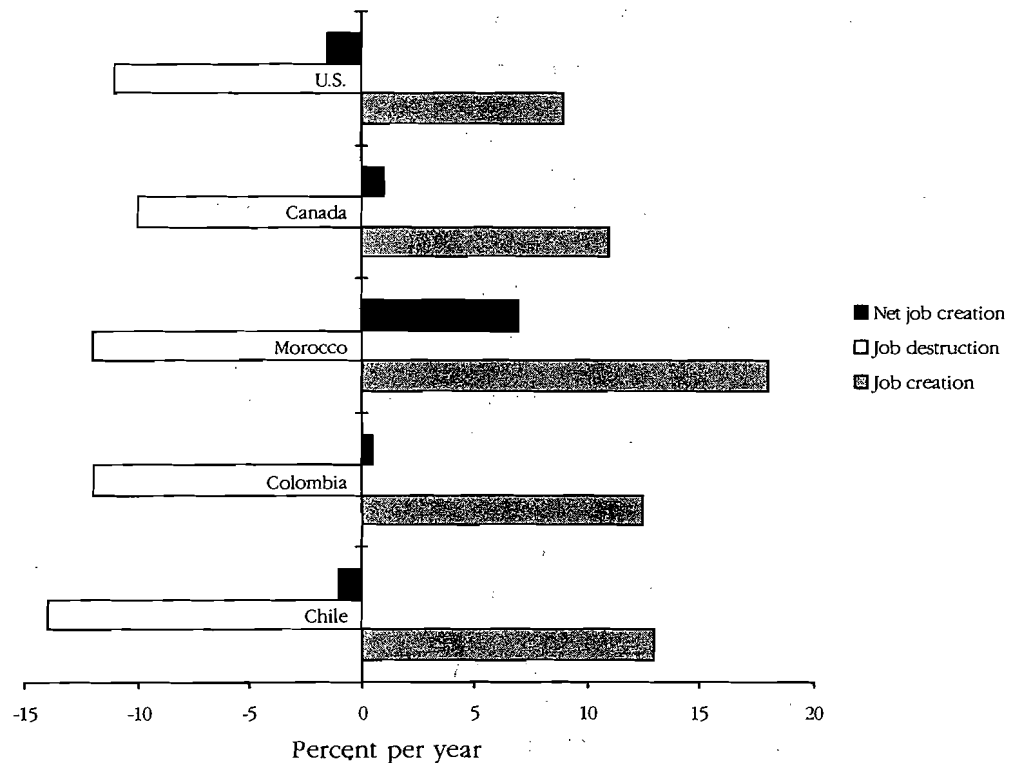
The second source of resource reallocations is short-run or cyclical fluctuations in demand that might arise from changing macroeconomic conditions or external market shocks. These cyclical fluctuations may be felt in all sectors, but their effects are likely to be particularly important in industries that have low sunk costs because in such cases short-term, or hit-and-run, entry may be profitable. In industrial countries cyclical patterns of job creation and destruction have been interpreted to have a "cleansing" effect because in recessions resources are released from those activities that produce the lowest return and are subsequently reemployed more productively when the economy expands (Caballero and Hammour 1994).

The third source of resource reallocation stems from market forces that create continual producer turnover within an industry even when macroeconomic conditions are stable. This phenomenon has only recently been formally modeled in the literature (see Jovanovic 1982; Lambson 1991, 1992; Hopenhayn 1992; and Pakes and Ericson 1995). It derives from the fact that sunk entry and exit costs, combined with uncertainty, make it possible for producers at different levels of efficiency to co-exist in the same industry. (Entry costs include licensing fees and irreversible purchases of capital goods; exit costs may include bankruptcy expenses or severance payments to employees.) Differences in efficiency arise from differences in managerial abilities or random variation in the returns on past investments in capital or technology. A given firm is uncertain about its relative efficiency and learns about it through market experience or by observing the outcomes of investment projects. Those companies that find they are relatively inefficient or that invest in unproductive assets eventually exit, while those that find they are efficient or that their investments are productive

survive and expand. New firms continually enter and try their hand at competing with the incumbents. The speed of this turnover process is affected by market conditions and by the magnitude of the sunk entry and exit costs involved. Institutional frictions such as severance laws and credit constraints also shape turnover patterns.

To study all three types of resource reallocation requires examining all the producers in a sector—not simply large continuing producers. Comprehensive panel data from Chile, Colombia, and Morocco were used to identify entering, incumbent, and exiting producers, impute productivity trajectories for each producer, and calculate market shares. Figure 1 summarizes the magnitude of annual job creation and destruction in the manufacturing sector of each country.²

Figure 1. Job Creation and Destruction



Note: Sample periods are Chile, 1979–86; Colombia, 1977–89; Morocco, 1984–89; Canada and United States, 1973–86. The annual rate of job creation is the number of employment positions added during a year, expressed as a percentage of total manufacturing employment at the start of the year. Similarly, the annual job destruction rate is the number of jobs lost during the year, expressed as a percentage of employment at the beginning of the year. The annual rate of employment growth in the manufacturing sector, referred to as net job creation, is the difference between jobs created and jobs destroyed.

