PRELIMINARY

DO NOT CITE

The Link Between Aggregate and Micro Productivity Growth:

Evidence from Retail Trade

Lucia Foster, John Haltiwanger and C.J. Krizan *

July 2001

* Respectively, Bureau of the Census; University of Maryland, Bureau of the Census, and NBER, and Fannie Mae and Bureau of the Census. We thank Michael Harper and the participants at seminars at the Bureau of the Census, George Washington University, and at the University of Chicago for many helpful comments on earlier drafts of this paper. The analyses and results presented in this paper are attributable to the authors and do not necessarily reflect concurrence by the Bureau of the Census or Fannie Mae. We thank Brian Friedman of the Bureau of Labor Statistics for providing us with the four-digit BLS series used in this paper.

I. Introduction

Economists have been interested for a while in understanding the connection between microeconomic and aggregate productivity dynamics, but, for the most part, have had to rely on evidence from one sector of the economy to illuminate this connection.[1] The existing work on productivity growth in *manufacturing* has found that a substantial fraction of aggregate growth is due to the reallocation of outputs and inputs from less productive to more productive individual microeconomic units. Moreover, entry and exit of establishments play an important role in this reallocation: roughly thirty percent of productivity growth (measured as either multifactor or labor productivity) over a ten-year horizon is accounted for by more productive entering plants displacing less productive exiting plants. One of the few studies to include empirical results from outside the manufacturing sector, Foster, Haltiwanger, Krizan (1998), examines one three-digit industry in the service sector (automobile repair shops). The reallocation effects via net entry account for virtually all of the (labor) productivity gains in this industry. This striking finding raises questions about the nature of the reallocation dynamics and their connection to productivity for sectors outside of manufacturing. In this paper we seek to expand our knowledge of the connection between microeconomic and aggregate productivity dynamics by examining this connection within the retail trade sector.

One would expect that reallocation contributes positively to productivity growth in a healthy, dynamic market economy. However, understanding the nature and the magnitude of the role of reallocation in this context is important for a number of reasons. For one, if reallocation effects dominate then models of technological change and productivity growth that focus on

[1] Bartelsman and Doms (2000) provide an excellent review of the literature.

within-establishment changes in technology are misleading. That is, the costs and associated dynamics of technological change and productivity growth are invariably impacted by the contribution and nature of the role of reallocation. If implementing new processes and introducing new products involves the reallocation of inputs and outputs between establishments and in particular if it involves entry and exit of establishments, the costs must be modeled and quantified in terms of these reallocation dynamics. Second, in a related manner, there are many potential distortions from market structure, institutions and government policies that impact the reallocation dynamics that, in turn, can have a profound impact upon the level and growth in productivity. Thus, it may be that understanding differences across countries, regions and time in the level and growth in productivity lies in understanding the differences in the reallocation dynamics induced by these factors.[2]

Using establishment-level data, we explore these issues by decomposing aggregate productivity in the retail trade sector into within-establishment effects and reallocation effects. In doing so, we characterize the heterogeneity and the degree of persistence in productivity across businesses within narrowly defined industries. Heterogeneity and its associated reallocation are the necessary ingredients for reallocation effects to play an important role in aggregate (industry-level) productivity growth. We pay particular attention to the role of net entry in productivity growth. As part of this analysis, we attempt to disentangle the influences of selection and learning effects on net entry. In addition to shedding light on productivity growth dynamics, this

[2] Distortions to the reallocation process will, in general, have an impact on the level of productivity. It may be, however, that there is no impact on long run steady state growth. Even in the latter situation, the level effect is of interest in its own right and the level effect implies that transition dynamics will be impacted by distortions and thus growth over the short and intermediate runs. More discussion of these issues is provided in Section II below.

paper also examines the job creation, job destruction, and reallocation rates for microeconomic units in retail trade. We find evidence of tremendous turbulence in retail trade – far more than what typically occurs in manufacturing.

According to official BLS productivity statistics, retail trade as a whole experienced modest overall labor productivity growth during the last decade. It is noteworthy that while many of the industries in retail trade experienced modest or even negative changes in productivity, other industries in retail trade made very large gains. Additionally, the retail trade sector (particularly in some detailed industries) underwent substantial within-industry restructuring as the format and nature of its establishments changed. Dumas (1998), for example, shows that Miscellaneous General Merchandise Stores and the Catalog and Mail-Order Houses industries experienced robust productivity growth in the 1990s and apparently exhibited much restructuring that accompanied that growth. The Miscellaneous General Merchandise Stores category includes warehouse clubs and catalog showrooms and similar discount stores. This industry experienced average annual increases of 6 percent in output per hour between 1987 and 1998 according to official BLS statistics.[3] Dumas (1998) provides evidence that warehouse clubs in particular, exhibited rapid growth and changes in size, merchandise mix, and services provided, allowing them to displace many catalog showrooms. The information technology revolution has played an important role in this industry through the management of inventories. These stores depend upon high volume of sales as they offer low prices on a wide range of goods and management of inventories is especially critical for these businesses.

---

[3] As we discuss later, differences in data sources and measurement methodology cause the growth rates based on Census micro data to differ from those based on BLS data. For the most part, the growth rates from the two sources match reasonably well.

Another industry that anecdotal evidence suggests has been favorably impacted by the information technology revolution is the Catalog and Mail-Order Houses industry. This is an industry which is inherently “wired” -- orders are taken by phone or via the internet and management of inventories is critical for success in this industry as well. It is important to note that retail businesses that sell primarily via the internet (i.e., e-commerce oriented businesses) are classified in this industry over this period of time.[4] This industry experienced average annual labor productivity growth of almost 3 percent between 1987 and 1998 according to BLS statistics.

While there is much anecdotal evidence that both of these industries have undergone substantial restructuring, the official BLS statistics can only provide the aggregate picture. Quantifying and understanding the nature of and the contribution of this restructuring and reallocation to productivity growth requires consistent measurement of the establishment data underlying the industry statistics. This is the type of data that we exploit in this paper and, accordingly, we can directly address these issues.

The paper proceeds as follows. Section II discusses the conceptual underpinnings that motivate the empirical analysis that follows. Section III describes the methodology for decomposing aggregate productivity growth. Section IV discusses the data used for this analysis. Section V presents results on the heterogeneity and persistence of productivity differences across employers and the reallocation rates of output and labor across businesses in the retail trade industries. Section VI presents the results of our decompositions of industry level

[4] Under the new industrial classification system (North American Industrial Classification System, NAICS), they are classified in a separate industry.

productivity growth into within establishment and reallocation effects. Section VII presents analysis of the role of selection and learning effects on the observed micro dynamics of productivity. Section VIII presents results for selected industries. Section IX provides concluding remarks.

II. Conceptual Underpinnings

A. Related Literature

A pervasive empirical finding in the recent literature is that within-sector differences dwarf between-sector differences in behavior across businesses on a variety of dimensions. For example, Haltiwanger (Table 1, 1997) shows that four-digit industry effects account for less than 10 percent of the cross-sectional heterogeneity in output, employment, capital equipment, capital structures, and productivity growth rates across establishments.

The magnitude of within-sector heterogeneity implies that idiosyncratic factors dominate the determination of which establishments create and destroy jobs and which establishments achieve rapid productivity growth or suffer productivity declines. An examination of the theoretical literature suggests that many factors may account for such establishment-level heterogeneity including: uncertainty; establishment-level differences in managerial/entrepreneurial ability, capital vintage, location and disturbances; learning about all of these factors; and diffusion of knowledge. Foster, Haltiwanger and Krizan (1998) provide a survey of the literature concerning these factors.

For our purposes, we are interested in the connection between micro and macro (in this case industry-level) productivity dynamics. Even though there is enormous micro-level heterogeneity and associated reallocation, it is possible that the reallocation is not very important for industry-level productivity dynamics. One reason is that there is undoubtedly substantial canceling out of the idiosyncratic shocks in the aggregation from micro-level to industry-level changes. Put differently, industry-level productivity dynamics may be primarily driven by industry-level productivity shocks that are common to all businesses in the industry.

Alternatively, there are classes of models where the process of reallocation plays a vital role in productivity growth. In the creative destruction models of Aghion and Howitt (1994) and Caballero and Hammour (1994), new technology can only be adopted by new establishments. Faster technological growth increases the pace of creative destruction in this class of models and is associated with an increased gap between the productivity levels between entering and exiting plants. Such models can be enhanced with uncertainty, learning and diffusion effects as in Jovanovic (1982), Jovanovic and MacDonald (1994) and Ericson and Pakes (1995). Uncertainty about initial type for entrants as well uncertainty about new innovations at existing businesses can generate increased churning that is closely connected to the process of productivity growth. Such uncertainty is motivated by the inevitable trial and error process of implementing new ways of doing business at a particular location and/or for new products and processes. The trial and error process suggests that both selection and learning effects are potentially important for aggregate (industry-level) productivity dynamics. In this paper, our primary objective is to quantify the extent of the entry and exit dynamics within industries in the retail trade sector and in turn to quantify the contribution of associated selection and learning effects associated with this reallocation process.

While the working hypothesis is that the reallocation should be productivity enhancing, both the magnitude and the sign of this relationship should be viewed as open empirical questions. As noted, it may be that the magnitude of the effect is small if technological change primarily involves within-plant upgrading of technologies.

