Investment and Employment by Manufacturing Plants

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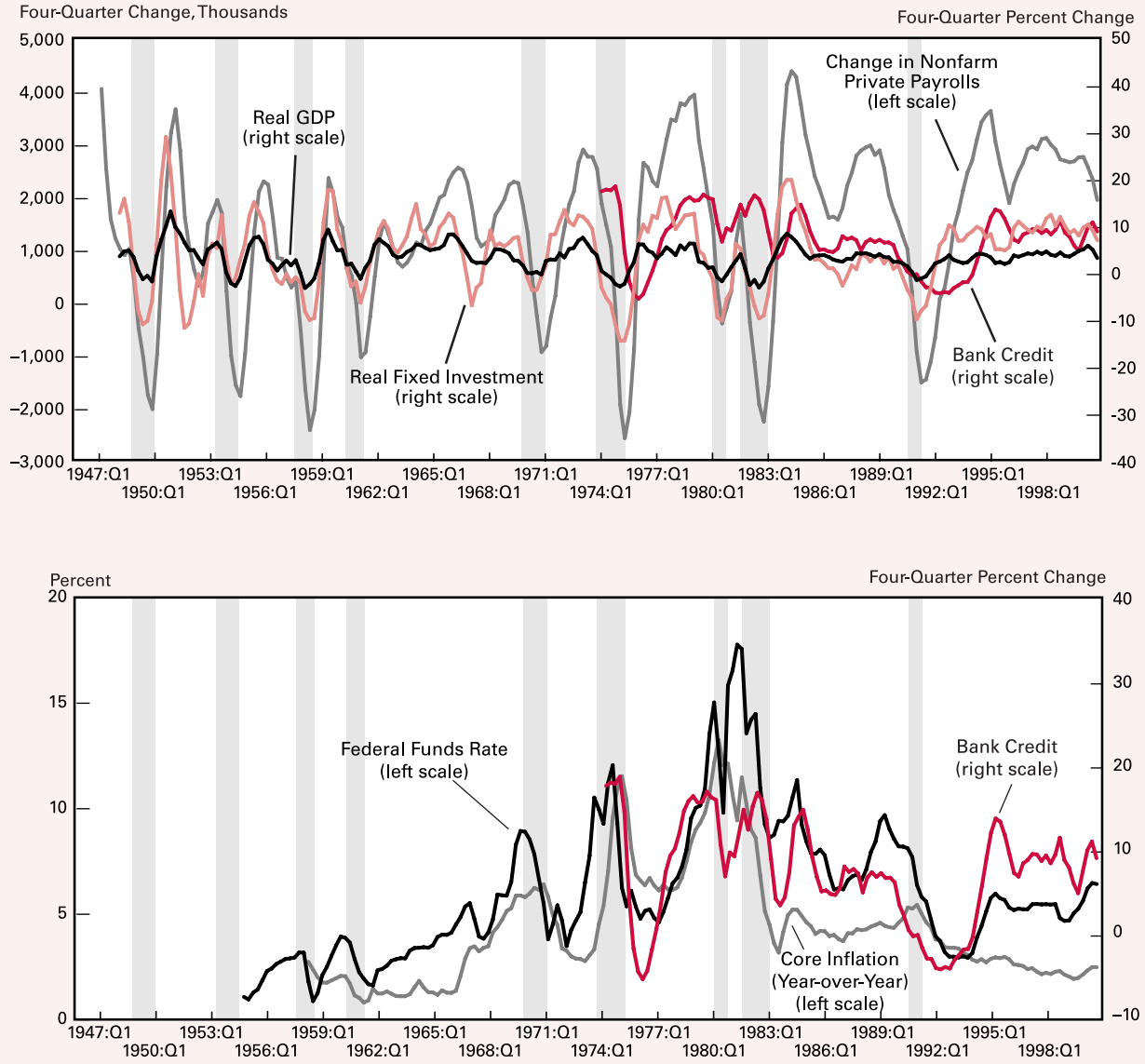
The preceding article, "The Performance of Traditional Macroeconomic Models of Business Investment Spending," by Richard W. Kopcke, analyzed the determinants of investment at the macro level. However, examination of investment at the macro level encounters several complications. In general, analysis of investment at this degree of aggregation implies that all firms in the economy react similarly to the same macro-level variables. Yet, examining macro data may obscure a great deal of variation in the forces that affect different firms, thus making quantification of the impact of these forces difficult. For example, smaller companies depend more on their proximate sources of funds, such as their own cash flow and loans from the local bank, while large firms have greater access to broader sources of funding, such as the resources of the larger enterprise and funds from the public capital markets. The decisions of smaller companies, therefore, depend more on their own current financial conditions and less on the current macro situation and the cost of capital in public markets, which affect the larger firms. Since different types of firms face an array of different constraints, this article will examine employment and investment at manufacturing plants at a finer level of distinction than was used in the previous article. The disaggregation helps clarify some of the determinants of firm behavior.

Figure 1

Cyclical Behavior of Selected Macro Variables

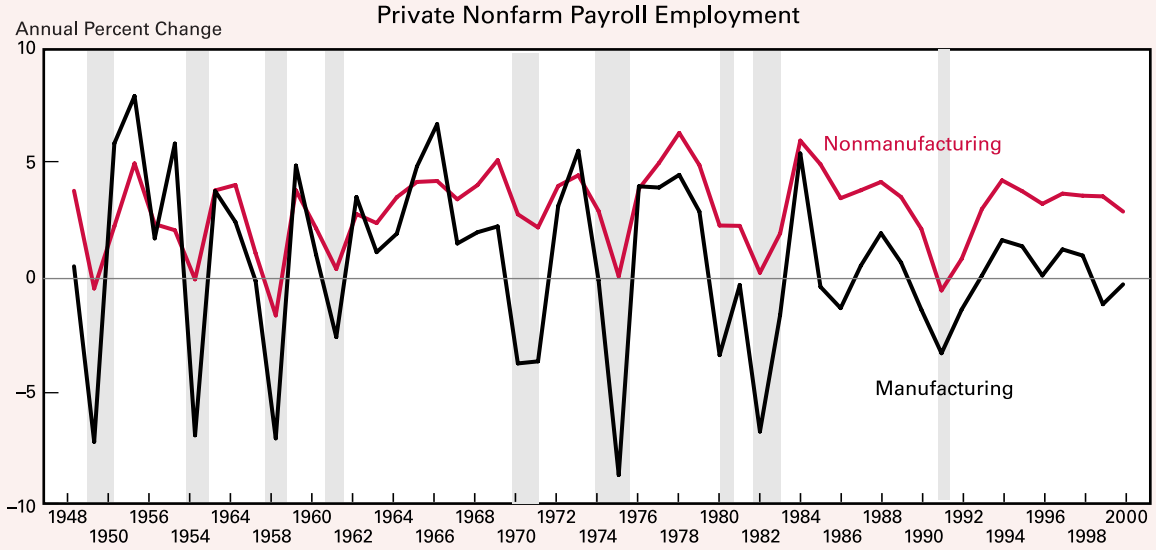


Note: Shaded areas indicate NBER-dated recessions.
Source: U.S. Bureau of Economic Analysis (GDP and investment), U.S. Bureau of Labor Statistics (employment and core inflation), and Federal Reserve Board (federal funds rate and bank credit).

