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PRODUCTIVITY AND FIRM TURNOVER IN ISRAELI INDUSTRY: 1979-1988

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ABSTRACT

An analysis of a large panel data set on Israeli industrial firms finds that most of the growth in aggregate productivity comes from productivity changes within firms rather than from entry, exit, or differential growth; that firms which will exit in the future have lower productivity performance several years earlier (the "shadow of death" effect); and that, overall, there was little total factor productivity growth in Israeli industry during 1979-1988 (another "lost decade").

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PRODUCTIVITY AND FIRM TURNOVER IN ISRAELI INDUSTRY: 1979-1988

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1. Introduction

This paper is part of a larger study of firms in Israeli industry (mining and manufacturing). It uses almost all of the data assembled by the Central Bureau of Statistics (CBS) on individual firms in industry to create a consistent panel data set, allowing one to trace both the growth in output and productivity, and the turnover of these firms over time, and investigate their correlates. In this paper we describe the evolution of this population of firms, look for factors affecting the growth in their productivity, and calculate the impact of exit, entry, and differential growth on the aggregate productivity of Israel's industrial sector. Additional analyses of these data, primarily for the earlier part of our time period, can be found in Bregman, Fuss, and Regev (1991a and b).

The data base for this study comes from the Industrial Surveys conducted by the CBS, not always annually, and augmented by various other occasional surveys (e.g, surveys of R&D, fixed capital, and labor skills) and other data bases, such as price indexes for industrial products (see Regev 1991 for additional detail on the construction of the data set and some of the variables to be described below). The coverage of larger firms (75+ employees, is essentially complete (the "certainty sample"), while smaller firms (5+ employees) are represented by a random sample drawn from the total population of industrial firms.

The number of firms in our panel differs from year to year because of the exit and dissolution of firms, because of the entry of new firms (sampled from additions to the National Insurance register), and also because of occasional sample adjustments due to undercoverage or large changes in the number of employees per firm. To analyze these data efficiently we defined three time periods: 1979-82, 1982-85, and 1985-88, and constructed for each period a consistent data set divided into continuing firms, those present both in the beginning and at the end of the period, and those that "closed" (exited) and "opened" (entered) by the end of the period (the latter two grouping appear in the tables on the "replaced" line under the beginning and end of the period respectively). Because of this definition we underestimate total turnover slightly, ignoring firms that entered in the middle of the periods and exited before their end. Except for very minor cleaning of obvious outliers, we tried to capture all the firms for which the CBS collected economic data during this period (1979-88).

Table 1 lists the number of firms in our sample in each of the years chosen by us for analysis: 1979, 1982, 1985, and 1988, and an estimate of the total number of industrial firms in Israel. Table 2 summarizes these numbers and computes turnover rates per year, defined as the absolute value of changes over a period divided by the number of firms or workers at its beginning. These are measures of the amount of gross "churning" in the number firms and workplaces. During a period of 3 years about 1/8th of the firms in our panel are "replaced" (Table 1, Panel A). Because entry and mortality occur at much higher rates for smaller firms, the estimated turnover of firms in the population at large (about 1/3rd per period) is much higher than the comparable sample numbers (Table 2). Figure 1 shows the same measures separately for each of our 17 2-digit level industrial groupings. There is quite a bit of variability in these numbers across industries, with most of the firm turnover occuring in the textiles and wood industries and least in chemicals. Figure 2 does the same for labor turnover rates, which are about half as large as the firm turnover rates. There is a strong positive correlation between firm and employment turnover rates. The major exception is the electronics industry, with above average firm turnover but below average employment turnover rates. The components of this measure are shown in Table 3.

The period surveyed by us experienced "stop-and-go" policies, accelerating inflation and later stabilization, and rather slow growth, at least relative to earlier Israeli experience. The slowdown in productivity growth that began in the mid-1970s (see Ben-Porath, 1986) continued through most of our period, with a brief revival of productivity growth in the mid 1980s. Our three periods can be characterized as follows: During the first (1979-82), repeated attempts to slow inflation were associated with slow growth in both output and productivity. The second period, 1982-85, saw the acceleration of inflation and the stabilization reform at its end, with some revival of output growth but little improvement in productivity. The third period, 1985-88, experienced a strong post-stabilization recovery in some industrial sectors but another slowdown was looming over its horizon, due to the world-wide slowdown of the growth in the electronics sector and the decline in defense expenditures.

In the next two sections we shall discuss our data in greater detail and describe the growth and death of firms and the turnover of workplaces and their impact on aggregate productivity measures, both at the 2-digit and total industry levels. In the subsequent sections we present the results of production function estimation and total factor productivity (TFP) calculations, in an effort to investigate other correlates of productivity change. The final section provides an interim summary and a discussion of our plans for further analyses of these data.

2. The Data

The data available to us contain the standard Sales, Expenses, Labor, Inventory Change, and Investment accounts of firms (augmented also by additional information from the monthly reports of firms to the CBS) and also occasional surveys on capital, labor quality, and R&D. The basic data from the Industrial Surveys were used to construct measures of gross output, value added, materials used, and labor input. The first three variables were converted to "constant" prices, i.e., to measures of "quantities" of output produced and materials used, in two stages. In the first, all nominal monetary magnitudes were deflated by the CPI, with CPI(1979) = 1.0, and converted to "1979 dollars" by the use of an appropriate exchange rate. In the second stage, the data were deflated again, using detailed (3-digit level) industrial and other price indexes and weights from the relevant input-output tables. Using information on a firm's share of exports in sales we calculated parallel output, materials, and value-added relative price deflators (relative to the CPI). The labor input is measured in person-year equivalents and the ratio of gross output in constant industry prices to person-years worked is our central measure of productivity. These data are analyzed at the firm level and summarized separately for each of the 17 distinct 2-digit level industrial groupings.

Capital, quality of labor, and R&D data are much more sparse. Two capital surveys were collected in Israel, in 1968 and 1982, covering only a subsample of our firms. Where available, these data were used as a benchmark to construct capital stock and capital services measures, based on the additional investment data (deflated by appropriate price indexes) and the perpetual inventory method. For the majority of the smaller firms we did not have an appropriate benchmark and capital services levels were imputed statistically using the information on investment in the sample and its relationship to the estimated capital services levels in the subsamples with available benchmark data. The resulting capital services "estimates" seem reasonable in the various cross-sections but are probably too imprecise to be used in the analysis of first differences and longer growth rates. Capital services were defined to equal the sum of estimated depreciation, interest on the net stock of capital (at 5 percent per year), and equipment and building rentals. (See Regev 1991 for more detail.)

Data on the occupational mix of the labor force in 1988 were collected in a special Survey of the Structure of Labor Force in Industry (1989). The groups distinguished were engineers, other academics, technicians, and other workers. Similar data were available for part of the sample in 1982, based on information from the Ministry of Industry and Trade (see Shaliv 1989). In the rest of the sample missing values were imputed using the 1988 information and tabulations by size and subindustry. Since the data on other academics were not comparable between the surveys we lumped them with the "other workers" and created an index of technical-scientific labor "quality" (per worker) with the different groups weighted by approximate relative wage weights (engineers=2, technicians = 1.75, and other workers and academics=1). The 1982 values of this index were used for the first period of data (1979 and 1982), the 1988 values for the last period, and the average of the 1982 and 1988 values for 1985.

3. Resource mobility and productivity growth

We start our substantive analysis by looking at various aspects of labor productivity and its change over time. In Table 4 we group our firms by their "mobility" status: continuing, closed, and opened, and give, for each group, two measures of average labor productivity per firm: gross output and value added (both in constant prices) per year of labor input. These are aggregate estimates, "inflated" by appropriate sampling weights. Table 5 shows the associated growth rates for the total industry aggregate and separately for the subset of "continuing" firms only. (Note that these aggregate numbers do not control, yet, for within group shifts.) Table 6 shows the same data for each of the 17 2-digit industrial sectors separately, while Figures 3 and 4 compare the average productivity of exiters with that of stayers, and of entrants with exiters.