It may also be the case that the reallocation reflects inefficiencies and as such is not productivity enhancing. Market imperfections in product, capital or labor markets can distort the reallocation process so that the timing, magnitude and or nature of reallocation is not productivity enhancing (see, e.g., Caballero and Hammour (2000)). While there is a presumption that the U.S. has generally well-functioning markets (at least relative to the rest of the world), it is not difficult to imagine that there are sectors or times in the U.S. during which a variety of market distortions play an important role. One possibility is that capital markets are especially imperfect for small and young businesses. Following this line of argument, the churning among small and young businesses may reflect such capital market imperfections. To the extent that this is the case, this will affect the link between reallocation and productivity growth. In this paper, since we focus on the retail trade sector which is dominated by small businesses (and evidently young businesses, as we find enormous rates of entry and exit), these issues may be of particular relevance.

B. The Interaction Between Conceptual and Measurement Issues

As will become apparent in the next section, the measure of labor productivity that is commonly used for retail trade is real sales per worker or real sales per hour. Before proceeding with the details of the measurement and subsequent analysis of this measure, it is useful to consider the potential sources in variation between and within establishments in this measure. For this purpose, we sketch a simple descriptive model that focuses on the measurement issues and then relate it to the above discussion of the literature.

Suppose establishment *e* in period *t* has output given by:

$$Q_{et} = A_{et}(L_{et} - f_e)^{\theta} \qquad \textbf{(1)}$$

where Q_{et} is output, A_{et} reflects a variety of factors (discussed below) that impact labor productivity, L_{et} is the labor input, f_e is overhead labor, and θ is a positive parameter (θ<1). For A_{et}, we want to think of this broadly as incorporating many potential factors including the level of productivity associated with the installed technology (e.g., to capture vintage effects as in Aghion and Howitt (1994)), technology shocks, and fixed and quasi-fixed factors like location and capital (both tangible and intangible). The presence of such fixed and quasi-fixed factors justifies the assumption that θ<1.

Labor productivity is thus given by:

$$LP_{et} = \frac{A_{et}(L_{et} - f_e)^{\theta}}{L_{et}} \qquad \textbf{(2)}$$

Suppose at least initially we assume that all establishments in the same industry are price takers.[5] If establishments can adjust labor costlessly and continuously, establishment specific differences in A_{et} will be reflected in both differences in size and in labor productivity (given the presence of overhead labor). That is, optimal frictionless employment is given by:

---

[5] The implications of product price differences across establishments in the same industry are discussed in the appendix -- it is our conjecture that many of the implications we emphasize should carry over to this case.

$$L_{et} = f_e + (\frac{p_t A_{et} \theta}{w_t})^{\frac{1}{1-\theta}} \quad \textbf{(3)}$$

where p_t is the price of the output and w_t is the wage (both presumed to be the same for businesses in the same industry for now). Within the same industry, establishments with larger values of A_{et} will have larger employment. As such, labor productivity with optimal frictionless employment will be given by:

$$LP_{et} = \frac{(\frac{p_t \theta}{w_t})^{\frac{\theta}{1-\theta}}}{(\frac{p_t \theta}{w_t})^{\frac{1}{1-\theta}} + f_e A_{et}^{\frac{1}{\theta-1}}} \quad \textbf{(4)}$$

The presence of overhead labor implies that establishments with higher A_{et} will have higher productivity (that is differences in A_{et} will not simply be reflected in differences in size even with employment at its frictionless level).

There may be a variety of frictions that prevent businesses from being at the optimal frictionless employment such as adjustment costs. Thus, at any given point in time, we are likely to see greater dispersion in productivity than suggested by equation (4). In turn, some adjustments will be induced by the departure from optimal frictionless employment. As such, even from this simple descriptive model, some predictions emerge linking reallocation to productivity differences for continuing businesses. Businesses with high productivity will increase employment and businesses with low productivity will decrease employment. In addition, for such continuing businesses, there will be a negative covariance between changes in employment and changes in labor productivity given the decreasing returns ($\theta<1$).

The connection between reallocation and aggregate productivity growth is likely to be closely connected to entry and exit dynamics in this environment. To consider entry and exit dynamics, we need to think about the incentives on both margins and their respective interaction. Businesses will exit when the value of continuing operations at the existing location is negative. On the flip side, businesses will enter until the expected discounted value of profits equals the cost of entry (assumed positive). The presence of the fixed costs of production (as captured here via overhead labor) imply that low productivity plants will exit. New businesses will have incentives to enter to replace the exiting businesses. The precise incentives for entry depend upon assumptions about the nature of shocks, uncertainty and the growth and adoption of new technologies. One obvious way to obtain a clear prediction regarding the contribution of entry and exit to aggregate growth is to assume that only entering businesses have access to the latest technology as in Aghion and Howitt (1994) and Caballero and Hammour (1994).

In an Aghion and Howitt (1994) or Caballero and Hammour (1994) environment, the growth in the productivity of the leading edge technology implies that the production real wage (wages divided by the industry output price) will be growing over time. New businesses will enter to take advantage of the new more productive technology. Existing businesses will contract and eventually exit (e.g., when they hit zero value) as they age since they face ever increasing real wages over time but no access to the leading technology.

As noted in the discussion in the prior section, this type of vintage model could be enhanced by assuming uncertainty about type/ability at entry so that even though new businesses are the only ones who have access to the latest technology, some businesses may be more capable of implementing the new technology than others. In addition, there may be learning-by-doing about the new technology. Uncertainty about types and learning can imply that, even though new businesses have access to the latest technology, entering businesses do not have higher average productivity than incumbents. Some of the new businesses will not be very good at implementing the new technology and fail. Even successful new businesses may take time to learn how to implement the new technology. Such selection and learning effects for any wave of entrants can enhance the connection between reallocation and productivity growth.

A modification of the view that new technology can only be implemented by new businesses is the view that new technology is embodied in capital that is quasi-fixed (which in principle could be either tangible physical capital or intangible organizational capital). This closely related view implies that reallocation across existing businesses may be closely linked to aggregate industry growth. Consider a new technology that will lead ultimately to industry-level productivity growth. Analogous to the impact of uncertainty on new businesses, if there is uncertainty about type/ability regarding the adoption of new technology by existing businesses then only some businesses may be successful in implementing the new technology. As such, resources will be reallocated to those who successfully implement and away from those who implement poorly. Thus, it may be that each new wave of innovations and implementation unleashes reallocation dynamics among existing businesses that is productivity enhancing.

In short, this simple description of plant-level labor productivity helps illustrate the potential connections between industry-level productivity growth and reallocation. As should be clear, industry-level productivity growth could reflect common technology shocks (or analogously common adoption of new technologies) that are shared by all businesses in the sector so that reallocation dynamics are not particularly important. Alternatively, reallocation dynamics may be vital for productivity growth if, for example, new technologies can only be implemented by new businesses and/or implementation of new technologies is inherently a noisy one with much trial and error (and associated success and failure). In the empirical analysis that follows, we will quantify the extent of and contribution of such reallocation dynamics to industry-level productivity growth.

III. Measurement Methodology for Relating Industry-level to Establishment-level Changes in Productivity

Our methodology follows the literature and decomposes aggregate productivity growth into within-establishment and reallocation effects. Virtually all of the studies in the literature consider some form of decomposition of an index of industry-level productivity:

$$LP_{it} = \sum_{e \in I} s_{et} LP_{et} \qquad \textbf{(5)}$$

where LP_{it} is the index of industry productivity, s_{et} is the share of plant *e* in industry *i* (e.g., output share), and LP_{et} is an index of plant-level productivity. The decomposition, then, considers the roles of changing shares versus changing productivity at the micro level in a manner that permits an integrated treatment of the contribution of entering and exiting establishments.

As shown in Foster, Haltiwanger, and Krizan (1998), there are alternatives as to the precise decomposition used and they can impact the results significantly. Therefore, we use a decomposition that we believe has the most direct economic interpretation of the terms in the decomposition. We use the following decomposition:[6]

$$\Delta LP_{it} = \sum_{e\in C} s_{et-1}\Delta LP_{et} + \sum_{e\in C} (LP_{et-1} - LP_{it-1})\Delta s_{et} + \sum_{e\in C} \Delta LP_{et}\Delta s_{et} + \sum_{e\in N} s_{et}(LP_{et} - LP_{it-1}) - \sum_{e\in X} s_{et-1}(LP_{et-1} - LP_{it-1}) \quad \textbf{(6)}$$

where *C* denotes continuing plants, *N* denotes entering plants, and *X* denotes exiting plants. The first term in this decomposition represents a within-plant component based on plant-level changes, weighted by initial shares in the industry. The second term represents a between-plant component that reflects changing shares, weighted by the deviation of initial plant productivity from the initial industry index. The third term represents a cross term (i.e., covariance-type) that tells us whether businesses with large positive productivity changes are more likely to have decreased employment and vice-versa. The last two terms represent the contribution of entering and exiting plants, respectively.