The interrelationships of many macro series over the business cycle was the grain of sand that helped create the pearl that is macroeconomics. Figure 1 presents a sampling of these macro series. Employment and investment, as well as prices, bank credit, and national output, all appear to move closely together over the business cycle. In part, this study examines whether the nature of these cycles can be discerned more clearly by examining data for individual manufacturing plants: specifically, whether these cycles are shared across the economy as a whole or only among certain types of firms or firms in certain industries.

Figure 2

Manufacturing and Nonmanufacturing Employment Growth



Note: Because recession dates are given on a monthly or quarterly basis, graphic approximations are made on the annual frequency above.
Source: U.S. Bureau of Labor Statistics (payroll employment) and National Bureau of Economic Research (recession dates).

However, this study explores broader issues besides the cyclical nature of these variables; it distinguishes the determinants of firm behavior that are shared by all types of businesses from those that differ among firms, and it explores whether the potential motives for firms' investment and employment decisions can be more clearly discerned in the data from individual plants. We find that disaggregation sheds light on several important aspects of firm behavior. Not only do different types of plants react directly to business cycle demand shifts in different ways, but these plants react quite differently to some of the indirect effects of business cycles, such as variations in relative wages or in the availability of certain sources of funding.

The first section of the article describes the data used in the analysis. Section II presents the basic empirical model used to examine the plant's choice of labor and capital, showing the results of this model for manufacturing as a whole. The next two sections examine whether further disaggregation of the data into different types of plants helps to clarify some of the determinants of firm investment and employment decisions. The third section discusses the variables that seem to affect all firms in a similar way. This section highlights the issues on which further disaggregation fails to shed much light. The fourth section examines the forces that appear to differ across all types of firms; these results show what may be lost by a simple macro analysis. The final section concludes.

I. The Data

Many of the data used in this study are found in the U.S. Census Bureau's Longitudinal Research Database (LRD), which provides income, employment, and investment variables at an annual frequency for a sample of manufacturing plants across the country. Although the importance of manufacturing in the economy has fallen during the past three decades, Figure 2 shows that manufacturing firms are a good laboratory in which to examine the reactions of firms to the forces in a business cycle. The figure illustrates that manufacturing employment, and thus output, is much more cyclical than employment in the nonmanufacturing sector. Thus, manufacturing is a good case study, particularly since it typically requires substantial tangible investment and skilled labor. Disaggregation of the macro data for services would be less likely to explain the cyclical behavior of investment and employment and, thus, less likely to shed any light on the usefulness of any such disaggregation.

The study uses plant-level data on income, investment, and employment taken from the LRD of the U.S. Bureau of the Census. The LRD contains historical economic data for 1963 to 1995 from the quinquennial Census of Manufactures (CM) and the Annual Survey of Manufactures (ASM). The CM is conducted in years ending with "2" or "7" (except for 1963) and covers the universe of manufacturing plants and firms with five or more employees (300,000 to 400,000 plants). The ASM is conducted annually in the years between censuses. It covers a random probability sample of plants in most years (50,000 to 70,000 plants). The basic sampling unit of the LRD is a plant, but information is included that accurately identifies both plants and their parent firms in each year. LRD data are available at annual and quarterly frequencies, and individual plants are assigned unique, time-invariant identifiers. Thus, the LRD constitutes a panel data set.

This study distinguishes the determinants of firm behavior that are shared by all types of businesses from those that differ among firms.

Many previous studies have used the LRD to examine aspects of employment changes and investment. Much of the work on employment has focused on gross job flows (for example, Davis, Haltiwanger, and Schuh 1996). Recent studies which have used the LRD to examine investment include Cooper, Haltiwanger, and Power (1999) and Doms and Dunne (1998). Kopcke with Howrey (1994) examines the determinants of investment using a panel of firms from the COMPUSTAT database.

With a little help, the LRD permits an examination of the effect of regional economic conditions on plant behavior. Since the LRD provides the location of the plant, the data for plants were merged with selected regional and industrial data, including measures of various economic conditions within the U.S. Bureau of Economic Analysis (BEA) regions. BEA regions roughly correspond with the local labor and banking markets. The annual growth in wage and salary disbursements within these regions reflects the growth of income in the area. Regional income captures income effects on demand besides those accounted for by GDP to the degree the plant disproportionately serves its local market, a result, say, of high transportation costs. A region's wages relative to those in the country as a whole are also included, to help explain investment and employment decisions in the area. If wages rise in a region relative to the nation, firms might shift production elsewhere and, thus, shift their local investment and employment away from the plant in the high-cost area. Finally, the condition of the banks in the region might help explain the behavior of plants in the area if these banks are an important source of credit to the firm. On the other hand, the overall health of the local banks may reflect the weakness of firms in the area. As a result, several variables describing the local banking market are included in the analysis.

A plant's performance might resemble that of its industry; thus, a variety of industrial variables are also included. An industry's growth of output and investment might reflect elements of its business conditions that are unaccounted for by the national data. These industrial variables include the rate of return and cash flow of the plant's industry as a whole, data that are not contained in the LRD. Because the LRD lacks firm-level cash flow and profit rates, potentially important determinants of both the plant's investment and its employment decisions, industry-level data on these variables are used to proxy, in part, for the missing firm-level information.

Finally, the analysis includes macro data. The growth in real GDP and the rate of unemployment represent general business conditions. GDP growth captures the change in aggregate demand, while the unemployment rate indicates the stage of the business cycle. The two influences are distinct. For example, when the unemployment rate is high, a firm might be hesitant to invest even though GDP is growing rapidly, either because the economy just passed through a recession and firms are still tentative or because excess capacity makes it unnecessary to do so. Conversely, when GDP is expanding relatively slowly but the unemployment rate is low, firms might be forced to invest substantially as a substitute for the labor which is in such short supply. The investment equations also include a national measure of the user cost of capital. Unfortunately, the user cost variable does not incorporate any local tax differences; the only idiosyncratic effects of the supply of funds regionally are captured by the local banking variables.

The next section briefly outlines the empirical approach used to examine the employment and investment decisions of manufacturing plants. A description of the results then follows.