Source: Roberts and Tybout (1996, ch. 2, table 2.1).

Economic conditions in these three countries were typical of those in most semi-industrial countries in the 1980s, so the findings are probably representative of a broader group of nations. Each of the three countries began the decade with an overvalued currency and was forced to devalue and contract during the debt crisis. By the end of the sample period, each country had undergone some degree of structural adjustment and resumed growing.

There were, however, important differences among the three. Chile suffered a major financial crisis in the early 1980s because the manufacturing sector had become heavily indebted in dollars. Its contraction was severe, with unemployment reaching almost 30 percent and large-scale shutdowns of manufacturing plants. Nonetheless, economic policies remained *laissez faire*, with low tariffs, almost no nontariff barriers, very little public ownership in manufacturing, and little intervention in the labor market. Colombia's recession was much milder, but its commercial policy remained more protectionist. The data base for Morocco does not begin until after the recession, so it describes only the prolonged recovery. During that time the government promoted manufactured exports with various tax exemptions but maintained some degree of protection from imports. These differences, as well as variations in the length of the sample periods and the degree of industrialization in each country, probably led to some differences in the reallocation of resources over the long term and in the volume of intra-industry turnover.

Cyclical Fluctuations

One way to quantify micro-level resource flows is to look at the creation and destruction of jobs (see figure 1). In Chile, Colombia, and Morocco, new jobs were created at an annual average rate of 13 to 19 percent of total employment in manufacturing, while the average rate at which jobs were eliminated varied from 12 to 14 percent. These rates were remarkably similar across the three countries, considering the very different macroeconomic conditions that prevailed. Together, the average number of new manufacturing positions that were added and existing positions that were lost came to 26 to 30 percent of total manufacturing employment in an average year—somewhat more volatility than one finds in the United States and Canada. One explanation for this result is that macroeconomic shocks were longer in the semi-industrial countries. Nonetheless, annual figures (table 1) show that most job creation and destruction takes place simultaneously at all phases of the business cycle, implying that inter- and intra-industry turnover together are more important than the effects of the business cycle.

If the costs of changing employers are similar for workers in semi-industrial countries and in the United States and Canada, the rapid rate of job turnover implies that the average adjustment burden per worker is relatively high. These costs may be somewhat offset, however, by the high geographic concentration of manufacturing activity in the semi-industrial countries, which makes it less likely that workers will need to move as employment demand shifts.

Table 1. Job Creation and Job Destruction by Phase of the Business Cycle
(percent)

Country	Rate of job growth	Gross job additions	Gross job losses
<i>Average during years of employment expansion</i>			
Chile	8.7	17.6	-8.9
Colombia	2.8	13.7	-11.0
Morocco	6.5	18.6	-12.1
Canada	2.6	11.4	-8.8
United States	3.2	11.1	-7.9
<i>Average during years of employment contraction</i>			
Chile	-8.2	9.4	-17.6
Colombia	-2.2	11.2	-13.3
Morocco	n.a.	n.a.	n.a.
Canada	-3.0	9.1	-12.1
United States	-5.5	7.4	-12.9

n.a. = Not available.

Note: Sample periods are Chile, 1979-86; Colombia, 1977-89; Morocco, 1984-89; Canada and United States, 1973-86.

Source: Roberts and Tybout (1996, ch. 2).

A comparison of the annual job creation and job destruction rates between the semi-industrial countries and the United States and Canada reveals an interesting contrast. As the two industrial countries move from recession to expansion, the reduction in the rate of job destruction is larger than the increase in the rate of job creation. As a result total employment turnover is countercyclical—and consistent with the view noted earlier that recessions “cleanse” the production structure (Caballero and Hammour 1994). In the semi-industrial countries job creation rates are equally—or more—sensitive than job destruction rates to fluctuations in aggregate economic activity. That is, the job creation rate differs more between expansionary and contractionary periods than does the job destruction rate. Thus, the dominant cyclical feature is the large increase in the creation of new job opportunities during expansionary periods. One interpretation is that limited access to financial markets in the semi-industrial countries forces plants to rely more heavily on internal finance, so expansion and entry are more sensitive to demand.

Structural Shifts

Despite the high turnover during the sample periods shown in figure 1, relatively little change occurred in the net size of the manufacturing sector in each of the three semi-industrial countries. Over the entire sample period, total manufacturing employment changed by an average of only 0.3 percent a year in Colombia, -1 percent in Chile, and 6.5 percent in Morocco. Especially in Chile and Colombia, therefore, intersectoral labor reallocation between manufacturing and

the rest of the economy (including the pool of unemployed workers) accounted for a small fraction of gross job reallocation flows. This is presumably because the time periods examined are relatively short and the sample countries were fairly industrialized at the beginning of the sample period. In any case, the data do not show the kind of broad intersectoral reallocation of jobs noted in earlier studies.