In this decomposition, the between-plant term and the entry and exit terms involve

[6] This decomposition is from Foster, Haltiwanger and Krizan (1998) and is a modified version of that used by Baily, Hulten, and Campbell (1992). The first term in this decomposition (the "within component") is identical to that in Baily, Hulten and Campbell (1992). They essentially combined the second two terms by calculating a term based upon the sum of changes in shares of activity weighted by ending period productivity. In addition, they did not deviate the terms in the between and net entry terms from initial levels. As Haltiwanger (1997) points out, this implies that even if all plants have the same productivity in both beginning and end periods, the between component and the net entry component in the Baily, Hulten and Campbell decomposition will, in general, be nonzero.

deviations of plant-level productivity from the initial industry index. For a continuing plant, this implies that an increase in its share contributes positively to the between-plant component only if the plant has higher productivity than average initial productivity for the industry. Similarly, an exiting plant contributes positively only if the plant exhibits productivity lower than the initial average, and an entering plant contributes positively only if the plant has higher productivity than the initial average.

Relating this decomposition to the discussion in Section II, if industry-level productivity growth is primarily driven by common shocks (or analogously common adoption of some new technology) then the within effect should dominate. Alternatively, if implementing new technology can only be accomplished via entry then the net entry terms should dominate. Reallocation among continuing plants may contribute positively to industry growth to the extent that the implementation of new technology at continuing plants involves experimentation and associated reallocation. Note as well that idiosyncratic shocks will tend to generate offsetting between and cross terms for continuing plants.

In the following analysis, we present evidence applying this decomposition methodology using establishment-level data from the Census of Retail Trade. Our focus is on the decomposition of industry-level labor productivity (measured both by worker and by hours). For this purpose, we use employment and manhours share weights. For labor productivity, the seemingly appropriate weight is employment (or hours) since this will yield a tight measurement link between most measures of labor productivity using industry-level data and industry-based measures built up from plant-level data. Both the Griliches and Regev (1995) and Baily, Bartelsman, and Haltiwanger (1996) papers use employment weights in this context. The index of establishment-level labor productivity used here is similar to that used by Baily, Hulten and Campbell (1992) and Foster, Haltiwanger and Krizan (1998). The index is measured as follows:

$$lnLP_{et} = lnQ_{et} - lnL_{et}, \qquad \textbf{(7)}$$

where Q_{et} is real gross output and L_{et} is labor input (either total employment or total hours) for establishment e at time t. Our measure of industry productivity aggregates this establishment-level measure with labor input weights and our decomposition of industry growth is based upon this measure. The growth in this industry measure is easily decomposed into the terms on the right-hand side of equation (6). As we will see in the next section, this measure of industry productivity growth yields results aggregated to the retail trade sector level that correspond reasonably well with official BLS labor productivity growth estimates for retail trade.

IV. Data Issues

A. Measurement Issues

The empirical analysis in this paper uses data from the Census of Retail Trade (CRT). Since the micro data from the CRT have been rarely used in empirical research of this kind, it is useful to describe some of its relevant features. The CRT is a quinquennial survey conducted in years ending in ‘2' and ‘7.’ This paper focuses on the years 1987, 1992, and 1997 for reasons associated with our ability to link establishments over time. As shown in Table 1, there are about 1.5 million establishments in the retail trade sector employing close to 20 million workers and generating close to $2 trillion in sales in these three census years.[7]

---

[7] All of the empirical work in this paper is based on the retail trade sector as defined by Standard Industrial Classification (SIC) system.

The CRT questionnaire is mailed out to all large and medium-sized firms and generally all firms that operate multiple establishments; most very small firms are excused from answering the questionnaire. The data for these very small firms come from two sources: a Census sample of these very small firms and administrative records from other federal agencies. These administrative records cases accounted for about 10 percent of total sales in 1987, 1992, and 1997.[8] Census' official tabulations include these administrative record data. Likewise, we use both reported data and administrative data in our empirical exercises because there is no reason to suppose that the administrative records data are inferior to the reported data for the variables being used in this study.

The CRT collects data on establishments concerning the kind of business, physical location, sales in dollars, annual and first quarter payroll, and employment for the pay period including March 12th. In some census years additional questions are asked and some questions are asked that are industry-specific. For our purposes, the relevant point is that while it is possible to construct measures of labor productivity, it is not possible to measure multifactor productivity. As noted above, we measure labor productivity as the difference between log real output and log labor input. We are constrained by the data to use sales as our current measure of output. A preferable measure of output for the retail trade sector might be gross margins (total sales less the cost of goods sold). Future work might be able to incorporate information from the Annual Retail Trade Survey on gross margins. We deflate sales using the four-digit industry deflators from the Bureau of Labor Statistics (BLS).[9] Since the CRT does not collect hours

---

[8] See the Data Appendix for the precise categories of administrative records cases by year. The percent of administrative cases for 1997 is based on the NAICS.

[9] The BLS data are discussed in more detail in the Data Appendix.

information we construct manhours at the establishment level by multiplying establishment employment by the industry average of hours as measured by BLS .

One of the first tasks in preparing the micro data is to link each establishment's data over time. These links allow us to measure establishment births and deaths and to measure productivity growth over time. In theory these linkages can take place via the unique permanent plant number (PPN) that is assigned to each establishment. In practice there are often problems with the PPNs that cause links to be incorrectly severed. We improve our links by using additional identifiers on the files and sophisticated matching software which uses the name and address information from the business establishment list that Census maintains.[10]

Another data issue concerns the existence of active establishments with zero total employment. Roughly speaking, an active establishment is one with positive payroll over the current year. It is not surprising to find active establishments with zero employment since employment is measured only for the pay period including March 12th. Since we use total employment (or employment times hours) in the denominator of our productivity measure and employment (or employment times hours) weights to aggregate, these observations would be dropped and/or contribute nothing to aggregate in year with zero employment. A concern about this is that the loss of an observation can potentially cause a false birth or death if the establishment has positive employment in the other years. Since we are interested in births and deaths it is important that we avoid creating false births and deaths. For this reason, we delete

[10] An additional problem with relying on the PPN for links is the existence of duplicate PPNs in a given Census year. This is a relatively small problem: the duplicate PPN establishments account for only 0.5 percent of establishments in 1987, 0.06 percent in 1992, and 0.01 percent in 1997. These duplicate PPNs do not appear to be predominantly in any one of the industries within retail trade. We drop these duplicate PPNs from our analysis.

establishments that have positive payroll but zero total employment in any of the three years in our analysis. Approximately 13 percent of the total three year sample is dropped using this rule. Of these observations that are dropped using the zero employment rule, the majority have zero employment or missing employment in all three years under consideration and thus would be dropped from all three years even with a less strict rule. The reason for this is that "true" entry and exit are so large that a substantial fraction of those establishments who have one observation of positive payroll and zero employment are not in the Census in other years. In fact, 68 percent of these dropped observations have missing employment in the other two years under consideration (recall one year must have zero employment to be in this group). In any event, we believe that this methodology yields a more conservative estimate of the contribution of entry and exit to the reallocation and productivity dynamics -- that is, if anything we are undercounting the contribution of entry and exit. [11]

B. Comparing Productivity Growth to BLS' Series

Since the CRT data have not been extensively used and our methodology is based on aggregating up micro data, it is helpful to compare the productivity measures based on the Census data to those officially published by the Bureau of Labor Statistics. The BLS creates a labor productivity per hours index for each of the 64 four-digit industries in retail trade. BLS does not, however, publish a productivity index for the retail trade division. Presumably one reason that BLS declines to publish an index for the division is that 24 industries of the 64 are

[11] These establishments could be seasonal establishments with sales/payroll activity at other times of year. They could be late year births or early year deaths (prior to March 12). We suspect that this latter case is more prevalent and this implies we may be undercounting the contribution of entry and exit to our analysis.

designated as having data that does not meet BLS' standards for publishing. Thus we cannot directly compare our retail trade productivity series with one from BLS. Conversely, it is not practical for us to attempt to replicate BLS' index numbers since BLS uses a Tornqvist index which would require us to use merchandise line data. Instead of attempting to replicate their methodology, we compare growth rates of the BLS series and our series at the industry and retail trade levels.

To create our measure of labor productivity growth, we create establishment-level productivity growth series which we aggregate up to the four-digit level using the manhours weights and then to the retail trade level using gross average nominal output weights by industry. For the BLS measure, we calculate the four-digit growth rate by taking the log difference of their four-digit productivity by hours index over the appropriate year pairs. We aggregate this from the four-digit industry level to the retail trade level using the same weights as for the Census measure so that we may concentrate on the within industry differences in these measures. Since the BLS data contains some known problem industries, we also calculated these measures excluding the industries which BLS designates as problematic. As is evident from Table 2, the two measures of productivity growth are roughly similar across all three sets of years. The correlations at the industry level for 1987-97 are 0.80 for all industries and 0.81 for the subset of industries that meet BLS' standards for publication. The five-year aggregate growth rates implied by the Census data are higher for 1987-92 (about 5 percent versus about 4 percent) than the BLS growth rates, but are lower for 1992-97 (about 6 percent versus about 9 percent).[12] Interestingly,

---

[12] The data appendix describes differences in the measurement of these series for Census and BLS.

the growth rates over the ten-year horizon are also reasonably close (especially for the BLS published industries).