II. The Empirical Model

This study examines the correlation of plants' decisions with the historically assumed determinants of firm behavior. The plant-level decision variables examined here include the number of employees at the plant, the number of hours these employees worked, the investment in capital equipment and structures at the plant, and the investment in inventories at the plant. Although the firm's decisions about these variables are related, each decision may depend on a slightly different set of variables. For example, the user cost of capital for structures may affect the fixed investment of the firm but have little or no effect on the employment or inventory decisions. As a result, the four equations modeling the four different decision variables of the plant have slightly different formulations.

Although the equation for fixed investment is similar to those found in the previous article, the specification does differ significantly, since the plant-level data permit an exploration of the role of regional, industrial, and plant-specific variables in the investment decision. The explanatory variables are separated into several broad categories. The first group includes the major macro data. The growth in real GDP and the level of the unemployment rate for the year are used to help explain the cyclical behavior of investment in a given plant. Also included in the national data for fixed investment is the cost of capital investment, for both structures and equipment. Macro investment is intended to capture potential changes in the investment outlook for the nation as a whole, such as technological change, which might be missed by the industry or plant-level information.

Unlike the data used in the previous study, the LRD allows for the incorporation of industrial characteristics into the analysis; thus, information on an industry's cash flow, investment, and output growth are included in order to capture industry performance that may differ from that of the national economy. For example, chip manufacturing may be booming because investment demand for information-processing equipment is high in the rest of the world, even though demand for all goods and, thus, to a large part for investment, has cooled in the United States. Finally, since the LRD provides the location of the plant, the role of the regional economy in the plant's investment decision can be examined. The region's income growth, loan growth, and a variable measuring the health of the local banks are included to quantify the strength of the local economy as well as to capture any local credit supply restrictions that might affect the plant's ability to invest. Including the relative labor costs in the region also accounts for regional pressures on costs. All of the regressions reported in this article include a full set of BEA region indicator variables (although the coefficients are not reported in the tables).[1]

Of course, a plant's employment decisions may depend on a different set of variables than its investment decisions. For example, although the user cost of capital may affect investment in the plant, and investment may affect employment, including investment in the employment equation should make the user cost variable unnecessary in the employment regression. Inventory investment should be sensitive to some measure of user cost; since the tax treatment of inventories is closer to that of equipment than that of structures, the user cost of equipment is used in the inventory equation. However, even though some differences do occur in the formulation of each of these decisions, the exercise is meant to highlight the broader patterns in these data; as a result, a large degree of continuity is maintained between the models of the four different decision variables.

Plant-level data permit an exploration of the role of regional, industrial, and plant-specific variables in the investment decision.

Since this study examines whether the macro data miss important lessons about the swings in investment and employment, Table 1 begins by presenting the results from estimation of the data for the manufacturing sector as a whole. (Variable definitions, means, and standard errors are shown in the Appendix Table.) The equations in Table 1 were estimated for all manufacturing plants taken together. Some broad patterns are visible, and it is clear that the micro data that are included add a richness to the determinants of investment and employment. Starting with fixed investment, several variables measuring the strength of the economy are important. Faster regional income growth and more rapid growth in the output of the

[1] The short duration in the sample of many of the small plants made estimation of plant-level fixed effects problematic. Specifically, the R^2 would have risen significantly. The majority of the variations in investment and employment occur from plant to plant rather than over time at one plant.

Table 1
All Manufacturing Plants
(Fixed)

Variables	Fixed Investment	Investment in Inventories	Employment Growth	Increase in Hours
Constant	.0332** (.0040)	.0217** (.0065)	.0985** (.0198)	.1290** (.0223)
Macro Variables				
Real GDP Growth	–.0019 (.0046)	.0085 (.0061)	–.0004 (.0463)	.2097** (.0485)
Investment/GDP	.1853** (.0168)			
User Cost of Capital–Equipment	–.0418** (.0187)	–.0231** (.0104)		
User Cost of Capital–Structures	–.1509** (.0207)			
Unemployment Rate	–.0007** (9.57E-05)	–.0021** (.0001)	–.0007 (.0005)	.0011 (.0009)
Cash Flow/GDP		–.1173** (.0165)		
BEA Regional Variables				
Relative Wage	–2.3894 (2.7128)	–5.3175 (6.1876)	–91.788** (20.5891)	–130.8892** (25.0636)
Growth in Wage and Salary Disbursements	.0362** (.0054)	.0900** (.0064)	.2744** (.0443)	.3315** (.0541)
Industry Variables				
Growth in Product (nominal)	.0138** (.0012)	.0284** (.0008)	–.0024 (.0066)	.0230** (.0080)
Investment/Output	.0004** (2.96E-05)			
Growth (Investment/Output)			–.1122** (.0226)	–.2264** (.0292)
Cash Flow/Output	–.0083** (.0007)	.0004 (.0003)		
Profits/Capital Stock		.0087** (.0008)	–.0010 (.0071)	–.0337** (.0078)
Growth in Cash Flow			.0026** (.0007)	.0053** (.0009)
Growth in Production Workers			.8238** (.0253)	.9968** (.0273)
Banking Variables				
Provision for Loan Losses/Interest Income	–.0007 (.0011)	–.0104** (.0036)	.0009 (.0047)	.0229** (.0085)
Growth in Total Loans	8.87E-07 (7.85E-07)	1.93E-07* (1.10E-06)	2.62E-06 (3.00E-06)	6.46E-06** (2.85E-06)
Plant-Level Variables				
Lagged Growth of Total Value of Shipments	7.15E-07 (4.64E-07)	5.16E-08 (6.46E-08)	5.87E-06** (2.67E-06)	5.09E-06** (2.46E-06)
Lagged Growth in Investment			1.24E-05 (9.56E-06)	1.72E-05 (1.15E-05)
Observations	660,514	660,514	660,514	660,514

Note: Standard errors are in parentheses.
** Significant at the 5% level.
* Significant at the 10% level.

plant's industry increase both fixed investment and investment in inventories. Certainly, the location of the economy in the cycle is important; the higher the unemployment rate, the lower is investment. In neither investment equation, however, does the growth of GDP affect investment beyond its effects on these other variables. In the aggregate, the evidence indicating the importance of user costs of capital to investment has been mixed. Examining data at the level of the plant, the evidence presented in Table 1, shows that the user cost variables are significant and correctly signed. The manufacturing data for plants provide fairly strong evidence that investment, both fixed and inventory, is affected by the user cost of capital. On the whole, the industry variables are also important, showing idiosyncratic industry effects that are not captured by the macro data.

Looking at manufacturing as a whole, there is very little evidence that variations in local conditions beyond local income have much effect on investment. Neither the relative wages in the region nor the local banking conditions appear to have a significant effect on these plants' investment. The health of local banks appears to have some effect on inventory investment, but not investment in plant and equipment.