Yet the industrial sectors of developing countries continually change character, as labor-intensive, light-manufacturing industries give way to more capital-intensive, durable goods industries (Chenery, Robinson, and Syrquin 1986). One might therefore expect a substantial shift in labor flows across industries *within* the manufacturing sector, even though aggregate manufacturing employment is not changing much. But we found no more shifting of jobs from one manufacturing industry to another in the semi-industrial countries than in the United States. After controlling for the net expansion or contraction of total manufacturing employment, we found that more than 80 percent of the shift of workers employed in manufacturing occurred *within*, rather than across, industries. That is, the shift in positions from plants that are contracting or failing to plants that are entering or expanding *in the same manufacturing industry* accounts for more than 80 percent of the annual change in employment on average. Presuming that worker skills are industry-specific rather than employer-specific, this turnover pattern implies that displaced workers require less retraining than they would if they moved to another sector altogether.

Intra-Industry Turnover

The dominance of internal flows of employment within the same industry suggests that industrial-evolution models best describe the data. If this is so, much of the job creation and destruction reflects the continual exit of producers who are relatively inefficient and the continual entrance into the same industry of new producers who are, on average, better. Another implication is that sunk entry and exit costs, which are largely dictated by the capital requirements of production, are fundamental determinants of the speed at which this cleansing process unfolds. Producers are reluctant to enter industries with high sunk costs, so incumbent producers are less likely to be driven from the market, and on average, these industries will purge inefficient plants relatively slowly. Further, in these same industries most of the output is controlled by a few producers, and operating profits are high, even when incumbents have no market power (Jovanovic 1982). This pattern tends to support the conclusion that conditions traditionally associated with monopoly rents may also be consistent with competitive behavior and that antitrust action may not be warranted on welfare grounds.

Several other patterns in the data suggest the importance of sunk entry and exit costs. First, the rate of job turnover, defined as the sum of the rates of job creation and destruction, differs substantially across industries, but the ranking

of industries from low to high turnover tends to be very similar across countries. Industrial technology, which is common to all countries, appears to play a large role in shaping this pattern. Second, the high-turnover industries, such as furniture, apparel, food processing, and wood products, are all ones with relatively small-scale production and low capital intensity, while the low-turnover industries, such as steel, chemicals, glass, and paper, are the opposite (table 2).

Job turnover resulting from entry and exit as well as from expansions and contractions in the size of existing plants reflects managerial reactions to the firm's success or failure in the market or the outcomes of investments—or both. The resource reallocations that accompany each process, however, are subject to different types of frictions. For example, because sunk costs are associated with opening or closing a business, the decision to enter is forward-looking and reflects expectations about the entire future profit stream. Adjustments by incumbents in the number of workers employed and the volume of materials purchased are driven mainly by current profit considerations, however. Policies such as bankruptcy laws, entry licensing requirements, and severance laws affect both entry and exit decisions and decisions on the scale of operations, but in different ways.

Although entry and exit account for about a third of total job turnover in Chile and Morocco, and nearly half the job turnover in Colombia, they are less important in the United States (table 3). In fact, when business-cycle effects are netted out, the difference between turnover rates in the United States and those in the semi-industrial countries can be attributed entirely to the latter group's rates of entry and exit. These higher rates, in turn, trace to the relative emphasis in those countries on light manufacturing industries, in which entry and exit costs are small. If low entry costs lead to strong competitive pressures, these

Table 2. *Average Annual Employment Turnover Rates by Three-Digit ISIC Industry*

<i>Industry</i>	<i>Percentage turnover</i>	<i>Industry</i>	<i>Percentage turnover</i>
Iron and steel	11	Professional/scientific equipment	19
Industrial chemicals	12	Printing	20
Glass	12	Nonmetallic mineral products	20
Ceramic products	12	Leather	20
Paper	13	Plastic products	20
Rubber	14	Footwear	21
Beverages	14	Fabricated metal products	22
Nonferrous metal refining	14	Nonelectrical machinery	22
Electrical machinery	16	Furniture	24
Transport equipment	16	Apparel	24
Other chemical products	16	Food processing	24
Textiles	18	Wood products	28

Note: Definition of industry group based on the International Standard Industrial Classification (ISIC) designed to promote international comparability in statistics of economic activity.

Source: Roberts and Tybout (1996).