V. Basic Facts -- Heterogeneity, Persistence, and Reallocation

In this section, we present basic facts about the shape and evolution of the distribution of productivities across businesses. We begin by simply characterizing the differences in labor productivity across businesses in the same narrowly defined industry. For this purpose, we examine the percentiles of the labor productivity distribution across businesses after removing four-digit industry fixed effects. The measure we use for this purpose is the log of output per hour at the businesses and we consider the hours-weighted distribution of this measure. Table 3 reports summary statistics of this distribution for 1987, 1992, and 1997.[13] By construction (since the four-digit effects have been removed), the distribution has a zero mean. The standard deviation and the interquartile range of this distribution are very large. In all years, the interquartile range is about 0.57 -- since establishment-level productivity is measured in logs, this represents a very large differential across businesses in the same four-digit industry. It is striking that within the same industry some businesses are so much more productive than others. It is also striking that this dispersion is quite stable over this time period. The latter of course does not mean that individual businesses are stable within this distribution. Indeed, much of our analysis is devoted towards examining the churning of businesses within this distribution including the role of entry and exit.

We begin our analysis of the dynamics of establishment-level productivity by examining

[13] We have also examined this distribution for output per worker and find very similar results.

the transition of individual businesses in the overall distribution of productivity over the 1987-97 period. In Table 4, we report statistics on the nature of these transitions. For this exercise, in each of the years under consideration, we classify establishments into quintiles of the hours-weighted labor productivity distribution. Then, we can look forwards or backwards in terms of where the establishments in 1987 end up or where the establishments in 1997 came from. In this exercise, we have removed four-digit industry effects from each year. As such, the quintiles should be interpreted as capturing relative productivity within the four-digit industry.

The most striking feature of Table 4 is the large role of births and deaths. For any quintile in 1987, the most likely outcome (row percentage) is death. For any quintile in 1997, the most likely place the establishment came from (column percentage) is birth. Interestingly, births arrive uniformly throughout the productivity distribution. In contrast, deaths are concentrated in the businesses with low productivity in 1987. For example, 70.32 percent of businesses in the lowest quintile in 1987 did not survive until 1997. In contrast, only 39.21 percent of businesses in the highest quintile in 1987 did not survive. While the latter probability of death is large in absolute terms it is much smaller than the probability of death for the least productive businesses.

Conditional on survival, substantial persistence is exhibited by individual businesses in terms of the relative productivity rankings. Businesses in the top quintile in 1987 had a 26.45 percent chance of being in the top quintile in 1997 and only a 4.88 percent chance of being in the bottom quintile. Likewise businesses in the lowest quintile in 1987 had a 12.80 percent chance of being in the lowest quintile again in 1997 and only a 2.79 percent chance of being in the highest quintile.

Comparing these results with analogous results for U.S. manufacturing establishments reported in Baily, Hulten and Campbell (1992) (hereafter BHC) , a number of similarities but also a number of differences arise. In manufacturing, BHC find a higher degree of persistence (see their Table 3) but part of this reflects much lower turnover of businesses in manufacturing as opposed to retail trade. That is, conditional on survival, the persistence rates are not so different between manufacturing and retail trade. The large difference, however, is that survival is much less likely in retail trade and it is closely linked to productivity.

It is evident from Table 4 that there is considerable turnover of businesses and associated reallocation of jobs. To examine these issues more directly, Table 5 presents estimates of the gross expansion and contraction rates of employment and output over the 1987-97 period (and the subperiods 1987-92 and 1992-97). The rates of output and input expansion (contraction) are measured as the weighted average of the growth rates of expanding (contracting) plants including the contribution of entering (exiting) plants using the methodology of Davis, Haltiwanger and Schuh (1996).[14] The pace of gross output and input expansion and contraction is extremely large over the ten-year horizon. Expanding plants yielded a gross rate of expansion of about 70 percent of outputs and inputs and contracting plants yielded a gross rate of contraction in excess of 40 percent of outputs and inputs. Net growth rate of output is higher than that of inputs (especially employment) reflecting the productivity growth over this period. A large fraction of the output and input gross creation from expanding plants came from entry and a large fraction of the output and input gross destruction came from exit.

---

[14] This methodology entails defining plant-level growth rates as the change divided by the average of the base and end year variable. The advantage of this growth rate measure is that it is symmetric for positive and negative changes and allows for an integrated treatment of entering and exiting plants.

Table 5 also includes the fraction of excess reallocation within four-digit industries in each of these industries. Excess reallocation is the sum of gross expansion and contraction rates less the absolute value of net change for the sector. Thus, excess reallocation reflects the gross reallocation (expansion plus contraction) that is in excess of that required to accommodate the net expansion of the sector. Following Davis, Haltiwanger and Schuh (1996)[15] excess reallocation rates for the entire retail trade sector can be decomposed into within and between sector effects. The far right column of Table 5 indicates that most of the excess reallocation at the retail trade level reflects excess reallocation within four-digit industries. Thus, the implied large shifts in the allocation of employment and output are primarily among producers in the same four-digit industry. This finding is especially noteworthy since there are large differences in the net growth rates across four-digit industries – however, apparently, these are dwarfed by the pace of reallocation within the four-digit industries.

Table 5 also shows the analogous results for the subperiods 1987-92 and 1992-97. The rates of expansion exceed 40 percent for both output and inputs and the rates of contraction exceed 25 percent. The implied cumulative change from the two five-year horizons is larger than the actual ten-year change reflecting the fact that some of the five-year changes reflect transitory movements. The shares of expansion accounted for by births and the shares of destruction accounted for by deaths are extremely high.

Table 6 presents the gross contraction and expansion rates by establishment size class along with information regarding the distribution of establishments by size class (where the business is assigned to the size class based upon the average of beginning and ending year

[15] See pages 52 and 53 for a description of the methodology.

employment). The pace of reallocation (and excess reallocation) falls systematically with the size of the business in all years. For example, between 1987 and 1997, the excess reallocation rate for the smallest size class (1-4 employees) was roughly 170 percent. By contrast, the rate for the largest establishments, those with over 50 employees, was only about 60 percent. Part of this difference is driven by the extremely large entry and exit rates for small businesses – observe the very high fraction of creation accounted for by entrants (about 96 percent) and the analogous high fraction of destruction accounted for by exits (roughly 96 percent) for the smallest businesses between 1987-97. As with reallocation rates, these fractions fall for the largest size classes. For the largest size class of businesses, births accounted for only about 73 percent of the jobs created and deaths accounted for only about 55 percent of jobs destroyed. The two subperiods show similar patterns.

Interestingly, net growth rates are actually increasing functions of the size of the business. For each of the three time periods, the smallest business class has negative net growth, while the largest business class has positive net job growth rate and the highest net growth of all the size groups. Since the majority of workers in retail trade work for employers with fewer than 50 employees, these patterns help account for the rapid pace of output and employment reallocation and the dominant role of entrants and exits seen in earlier results. Many studies (see the survey in Davis and Haltiwanger (1999)) have shown that the pace of reallocation as well as entry and exit rates are sharply decreasing functions of employer size.

Table 7 presents the gross contraction and expansion rates by two-digit industry. The pace of reallocation also varies substantially across the two-digit industries. Apparel and furniture stores for example have especially high paces of job reallocation with gross creation and destruction rates roughly between 50-80 percent and excess reallocation about 100 percent. Industries with relatively low rates of job reallocation include general merchandise stores and food stores. General merchandise has particularly low creation and destruction rates (roughly 30-50 percent) and excess reallocation rates (about 50-80 percent). In all industries, entry and exit play a very large role with about three quarters of creation (destruction) accounted for by entry (exit) over a ten-year horizon.

Overall, retail trade is a sector that has exhibited tremendous turbulence. There are substantial differences in the net growth rates across two-digit industries but these are dwarfed by the gross rates of reallocation. The large differences between net and gross rates helps account for the finding in Table 5 that much of the reallocation is within as opposed to between industries. Comparing the results here with those reported in Foster, Haltiwanger and Krizan (1998) reveals that retail trade gross flows are about 50 percent larger than those in manufacturing with a higher share of the flows accounted for by entry and exit. A key factor here is that retail trade is a sector dominated by small businesses both in terms of number of businesses and numbers of workers at those businesses. Moreover, we find that the smallest businesses within retail trade exhibit disproportionately large reallocation and associated entry and exit rates. Finally, and quite importantly, we find that virtually all of the reallocation is a within-industry phenomenon. As such, the standard approach of measuring change and growth at the four-digit level will miss much of the action and it is impossible with such data to be able to capture the contribution of reallocation to productivity growth with industry-level data.[16]

[16] An important point to emphasize here is that the reallocation rates and the role of net entry reflect reallocation across establishments and net entry of establishments. It may be that the between establishment reallocation (including net entry) reflects reallocation *within firms*. This

VI. Productivity Decompositions

The large differences in productivity across businesses in the same sector and the large within-sector reallocation rates motivate our analysis of productivity decompositions at the four-digit level. We apply the decomposition in equation (6) at the four-digit level. In most of our results, we report the results for the average industry. Following Baily, Hulten, and Campbell (1992), the weights used to average across industries are nominal gross output by industry averaged over the beginning and ending years of the period for which the change is measured. The same industry weights are used to aggregate the industry results across all of the decompositions because the focus is on within-industry decompositions. By using the same weights, the results do not reflect changing industry composition.

The decompositions of labor productivity are reported in Table 8.[17] We measure labor productivity at the establishment level using two alternatives: output per manhour and output per worker. In general, the results are very similar between these alternatives. For all time periods and for both measures of labor productivity, we find that reallocation effects account for the majority of changes in labor productivity. That is, the within-plant contribution is less than half for each of the five-year changes and for the ten-year change. In considering the role of reallocation effects, the contribution of net entry is enormous. For the five-year changes, net entry accounts for virtually all of the overall change. Moreover, the between-plant contribution is positive and significant as well. In combination, the within, between and net entry effects add

---

is an area for future research.