The results are similar for the hours and employment regressions. The strength of the economy explains much of the movement in labor input. Although the firm's employment decision appears to be unrelated to the expansion in GDP, the growth in hours worked does depend strongly on the acceleration of national income. Rapid regional income growth significantly increases both employment and hours in these plants. The importance of regional income growth beyond its correlation with the expansion of national output suggests that there might be a significant local market for the goods produced by these manufacturing plants. Alternatively, regional income growth may reflect the fact that suppliers and producers tend to congregate in the same area; thus, when business goes bad for a final goods producer, its suppliers are hit hard as well.

Industry data, such as the growth of employment and cash flow, also affect the growth in employment and hours in these plants. An acceleration in an industry's employment and cash flow tends to accompany more rapid expansion in a plant's employment and hours. Interestingly, rapid investment in an industry, given its output growth, results in slower labor demand at the plant level. The industrial investment data appear to be suggesting that the expansion of the competition's capacity tends to reduce the desire of a plant to increase its own capacity. The history of investment and output in the plant also affects employment and hours, emphasizing the complementarity of these two inputs in manufacturing plants. Finally, employment and hours are very sensitive to the relative wage in the region. As a region's labor becomes relatively more expensive, both employment and hours decline in manufacturing plants located in that market.

There are important differences between the hours and the employment regressions. Although changes in employment were little affected by industry output or profits, or by GDP for that matter, growth in hours was much more sensitive to these variables. Hours also seems to respond to the local banking data. Loan growth was more closely associated with increases in hours than with increases in employment. Since growth in hours is a more flexible margin, perhaps due to changes in overtime, hours might be more responsive to changes in banking conditions in particular, or the economy in general. Overall, these two regressions suggest that a plant tends to adjust hours more rapidly than employment when the demand for its product changes; this makes sense given the costs of labor turnover, particularly when the change in demand is viewed as temporary.

Overall, the regressions suggest that a plant tends to adjust hours more rapidly than employment when the demand for its product changes.

However, several puzzles jump out from the results presented in Table 1. Why are many of the plants' actions so impervious to the growth in GDP? As a potentially important source of funds, why isn't the health of the local banking community more important, particularly for investment in plant and equipment? Why don't the relative costs in the area, the relative wage rates, play more of a role in the flow of capital to different areas—shouldn't capital flee, and investment decline, in plants located in high-wage regions? Do different types of plants take different paths in the hours/employment balancing act as demand changes? The next two sections examine

Table 2
Coefficients on Nationwide Unemployment Rate

Sample	Fixed Investment	Investment in Inventories	Employment Growth	Increase in Hours
Durables	–.0005**	–.0024**	–.0008	.0015
	(1.17E-04)	(1.36E-04)	(.0008)	(.0012)
Nondurables	–.0006**	–.0018**	–.0007	.0004
	(1.18E-04)	(1.30E-04)	(4.64E-04)	(.0008)
Single Plant	–.0006**	–.0017**	–.0021**	–.0013
	(2.60E-04)	(1.11E-04)	(.0010)	(.0014)
Multiplant	–.0007**	–.0022**	–.0010*	.0010
	(1.04E-04)	(1.21E-04)	(.0005)	(.0009)

Note: Standard errors are in parentheses.
** Significant at the 5% level.
* Significant at the 10% level.

whether further disaggregation of these manufacturing plants into different categories helps explain any of these puzzles.

III. Common Themes Across Plants

This section reestimates the four basic regressions over a variety of different subsets of these manufacturing plants, examining common strands in the subsets, in an attempt to answer the questions above. The next section explores where the strands diverge. Four different types of plants are examined. Since the reaction to growth in GDP is one puzzle, the results for plants in durable goods industries and those in nondurable goods industries are analyzed separately. Theory and much macro evidence suggest that plants in the two sectors should react differently to aggregate business conditions. As a result, combining the two types of industries may confuse the story.

Further, since the reaction to credit conditions at the local banks seems to be ambiguous in the results for all manufacturing, the distinction between affiliated and unaffiliated plants is examined. An unaffiliated plant is a firm unto itself, while affiliated plants belong to larger enterprises. The distinction could be important for a variety of reasons. First, since affiliated plants are generally larger, their funding could draw from other regions and sources of credit, and the effect on these plants of their current financial circumstances and the conditions in the local banking market might be significantly weaker. On the other hand, unaffiliated plants, without access to other sources of financing, should depend on local banks for funds to finance investment and inventories. If so, the health of the local bank might affect unaffiliated plants in a region more than affiliated ones, and, conversely, the health of the local banks might depend more on the health of the local unaffiliated plants, which might disproportionately receive funding from these banks. Separating affiliated from unaffiliated plants might also help clarify why investment does not appear to depend on the relative wages in the region. Affiliated plants should have more flexibility in shifting production between different regions and, thus, might have very different responses than unaffiliated plants to relative wage differentials.

It is surprising to find that all the important measures of the national business cycle are not important determinants in all four decisions for all four types of manufacturing plants. Table 2 presents the coefficients on the unemployment rate for regressions with the same specification as those in Table 1, but now estimated separately for affiliated and unaffiliated plants, as well as for plants in durable goods industries and those in nondurable goods industries. For brevity, only the coefficients on the unemployment rate are shown. The results in Table 2 reveal that the unemployment rate has a significant effect on some of the investment and employment decisions for all four types of plants. The relationship of the unemployment rate to investment, either fixed or inventory, is the same across the four categories of plants. The higher the unemployment rate, the less likely a plant is to invest in equipment or hold inventories, regardless of whether that plant makes a durable or nondurable good or is part of a larger firm or not. Employment growth also tends to decline across all types of firms when the unemployment rate is high, although the effect is less clearly visible in the data. Although the coefficients are statistically insignificant, their signs suggest that hours tend to rise when the unemployment rate is high; this finding, taken with the results on employment, implies that when the unemployment rate is high, firms tend to economize on employment by raising hours per worker. Since these reactions are fairly consistent across these different types of plants, the disaggregation reveals little new information about the response of manufacturing plants to the stage of the business

cycle above that found in the manufacturing regressions in Table 1.

Table 3 shows that the different types of plants also share a fairly common reaction to the strength of the local economy. Whether the plant was affiliated or unaffiliated, or whether it produced durable or nondurable goods, had little effect on the plant's response to the performance of the regional economy; all four types of plants shifted employment, hours, and investment in response to local economic conditions. The importance of the regional economy is somewhat surprising given the inclusion of GDP growth in the analysis. This finding suggests that plants tend to locate near their customers. For example, suppliers of intermediate products tend to locate their plants near the facilities of the firms that demand these intermediate products. As a result, when demand for the final good weakens, so does the demand for all the intermediate goods. The local income in this case would reflect the high correlation of demand across all plants in the same area. An alternative explanation is that all four subsets of plants have a significant share of plants that produce non-traded goods. Local newspapers and concrete, for example, historically have been traded only within a very small market.