Table 3. Entry and Exit as a Source of Job Turnover
(percent)

Country	Total job turnover	Job turnover due to plant entry and exit	Job turnover among incumbent plants
<i>Average during years of employment expansion</i>			
Chile	26.5	8.9	17.6
Colombia	24.7	11.9	13.0
Morocco	30.8	8.9	21.8
United States	19.0	3.5	15.5
<i>Average during years of employment contraction</i>			
Chile	27.0	10.4	16.6
Colombia	25.5	11.3	13.2
Morocco	n.a.	n.a.	n.a.
United States	20.3	4.0	16.3

n.a. = Not available.
Source: Roberts and Tybout (1996).

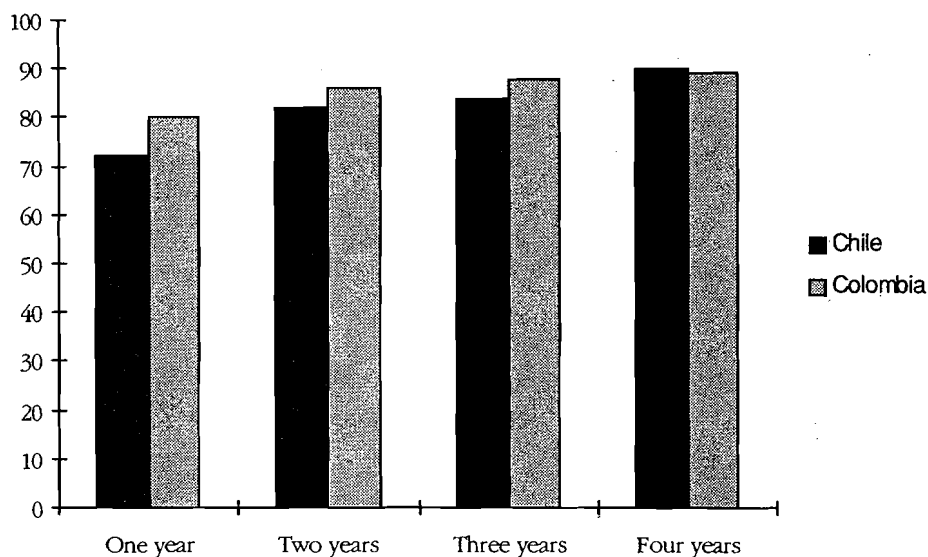
high turnover rates challenge the popular perception that the high concentration of manufacturing in many developing countries reflects less market competition than is seen in industrial countries (Rodrik 1988, Krugman 1989).

One view of the life cycle of individual plants is that new entrants embody the latest technology and thus are more efficient than older plants. These new plants gradually expand and become significant producers but are eventually replaced, in turn, by producers embodying newer technology. Under this scenario, exiting plants should be among the oldest because they are likely to be relying on outdated technology. An alternative view, however, suggests a contrasting pattern. If plants are born with different efficiencies and only learn their relative efficiency gradually as they gain experience, it follows that the efficient ones survive and grow, while the inefficient ones contract and exit. In this case, exit should be concentrated among younger plants, while older plants, having survived a shakedown process, will be the most efficient.

The data on failures by manufacturing plants in semi-industrial countries support the latter view. Figure 2 shows the share of new manufacturing plants in Chile and Colombia that survived each year during their first four years of operation. As each cohort of new plants ages, the proportion of plants that survive clearly increases. For example, the one-year survival rate in Colombia increased from 79.4 percent for one-year-old plants to approximately 87 percent for plants more than three years old. In Chile, first-year survival rates averaged 73.2 percent, while four-year-old plants had survival rates of 89.2 percent.

Additionally, the average size of the surviving members of the cohort increases over time. For example, in a typical year, one-year-old plants in Chile and Colombia are only 26 percent and 39 percent as large, respectively, as the average incumbent plant, but five-year-old plants are 75 percent and 65 percent as large,

Figure 2. *Survival Rate of Manufacturing Plants*
(percent)



Source: Roberts and Tybout (1996, ch. 7, 8).

respectively. This increase reflects two effects: the growth of the surviving cohort members and the failure of the smaller plants in the cohort. Both factors, however, indicate that in each year, it is the older plants that are the dominant source of industry output.

Overall, the qualitative patterns of plant turnover are similar to those found in the manufacturing sectors of industrial countries: continual waves of small-scale entrants, many of which exit the market within the first few years of their existence. Theory suggests that heterogeneity in profit or efficiency levels and uncertainty on the part of entrants about their future ranking relative to industry norms lie behind these phenomena. In addition, turnover rates differ across industries, with high-entry industries generally characterized by high exit. At a minimum, the turnover patterns we find in the semi-industrial countries—whether measured in terms of jobs or number of plants—imply an environment with substantial resource mobility, much of it occurring among producers within the same industry.

The Relationship between Productivity and Turnover

Turnover-based productivity gains can come from two basic sources. One is the continual exit of relatively inefficient producers and the simultaneous entry of producers who do better. The other source is a reallocation of market share

from inefficient toward efficient plants. These gains can be compared with the changes in productivity within plants, which have been the focus of most studies of productivity in semi-industrial countries.