[17] Due to concerns about the data, we also performed these decompositions excluding establishments in the computer store industry. The results of the decompositions are qualitatively similar to those using establishments in all industries.

up to more than the total. The reason for this is that the cross term among continuing plants actually acts to decrease labor productivity over these periods. This latter finding reflects a negative covariance between labor productivity and employment changes. The offsetting nature of the between and cross term is consistent with the view that idiosyncratic productivity shocks induce changes in size and that such changes in size in turn induce productivity changes given within establishment decreasing returns.

Putting all of this together suggests that the average plant exhibited modest productivity growth over the period, reallocation played a dominant role primarily due to net entry but also because output and employment were reallocated towards plants who had higher than average productivity at the beginning of the period, and plants that downsized tended to exhibit increases in productivity (the negative cross term).

To shed further light on these results, Table 9 presents correlations of the growth rates of some of the key variables for the continuing establishments over the 1987-97 period and the two subperiods. Both measures of labor productivity growth are very highly correlated and both measures of labor input growth (employment and manhours) are very highly correlated. These high correlations underlie the very similar results for output per worker and output per hour. Output and employment growth are positively correlated as one might expect but labor productivity growth is inversely correlated with labor input growth for all periods. This latter finding underlies the negative cross term in the decompositions. In the retail trade sector, downsizing by continuing establishments is associated with rising labor productivity growth.

The dominant role of net entry is the main finding of this section. Table 10 presents key underlying components of the contribution of net entry. It is readily seen that the shares of output and employment accounted for by entrants and exits are large. However, comparing these shares to those in Table 8, it is clear that the contribution of net entry to productivity growth far exceeds these shares. This disproportionate contribution of net entry can be understood by examining the relative productivities of entering versus exiting plants. It is striking that exiting plants are substantially less productive than incumbents and entering plants. For example, the businesses that existed in 1987 but did not survive to 1997 are only 78 percent as productive as the incumbents who survived from 1987 to 1997. Interestingly, entering plants are slightly less productive than the incumbents at five-year horizons and only slightly more productive than incumbents at ten-year horizons. This role of horizon may reflect learning effects – a topic to which we turn in the next section.

Before proceeding to the next section, it is worthwhile to compare the findings presented here for retail trade with the prior literature that focuses on manufacturing. The primary difference is that in manufacturing net entry was part of the story while in retail trade it appears to be almost the entire story. The retail trade industry would have exhibited no (or even negative) productivity growth without the contribution of net entry.

VII. Learning and Selection Effects

The results from Tables 8 and 10 make clear that entry and exit dynamics dominate the productivity growth for the retail trade sector. By exploring the differences in productivity dynamics between incumbents, entrants and exiting plants in more detail, we can provide a richer picture of the role of learning and selection effects that underlie these dynamics.[18] Table 11

---

[18] We use the term "learning" effects broadly in this context to include any "learning" about how best to run the business at the specific location. An example might be learning how to attract customers to the specific location of the retail establishment.

begins this process by presenting regression results using the pooled 1987-97 data. The upper panel considers a simple regression of (the log of) productivity on a set of dummies indicating whether the plant exited in 1987 (YRDEA87), entered in 1997 (YRBIR97), a year effect to control for average differences in productivity across the two years (YR97), and four-digit industry dummies (not reported).[19] The omitted group is continuing establishments in 1987 so the coefficients can be interpreted accordingly.[20] The specification is given by:

$$P_{et} = \psi + \beta * YRDEA87_{et} + \delta * YRBIR97_{et} + \varphi_i \sum_{i=1}^{63} Industry_{iet} + \upsilon * YR97_{et} + \varepsilon_{et} \qquad \textbf{(8)}$$

This first set of results confirm earlier results and help quantify statistical significance: exiting establishments have significantly lower productivity than continuing establishments, establishments in 1997 have significantly higher productivity than establishments in 1987, and entering establishments in 1997 have lower labor productivity than the continuing establishments in 1997. Also reported in the upper panel is the F-test on the difference between entering and exiting establishments which is highly significant, even after controlling for year effects.

---

[19] By pooling the data across industries, we are pursuing a slightly different approach than in prior decomposition exercises where we calculated the decomposition for each industry and then took the weighted average of the four-digit results. However, by controlling for four-digit effects and using analogous weights to those used in the decomposition exercises, these results are close to being the regression analogues of earlier tables.

[20] Care must be taken when interpreting the coefficient on the entry dummy (δ). This coefficient shows how entering plants compare to incumbents *abstracting* from the overall growth. In order to compare births in 1997 to the incumbents in 1987, one must also consider the year effects (i.e., look at $\delta+\nu$). Thus entering establishments in 1997 are more productive than incumbents in 1987 ($\delta+\nu>0$), but less productive than incumbents in 1997 ($\delta<0$).

The lower panel of Table 11 shows results concerning the dynamics of entering cohorts. Essentially the same specification as in the upper panel is used except that here we classify entering establishments based on whether they entered between 1987-92 (YRBOLD97) or 1992-97 (YRBYNG97). The specification is given by:

$$P_{et} = \psi + \beta * YRDEA87_{et} + \eta * YRBOLD97_{et} + \mu * YRBYNG97_{et} + \varphi_i \sum_{i=1}^{63} Industry_{iet} + \upsilon * YR97_{et} + \varepsilon_{et} \quad \textbf{(9)}$$

The results in the lower panel indicate that there are significant differences between the cohorts of establishments. The establishments that entered earlier have significantly higher productivity than establishments that entered later. These cohort effects could be driven by selection and/or learning effects. That is, it could be that the results reflect that the entrants from 1987- 92 that make it to 1997 are more productive entrants, or it could be that the earlier entrants had more time to learn than the later entrants. We attempt to disentangle these effects later in the paper.

We also examine the significance of net entry for the five-year changes 1987-92 and 1992-97. The regressions for the five-years changes have the same form as the net entry regressions for the ten-year change.[21] Table 12 reports the regressions results. Interestingly, the patterns for the five-year changes regarding the differences between entering and exiting establishments are similar to those for the ten-year period. In particular, we observe that entering establishments have higher productivity than exiting establishments even while controlling for

[21] All specifications include four-digit industry effects, year effects, and entry and exit dummies.

year effects (δ>β). There are differences across the periods as the average continuing plant exhibited productivity declines in 1987-92 (ν<0) but modest productivity gains in 1992-97 (ν>0). We know from Table 8 that both periods exhibited overall productivity gains. As is clear from Table 12, this comes overwhelmingly from the contribution of net entry and in particular from the exit of the least productive businesses.

The results in Tables 11 and 12 make clear the role of entry and exit but do not permit disentangling selection and learning effects. In Table 13, we report results of regressions that shed some light on learning and selection effects by looking at the dynamics for 1992-97. These regressions use a similar pooled specification as before (with year effects, entry dummy, exit dummy and four-digit effects), but also use additional information about establishments that entered between 1987-92. By dividing this entering cohort into exiters and survivors, we can characterize selection and learning effects. Thus in our specification we have dummies for those from the entering cohort who then die (ENTDEA), all other deaths (OTHDEA), and entering cohort that survive (SURV92 and SURV97) in addition to the usual birth, year, and industry dummies. The specification is given by:

$$P_{et} = \psi + \alpha * ENTDEA_{et} + \gamma * OTHDEA_{et} + \delta * YRBIR97_{et} + \theta * SURV92_{et} + \lambda * SURV97_{et} + \varphi_i \sum_{i=1}^{63} Industry_{iet} + \upsilon * YR97_{et} + \varepsilon_{et} \qquad \textbf{(10)}$$

Using this specification, we make three comparisons. First, for exits, we distinguish among exits in the 1992-97 period between those who entered during 1987-92 and those who did not (comparing α and γ). Second, among the entering cohort we distinguish between those that exit and those that survive to 1997 (comparing α and θ). Finally, for the surviving 1987-92 cohort, we also examine productivity in 1992 (the entering year) and productivity five years later (comparing θ and λ).

Establishments that entered between 1987-92 and then exited are significantly less productive in 1992 than continuing incumbents in 1992 (who are not from that entering cohort, i.e., $\alpha<0$). Of exiting establishments, those that entered between 1987-92 are less productive in 1992 than other exiting establishments ($\alpha<\gamma$). The exiting establishments from this entering cohort are also less productive in 1992 than the surviving members of this cohort ($\alpha<\theta$). The latter findings are broadly consistent with selection effects since it is the less productive establishments from the entering cohort that exit .

The surviving members of the entering 1987-92 cohort are actually more productive than incumbents ($\theta>0$) even upon entry. Moreover, for the entering cohort, we observe significant increases in productivity over the five years ($\theta<\lambda$), even though we control for overall year effects. This pattern is consistent with learning effects playing an important role. It is noteworthy that once we have separately accounted for the learning of the entering cohort, there is essentially no productivity growth for incumbents between 1992 and 1997 who also were present in 1987 ($\nu=0$). Put differently, much of the productivity growth from 1992 to 1997 is accounted for by the combination of the exit of the least productive plants and the learning amongst the cohort of plants that entered between 1987 and 1992.