Table 3
Coefficients on Growth of Wage and Salary Disbursements in BEA Regions

Sample	Fixed Investment	Investment in Inventories	Employment Growth	Increase in Hours
Durables	.0602**	.1154**	.4163**	.4811**
	(.0069)	(.0082)	(.0522)	(.0727)
Nondurables	.0123**	.0640**	.1267**	.1671**
	(.0060)	(.0056)	(.0380)	(.0373)
Single Plant	.0479**	.0505**	.2735**	.3691**
	(.0082)	(.0039)	(.0857)	(.0994)
Multiplant	.0344**	.0993**	.2677**	.3114**
	(.0057)	(.0071)	(.0373)	(.0487)

Note: Standard errors are in parentheses.
** Significant at the 5% level.
* Significant at the 10% level.

Dividing the sample into these four subsets also does not appear to illuminate the relationship between industry variables and the plant's behavior. The expansion of the industry as a whole significantly affects investment at the local plant. The coefficients in Table 4 reveal a close association between industry output growth and investment for all four types of plants examined here. When an industry expands more (or less) rapidly than the nation or the local region, investment in all four types of plants in that industry tends to rise (or fall). The coefficients presented in Table 4 show that the response to industry investment is very similar across the different types of plants. Again, disaggregation reveals little about the nature of this relationship, but there is little reason to expect that such a disaggregation would have helped.

For all four types of plants, investment in the industry as a whole strongly influences the plant's decisions about employment and hours, even after taking the plant's own investment into account. The first two columns of Table 5 show that a change in the capital stock in the industry as a whole affects both hours and employment similarly across the different types of plants. All the coefficients are negative and significant. The negative effect of industry investment on the plant's labor input could reflect a response to changes in a plant's market share—as capacity in the industry rises, the market share and output of a single plant decline. In general, the effects of investment in the industry are similar across the various types of plants. The only difference appears to be the size of the coefficient in the plants that produce nondurable goods. Labor inputs appear to be less reactive to

Table 4
Coefficients on Growth of Industry Nominal Output

Sample	Fixed Investment	Investment in Inventories
Durables	.0056**	.0278**
	(.0015)	(.0012)
Nondurables	.0206**	.0200**
	(.0019)	(.0015)
Single Plant	.0219**	.0239**
	(.0028)	(.0020)
Multiplant	.0115**	.0290**
	(.0012)	(.0011)

Note: Standard errors are in parentheses.
** Significant at the 5% level.
* Significant at the 10% level.

Table 5
Coefficients on Investment

Sample	Coefficients on Industry Investment Growth: Employment Growth	Coefficients on Industry Investment Growth: Increase in Hours	Coefficients on Lagged Plant Investment Growth: Employment Growth	Coefficients on Lagged Plant Investment Growth: Increase in Hours
Durables	–.1468**	–.2629**	3.27E-05	3.34E-05
	(.0261)	(.0334)	(3.23E-05)	(3.40E-05)
Nondurables	–.0489**	–.1483**	8.33E-06	1.40E-05
	(.0174)	(.0223)	(8.20E-06)	(1.12E-05)
Single Plant	–.1420**	–.2000**	5.75E-05*	2.95E-05
	(.0466)	(.0538)	(2.97E-05)	(2.51E-05)
Multiplant	–.0908**	–.2136**	1.12E-05	1.70E-05
	(.0199)	(.0271)	(9.22E-06)	(1.16E-05)

Note: Standard errors are in parentheses.
** Significant at the 5% level.
* Significant at the 10% level.

changes in the industrial capital stock in industries that produce nondurable goods. The positive coefficients on the plant's lagged investment in the third and fourth columns of Table 5 imply some complementarity between capital and labor at the plant level.

Also, as one would expect, the growth of labor inputs varies inversely with the wages in the region relative to the national average, whether the plant produces durable or nondurable goods, is affiliated or unaffiliated. Table 6 shows that both employment and hours decline significantly in plants located in high-wage areas. Whether the plant is affiliated or not, or produces durable or nondurable goods, being located in a high-wage market makes the plant less competitive, and thus, as one would expect, its output declines.

Table 6
Coefficients on BEA Region Relative Wage

Sample	Employment Growth	Increase in Hours
Durables	–.1331**	–.1748**
	(.0228)	(.0309)
Nondurables	–.0496**	–.0851**
	(.0198)	(.0210)
Single Plant	–.0952**	–.1473**
	(.0360)	(.0343)
Multiplant	–.0906**	–.1232**
	(.0168)	(.0248)

Note: Standard errors are in parentheses.
** Significant at the 5% level.
* Significant at the 10% level.

Only in industries that are non-traded would one expect to see some insulation of the employment decision from the relative wage rates in the region, since competition from plants producing the same good in low-wage regions would be low. However, there is little evidence that any one sector has more non-traded goods than another, and the issue cannot be examined using these distinctions. The effect of a region's relative wages does depend on the broad type of industry or firm it is associated with, which will be discussed further later.

The evidence regarding the influence of the user cost of capital on investment has been mixed. Table 1, however, presents strong evidence that investment in manufacturing plants, whether in plant and equipment or inventories, varies inversely with the user cost of capital. Table 7 shows that the cost of capital significantly affects investment in almost every type of plant, although the strength of the result varies somewhat with the type of plant being examined. The different tax treatment of structures compared to equipment requires a measure for each, although the two measures are highly correlated. Broadly, the results in Table 7 show that the user costs do tend to affect investment in structures and equipment across all four types of plants. The magnitude of the effect varies somewhat by plant type, but these differences may be an artifact of the collinearity between the two measures. For example, the effect of the equipment measure is more pronounced in plants that manufacture durable goods and in unaffiliated plants, while the effect of the measure of structures is more pronounced on plants that produce nondurable goods and those that are affiliated. However, the two measures are very collinear, and there is little obvious reason to believe that structures investment is more important in durable industries than in nondurables industries. Suffice it to say that all four types of plants examined in this study have a negative and significant coefficient on one of these two measures of user costs.

Perhaps more interesting is the relationship between the user cost of equipment and inventories at these plants. Evidence that the cost of capital affects inventory investment has been sparse (Blinder and

Maccini 1991; Ramey 1989), but Table 7 provides some support that it does. The effect of the user cost on inventory investment is of the predicted sign in all four types of plants. Furthermore, the size of the effect is the same for all but plants that produce nondurable goods. The effect is also statistically significant at or near the 10 percent level for all types of plants except, again, those that produce nondurable goods. The weaker response in plants that produce nondurable goods may be due to the nature of the product itself. Since highly perishable, or seasonal, goods are in this category, such plants may have less leeway to hold inventories, no matter what their opportunity cost, than plants that produce durable goods. Still, consideration of these four different types of plants does not add much to the understanding of the relationship between inventory investment and the user cost of capital, since the coefficients are similar across groupings.