There are three findings in these tables (4 and 5) which are worth bringing out: First, the average productivity of exiting firms is significantly lower than that of the continuing ones. Second, entering firms are somewhat more productive than exiting firms, but not always so, and only in the last period is the difference large. Third, the aggregate growth rates of labor productivity are very similar for the total sample and for the continuing subset of firms, indicating that most of the changes in aggregate productivity are coming primarily from changes within firms rather than from various weight shifts and mix changes. Figure 3 shows that the first finding is true separately for all of our industrial groupings. The second finding, that new entrants are more productive than exiters, is true for the majority but not for all of the industries examined in Figure 4.

The large amount of mobility in Israeli industry is already visible in the earlier tables and figures. Table 3 shows the information on labor mobility in greater industrial detail. While overall employment in Israeli industry declined at roughly half-a-percent per year, there was much diversity in individual industry experience: much turnover with little net change in the apparel industry, positive net growth in electronics, food, printing, and paper, and significant declines in mining, metals, transportation equipment and food industry employment. Where employment expanded, e.g., in paper and printing, most of the new jobs were created by existing firms. Only in electronics were new firms the major contributor to net expansion in employment. (See Baldwin and Gorecki 1990, Davis and Haltiwanger 1990, and Dunne et al. 1989, for more detailed analyses of such data and Regev 1989 for additional discussion in the Israeli context.)

Having seen already, in Table 4, that the average productivity of entering and exiting firms is quite different from the overall average, we ask next how much of the growth in average productivity occurs within firms and how much is the result of the mobility of resources between them, both as the result of exit and entry and also as the consequence of differential growth of surviving firms. Such a decomposition of the changes in aggregate productivity can be derived from a very simple "accounting" framework. At any point of time, the contribution of a particular firm to aggregate productivity (at any level of aggregation) is $w(t)q(t)$, where $q(t)$ is its own level of productivity (say, gross output per labor-year) and $w(t)$ is its relative weight in the aggregate. For the measurement of labor productivity the relevant weight is the firm's total labor input. In our case, because we are dealing with a sample of firms, the weight is further multiplied (inflated) by the appropriate sampling weight (expansion factor). The change in a firm's contribution to the total can be decomposed as follows:

$$w(t)q(t) - w(t-1)q(t-1) = w(a)dq + (dw)q(a) \quad .$$

where $x(a) = \{x(t) + x(t-1)\}/2$ equals the period average for a variable and $dx = x(t) - x(t-1)$ its change. This decomposition is meaningful for continuing firms, allowing us to separate the contribution of within-firm productivity growth from the between firm shifts in the relative weight of high versus low productivity firms. We cannot do the same, however, for firms that exit and enter the sample during the period. We treat them instead as one firm and make a direct comparison of the change in the average productivity between all entering and exiting firms and the change in their relative weight in the total.

Figure 5 shows the results of this decomposition for the average growth rate in value-added per man-year for the whole 1979-88 period. (It is constructed by averaging the separate calculations for each of our three sub-periods.) The results using gross production instead of value added are shown in Figure 6 and are similar. As was implied already by the results listed in Table 4, the bulk of the growth in labor productivity per man occurs within firms, with mobility, i.e., the sum of the replacement effect (differences in the productivity of entering versus exiting firms) and the weight-shift (the movement of employment from low productivity to higher productivity firms) accounting for only about a tenth of the overall growth in value added productivity. Again, there are some significant deviations from the average experience to be noted in this figure. For some industries, such as apparel, mineral products, and wood, the mobility effect accounts for a half or more of all the productivity change. While the mobility effect is positive on average, exceptions do occur (e.g., in food and basic metals). A more detailed look at these differences between industries is warranted and is part of our agenda for future research. So is also a study of the subsequent performance of the new entrants, to assess their longer run contribution to the growth in industrial productivity.

4. Productivity differences across firms

In this section we use the production function framework to look at the dispersion of labor productivity across firms and time and to search for some of the factors that may account for it. We look first, in Table 7, at the results of estimating a pooled (over time and firms) production function and focus, primarily on some of the additional variables, besides the conventional measures of capital, labor, and materials inputs, which might help to explain the differences in observed productivity. We have tried, also, to improve on this procedure by allowing for unmeasured firm level variables via the use of first differences, and explored the alternative approach of computing total factor productivity growth measures, using firm level factor shares as weights, allowing thereby some of the coefficients to vary across firms and industries.

To proceed with the production function framework we need estimates of capital input for all of our sample. We have information on investment for almost all of our firms but decent benchmarks only for about a third of them. Because of our interest in the impact of firm mortality and resource mobility on aggregate productivity, we wanted to have as complete a sample of firms as possible and not just a selected, limited "good data" subsample. This pushed us to estimate missing capital values using standard missing data regression techniques and the available investment data and other firm level data. A more detailed description of what was actually done and some of the intermediate results can be found in Regev (1991). Since it is doubtful how much one can really gain from "fabricating" so much data (especially given the relatively low fits of the estimating equations: R squares of about 0.45 or less) and because there is also a question whether these data are really missing at random, a prerequisite for the consistency of such imputation methods (see Griliches 1986 for additional discussion of this range of issues) we also present, in the same table, estimates based solely on the "good capital data" portion of our sample.

The first column of Table 7 lists our most inclusive cross-sectional estimates, based on pooling all four years (1977 to 1988), and approximately 7600 observations. Table 8 gives similar results for each of the four cross-sections separately. One can group the estimated coefficients into nine groups: 1. Materials and capital; 2. R&D and labor quality; 3. Size; 4. Region; 5. Ownership; 6. Industry grouping; 7. Establishment year; 8. "Mobility" status, and 9. Year dummies.

Looking first at the materials use variable we see that it is the most important variable in accounting for differences in gross labor productivity, both in terms of the size of its coefficient and its statistical "significance." The estimated coefficient of 0.64 is somewhat above the share of materials in gross output in industry as a whole, which had drifted down from 0.63 to about 0.60 between our first and third periods. This discrepancy could be due to the simultaneity bias in the estimation of this coefficient, a topic we shall return to below. In parallel, and perhaps not unrelatedly, the estimated coefficient of capital services of 0.062 is significantly below the implied share of capital in Israeli industry, which had been rising from about 0.085 to 0.14 of gross output during our period (see Table 10). It is close to the 0.055 estimated by Bregman, Fuss, and Regev (1991, Table 1, column 2) for their much smaller and "cleaner" 1982 cross-section. Both estimates are subject, possibly, to serious downward bias due to unavoidable errors in the construction of the capital variable. On the other hand, the residually estimated capital share probably overestimates the "true" output elasticity of physical capital. It contains also some not-elsewhere allocated business services and some return to R&D and to inventory and working capital, neither of which are included in our definition of capital services. The possibility remains, however, that the smaller estimated elasticity of capital represents truly lower returns while the larger factor share is a reflection of extensive market power in Israeli industry.

Among the other variables, the role of the quality of labor is most important, both substantively and statistically. The estimated coefficient of 0.39 is higher than one might expect for a pure "quality" of labor index which should have a coefficient on the order of the coefficient of labor quantity. The latter is estimated implicitly at 0.30. The higher estimate for the labor quality index may reflect the absence of other important variables, such as quality of capital measures, and the fact that it is not fully inclusive. The actual estimates are somewhat unstable over time (see the separate annual estimates in Table 8), becoming larger and more significant towards the end of the period. This may reflect both the better quality of our estimates of this variable in 1988 and also, possibly, the rising importance of skills and education in the economy over time, a trend that became apparent in the US and other countries in the 1980s. What is interesting about this finding is that it uses productivity data directly to validate the evidence on returns to education, rather than deriving it, as is done usually, from income data and earnings function estimation.

The R&D variable used is the logarithm of deflated R&D expenditures per unit of labor in the year prior to the observation year. A seperate dummy variable is added for firms reporting no formal R&D at all. The expectation is that its coefficient will be positive, picking up some of the equivalent informal activity in smaller firms. The expenditure variable is a flow measure rather than a direct estimate of R&D "capital services" as in Bregman, Fuss, and Regev. They constructed an R&D "capital" measure for 1982, covering a more limited range of firms. We plan to construct a similar measure for a more limited subset of our sample and for the other years of the panel. Here we use the R&D flow variable as a proxy for the potentially better measure to see whether it has any first order effects at all in our data. The resulting coefficient of 0.03 is both statistically and economically significant. It is about half the size of the physical capital elasticity.