In sum, we find that net entry contributes disproportionately to productivity growth. The disproportionate contribution is associated with less productive exiting establishments being displaced by more productive entering establishments. New entrants tend to be less productive than surviving incumbents but exhibit substantial productivity growth. The latter reflects both selection effects (the less productive amongst the entrants exit) and learning effects.

VIII. Results for Selected Industries

In all of the results presented thus far, we have controlled for four-digit industry effects but have reported the effects for the "average" retail trade industry. There is undoubtedly considerable heterogeneity in the technology, cost and demand variation across industries. In this section, we explore the results for two selected industries: Miscellaneous General Merchandise Stores (hereafter General Stores) and Catalog and Mail-Order Houses (hereafter Catalog Houses). We selected these two industries because they both exhibited especially robust productivity growth over this period of time and anecdotal/descriptive evidence suggests that both industries experienced substantial structural change over this period of time. As noted in the introduction, General Stores underwent substantial between-store restructuring as some types of stores fared especially well relative to others (e.g., discount warehouses fared well relative to catalog showrooms). The Catalog Houses industry is of particular interest as new e-commerce retail businesses would be classified in this industry over this period of time (although the amount of this might be limited by 1997). More generally, the IT revolution could potentially substantially change business practices in this industry via changes in telecommunications and computer technologies.

Table 14 shows the gross reallocation rates of employment and output over 1987-97 for these two industries. Both industries exhibited dramatic net growth in employment (25 percent for General Stores and 50 percent for Catalog Houses) and output (50 percent for General Stores and 97 percent for Catalog Houses). Moreover, extremely large gross flows account for the net growth in both industries. For example, the employment creation rates are over 75 percent and the employment destruction rates are about 50 percent in both industries. Entry and exit dominate the gross flows, with shares ranging from 69 percent to 93 percent. Compared to Table 5, the results in Table 14 show that these two industries exhibit substantially larger net and gross flows than other industries in retail trade.

Table 15 presents the decompositions of labor productivity per hour for 1987-97. For General Stores, overall productivity growth is large and positive (23 percent) but the within-establishment contribution is substantially negative (-0.46). Thus, more than all of the productivity growth in this industry is accounted for by reallocation, and in particular by net entry. Net entry accounts for 142 percent of the change in productivity. Combined with Table 14, it is apparent that this industry exhibited enormous between establishment restructuring and that this restructuring had an enormous productivity payoff.

For Catalog Houses, the story is substantially different. For this industry, overall productivity growth is again very large and positive (39 percent) over 1987-97. However, while most of the increase in productivity is due to reallocation effects via net entry, about 30 percent is a within-establishment effect. In this industry, there is apparently substantial within and between establishment restructuring and both had substantial productivity payoffs.

Table 16 shows the relative productivity levels of continuers and entering and exiting establishments along with the shares of entering and exiting establishments. The extremely low productivity level of exiting plants for the General Stores stands out: these establishments have average productivity 53 log points less than the average level for continuing incumbents. Strikingly, continuing businesses exhibited a decline in productivity levels for this industry (21 log points lower over time). For Catalog Houses, the notable finding is that entering businesses enter at such high levels of productivity (42 log points above incumbents) and that continuing incumbents exhibit very robust productivity growth (33 log points higher over time).

Tables 17 and 18 report the regressions that identify the contribution of selection and learning effects. For both industries, selection and learning effects are large in magnitude and statistically significant. Entering businesses have substantially higher productivity than exiting businesses even after controlling for average overall growth in productivity. Over a ten-year horizon, those that entered in the first half of the decade and survive exhibit substantially greater productivity than those that entered in the second half of the decade. Following an entering cohort over time, we observe that establishments that enter and then fail are those that had very low productivity upon entry. For those that enter and survive, we observe productivity growth more rapid than that exhibited over the same period of time by surviving incumbents.

The selection and learning effects are particularly dramatic for the General Stores. For example, an establishment that entered between 1987 and 1992 but did not survive until 1997 exhibited average productivity that is more than 40 log points less than continuing establishments. Moreover, for the same cohort, those that survived exhibited an 18 point log increase in productivity from 1992 to 1997 relative to other surviving incumbents.

In many ways, these two industries are more dramatic versions of what we observed for retail trade as a whole. Perhaps the most interesting aspect of these industry-specific results is that we observe substantial differences in the importance of the within-establishment contribution. Both industries exhibit rapid productivity growth with net entry playing a very large role. However, in one case the net entry is accompanied by a positive within-establishment effect and the other a negative within-establishment effect. The most natural interpretation is that continuing establishments in the Catalog Houses industry were able to find ways to improve their productivity internally while continuing establishments in the General Stores apparently were not able to reinvent themselves in such a positive manner. Interestingly, in this latter industry, net entry more than compensated for the poor performance of continuing businesses.

IX. Concluding Remarks

Our main findings are summarized as follows:

- Retail trade businesses exhibit tremendous churning. Gross job and output *creation* rates over a five-year horizon are over 40 percent with about 70 percent accounted for by entry. Gross job and output *destruction* rates over a five-year horizon are over 25 percent with about 70 percent accounted for by exit. Virtually all of the output and employment reallocation occurs across establishments within four-digit industries.
- Retail trade businesses in the same four-digit industry exhibit tremendous productivity differences. The interquartile range of labor productivity across businesses in the same industry is almost 60 log points. New businesses enter at roughly equal rates across the distribution of labor productivity. Exiting businesses disproportionately are from the lowest percentiles of the labor productivity distribution. Continuing establishments in retail trade exhibit substantial persistence in labor productivity.
- Net entry accounts for virtually all of the labor productivity growth in retail trade. The reason for this is the very large rates of entry and exit along with the very low productivity rates of exiting businesses. Exiting businesses are approximately 25 percent less productive than incumbents.

- The productivity dynamics of an entering cohort of businesses in retail trade reflect substantial learning and selection effects. Following an entering cohort over time, one observes that the businesses that exit soon after entry are much less productive than incumbents and even less productive than other exiting establishments. Successful entering businesses exhibit substantial learning as their productivity growth exceeds that of incumbents.
- The results vary by industry in significant ways. Two of the retail trade industries that exhibited especially rapid productivity growth over this period of time are Miscellaneous General Merchandise Stores and Catalog and Mail-Order Houses. For both industries, reallocation rates are extremely large and account for a very large fraction of the overall productivity growth. Moreover, selection and learning effects are significant in both industries. However, these two industries differ substantially on one key dimension: continuing establishments actually exhibit declining productivity growth for General Stores but positive and substantial growth for Catalog Houses. Thus, for some industries, we find that it is only reallocation effects that account for the growth while in others within-establishment effects make an important contribution.

Broadly speaking, these findings show that reallocation effects dominate productivity growth in retail trade. Compared to the results for U.S. manufacturing in the prior literature, in retail trade net entry is virtually the entire story while in U.S. manufacturing net entry accounts for only about one third of the story. Indeed, in an accounting sense, without churning retail trade would not have exhibited any productivity growth. The clear message that emerges is that in the U.S. retail trade sector the manner that new ways of doing business are introduced and successfully contribute to productivity growth is via entry and exit. Within-establishment restructuring does not contribute much to productivity growth for the overall sector but we did find some detailed industries where the within-establishment contribution is substantially greater.

While these findings are interesting, they raise many questions that deserve further attention. For one, it would be of interest to document the precise nature of the organizational and structural changes that are driving the enormous pace of entry and exit in the retail trade sector. We have found that in industries where the descriptive evidence suggests substantial restructuring that we observe such restructuring and that it contributes substantially to overall productivity growth. A natural next step is to link the establishment-level productivity and employment dynamics that we have been exploiting here with observable indicators of the types of technological changes (broadly speaking) that are observed across establishments. There is some scope to do this with the Census of Retail Trade data since there is much information about the types of establishments that we have not yet exploited in the micro Census data.

While the churning appears to be productivity enhancing for the entire retail trade sector, it would be of interest to explore whether this finding holds up for all industries and for all types of businesses. Market imperfections such as imperfect capital markets can distort the reallocation process. It may be that such market imperfections are more important for small businesses so it would be of interest to focus attention on the role of churning for small businesses. In addition, the smallest retail establishments are often single establishments with an owner/manager. The dynamics of such owner-managed businesses may be very different as we know for example that the presence of an owner-manager at an establishment yields a lower probability of exit (see, e.g., Holmes and Schmitz (1992)). Examining the connection between churning and productivity growth for such owner-managed businesses is another area for future work.

REFERENCES

Aghion, Philippe and Peter Howitt, "Growth and Unemployment," *Review of Economic Studies,* July 1994, 477-494.

Baily, Martin Neil, Eric J. Bartelsman and John Haltiwanger. "Labor Productivity: Structural Change and Cyclical Dynamics," NBER Working Paper No. 5503, revised 1997.

Baily, Martin Neil, Charles Hulten and David Campbell. "Productivity Dynamics in Manufacturing Plants," *Brookings Papers on Economic Activity: Microeconomics,* 1992, 187-249.

Bartelsman, Eric J. and Mark Doms. "Understanding Productivity: Lessons from Longitudinal Microdata," *Journal of Economic Literature*, 2000, 38, 569-594

Bureau of the Census. *History of the 1987 Economic Census*, Washington: U.S. Government Printing Office, 1992.

Bureau of the Census. *History of the 1992 Economic Census*, Washington: U.S. Government Printing Office, 1996.

Bureau of the Census. *1997 Economic Census, Retail Trade, Geographic Area Series*, 2000.