Table 7
Coefficients on User Cost of Capital

Sample	Investment (Cost of Equipment)	Investment in Inventories (Cost of Equipment)	Investment (Cost of Structures)
Durables	–.1362**	–.0256	.0189
	(.0216)	(.0164)	(.0254)
Nondurables	.0452*	–.0051	–.2998**
	(.0259)	(.0073)	(.0290)
Single Plant	–.1421**	–.0241*	.0092
	(.0519)	(.0141)	(.0395)
Multiplant	–.0126	–.0293**	–.1971**
	(.0209)	(.0117)	(.0241)

Note: Standard errors are in parentheses.
** Significant at the 5% level.
* Significant at the 10% level.

This section has highlighted the finding that in many ways, different types of plants react similarly to various economic forces. As would be expected, common strands run throughout these different subsets of plants. Distinguishing between the different types of plants does help identify the similarities across these dimensions. However, other results uncover important distinctions between these groups, helping to clarify some of the results found in the broader macro or manufacturing-level regressions. The next section examines these differences.

IV. The Differences

The plants in the four groups could respond differently to several economic factors. In the regression results shown in Table 1, plants did not appear sensitive to the growth in GDP, but it is possible that mixing together all manufacturing plants masks the sensitivity of some plants, most likely those that produce durable goods, to the expansion of national income. Furthermore, mixing together affiliated plants, which tend to be large, with unaffiliated plants, which tend to be small, may mask the significance to investment of internal financing and local bank credit. The effect of the region's relative wage on investment could depend on whether or not the plant has affiliated facilities in other areas. In fact, all of these distinctions prove to be important.

For a variety of reasons, theory suggests that investment in plants that produce durable goods varies more with the expansion of GDP than investment in other plants because the demand for durable goods is more cyclical. First, since a durable good really contains a long stream of consumption or investment through time, a cutback on this stream appears as a large reduction of an agglomeration of service flows. Furthermore, since many durable goods purchases are merely replacements for old stocks, such as autos, the ability to postpone such expenditures is greater. A consumer can continue to drive an old car if concerns about income or employment arise. Thus, the growth in GDP should have a larger effect on new durable-goods purchases than on those of nondurables, and, as a result, should have a larger effect on investment and employment in the durable-goods industries.

The regressions in Table 1 indicate that real GDP growth has a significant effect only on the growth in hours for manufacturing plants as a whole. The last column of Table 8 reveals that the growth in GDP affects hours in all four types of manufacturing plants. Not surprisingly, as GDP accelerates, so do hours. However, these coefficients also show that the reaction is twice as great in plants in durable-goods industries as it is in plants that produce nondurable goods. Thus, the evidence for hours is consistent with the known sensitivity of durable goods industries to real growth.

Table 8
Coefficients on Nationwide Growth of Real GDP

Sample	Fixed Investment	Investment in Inventories	Employment Growth	Increase in Hours
Durables	–.0070	.0109	–.0050	.3148**
	(.0068)	(.0086)	(.0356)	(.0528)
Nondurables	.0085	.0044	.0438	.1836**
	(.0058)	(.0063)	(.0573)	(.0662)
Single Plant	.0002	.0258**	.2165*	.2581**
	(.0070)	(.0097)	(.1196)	(.1110)
Multiplant	–.0049	.0064	–.0361	.2042**
	(.0052)	(.0064)	(.0307)	(.0387)

Note: Standard errors are in parentheses.
** Significant at the 5% level.
* Significant at the 10% level.

Consequently, whereas an examination of all manufacturing plants suggests some sensitivity of hours to the growth in GDP, this aggregation masks important distinctions between the two types of industries.

The effect of GDP growth on the growth of employment varies even more significantly across the different types of plants than does its effect on hours. The types of plants that have the most sensitive response of employment growth to the expansion of national income differ from those in the hours equations. Nondurable-goods industries tend to alter their hiring more than durable-goods industries, even though this difference is less certain statistically. This appears to be a puzzle, since employment does vary with output during booms and busts. There are several reasons why it might not show up in these regressions. First, much of the cyclical effect might be captured by regional income growth, a variable that is highly significant. Second, employment usually lags in its response to changes in sales. Since plants change hours first, and the regression examines the immediate response, the result might appear to be stronger in hours than in employment. Finally, it is possible that the most cyclical industries, those that manufacture durable goods, are more apt to adjust hours of employment rather than the number of workers, although that does not appear consistent with the aggregate data.

Table 8 also reveals that although the effect of national GDP growth on investment tends to be small, it is of some consequence. This finding differs somewhat from those in Table 1, which showed that when manufacturing as a whole is examined, GDP growth has no effect on investment. Inventory investment varies with GDP, particularly in durable-goods industries and unaffiliated institutions. There is little evidence that GDP affects investment in plant and equipment in any of these types of plants. These results make sense if plant and equipment investment, both its financing and its desired level, depend on long-run profit opportunities rather than on short-run cyclical fluctuations. Inventories, of course, are driven by shorter-run concerns, since the desired stock of inventories depends on the state of demand in the near future. Finally, the various measures of aggregate cash flow, at the national and the industry levels, that are included in these regressions may capture the improvement in financial conditions that can occur when GDP grows more rapidly.

A plant's plans to employ capital and labor vary with its industry's output. In Table 1, the growth in industry output has a positive and significant effect on investment and hours, but Table 9 reveals that the effect is far from constant across different types of

Table 9
Coefficients on Industry Growth of Nominal Output

Sample	Fixed Investment	Investment in Inventories	Employment Growth	Increase in Hours
Durables	.0056**	.0278**	–.0316**	–.0225
	(.0015)	(.0012)	(.0111)	(.0141)
Nondurables	.0206**	.0200**	.0128*	.0506**
	(.0019)	(.0015)	(.0071)	(.0091)
Single Plant	.0219**	.0239**	–.0017	.0477**
	(.0028)	(.0020)	(.0132)	(.0163)
Multiplant	.0115**	.0290**	.0025	.0220**
	(.0012)	(.0011)	(.0065)	(.0081)

Note: Standard errors are in parentheses.
** Significant at the 5% level.
* Significant at the 10% level.