The next finding of interest is what one might call "the shadow of death" effect. Firms that are going to die, to exit in the future, are significantly less productive currently. Perhaps not surprisingly, the dummy variables for "closed" are significantly negative, implying lower productivities on the order of 6 to 13 percent. This is consistent with the Pakes and Olley (1990) model and implies that low productivity will be a major cause of exit when we turn to an explicit analysis of its determinants.

Firms that entered ("opened") during our period of analysis are also somewhat less productive, though that may be the result of our overestimating their beginning capital stock (we do not have good benchmarks for them). But it is also consistent with the higher mortality rate observed for them in the first years of their existence. The age effect is less clear and is confounded with vintage effects. Over time, the productivity of older firms, those established before 1962 (and also before 1976), falls relatively to the levels of firms established subsequently (see Table 8). In subsequent work we plan to extend our panel backwards in time, through the 1970s and 1960s, and investigate in more detail the "life-cycle" of these firms.

Firm size turns out not to be particularly important. We imposed a constant returns to scale formulation (partly to facilitate the protection of confidentiality for these data) after some experimentation that indicated that this held approximately for our data (Bregman, Fuss, and Regev estimate the elasticity of scale in their data at 0.96). We include among our variables four (employment) size-class dummy variables whose coefficients are neither very stable or economically significant, though they do indicate some decreasing returns to scale, especially when the regression is weighted to give larger firms a larger weight in the final results (see columns 5-6 of Table 7).

Among the other variables, the notable findings are lower productivity in enterprises located in the development areas (subsidized capital pushed into lower marginal product region?), higher than average productivity in the chemicals and mineral and machinery industry groupings and lower than average productivity levels in the light industries, textile and apparel, and food groupings (with electronics being the reference group). Among the organizational classifications, only the kibbutzim enterprises, and only in the weighted regression version show a small consistent productivity advantage, possibly due to an undercounting of the total resources devoted to them.

The story told in Table 9, based on differences over time (for continuing firms only), is roughly similar. Leaving out most of the firm variables that do not change over time gives us rather similar but less stable estimates for the material and capital services inputs, the latter being close to zero during the first period, and significantly higher during the last period which witnessed a major expansion in capital services per worker. There is some evidence that firms with higher human capital (labor quality) had somewhat higher productivity growth during the second period and that R&D doing firms had higher productivity growth over the period as a whole, but most of the remaining variability in growth rates across firms appears to be random.

Looking at the time dummies, which implicitly provide an estimate of average total factor productivity in industry as a whole, we observe a significant disagreement on what happened, based on alternative weightings of the data. In the complete sample average productivity declines at over 1 percent per year during the first two periods (from 1979 through 1985) and recovers sharply from 1985 to 1988, leaving the average firm in 1988 about where it was in 1979. The results are similar also for the cleaner, part-sample, reported in Column 2, and also in the unweighted first differences, reported in Table 9, with essentially zero total factor productivity growth in the first two periods and positive in the last, for a net of less than 0.24 percent per year growth over the period as a whole. Weighting the same firms by their relative importance in Israeli industry does not change the various other coefficient estimates much, but does change the estimated year effects, implying a much higher total factor productivity growth: about 0.6 in first differences and about 1 percent per year instead of zero in the full sample (Table 7).

An alternative to the differences regressions is given by the total factor productivity growth calculations reported in Table 10. These calculations do not impose a common coefficient on all firms across all times. They use instead individual firm period-average factor shares as weights. A closer look at these data indicates that our main conclusion about the lack of overall TFP growth is sensitive in two crucial decisions, weighting of the observations and the definition of the capital share, i.e., whether we use cost shares or output shares (residual). The latter is important because capital is growing rather rapidly, especially in the last subperiod, and because the residual share is close to twice as large as the comparable cost definition. Weighting of firms appears to matter. The average firm had no positive TFP growth in the period as a whole but this does not seem to be the case for the larger firms in the sample. When weighted appropriately, there is some positive TFP growth in the Israeli industry as a whole, albeit not at an impressive rate. The estimated magnitude of this growth depends on the weight assigned to the fast growing capital variable. Using the residual share instead of the cost based one, reduces the estimated average TFP growth by more than a half. The choice between the two weight schemes depends on what we assume about the growth rate of the excluded inputs: inventory services, financial services, and R&D. If they grew as fast as capital, then the residual share is the correct weight for it. If they grew slower, at a rate roughly equal to the combined growth rate of all the measured inputs, then the cost share weights are closer to being right. The latter seems more likely. Since the regression coefficient estimates are also close to the cost shares, estimates of TFP growth from the weighted regressions yield rather similar conclusions: no TFP growth for the average firm but some positive TFP growth for industry as a whole, with almost all of it coming in the last sub-period.

This rather slow growth in TFP is comparable to the 1970s and is significantly below the Israeli experience in the 1950's and 1960's. In this sense, the 1980s may have been another "lost decade" in the development of the Israeli economy. Though total output increased significantly during this period while employment remained essentially unchanged, much of the growth in labor productivity appears to be accounted for by additional investments in capital and material inputs. If there were significant improvements in the technologies used and in the organizational structure of industry, they are not clearly visible in the aggregate data. When TFP growth is computed separately by industry (Table 11), only electronics firms show a consistent positive growth in all the sub-periods separately. For the period overall significant TFP growth is also estimated for the "Chemicals and Minerals" and "Metals and Machinery" subsectors, or exactly half of the subsectors examined.

A comparison of the level and differences estimates (Tables 7 and 9) brings also to the fore the fact that the bulk of productivity differences across firms is not accounted for by the regression and that such "firm effects" or "unobservable factors" are a relatively permanent aspect of the firm and an important part of the story. For example, the standard error of the overall level regression in Table 7 is about 0.33. That is, the level regression (in spite of its high R square) does not explain productivity differences across firms very well, leaving us with an error whose standard deviation is over 30 percent! At the same time, the standard deviation of the error in the differences regressions is only about 1 to 3 percent. In terms of variance components, the unobserved firm factors account for over three quarters of the residual variance.

This is the appropriate place, also, to note several econometric loose ends. First, the standard errors of the various coefficients reported in Table 7 are probably underestimated and the associated "significance" levels overestimated because no account is taken of the strong correlation in the error for the same firm across time (alluded to in the previous paragraph). This could be adjusted for by implementing an appropriate GLS procedure. That, however, is somewhat complicated for unbalanced panels and is beyond the computer resources of the CBS at this moment. Implementing a GLS procedure would also help us to allow for different error variances across time and across those parts of the sample where we use imputed rather than "actual" capital estimates. We tried to take care of the sample selectivity problem by using an unbalanced panel and including all of the firms we could lay our hands on. Moreover, we condition our estimates on future selectivity. We have not been able, however, to do much about possible simultaneity biases. We have no reasonable instruments left in our data (we have used the investment variable, which gives leverage in the Pakes-Olley work, to impute the missing capital data and thus cannot really reuse it again). We evade the simultaneity problem when we use TFP estimates but they, in turn, do not allow us to ask all of the interesting questions that we would like to ask. We could do more with the errors in variables problem and we intend to do so in the future. That there may be some payoff from doing so is implied by the fact that when we use two period averages to estimate the production function, the capital services coefficient (not shown here) rises by more than 30 percent, from 0.051 to 0.067.

5. Interim conclusions and future work plans

The most important roadblock to effective analysis of these data is the lack of up to date information on the stock of the various capitals for most of our firms. The last capital survey was done in 1982 and covered only a sub-sample, about a third, of all the firms in the panel. A new and detailed survey of what remains of all the past investments of the last decades is long overdue. Without such a survey we will not be able to learn as much as we should and could from such data. We also need to know more about the educational-occupational structure of the labor force, its human capital. A reduction in the rate of inflation may also help to analyze such data better in the future. For us, small relative errors in the price deflators can introduce errors which are several times larger than the productivity effects we are looking for. It would be desirable, also, to have more data on the exogeneous variables which determine the input choices and investment decisions of these firms: access to government subsidies, the presence and strength of unions, and movements in the relevant export prices. Without such more "causal" variables, it is hard to interpret the production function estimates as reflecting primarily the technological-organizational aspects of production that we would like to uncover.