To document these processes, two approaches have been used. One simply amounts to constructing output-to-labor ratios, plant by plant (see Tybout 1992). The other begins by estimating a production function describing the relationship between the output of a good and the inputs required to make that good (see Liu and Tybout 1996).³ Plant-specific productivity in each year is calculated as the ratio of actual output to the output predicted by the production function, assuming a given level of inputs. Once each plant's productivity trajectory is calculated, it can be used to show the growth of productivity among incumbent plants that have been operating throughout the sample period and the effects of turnover (entry and exit of plants). The former is simply attributable to improved efficiency; the latter is attributable to productivity gaps among incumbents, entering producers (who are in their first year of operation), and exiting producers (who are in their last year of operation). For example, if incumbents are more productive than entering and exiting plants, net entry dampens productivity growth and net exit boosts productivity. And if new producers are more productive than the producers they replace, ongoing turnover is a steady source of productivity gain. Algebraic details are provided in the appendix.

Some of the growth in efficiency among incumbent producers reflects improved productivity. But gains are also generated when resources shift from low- to high-productivity manufacturers, a shift that is generally accompanied by the creation of new jobs and the destruction of old ones. We consider this turbulence arising from the reallocation of market shares to be one source of the gains in efficiency, and we distinguish it from the increase in productivity that occurs within individual plants (see appendix).

Findings on the effects of turnover in industrial countries are quite mixed. The relevant references include Baldwin and Gorecki (1991); Griliches and Regev 1995; Baily, Hulten, and Campbell 1992; and Olley and Pakes 1996; for a summary see Tybout (1996). For the semi-industrial countries, several basic patterns emerge. First, macroeconomic fluctuations can induce significant turnover with far-reaching effects on productivity. Because entry and exit rates vary during the business cycle, so do the market shares of incumbent producers. During upswings incumbents lose market share because new plants enter more rapidly than incumbents fail. This pattern exerts a countercyclic influence on productivity because new and dying firms are typically less productive than continuing producers. Plant exits during the recession in Chile improved labor productivity more than 1 percent, and the rapid entry of inexperienced firms during Morocco's boom period reduced labor productivity almost 2 percent (Tybout 1992).

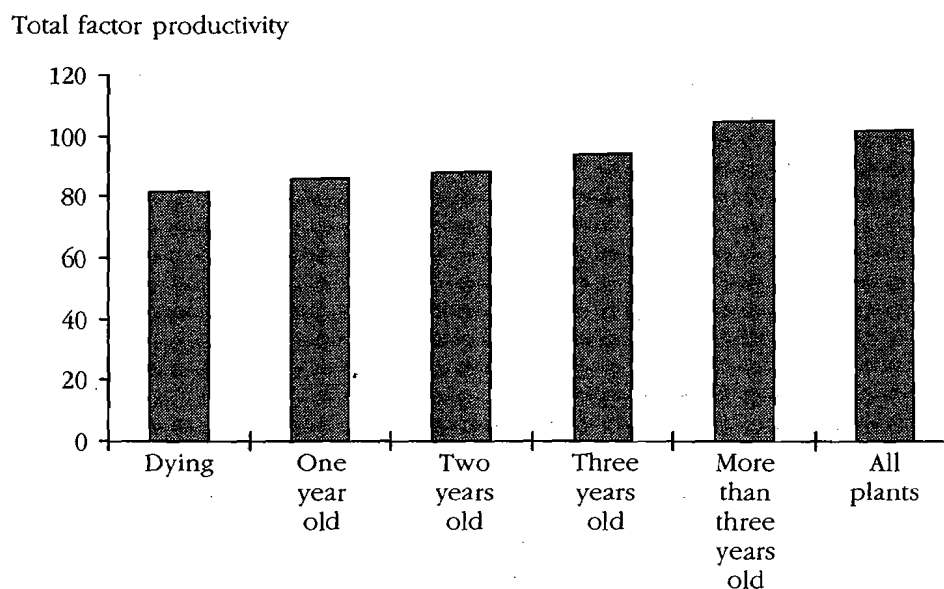
Similarly, the productivity effect of the reallocation of market shares can be substantial in the short run, because firms do not all expand and contract proportionately over the course of the business cycle. In Colombia, inefficient plants shrank relatively more as the economy went into recession and recovered rela-

tively rapidly when aggregate demand rebounded. This countercyclic productivity effect amounted to several percentage points of efficiency gain or loss in some years and industries. The *net* market share effect over the course of a full business cycle is not typically large, however.

Second, replacing dying plants with new plants also has a rather small average impact on productivity. The average gains during downturns are roughly offset by the losses from turnover during upswings, so most of the measured productivity growth comes from gains in efficiency by incumbent plants. In part, this is because entering and exiting plants account for only 3 to 5 percent of production in a typical year. It is also because the productivity gap between plants in their first year of operation and those in their last year of operation is small. Entering plants are only about 85 percent as productive as the industrywide average, and exiting plants are roughly 80 percent as productive (figure 3).