Bureau of Labor Statistics. *BLS Handbook of Methods*, Bulletin 2490, Washington: U.S. Government Printing Office, 1997.

Caballero, Ricardo, and Mohamad Hammour. "The Cleansing Effect of Recessions," *American Economic Review*, 84(5), 1350-1368.

Caballero, Ricardo, and Mohamad Hammour. "Creative Destruction and Development: Institutions, Crises, and Restructuring", Working Paper, 2000.

Davis, Steven J., and John Haltiwanger. "Gross Job Flows," in Ashenfelter and Card (eds.), *Handbook of Labor Economics*, 1999.

Davis, Steven J., John C. Haltiwanger and Scott Schuh. *Job Creation and Destruction*, Cambridge: MIT Press, 1996.

Dumas, Mark W. "Productivity Trends in Two Retail Trade Industries, 1987-95," *Monthly Labor Review*, July 1997, 35-39.

Ericson, Richard and Ariel Pakes. "Markov Perfect Industry Dynamics: A Framework for Empirical Work," *Review of Economic Studies*, Vol 62(1), 1995, 53-82.

Foster, Lucia, Haltiwanger, John, and C.J. Krizan. "Aggregate Productivity Growth: Lessons from Microeconomic Evidence," NBER Working Paper No. 6803, 1998 (this paper is forthcoming in *New Developments in Productivity Analysis*, editors: Edward Dean, Michael Harper and Charles Hulten, University of Chicago Press).

Griliches, Zvi, and Haim Regev. "Productivity and Firm Turnover in Israeli Industry: 1979-1988,"*Journal of Econometrics*, 65, 1995, 175-203.

Haltiwanger, John. "Measuring and Analyzing Aggregate Fluctuations: The Importance of Building from Microeconomic Evidence, " *Federal Reserve Bank of St. Louis Economic Review*, January/February, 1997.

Jovanovic, Boyan. "Selection and the Evolution of Industry," *Econometrica*, 50(3), 1982, 649-670.

Jovanovic, Boyan and Glenn MacDonal, "Competitive Diffusion," *Journal of Political Economy*, 98, 1994, 24-52.

Holmes, Thomas and James Schmitz. "Managerial Tenure, Business Age And Small Business Dynamics," Center for Economic Studies Working Paper No. 92-11, 1992.

Appendix A – Product Price Differences Across Establishments

An interesting and related complicating factor in theory and practice in measuring establishment-level productivity is that establishments may have different output prices reflecting some degree of market power.[22] To consider this idea in this context, suppose that the establishment-specific demand is given as follows:

$$p_{et} = \delta_{et} Y_{et}^{-\eta} \qquad \textbf{(11)}$$

where p_{et} is the price of output, δ_{et} is a demand shock, and η is a positive parameter (where $\eta<1$ will be assumed consistent with the related product differentiation models such as that of Melitz (2000)). Such establishment-specific demand factors complicate not only matters conceptually but the practical measurement issues since establishment-level prices are not readily available. That is, measured labor productivity for an establishment in an industry is typically establishment-level revenue deflated with an industry-level deflator divided by labor input. Under this specification, measured labor productivity would thus be given by:

$$LP_{et} = \frac{\delta_{et}(A_{et}(L_{et}-f_e)^{\theta})^{(1-\eta)}}{p_t L_{et}} \qquad \textbf{(12)}$$

In principle, then, for a given employment level (given that labor may not be costlessly adjusted) measured labor productivity could thus reflect a wide variety of factors including demand factors directly. As before, if the labor input is fully flexible and chosen to maximize short run profits then the labor input would satisfy:

$$L_{et} = f_e + \left(\frac{\delta_{et}\alpha(A_{et})^{1-\eta}}{w_t}\right)^{\frac{1}{1-\alpha}} \qquad \textbf{(13)}$$

where $\alpha=\theta(1-\eta)$. As such, measured labor productivity across establishments in the same industry would be given by:

[22] This may be especially appropriate in retail as one might think of the location of the product yielding a differentiated product market structure

$$LP_{et} = \frac{(\frac{\alpha}{w_t})^{\frac{\alpha}{1-\alpha}}}{p_t(\frac{\alpha}{w_t})^{\frac{1}{1-\alpha}} + p_t f_e \delta_{et}^{\frac{1}{\alpha-1}} A_{et}^{\frac{1-\eta}{\alpha-1}}} \quad \textbf{(14)}$$

Thus, idiosyncratic demand and technology differences yield differences in the employment across businesses and differences in measured productivity across businesses.

Interestingly, even though measured labor productivity reflects demand factors the dynamics of the distribution of measured labor productivity are likely to exhibit similar dynamics to those described in section II. That is, frictions in the adjustment of employment will imply differences in measured labor productivity that in turn yield incentives for adjusting employment. Businesses with high measured productivity will expand and businesses with low measured productivity will contract. In addition, businesses with low measured productivity will be more likely to exit as they will be unable to cover their fixed costs. The connection between micro and industry level productivity dynamics is likely to be similar in this context as well. That is, for example, if new technology can only be implemented by new businesses then measured industry productivity growth will be associated with entering businesses displacing lower measured productivity exiting businesses. Thus, we conjecture that many of the inferences to be drawn from our analysis based upon the homogenous price case still apply in this more complicated environment. However, our methodology of measuring the level of establishment and industry-productivity will be biased in this case in the manner described by Klette and Griliches (1996). Possible corrections for these biases are also discussed in Klette and Griliches (1996).

It is worth noting that official BLS productivity statistics at the industry-level also suffer from these biases induced by within industry product differentiation to the extent that the price dispersion (and associated product differentiation) occurs within the most disaggregated product classes underlying BLS gross output series. We note in this regard that BLS has used data at the merchandise line level to construct their gross output indices and thus may be less subject to these biases at the industry level. Since our industry-level productivity measures that use only 4-digit deflators (rather than merchandise line deflators) align closely with BLS series, this suggests that either these biases are small and/or they occur mostly within merchandise lines.

Data Appendix

A. Administrative Records in the Census of Retail Trade

The Census Bureau relies on administrative records to gather data on nonemployers and selected small establishments. The definition of selected small establishments varies by year. The following gives the rules for each Census year:

! In 1987, "'[s]elected small establishments' consisted of all business firms with paid employees and with payrolls below a specified cutoff....Although the cutoff varied by kind of business, the small-employer segment generally included firms with one to three paid employees and represented about 10 percent of total retail sales. Also, a 10-percent sample of those firms was included in the mail canvass ... (Bureau of the Census (1992), p.21)."

! In 1992, "'[s]elected small establishments' were all single-establishment business firms with paid employees and with payrolls below a specified cutoff....Although the cutoff varied by kind of business, the small-employer segment generally included firms with one to three paid employees. Also, a variable-rate sample (averaging 20.6 percent across all retail industries) of those firms was included in the mail canvass ...." (Bureau of the Census (1996), p. 70).

! In 1997, "'[s]elected small employers' are "single-establishment firms with payroll below a specified cutoff. Although the payroll cutoff varied by kind of business, small employers in the nonmail universe generally included firms with less than 10 employees and represented about 10 percent of total sales of establishments covered in the census." A sample of small employers was included in the mail universe. These were establishments "for which specialized data precluded reliance solely on administrative sources" (Bureau of the Census (2000), p. C-1).

B. Defining Manhours

We use BLS' manhours series in our calculations of labor productivity per hour. From BLS' manhours and employment series we derive a measure of average hours for each four-digit industry which we then multiply by our establishment-level employment series. There are 24 four-digit industries that do not meet BLS standards for publication.

C. Bureau of Labor Statistics Data

For all of the four-digit industry indices that we are using from BLS, there are 24 four-digit industries that do not meet BLS standards for publication.

1. <u>Deflators</u>

The BLS deflators that we use are industry implicit price deflators. "In the case of retail trade industries, the industry price index is developed by combining current-year consumer price indexes with weights based in sales for each category of merchandise in Census years (Bureau of Labor Statistics (1997), p.105)."

2. <u>Hours</u>

The BLS employee hours index is for “all employees”which includes the self-employed and unpaid family workers (except for industries 5311 and 5511 which are all paid employees). The index of hours is created by dividing a measure of total hours in the industry in each year by the hours for the base year. Total hours are measured for each industry as the industry’s annual employment times the industry’s average weekly hours times 52.

3. Employment

We do not use the BLS employment index in our calculations. However, we do use it implicitly in our comparison of our productivity growth series with that implied by the BLS productivity indices. The BLS employment index is for “all employees”which includes the self-employed and unpaid family workers (except for industries 5311 and 5511 which are all paid employees).

Although it was not possible to directly compare the productivity measures derived from Census data to those published by BLS, we were able to directly compare the employment *series* used by the agencies. The differences in these employment series yield additional information about the comparability of the two productivity series. We expect there to be some differences even for employment due to differences in coverage, definitions, sampling, and reporting (see Bureau of Labor Statistics (1997) p. 106 for this discussion). For example, the BLS employment series is for “all employees,” while the Census data are for “paid employees.”The correlation between the Census and BLS employment series is 0.9985. Underlying this high correlation over all industries in retail trade are some very large differences in the correlations between the BLS and Census series at the four-digit industry level. For example, six of the 64 industries have negative correlations between the two employment series (industries 5399, 5431, 5461, 5943, 5948, and 5984).