All these reservations not withstanding, we have learned quite a bit in this work. Productivity growth in Israeli industry was rather slow in the 1980s and only a few industries stood out positively. In spite of the large amount of turnover and churning in firms and jobs, most of the productivity growth occurred within firms. Productivity growth in industry as a whole did not come primarily from the exit of failing firms, or from the faster growth of more productive firms. What happened within firms was decisive and that is also what needs attention if the productivity performance of Israeli industry is to be improved in the future.

Footnotes

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1. The numbers in Table 4 and Figure 5 are not exactly comparable because the former uses value-added in overall (CPI) constant prices, while the calculations summarized in Figure 5 are based on individual firm weighted 3-digit level industrial price deflators.

2. See, e.g., Mairesse and Sevestre 1991, for an attempt to do something about errors-of-measurement in capital within the context of rather similar data.

3. 1984 values of R&D were also used for 1988, due to lack of data for smaller firms in that year.

4. Some of the differences due to weighting are a higher coefficient for the quality of labor variable, non-significance of the development areas effects and a positive productivity effect for firms located in the Jerusalem area, and somewhat stronger life cycle effects.

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TABLE 1 : FIRMS AND LABOR BY CONTINUITY AND PERIOD

	PERIOD 1		PERIOD 2		PERIOD 3	
	BEGINNING	END	BEGINNING	END	BEGINNING	END
	1979	1982	1982	1985	1985	1988
A : FIRMS IN PANEL						
CONTINUING	1644	1644	1682	1682	1759	1759
REPLACED	295	242	216	226	259	217
TOTAL	1939	1886	1898	1908	2018	1976
B : FIRMS IN POPULATION						
CONTINUING	4608	4608	5337	5337	5342	5342
REPLACED	1607	1664	992	1483	1432	1448
TOTAL	6215	6272	6329	6820	6774	6790
C : LABOR (PERSON- YEARS)						
CONTINUING	257902	256063	261165	273087	281107	269173
REPLACED	27188	22452	18303	20026	18337	16506
TOTAL	285090	278515	279468	293113	299444	285679

TABLE 2 : FIRM AND LABOR TURNOVER RATES BY PERIOD (PER YEAR)

	PERIOD 1	PERIOD 2	PERIOD 3	PERIODS 1-3
	1979 - 1982	1982 - 1985	1985 - 1988	1979 - 1988
FIRM TURNOVER	13.5	8.5	11.6	11.4
LABOR TURNOVER	5.9	4.1	3.9	4.6

TABLE 3 : LABOR MOBILITY BY INDUSTRY
-% CHANGES IN PERSON -YEARS
AVERAGE OVER THE 3 PERIODS (ANNUAL RATES)

INDUSTRY	Net Change (1)	Gross Change (2)	Jobs Created Contin. (3)	Jobs Created Opened (4)	Jobs Ended Contin. (5)	Jobs Ended Closed (6)
TOTAL	-0.411	12.564	3.790	2.287	-4.010	-2.478
MINING	-4.460	10.569	1.978	1.076	-6.472	-1.042
FOOD AND BEVERAGES	2.767	11.985	5.302	2.074	-2.945	-1.664
TEXTILES	-5.788	13.583	2.487	1.412	-5.772	-3.913
CLOTHING	0.272	19.047	4.933	4.727	-4.200	-5.188
LEATHER	0.993	17.677	5.010	4.325	-3.538	-4.804
WOOD	-2.890	17.048	3.509	3.570	-3.938	-6.031
PAPER	2.365	13.218	5.967	1.851	-3.986	-1.468
PRINTING	2.939	12.777	4.336	3.522	-2.562	-2.356
RUBBER. PLASTIC	0.883	12.896	4.260	2.629	-3.898	-2.109
CHEMICAL	-0.388	7.164	2.561	0.827	-2.950	-1.825
MINERAL METAL	-1.897	14.040	3.441	2.630	-4.785	-3.183
BASIC METAL	-4.252	15.448	3.338	2.259	-6.799	-3.051
METAL PRODUCTS	-1.438	11.612	2.968	2.119	-3.988	-2.536
MACHINERY	-1.470	9.626	3.017	1.061	-4.305	-1.243
ELECTR.ELECTRONIC	0.578	10.231	3.521	1.884	-3.520	-1.306
TRANSPORT EQUIPMENT	-4.075	9.606	2.570	0.195	-6.050	-6.784
MISCELLANEOUS	1.390	17.374	4.344	5.038	-3.976	-4.016

(1)=(3)+(4)-(5)-(6)
(2)=(3)+(4)+(5)+(6)

TABLE 4 : GROSS PRODUCTION AND VALUE ADDED PER PERSON-YEAR
1000s OF 1979 DOLLARS

	PERIOD 1		PERIOD 2		PERIOD 3	
	BEGINNING	END	BEGINNING	END	BEGINNING	END
	1979	1982	1982	1985	1985	1988
A : GROSS PRODUCTION						
CONTINUING	36.3	37.9	37.1	40.1	40.7	52.8
REPLACED	27.6	27.1	25.9	29.9	25.9	45.0
TOTAL	35.6	37.1	36.7	39.6	40.1	52.6
B: VALUE ADDED						
CONTINUING	12.2	14.2	14.1	15.1	15.0	22.7
REPLACED	8.3	10.2	7.7	8.5	8.6	17.2
TOTAL	11.9	13.9	13.9	14.8	14.7	22.5

TABLE 5 : GROWTH IN LABOR PRODUCTIVITY (ANNUAL RATES)

	PERIOD 1		PERIOD 2		PERIOD 3	
	BEGINNING	END	BEGINNING	END	BEGINNING	END
	1979	1982	1982	1985	1985	1988
A : GROSS PRODUCTION						
CONTINUING	1.32		2.59		9.14	
REPLACED	0.66		4.77		11.33	
TOTAL	1.31		2.59		9.42	
B: VALUE ADDED						
CONTINUING	5.02		2.28		14.72	
REPLACED	7.14		3.23		25.99	
TOTAL	5.37		1.96		15.29	

TABLE 6

GROWTH IN LABOR PRODUCTIVITY BY INDUSTRY 1979-1988
(Annual rates)

	INDUSTRY	GROSS PRODUCT	VALUE ADDED
00	TOTAL	4.44	7.54
10	MINING AND QUARRYING	3.78	11.48
11	FOOD AND BEVERAGES	-0.88	-15.15
13	TEXTILES	4.76	-2.59
14	CLOTHING	5.51	15.85
15	LEATHER	-3.56	-3.54
16	WOOD	7.93	11.28
17	PAPER	-2.12	-5.17
18	PRINTING	-2.25	3.57
19	RUBBER,PLASTIC	10.25	1.71
20	CHEMICAL	0.98	3.55
21	MINERAL PRODUCTS	-0.01	1.54
22	BASIC METAL	11.83	14.85
23	METAL PRODUCTS	3.52	7.39
24	MACHINERY	5.39	8.62
25	ELECTRIC & ELECTRONIC	8.04	16.45
26	TRANSPORT EQUIP	3.91	1.50
28	MISCELLANOUS	5.58	8.27

TABLE 7.