Third, by focusing on the efficiency gap between exiting and entering plants, one substantially understates the productivity effects of turnover. As noted earlier, the average productivity of each new cohort of plants rises as it matures, reaching industry norms after about four years of experience (see figure 3). Thus an entering cohort of plants eventually becomes *substantially* more productive than the cohort of exiting plants it replaced, and this latter group might well have gotten worse if it had not exited (Liu 1993; Griliches and Regev 1995). Although the market share of entering and exiting plants in the transition year is small, 20 to 30 percent of the population of plants typically turns over within four years.

Figure 3. Cohort-Specific Productivity of Manufacturing Plants in Colombia, 1982-86



Source: Roberts and Tybout (1996).

In assessing the gains from plant turnover, it is useful to ask what would have happened without any entering or departing plants? This question can only be answered with a forward-looking model of entry and exit decisions, as well as a counterfactual representation of the productivity trajectory for plants that are prevented from exiting. Developing this framework is an important topic for further research. At present we can only point to anecdotal evidence from countries that distort turnover patterns (by subsidizing or limiting entry, or by propping up inefficient producers that would otherwise exit), which suggests that the costs of such distortions are large (Pursell 1990).

Other Aspects of Productivity

In addition to the sources of productivity gains mentioned above, several others have been investigated in the research program summarized herein, including technology transfers and learning spillovers, ownership structure, scale economies, and international trade.

Technology Transfer

Harrison (1996) finds that plants owned by multinationals are typically closer to the efficient production frontier than domestically owned firms. Contrary to earlier studies based on cross-sectional data, however, foreign direct investment does *not* appear to generate positive spillover effects for domestic firms in the same industry or region. At least in the short run, it appears that multinationals siphon off demand and high-quality labor from domestic competitors.

Ownership Structure

Foroutan (1996) finds that the distinction between private and public ownership is also relevant to productivity levels. In Turkey publicly owned plants are significantly less productive than privately owned plants, and they exhibit qualitatively different responses to trade liberalization. This finding is consistent with the assumption that public sector managers, lacking the disciplining influence of shareholders, pursue objectives such as job security and compensation.

Scale Economies

If there are economies of scale in production, large plants will be more efficient than small ones, so policies that influence the size of manufacturing plants also affect productivity. For example, trade development strategies may increase the size of export-oriented producers by expanding their potential market. Conversely, to the extent that economies of scale exist, the

same policies may reduce scale efficiencies in those firms that compete with imports, since these producers typically contract when trade liberalization increases import penetration in the domestic market (Rodrik 1988). As a source of productivity growth, however, such changes have probably been overemphasized relative to the other dimensions of performance. The largest plants in most industries typically have attained minimum efficient scale, and these are the plants that dominate industrywide performance (Tybout and Westbrook 1996). One implication is that the computable general equilibrium models that have been used to estimate the gains from trade liberalization do not recognize differences in the size of plants within an industry and thus have often overstated the potential gains from scale economies that accompany trade liberalization (Tybout 1993).

International Trade

The degree of exposure of the domestic industry to international markets may affect productivity through other channels. Differences in productivity within an industry are typically greater in industries protected from international competition, suggesting that protection nurtures inefficiency. Higher productivity growth generally is associated with the production of tradable goods. These patterns may reflect limited access to foreign technology and expertise as well as problems acquiring imported intermediate and capital goods under protectionist trade regimes. But there are plausible alternative explanations for the negative association between protection and productivity. For example, economic models suggest that sectors with large start-up costs have relatively little turnover and tend not to sort out firms with low productivity. These sectors may also be relatively protected because they are not sectors in which the semi-industrial countries have a comparative advantage.

Conclusion

The turnover patterns we document are difficult to reconcile with the view that entry and exit primarily reflect aggregate demand fluctuations or long-term changes in technology. Instead, they seem most consistent with recent theories that emphasize the heterogeneity of producers, the uncertainty each producer faces about its ability to survive, and the constraints on turnover introduced by the sunk costs of entry and exit.

One implication of the evidence cited here is that artificial impediments that prevent failing businesses from going out of business can be very counterproductive, particularly if they are maintained over long periods of time. Mandated severance payments or prohibitions on plant closings not only inhibit intersectoral reallocations, but also tend to discourage transfers that could lead to a more productive use of resources within an industry. It is not even clear that these

restrictive policies are useful in preserving employment. If they prevent the transfer of production to more efficient producers, they may eventually result in a smaller industrial sector. Similarly, restrictions on access to credit, equity, or other financial markets can reduce the entrance of potentially productive plants or the expansion of incumbents. Policies that reduce entry keep relatively inefficient producers in operation and slow the productive transfer of resources.