Table 10
Coefficients on BEA Region Relative Wage

Sample	Fixed Investment	Investment in Inventories
Durables	–.0060	–.0010
	(.0042)	(.0081)
Nondurables	.0016	–.0029
	(.0030)	(.0042)
Single Plant	–.0124**	–.0086**
	(.0040)	(.0023)
Multiplant	.0032	–.0040
	(.0036)	(.0076)

Note: Standard errors are in parentheses.
** Significant at the 5% level.
* Significant at the 10% level.

plants. Investment and employment in plants that produce durable goods are less sensitive to industry-specific growth than the other plants. Given the heavily cyclical nature of the durable-goods industries, they might tend to hoard more capital and labor. Then, as industry-specific demand increases, these industries would need to adjust less.

One important puzzle in the results in Table 1 is why the relative wages in the plant's region fail to have a significant effect on the plant's investment. Although Table 1 revealed that the region's relative wage had the predicted effect on the hours and employment decisions, it was unclear, first, whether that effect was uniformly important across the different types of firms, or second, why investment was so little affected by the relative wages in the area. Certainly, firms with more than one plant might have much more flexibility to shift employment and production across different plants if the relative wages in the region warranted. On the contrary, however, Table 6 (above) reveals that, if anything, multiplant firms appear to shift hours and employment less than unaffiliated plants in high-wage areas. Perhaps multiplant firms tend to congregate in high-wage regions; these firms may need big labor markets and these markets tend to have high wages, and the variance across their relevant regions is very low. The answer is unclear.

The effect of relative wages on investment, shown in Table 10, is slightly less puzzling. Although all types of plants tend to strongly adjust hours and employment with the industry's output, the response of investment is much stronger and statistically significant only for single-plant firms in the area. Multiplant firms do not appear to significantly reduce their investment in high-wage regions, while unaffiliated plants do. For a variety of reasons, multi-unit plants may be less sensitive to regional wages than unaffiliated plants. One explanation may be related to the reason why they do not shift their labor input, as discussed above. Alternatively, affiliated plants may need less investment because they can easily shift production across regions; perhaps each plant carries excess capacity in both capital and labor in order to take advantage of such shifts. On the other hand, single-unit plants in high-wage areas cut back on investment, while single-unit plants in low-wage areas increase investment. If unaffiliated plants are distributed throughout the country, then capital "flees" from high-wage areas via increased investment in unaffiliated plants in low-wage areas and decreased investment in unaffiliated plants in high-wage areas. Capital "moves" by shifting between single-unit plants.[2]

One question that has attracted renewed attention since Bernanke and Blinder (1988) involves the methods different types of firms use to finance investment. Small companies, which tend to operate only one plant, do not have access to the diverse sources of financing available to larger firms. Specifically, local bank financing, and perhaps internal sources of funding, should be much more important for these smaller firms than for the multiplant companies, which are more likely to have access to other types of financing, such as bond and equity issuance or banks in other regions. Thus, there is little wonder that bank variables are found to be insignificant in the regressions that cover all manufacturing, as shown in Table 1. A vast literature has suggested that a study of individual plants is essential

Small companies, which tend to operate only one plant, do not have access to the diverse sources of financing available to larger firms.

[2] On the other hand, one might expect single-unit firms to feel more pressure to substitute capital for labor when wages rise, implying a positive coefficient on relative wages in the investment equation for these plants. The impact on demand of an increase in the relative costs of the plant appears to outweigh the effects of any substitution.

Table 11
Coefficients on Loan Growth

Sample	Fixed Investment	Investment in Inventories	Employment Growth	Increase in Hours
Durables	1.28E-06**	–7.94E-07	4.57E-06	8.53E-06
	(5.09E-07)	(1.23E-06)	(4.39E-06)	(6.43E-06)
Nondurables	1.10E-07	1.24E-06*	–9.25E-07	2.92E-06
	(1.08E-06)	(7.47E-07)	(2.46E-06)	(3.32E-06)
Single Plant	5.77E-06**	2.54E-06	8.70E-06	2.00E-06
	(1.06E-06)	(1.72E-06)	(1.74E-05)	(1.23E-05)
Multiplant	–2.75E-07	–4.09E-07	1.08E-06	7.11E-06
	(5.50E-07)	(9.85E-07)	(2.65E-06)	(1.73E-06)

Note: Standard errors are in parentheses.
** Significant at the 5% level.
* Significant at the 10% level.

to find the role of banks in the investment and employment decisions of firms. If this is correct, the health of local banks should affect the behavior of multi- and single-plant firms differently.

In fact, Tables 11 and 12 provide evidence that single-plant firms do rely on bank financing. The coefficients in Table 11 represent the influence of the growth of local bank lending on investment and labor input. Plant and equipment investment at unaffiliated plants is positively and significantly correlated with the growth of loans at the regional banks. On the other hand, plant and equipment investment at affiliated plants is unaffected by regional loan growth, as the coefficient is of the wrong sign and statistically insignificant. The results in the first column of Table 11 suggest that single-plant firms are more sensitive to the availability of credit through the local banks, or that the demand for loans at these banks is sensitive to the vitality of these smaller firms.

Results that are, perhaps, sharper are found in the second column of Table 11. Inventory investment is an important segment of bank lending. As a result, one would expect to find a large effect of loan growth on inventory investment. Again, the second column of Table 11 shows that loan growth seems to affect inventory investment in single-plant firms much more than in multi-plant firms. As with investment in plant and equipment, inventory investment was positively correlated with regional bank loan growth for single-plant firms but negatively correlated, though insignificantly so, for multi-unit firms.

The regressions also examine one possible measure of the willingness of the local banks to lend, banks' provisions for losses on loans. The poor condition of banks could represent either a restricted supply of credit to the small companies, or the poor health of these small firms showing up as poor health for the banks that lend to them. Table 12 presents the coefficients for the provisions for loan losses in each of the decisions made by the firm. The effect of these provisions on plant and equipment investment is as predicted above. Small firms, the unaffiliated plants, do reduce their investment as predicted. The decrease is statistically significant. The evidence also suggests that investment by multi-unit firms is not affected by this local bank variable, because the coefficient is incorrectly signed and insignificant. Table 12 reveals that employment also tends to be cut back in single-unit plants and not in multi-unit plants when local banks increase their provisions for loan losses; however, neither coefficient is significant at the 10 percent level. Table 12 provides some evidence that the unwillingness of banks to lend may harm investment, particularly in unaffiliated plants.

Table 12
Coefficients on Provisions for Loan Losses

Sample	Fixed Investment	Investment in Inventories	Employment Growth	Increase in Hours
Durables	–.0011	–.0134**	.0059	.0240**
	(.0014)	(.0045)	(.0063)	(.0113)
Nondurables	–.0003	–.0073**	–.0058	.0183**
	(.0016)	(.0029)	(.0055)	(.0077)
Single Plant	–.0064**	–.0048**	–.0102	.0124
	(.0023)	(.0013)	(.0155)	(.0176)
Multiplant	.0005	–.0112**	.0013	.0229**
	(.0010)	(.0043)	(.0050)	(.0072)

Note: Standard errors are in parentheses.
** Significant at the 5% level.
* Significant at the 10% level.