POOLED REGRESSIONS							
DEPENDENT VARIABLE: GROWTH IN PRODUCTION PER PERSON-YEAR							
	UNWEIGHTED				WEIGHTED		
	FULL SAMPLE		PART SAMPLE		FULL SAMPLE		
TOTAL	7617		3393		7617		
R-SQR	0.8342		0.8590		0.8971		
RMSE	0.3336		0.2825		0.2488		
	COEF	T-STAT	COEF	T-STAT	COEF	T-STAT	
INT	1.665	71.140	1.595	52.801	1.438	72.779	INTERCEPT
LM	0.641	138.336	0.670	108.632	0.730	177.892	MATERIALS/PERSON-YEAR (L)
LKS	0.062	9.973	0.049	8.444	0.067	14.070	CAPITAL SERVICES/PERSON-YEAR (L)
R&D VARIABLES							
LRD	0.029	5.625	0.032	5.821	0.024	9.194	R&D (L)
NORD	0.009	0.521	0.005	0.292	0.031	3.350	NO R&D DUMMY
QUALITY OF LABOR							
LQL	0.390	7.610	0.337	3.763	0.699	17.850	QUALITY OF LABOR
SCALE (REF=5-49 WORKER-YEARS)							
S2	0.002	0.212	-0.010	-0.730	0.008	0.671	50-99 EMPLOYEES
S3	-0.021	-1.805	-0.039	-2.874	-0.015	-1.573	100-299 EMPLOYEES
S4	-0.031	-1.704	-0.056	-3.079	-0.037	-3.450	300+ EMPLOYEES
DEVELOPMENT AREA (REF=NOT DEV. AREA)							
DA	-0.043	-2.626	0.019	0.989	0.010	0.816	DEVELOPMENT AREA A
DB	-0.022	-1.665	0.001	0.042	-0.008	-0.870	DEVELOPMENT AREA B
DI	-0.025	-1.401	-0.041	-1.757	0.049	3.476	JERUSALEM
SECTOR (REF=PRIVATE)							
STK	-0.046	-2.297	-0.040	-2.083	-0.050	-4.586	REG. STOCK MARKET
HI	-0.010	-0.693	0.005	0.357	-0.088	-8.927	HISTADRUT
KI	0.013	0.920	0.004	0.208	0.036	3.006	KIBBUTZIM
PU	0.019	0.612	-0.018	-0.577	0.017	1.527	PUBLIC LTD
BRANCH (REF=ELECTRONICS)							
FD	-0.015	-0.925	-0.035	-1.694	-0.138	-10.948	FOOD
TX	-0.051	-3.548	-0.079	-4.096	-0.142	-10.765	TEXTILE, CLOTHING, LEATHER
LH	-0.054	-4.011	-0.048	-2.575	-0.121	-9.661	LIGHT INDUSTRIES
HM	0.081	4.439	0.095	4.490	-0.064	-5.347	CHEMICALS, MINERALS
MA	0.041	3.113	0.018	1.034	-0.020	-1.850	METAL, MACHINERY
LIFE-CYCLE (REF=ESTABLISHED FROM 1963-1976)							
EY0	-0.010	-0.567	0.268	1.336	0.018	0.984	ESTABLISHMENT YEAR UNKNOWN
EY1	0.001	0.097	-0.022	-0.710	-0.009	-0.658	ESTABLISHED FROM 1977
EY3	0.026	-2.574	0.002	0.166	-0.028	-3.720	ESTABLISHED FROM 1950-1962
EY4	-0.009	-0.731	0.006	0.408	-0.094	-9.983	ESTABLISHED BEFORE 1950
MOBILITY (REF=STAY)							
CL1	-0.135	-5.609	-0.075	-1.514	-0.069	-2.609	CLOSED 1979-1982
CL2	-0.066	-3.691	-0.061	-2.465	-0.053	-2.476	CLOSED 1983-1985
CL3	-0.061	-4.126	-0.080	-3.7797	-0.020	-1.092	CLOSED 1985-1988
OP1	-0.058	-3.160	-0.209	-4.038	-0.075	-4.010	OPENED 1979-1982
OP2	-0.043	-2.010			0.037	1.884	OPENED 1982-1985
YEAR DUMMIES (REF=1979)							
YR82	-0.023	-1.960	-0.022	-1.621	0.034	3.834	1982 YEAR DUMMY
YR85	-0.072	-5.999	-0.065	-4.429	0.001	0.162	1985 YEAR DUMMY
YR88	-0.020	-1.533	-0.017	-1.098	0.093	9.513	1988 YEAR DUMMY

TABLE 8.

CROSS SECTION REGRESSIONS									
DEPENDENT VARIABLE: GROWTH IN PRODUCTION PER PERSON-YEAR									
FULL SAMPLE									
UNWEIGHTED									
	1979		1982		1985		1988		
TOTAL	1936		1896		2002		1784		
R-SQR	0.8583		0.8532		0.8259		0.8173		
RMSE	0.3054		0.3185		0.3482		0.3467		
	COEFF	T-STAT	COEFF	T-STAT	COEFF	T-STAT	COEFF	T-STAT	
INT	1.616	37.017	1.670	39.901	1.569	36.251	1.731	38.274	INTERCEPT
LM	0.643	77.232	0.615	70.199	0.666	70.771	0.635	59.123	MATERIALS/PERSON-YEAR (L)
LKS	0.036	3.061	0.063	5.403	0.073	5.676	0.078	5.717	CAPITAL SERVICES/PERSON-YEAR (L)
R&D VARIABLES									
LRD	0.026	2.294	0.030	2.876	0.027	2.685	0.033	3.274	R&D (L)
NORD	0.016	0.507	0.018	0.562	-0.022	-0.637	0.005	0.136	NO R&D DUMMY
QUALITY OF LABOR									
LQL	0.089	0.575	-0.005	-0.033	0.481	5.512	0.372	4.478	QUALITY OF LABOR
SCALE (REF=5-49 WORKER-YEARS)									
S2	-0.020	-1.018	-0.007	-0.366	-0.011	-0.503	0.049	2.714	50-99 EMPLOYEES
S3	-0.061	-2.789	-0.014	-0.598	-0.036	-1.483	0.041	1.639	100-299 EMPLOYEES
S4	-0.091	-2.747	-0.040	-0.151	-0.041	-1.066	0.080	2.066	300+ EMPLOYEES
DEVELOPMENT AREA (REF=NOT DEV. AREA)									
DA	0.040	1.339	0.002	0.079	-0.094	-.2760	-0.113	-3.715	DEVELOPMENT AREA A
DB	0.016	0.602	-0.027	-1.040	-0.001	-0.051	-0.026	-0.845	DEVELOPMENT AREA B
DI	-0.043	-1.264	-0.029	-0.836	-0.014	-0.377	-0.032	-0.828	JERUSALEM
SECTOR (REF=PRIVATE)									
STK	-0.038	-0.955	-0.056	-1.467	-0.056	-1.430	-0.073	-1.765	REG. STOCK MARKET
HI	0.001	0.022	0.005	0.181	-0.033	-1.063	-0.034	-1.029	HISTADRUT
KI	0.040	1.298	-0.046	-1.477	0.046	0.582	0.024	0.882	KIBBUTZIM
PU	0.042	0.741	0.031	0.514	-0.045	-0.663	0.060	0.878	PUBLIC LTD
BRANCH (REF=ELECTRONICS)									
FD	0.086	2.930	0.089	2.914	-0.109	-3.402	-0.134	-4.051	FOOD
TX	-0.053	-2.050	-0.002	-0.063	-0.045	-1.548	-0.123	-3.997	TEXTILE, CLOTHING, LEATHER
LH	0.042	1.643	0.013	0.492	-0.102	-3.783	-0.176	-6.183	LIGHT INDUSTRIES
HM	0.113	3.367	0.140	3.945	0.043	1.150	0.037	0.962	CHEMICALS, MINERALS
MA	0.049	2.012	0.087	3.448	0.050	1.848	-0.027	-0.930	METAL, MACHINERY
LIFE-CYCLE (REF=ESTABLISHED FROM 1963-1976)									
EY0	-0.097	-3.315	0.005	0.120	0.048	1.367	0.024	0.595	ESTABLISHMENT YEAR UNKNOWN
EY1	-0.067	-2.381	-0.004	-0.142	0.016	0.549	0.054	1.701	ESTABLISHED SINCE 1977
EY3	-0.017	-0.974	-0.015	-0.777	-0.018	-0.802	-0.068	-2.939	ESTABLISHED FROM 1950-1062
EY4	0.011	0.448	0.015	0.562	-0.009	-0.370	-0.059	-2.370	ESTABLISHED BEFORE 1950
MOBILITY (REF=STAY)									
CL1	-0.089	-3.258							CLOSED 1980-1982
CL2	-0.054	-2.246	-0.104	-4.180					CLOSED 1983-1985
CL3	-0.059	-2.152	-0.056	-2.178	-0.085	-3.358			CLOSED 1986-1988
OP1			-0065	-1.866	-0.056	-1.700	-0.080	-2.231	OPENED 1980-1982
OP2					-0.044	-1.349	-0.072	-1.935	OPENED 1983-1985

TABLE 9.