Another implication is that industrial concentration may be a very poor measure of market power; it is more likely to reflect the magnitude of sunk costs that constrain entry. Industries with high entry costs tend to have high operating profits and typically remain concentrated for long periods of time, even if firms are behaving competitively. Hence, antitrust policies designed to limit producer concentration may simply reduce efficiency.

Finally, that the cyclical component of job flows is small relative to the average level of reallocation in any year suggests that policymakers who focus on the macroeconomic causes of employment fluctuations may miss the largest source of worker transitions. Attention to the search process and associated market failures may be a much more effective means of reducing the duration and frequency of unemployment spells and the associated efficiency losses they entail.

Appendix. Productivity Decompositions

Define $E_{it} = Y_{it} / f(v_{it}, t_0)$ as the efficiency of the i^{th} producers in year t , where Y_{it} is realized output, v_{it} is its input vector, and $f(v_{it}, t_0)$ is an estimated production function evaluated at the firm's period t input vector and the technology prevailing in period t_0 . (In some instances, capital stocks or intermediate inputs are unobservable, so $f(v_{it}, t_0)$ is replaced with a simple measure of factor use, such as total employment.) Industrywide productivity can then be written as a weighted average of the n plant-specific trajectories, $E_t = \sum_{i=1}^n E_{it} \theta_{it}$, where $\theta_{it} = f(v_{it}, t_0) / \sum_{i=1}^n f(v_{it}, t_0)$ is the period t market share of the i^{th} producer in terms of factor use.

To isolate turnover-based productivity growth, one can express growth in this industrywide productivity measure as the sum of three components:

$$(A1) \quad \frac{\Delta E_t}{E_{t-1}} = \bar{\theta}_c \left(\frac{\Delta E_c}{E_{t-1}} \right) + \Delta \theta_c \left[\frac{\bar{E}_c}{E_{t-1}} - \left(\frac{E_{bt} + E_{dt-1}}{2E_{t-1}} \right) \right] + \left(\frac{E_{bt} - E_{dt-1}}{E_{t-1}} \right) [1 - \bar{\theta}_c].$$

Here overbars denote averages over the periods $t-1$ and t , E_c is weighted average efficiency among continuing plants (denoted by $i \in c$), E_{bt} is the weighted average efficiency among plants that enter in year t (denoted by $i \in b$), E_{dt-1} is the weighted average efficiency among plants that exit (die) after year $t-1$ (denoted by $i \in d$), and θ_c is the market share of continuing plants.

Both the second and the third term in equation A1 pick up turnover-based productivity effects. But efficiency gains attributable to resource reallocations

among incumbent plants are also potentially important and worth isolating. To this end the first right-hand side element of equation A1 can be further decomposed as:

$$(A2) \quad \bar{\theta}_c \frac{\Delta E_c}{E_{t-1}} = \bar{\theta}_c \left[\sum_{i \in c} \left(\frac{\bar{\theta}_i}{\bar{\theta}_c} \right) \Delta E_{it} + \sum_{i \in c} \Delta \left(\frac{\theta_{it}}{\bar{\theta}_c} \right) \bar{E}_i \right]$$

where summations are only over continuing plants ($i \in c$). The first term on the right can be thought of as measuring the intraplant productivity growth effects that are the focus of representative-plant analysis. The second term—market share reallocation effects—picks up productivity gains or losses due to size adjustments among incumbents.

Notes

Mark J. Roberts is professor of economics at Pennsylvania State University and a research associate of the National Bureau of Economic Research. James R. Tybout is professor of economics at Georgetown University and a consultant to the World Bank. Much of the material presented here is based on a World Bank research project that has been incorporated into a book entitled *Industrial Evolution in Developing Countries: Micro Patterns of Turnover, Productivity, and Market Structure*, which the authors edited.

1. Kuznets (1979) observed that the common three-sector dichotomy—agriculture, manufacturing, and services—neglects all within-sector reallocations, which Kuznets said may have been an important reason why the productivity growth in Taiwan was poorly explained by the structural change methodology. Syrquin (1984, p. 95) summarizes this weakness of the traditional aggregate approach: “The estimated contributions of structural change to growth probably underestimate the impact of resource shifts. The broad definitions of sectors, even in fairly disaggregated studies, hides all [intra-sectoral] factor reallocations. . . . This is important for industrialized countries and for rapidly growing economies.”

2. The unit of observation in the Chilean and Colombian data sets is the manufacturing plant. In the Moroccan data set, it is the firm. This is a minor point because firms tend to be small, single-plant operations. In this paper we refer to the observations for all the countries as manufacturing plants.

3. $Y_{it}^* = f(v_{it}, t)$, where Y represents the amount of output attained by the average plant at the input vector v_{it} in period t . Given $f(\cdot)$, the efficiency of the i^{th} plant in year t is then imputed as $E_{it} = Y_{it} / f(v_{it}, t_0)$, where Y_{it} is the realized output of the i^{th} plant, v_{it} is its input vector, and the denominator is a benchmark productivity level in period t_0 .