Since much of bank financing is for inventories, the results for the inventory regressions suggest not only that single-unit firms are more closely in tune with the same forces that drive loan growth in the area, but that the correlations may be capturing the effect of the willingness of banks to lend rather than the desire of these plants to borrow. The regressions all include national, regional, and industry performance, which should fairly effectively capture the determinants of the plant's loan demand. Table 11 provides evidence consistent with the conclusion that investment by small firms is more bank-dependent, and it declines as the willingness of banks to lend declines.

The results provide evidence consistent with the conclusion that investment by small firms is more bank-dependent, and it declines as the willingness of banks to lend declines.

However, not all the evidence points to causality rather than correlation. Inventory investment declines for all types of plants when loan-loss provisions increase. In fact, the decline is larger for affiliated plants than for unaffiliated. It might be that plants in a large firm tend to get inventory investment locally, rather than at the firm level, but it seems unlikely that a large firm would allow one of its plants to suffer too long without the funds necessary to maintain its inventories. The uniformity of response across small and large firms in the sector where bank financing is most important provides possible evidence that the provisions variable represents weak conditions in the firms, rather than a tightening of credit to healthy firms. Thus, these results do not answer the question of the causality between bank lending and output. They do make it clearer that the correlation is between loan growth and those parts of investment that are most bank sensitive; it is still unclear whether the correlation is due to the health of the banks playing a role in, or merely reflecting, these aspects of a firm's decision.

Breaking the sample into different types of firms has uncovered richness that was hidden in the results for manufacturing, shown in Table 1. Although the decisions made by the four different types of plants share many determinants, they have their differences. The evidence indicates that durable goods industries are more cyclical than nondurable industries. The variety in the response of investment to relative wage differentials also suggests the way that capital tends to migrate. Finally, the sensitivity to the local banking conditions of single-unit plants, but not multi-unit plants, particularly in their inventory investment, reinforces the importance of banks to small businesses. However, the sensitivity of investment in both affiliated and unaffiliated plants suggests that, at least to some degree, poor bank health reflects weakness in the local economy.

V. Conclusion

Examinations of investment and employment at the macro level could be missing a great many of the nuances of their economic effects. This paper briefly examines some simple investment and employment equations at a more disaggregated level and compares them to an aggregate equation. Using micro data allows the incorporation of regional and industry-level data that appear to be quite important in the employment and investment decisions of these plants. Sorting the manufacturing data into four different groups allows the exploration of other important issues that cannot be examined using macro data. The findings are somewhat mixed. For many variables, examining broad aggregates does not affect the estimation of the relationship. The strength of the economy as a whole affects all types of plants, the durable-goods industries more so. These results merely reinforce the finding that business cycles tend to be broadly based. The cost of funds also tends to have a similar effect across all firms, as one might expect given the integration of the capital markets in the United States. However, regional effects do explain much of the difference in performance of firms, as regional income and relative wages determine investment and employment across regions. Also, different types of firms tend to react differently to several variables, perhaps the most interesting of which is bank lending, which is clearly more highly correlated with small rather than large firms.

Appendix Table

Variable Definitions and Descriptive Statistics

Variable	Definition	Full Sample Mean	Full Sample Standard Error
Fixed Investment	Investment (new building, new machinery, and used equipment expenditures) divided by the total value of shipments	.035	.054
Investment in Inventories	(Total inventories at the end of year minus total inventories at the beginning of the year) divided by the total value of shipments	.006	.039
Employment Growth	(Total employment minus total employment from the year before) divided by the total employment from the year before	.013	.229
Increase in Hours	(Total man-hours of production workers minus the total man-hours of production from the year before) divided by the total man-hours of production from the year before	.019	.277
Real GDP Growth	Nationwide annual growth rate of real Gross Domestic Product (GDP), by year, from Bureau of Economic Analysis (BEA)	.031	.027
Investment/GDP	Nationwide nominal fixed investment (structures plus equipment) divided by nationwide nominal GDP, by year, from BEA	.136	.011
User Cost of Capital-Equipment	Nationwide user costs of capital-equipment, by year, from Federal Reserve Bank of Boston	.116	.011
User Cost of Capital-Structures	Nationwide user costs of capital-structures, by year, from Federal Reserve Bank of Boston	.116	.015
Unemployment Rate	Nationwide unemployment rate, by year, from the Bureau of Labor Statistics (BLS)	6.940	1.148
Cash Flow/GDP	Nationwide nominal cash flow divided by the nationwide nominal GDP, by year, from BEA	.019	.007
Relative Wage	(Regional wage and salary disbursements divided by the regional wage and salary employment) divided by (the total U.S. wage and salary disbursements divided by the total U.S. wage and salary employment), by BEA region and year, from BEA	.988	.133
Growth in Wage and Salary Disbursements	Annual growth in regional wage and salary disbursement, by BEA region and year, from BEA	.075	.038

Appendix Table (continued)

Variable Definitions and Descriptive Statistics

Variable	Definition	Full Sample Mean	Full Sample Standard Error
Growth in Product (nominal)	Annual growth in nominal productivity, by 2-digit SIC code within manufacturing and by year, from BEA	.069	.081
Investment/Output	Investment (capital stock quantity index times capital stock cost index minus the one year lagged value of that product) divided by nominal output, by 2-digit SIC code within manufacturing and by year, from BEA	7.980	7.009
Growth (Investment/Output)	Investment/Output divided by the lagged value of capital stock quantity index times capital stock cost index, by 2-digit SIC code within manufacturing and by year, from BEA	.076	.054
Cash Flow/Output	Cash flow divided by nominal output, by 2-digit SIC code within manufacturing and by year, from BEA	.151	.185
Profits/Capital Stock	Industry profits divided by industry total capital stock, by 2-digit SIC industries and by year, from BEA	.120	.082
Growth in Cash Flow	Annual growth in real cash flow, by industry and year, from BEA	.091	.625
Growth in Production Workers	Annual growth in production workers, by industry and year, from BLS	–.002	.041
Provision for Loan Losses/ Interest Income	Provisions for loan losses divided by the income from interest from total loans, by BEA region and year, from Federal Reserve System Call Reports	.079	.081
Growth in Total Loans	Total loans minus total loans from the previous year divided by the total loans from the previous year, by BEA region and year, from Federal Reserve System Call Reports	10.723	124.341
Lagged Growth of Total Value of Shipments	Previous year's value of the quantity (Total value of shipments minus total value of shipments the year before divided by the total value of shipments the year before)	1.005	257.751
Lagged Growth in Investment	Previous year's value of the quantity (Investment minus investment the year before divided by investment the year before)	2.789	96.058

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