GROWTH RATE PRODUCTION FUNCTION REGRESSION											
DEPENDENT VARIABLE-GROWTH IN PRODUCTION PER PERSON-YEAR PART SAMPLE											
	UNWEIGHTED								WEIGHTED		
	1979-1982		1982-1985		1985-1988		1979-1988		1979-1988		
TOTAL	882		818		755		746		746		
R-SQR	.6543		.6224		.6938		.6930		.7959		
RMSE	.0893		.0838		.0819		.1059		.0901		
	COEF	T	COEF	T	COEF	T	COEF	T	COEF	T	
INT	-0.000	-0.008	0.001	0.100	0.029	1.862	0.022	1.032	0.055	2.615	INTERCEPT
DLM	0.692	37.556	0.645	33.873	0.638	36.382	0.685	36.829	0.716	39.635	DIFF. IN MATERIALS/PERSON-YEAR (L)
DLKS	0.023	1.076	0.029	1.097	0.108	4.655	0.036	1.860	0.016	0.867	DIFF. IN CAP. SRV./PERSON-YEAR (L)
ALL FIRM CHARACTERISTICS ARE VALUES FOR FIRST YEAR OF PERIOD R&D VARIABLES											
LRD	-0.002	-0.435	0.001	0.273	-0.002	-0.703	-0.004	-0.823	-0.004	-1.257	R&D (L)
NORD	-0.009	-0.886	-0.010	-1.082	-0.011	-1.155	-0.024	-1.909	-0.042	-4.311	NO R&D DUMMY
QUALITY OF LABOR											
LQL	-0.012	-0.187	0.113	1.772	0.066	1.143	0.226	2.745	0.277	4.395	QUALITY OF LABOR
SCALE (REF=5-49 WORKER-YEARS)											
S2	-0.005	-0.529	-0.010	-1.220	0.021	2.392	0.019	1.659	0.02	1.245	50-99 EMPLOYEES
S3	0.003	0.359	-0.001	-0.094	0.012	1.393	0.012	1.068	0.003	0.216	100-299 EMPLOYEES
S4	0.015	1.296	0.001	0.085	0.020	1.768	0.037	2.615	0.023	1.693	300+ EMPLOYEES
DEVELOPMENT AREA (REF=NOT DEV. AREA)											
DA	-0.005	-0.474	0.007	0.628	0.005	0.372	-0.016	-1.058	-0.014	-1.103	DEVELOPMENT AREA A
DB	-0.010	-1.068	0.013	1.356	-0.005	-0.479	-0.008	-0.629	-0.008	-0.823	DEVELOPMENT AREA B
DI	0.000	0.034	0.002	0.173	00.000	-0.006	-0.005	-0.256	-0.021	-1.131	JERUSALEM
SECTOR (REF=PRIVATE)											
STK	-0.016	-1.174	-0.019	-1.615	0.003	0.230	-0.001	-0.070	0.035	2.830	REG. STOCK MARKET
HI	-0.010	-1.043	0.002	0.274	-0.001	-0.158	0.009	0.762	0.021	2.094	HISTADRUT
KI	-0.019	-1.522	0.041	3.486	-0.022	-2.183	0.002	0.099	-0.022	-1.613	KIBBUTZIM
PU	-0.021	-1.069	0.001	0.041	0.016	0.864	-0.002	-0.083	0.052	3.974	PUBLIC LTD
BRANCH (REF=ELECTRONICS)											
FD	0.001	0.044	-0.048	-4.126	-0.012	-0.969	-0.061	-3.829	-0.089	-6.150	FOOD
TX	0.012	1.035	0.012	1.035	-0.056	-4.574	-0.031	-1.928	-0.047	-2.894	TEXTILE, CLOTHING, LEATHER
LH	-0.025	-2.172	-0.02	-1.770	-0.018	-1.514	-0.062	-4.088	-0.09	-6.104	LIGHT INDUSTRIES
HM	0.022	1.713	-0.015	-1.169	-0.036	-2.877	-0.027	-1.623	-0.089	-6.951	CHEMICALS, MINERALS
MA	0.015	1.398	-0.001	-0.136	-0.031	-2.883	-0.019	-1.335	-0.036	-2.685	METAL, MACHINERY
LIFE-CYCLE (REF=ESTABLISHED FROM 1963-1976)											
EY1	0.043	2.422	-0.004	-0.246	0.025	1.317	0.052	1.816	0.115	3.387	ESTABLISHED SINCE 1977
EY3	0.009	1.315	-0.005	-0.765	-0.009	-1.186	-0.001	-0.158	0.008	1.090	ESTABLISHED FROM 1950-1062
EY4	0.004	0.347	0.012	1.009	-0.011	-1.343	-0.007	-0.434	-0.029	-2.044	ESTABLISHED BEFORE 1950
MOBILITY (REF=STAY)											
CL2	-0.049	-4.193									CLOSED 1983-1985
CL3	-0.004	-0.300	-0.016	-1.442							CLOSED 1985-1988

FIRM TURNOVER RATES BY INDUSTRY

1979-1988 (ANNUAL RATES)

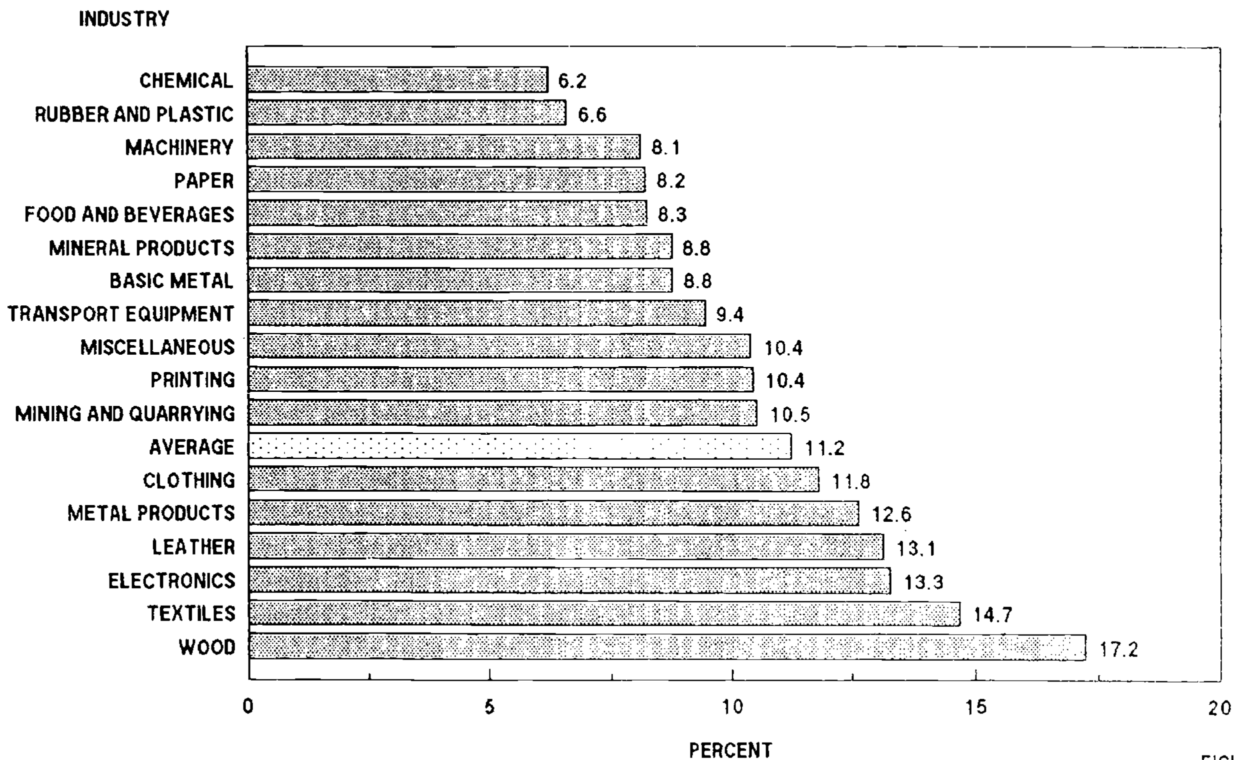

FIGURE 1

LABOR TURNOVER RATES BY INDUSTRY

1979-1988 (ANNUAL RATES)