References

- Baily, Martin N., Charles Hulten, and David Campbell. 1992. “Productivity Dynamics in Manufacturing Plants.” *Brookings Papers on Economic Activity: Microeconomics*: 187–249.
- Baldwin, John, and Paul Gorecki. 1991. “Firm Entry and Exit in the Canadian Manufacturing Sector, 1970–1982.” *Canadian Journal of Economics* 24:300–23.
- Caballero, Ricardo J., and Mohamad L. Hammour. 1994. “The Cleansing Effect of Recessions.” *American Economic Review* 84:1350–68.

- Chenery, Hollis. 1979. *Structural Change and Development Policy*. New York: Oxford University Press.
- Chenery, Hollis, Sherman Robinson, and Moshe Syrquin. 1986. *Industrialization and Growth: A Comparative Study*. New York: Oxford University Press.
- Foroutan, Faezeh. 1996. "Turkey, 1976–85: Foreign Trade, Industrial Productivity, and Competition." In Mark J. Roberts and James R. Tybout (1996).
- Griliches, Zvi, and Haim Regev. 1995. "Firm Productivity in Israeli Industry, 1979–1988." *Journal of Econometrics* 65:175–203.
- Harrison, Ann. 1996. "Determinants and Consequences of Foreign Direct Investment." In Mark J. Roberts and James R. Tybout (1996).
- Hopenhayn, Hugo. 1992. "Entry, Exit, and Firm Dynamics in Long-Run Equilibrium." *Econometrica* 60:1127–50.
- Jovanovic, Boyan. 1982. "Selection and the Evolution of Industry." *Econometrica* 50:649–70.
- Krugman, Paul. 1989. "New Trade Theory and the Less-Developed Countries." In Guillermo Calvo, ed., *Debt, Stabilization, and Development: Essays in Honor of Carlos Diaz-Alejandro*. New York: Basil Blackwell.
- Kuznets, Simon. 1979. "Growth and Structural Shifts." In W. Galenson, ed., *Economic Growth and Structural Change in Taiwan: The Postwar Experience of the Republic of China*. Ithaca, N.Y.: Cornell University Press.
- Lambson, Val E. 1991. "Industry Evolution With Sunk Costs and Uncertain Market Conditions." *International Journal of Industrial Organization* 9:171–96.
- . 1992. "Competitive Profits in the Long Run." *Review of Economic Studies* 59:125–42.
- Liu, Lili. 1993. "Entry, Exit, Learning, and Productivity Change in Chilean Manufacturing." *Journal of Development Economics* 42:217–42.
- Liu, Lili, and James R. Tybout. 1996. "Productivity Growth in Chile and Colombia: The Role of Entry, Exit, and Learning." In Mark J. Roberts and James R. Tybout (1996).
- Olley, Steven, and Ariel Pakes. 1996. "The Dynamics of Productivity in the Telecommunications Equipment Industry." *Econometrica* 64:1264–98.
- Pakes, Ariel, and Richard Ericson. 1995. "Markov-Perfect Industry Dynamics: A Framework for Empirical Work." *Review of Economic Studies* 62:53–82.
- Pursell, Gary. 1990. "Industrial Sickness, Primary and Secondary: The Effects of Exit Constraints on Industrial Performance." *The World Bank Economic Review* 4(1): 103–14.
- Roberts, Mark J., and James R. Tybout. 1996. *Industrial Evolution in Developing Countries: Micro Patterns of Turnover, Productivity, and Market Structure*. New York: Oxford University Press.
- Rodrik, Dani. 1988. "Imperfect Competition, Scale Economies, and Trade Policy in Developing Countries." In Robert E. Baldwin, ed., *Trade Policy Issues and Empirical Analysis*. Chicago, Illinois: University of Chicago Press for the National Bureau of Economic Research.
- Syrquin, Moshe. 1984. "Resource Reallocation and Productivity Growth." In Moshe Syrquin, Lance Taylor, and Larry E. Westphal, eds., *Economic Structure and Performance*. New York: Academic Press.
- . 1988. "Patterns of Structural Change." In Hollis Chenery and T. N. Srinivasan, eds., *The Handbook of Development Economics*, Vol. 1. Amsterdam: Elsevier Science Publishers.
- Tybout, James R. 1992. "Linking Trade and Productivity: New Research Directions." *The World Bank Economic Review* 6:189–211.

- . 1993. "Returns to Scale as a Source of Comparative Advantage." *American Economic Review: Papers and Proceedings* 83:440-44.
- . 1996. "Heterogeneity and Productivity Growth: Assessing the Evidence." In Mark J. Roberts and James R. Tybout (1996).
- Tybout, James, and M. D. Westbrook. 1996. "Scale Economies as a Source of Efficiency Gains." In Mark J. Roberts and James R. Tybout (1996).