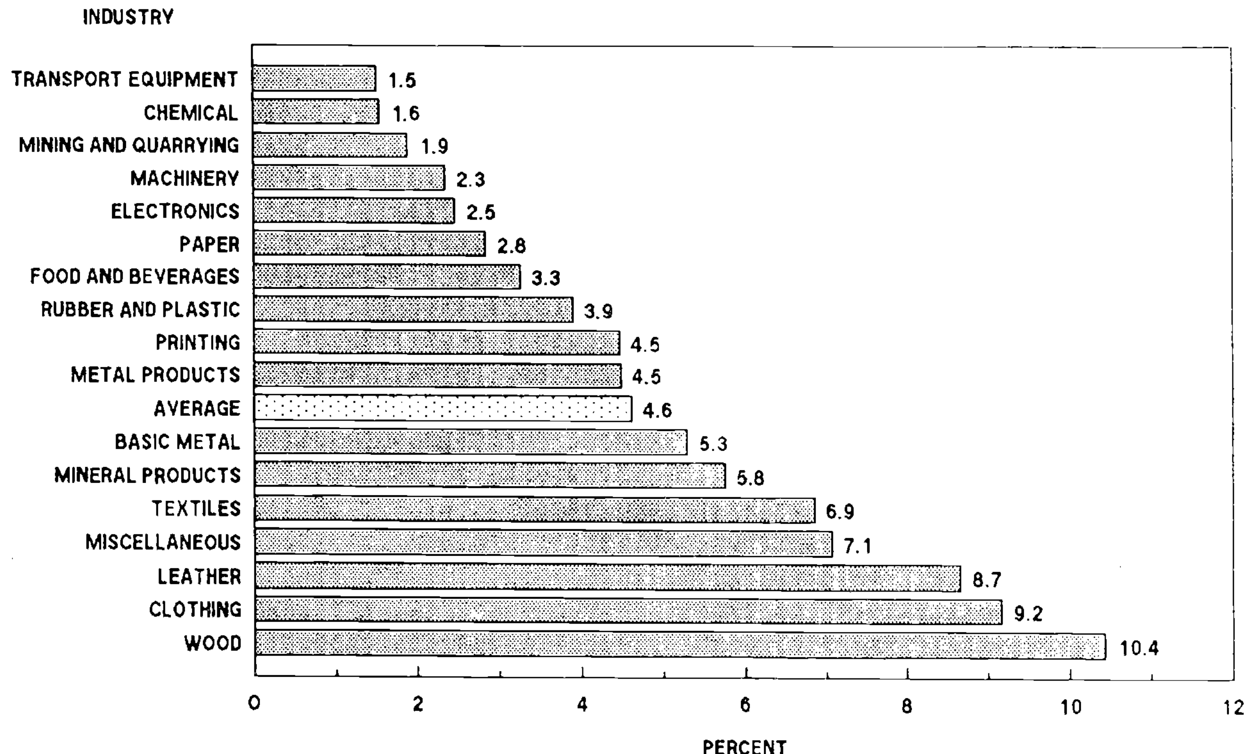

FIGURE 2

VALUE ADDED PER PERSON-YEAR

EXITING FIRMS RELATIVE TO STAYERS (BEG.)

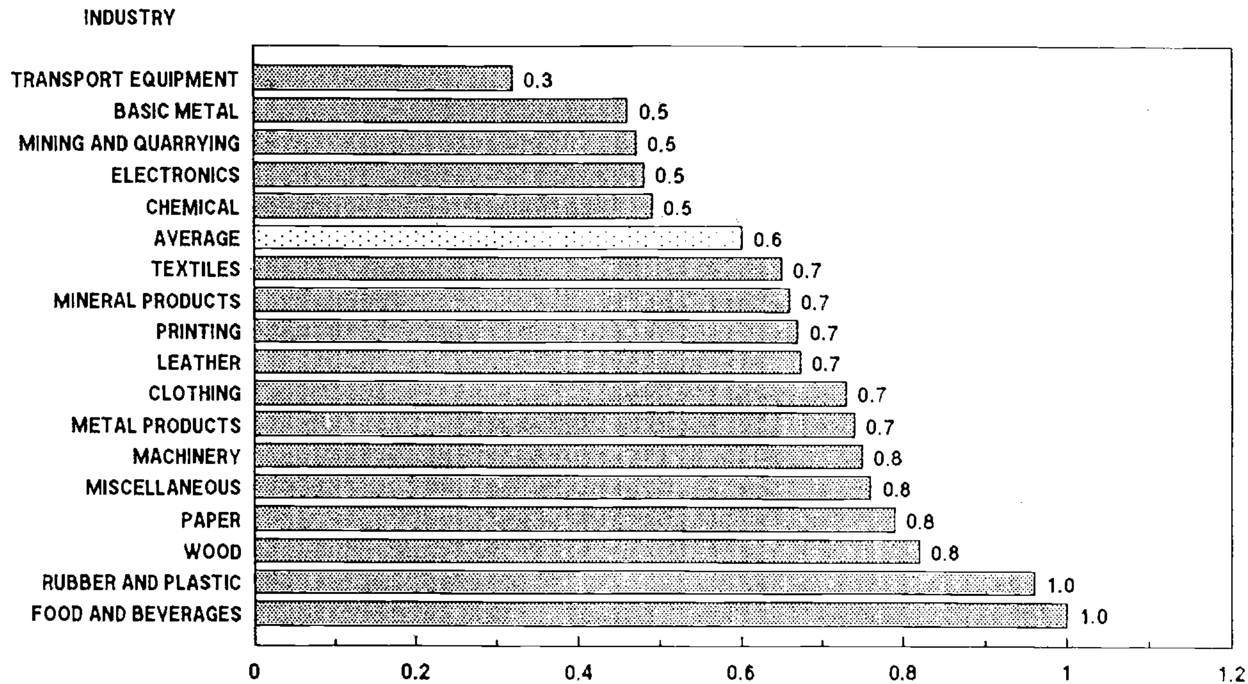

FIGURE 3

VALUE ADDED PER PERSON-YEAR

(ENTRING/STAYERS) RELATIVE TO (EXITING/STAYERS)

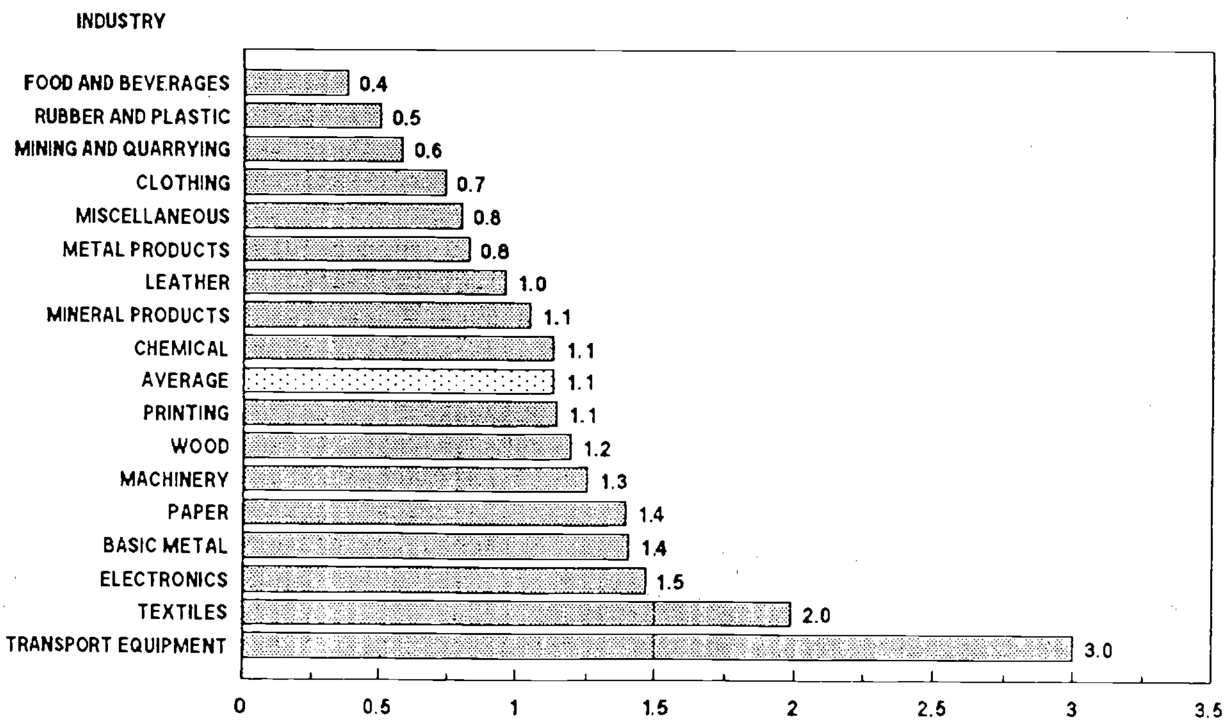

FIGURE 4

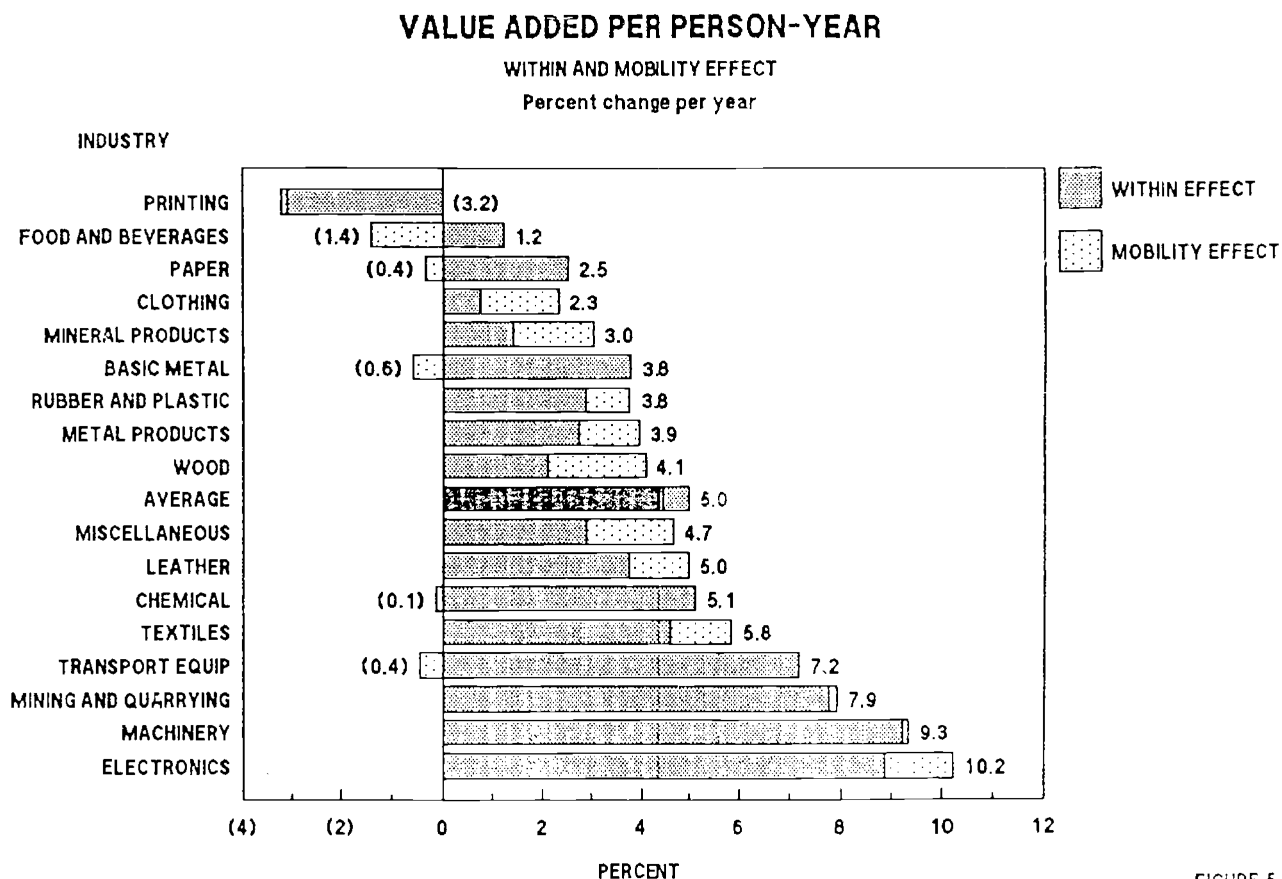
VALUE ADDED PER PERSON-YEAR
WITHIN AND MOBILITY EFFECT
Percent change per year
INDUSTRY
PRINTING
FOOD AND BEVERAGES
PAPER
CLOTHING
MINERAL PRODUCTS
BASIC METAL
RUBBER AND PLASTIC
METAL PRODUCTS
WOOD
AVERAGE
MISCELLANEOUS
LEATHER
CHEMICAL
TEXTILES
TRANSPORT EQUIP
MINING AND QUARRYING
MACHINERY
ELECTRONICS
(3.2)
(1.4)
1.2
(0.4)
2.5
2.3
3.0
(0.6)
3.8
3.8
3.9
4.1
5.0
4.7
5.0
(0.1)
5.1
5.8
(0.4)
7.2
7.9
9.3
10.2
WITHIN EFFECT
MOBILITY EFFECT
(4)
(2)
0
2
4
6
8
10
12
PERCENT

FIGURE 5

PRODUCTION PER PERSON-YEAR

WITHIN AND MOBILITY EFFECT

Percent change per year

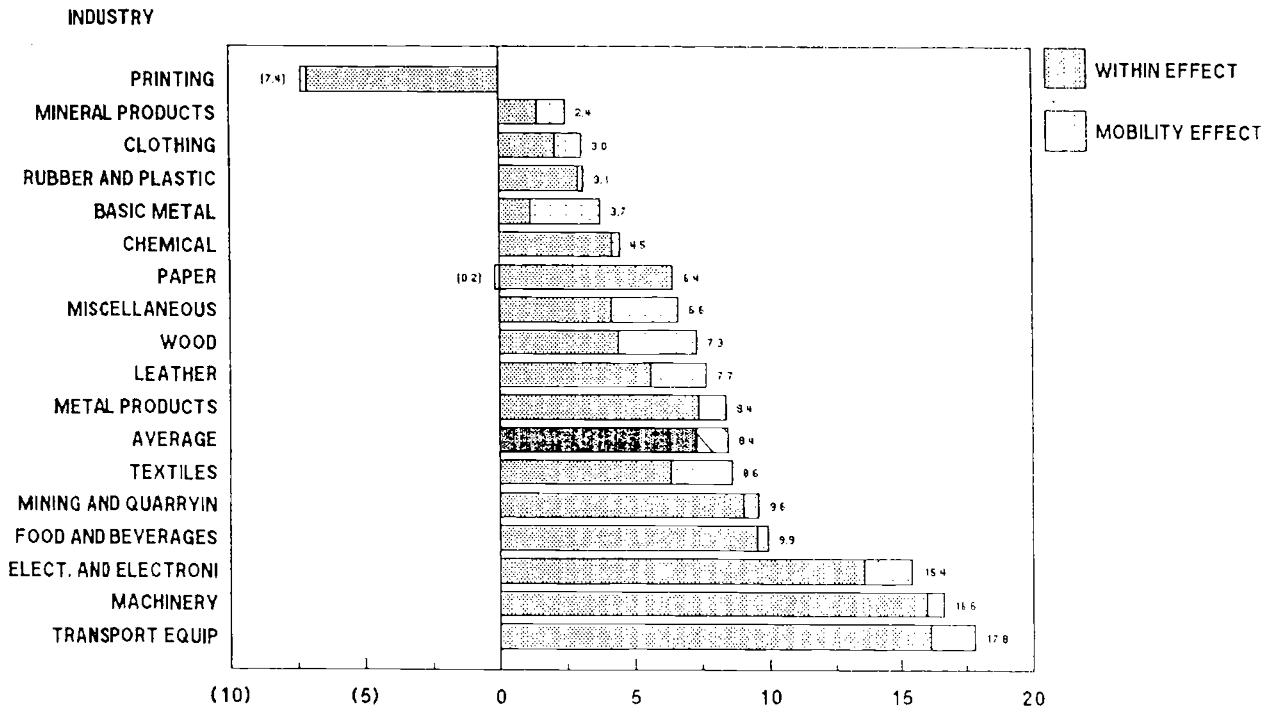

FIGURE 6