4. Labor Productivity

The labor productivity index is computed as the index of output divided by the index of hours. The index of hours has been described above. The index of output is a Tornqvist index. This index is a weighted average of the growth rates of the various industry products between two periods, where the weights are based on the product’s shares in industry value of production. Specifically, the weights for each product are its average value share in the two time periods. Hence these weights utilize information at the merchandise line level. The output series used is current dollar sales data deflated by the appropriate price indices for the products within that industry.

Table 1: Summary Statistics for the Census of Retail Trade 1987-1997			
	1987	1992	1997
Establishments	1,503,593	1,526,215	1,561,195
Sales (thousands $)	1,493,308,759	1,894,880,209	2,545,881,473
Employees	17,779,942	18,407,453	21,165,862

Sources:
1987: CRT, Geographic Area Series, Table 1
1992: CRT, RCS-92-S-1 Subject Series, Table 1
1997: www.census.gov/epcd/ec97sic/E97SU8.HTM

Table 2: Comparison of Labor Productivity Per Hour Growth Measures			
Sample	Census	BLS	Correlation at Industry-Level
1987-92			
All Industries	5.00	4.35	0.64
Published Industries	4.78	4.01	0.78
1992-97			
All Industries	6.48	9.37	0.75
Published Industries	5.67	8.33	0.68
1987-97			
All Industries	11.43	14.10	0.80
Published Industries	10.30	12.45	0.81

Sources: Calculations using the Census of Retail Trade and BLS industry productivity. Published Industries refers to the 40 four-digit industries that meet BLS' standards for publication.

Table 3: Summary Statistics on Hours-Weighted Distribution of Labor Productivity Across Businesses Within four-digit Industries		
Year	Std. Deviation	Interquartile Range
1987	0.54	0.58
1992	0.54	0.57
1997	0.55	0.57

Table 4: Matrix of Relative Productivity in 1987 and 1997, Weighted by Hours
(Highest Productivity is Quintile 5; Lowest is Quintile 1)

Establish-ment Group	Quintile 1 (1997)	Quintile 2 (1997)	Quintile 3 (1997)	Quintile 4 (1997)	Quintile 5 (1997)	Deaths	Row Total
Quintile 1 (1987)	12.80 11.04	6.51 5.63	4.21 3.61	3.38 2.86	2.79 2.27	70.32 28.00	11.90
Quintile 2 (1987)	11.58 10.07	15.29 13.33	10.25 8.88	6.69 5.72	4.08 3.35	52.12 20.93	12.01
Quintile 3 (1987)	8.34 7.39	15.04 13.36	16.06 14.16	11.80 10.28	6.28 5.25	42.48 17.37	12.23
Quintile 4 (1987)	6.61 5.96	10.74 9.72	15.23 13.67	17.27 15.32	10.91 9.29	39.26 16.35	12.45
Quintile 5 (1987)	4.88 4.68	6.41 6.16	8.29 7.91	14.76 13.92	26.45 23.93	39.21 17.35	13.23
Births	22.00 60.85	18.68 51.80	18.81 51.77	19.08 51.90	21.43 55.91		38.17
Column Total	13.80	13.77	13.87	14.04	14.63	29.90	100

Top number in each cell is row percentage (shows where the establishments that were in a given quintile in 1987 are in 1997); Bottom number in each cell is column percentage (shows where the establishments in a given quintile in 1997 came from).

Table 5 : Gross Reallocation of Employment and Output

Measure	Creation (Expansion) Rate	Share of Creation (Expansion) Due to Entrants	Destruction (Contraction) Rate	Share of Destruction (Contraction) Due to Exits	Fraction of Excess Reallocation Within Four-digit Industry	Net Flows	Excess Reallocation
1987-92							
Employment	45.0	76.6	42.7	69.5	0.94	2.2	85.5
Real Output	42.6	74.1	37.4	63.9	0.96	5.2	74.8
1992-97							
Employment	48.7	73.0	36.3	72.0	0.97	12.4	72.5
Real Output	48.6	67.4	27.8	68.9	1.00	20.8	55.7
1987-97							
Employment	69.2	84.4	54.6	81.9	0.96	14.6	109.2
Real Output	71.5	80.4	45.5	78.9	0.98	26.0	91.0

Source: Tabulations from the Census of Retail Trade

Table 6 : Gross Reallocation of Employment by Size Class								
Establishment Average Employment	Number of Establishments (thousands)	Average Number of Employees (millions)	Creation (Expansion) Rate	Share of Creation Due to Entrants	Destruction (Contraction) Rate	Share of Destruction Due to Exits	Net Job Flows	Excess Reallocation
1987-92								
1-4	1132.3	2.3	74.3	91.3	76.6	90.4	-2.4	148.5
5-9	374.5	2.5	53.3	80.1	52.4	76.9	1.0	104.7
10-19	214.9	2.9	50.5	76.9	47.5	72.3	3.0	94.9
20-49	137.5	4.2	41.8	72.3	39.5	65.9	2.3	78.9
50+	58.8	5.7	28.8	62.6	24.7	37.7	4.1	49.3
1992-97								
1-4	1084.9	2.2	74.8	91.1	75.2	91.2	-0.4	149.6
5-9	379.3	2.6	56.4	79.0	48.1	79.2	8.3	96.3
10-19	226.6	3.1	54.7	75.9	41.6	74.0	13.2	83.2
20-49	149.3	4.5	44.9	71.4	33.6	66.3	11.3	67.3
50+	64.9	6.6	36.6	56.3	17.7	41.5	18.9	35.4
1987-97								
1-4	1367.2	2.8	87.3	95.8	89.6	95.6	-2.2	174.7
5-9	402.6	2.7	76.5	88.6	67.4	88.3	9.1	134.9
10-19	230.8	3.2	76.2	86.6	60.0	85.1	16.2	120.1
20-49	145.0	4.4	66.1	83.4	53.0	80.5	13.1	105.9
50+	59.5	5.9	56.0	72.8	30.5	55.1	25.5	61.1
Source: Tabulations from the Census of Retail Trade								

Table 7a : Gross Reallocation of Employment by Two-digit Industry, 1987-1992								
Industry	Number of Establish-ments (thousands)	Average Number of Employees (millions)	Creation (Expansion) Rate	Share of Creation Due to Entrants	Destruction (Contraction) Rate	Share of Destruction Due to Exits	Net Job Flows	Excess Reallocation
52. Building Materials	89.6	0.7	40.6	67.4	41.9	67.7	-1.3	81.1
53. General Merchandise	42.6	2.0	31.7	78.4	26.9	52.8	4.7	53.9
54. Food	232.0	2.8	39.9	70.0	36.2	70.3	3.6	72.5
55. Auto Dealers	267.3	2.0	38.3	73.0	46.5	72.1	-8.2	76.6
56. Apparel	190.5	1.1	48.6	76.4	50.2	68.0	-1.5	97.3
57. Furniture	143.0	0.7	48.5	76.4	50.9	71.4	-2.4	97.0
58. Eating & Drinking	519.2	6.2	51.8	81.4	46.4	71.2	5.3	92.8
59. Misc.	433.7	2.2	48.8	73.5	45.7	71.0	3.1	91.5
Source: Tabulations from the Census of Retail Trade.								

Table 7b : Gross Reallocation of Employment by Two-digit Industry, 1992-1997								
Industry	Number of Establish-ments (thousands)	Average Number of Employees (millions)	Creation (Expansion) Rate	Share of Creation Due to Entrants	Destruction (Contraction) Rate	Share of Destruction Due to Exits	Net Job Flows	Excess Reallocation
52. Building Materials	86.1	0.7	56.6	73.8	35.3	77.5	21.3	70.6
53. General Merchandise	41.7	2.2	38.3	62.1	22.6	60.0	15.7	45.2
54. Food	211.7	2.9	37.4	69.2	32.8	67.6	4.7	65.5
55. Auto Dealers	246.3	2.1	44.3	61.8	29.8	74.8	14.5	59.6
56. Apparel	173.1	1.1	45.8	75.5	51.5	72.0	-5.8	91.6
57. Furniture	143.2	0.8	58.7	75.9	39.9	74.0	18.8	79.9
58. Eating & Drinking	559.1	6.8	54.4	80.0	40.3	73.1	14.1	80.5
59. Misc.	443.8	2.5	55.2	69.5	39.4	75.1	15.8	78.9
Source: Tabulations from the Census of Retail Trade.								

Table 7c : Gross Reallocation of Employment by Two-digit Industry, 1987-1997								
Industry	Number of Establish-ments (thousands)	Average Number of Employees (millions)	Creation (Expansion) Rate	Share of Creation Due to Entrants	Destruction (Contraction) Rate	Share of Destruction Due to Exits	Net Job Flows	Excess Reallocation
52. Building Materials	101.2	0.7	73.3	82.3	53.2	84.9	20.1	106.4
53. General Merchandise	49.2	2.2	59.4	80.5	39.6	68.2	19.8	79.2
54. Food	255.1	2.9	58.4	78.4	51.0	81.6	7.4	101.9
55. Auto Dealers	301.7	2.1	60.6	77.6	53.7	84.3	6.8	107.5
56. Apparel	207.6	1.1	66.4	88.8	72.6	84.5	-6.3	132.7
57. Furniture	165.4	0.8	76.4	86.4	60.1	83.2	16.3	120.2
58. Eating & Drinking	619.5	6.7	76.9	89.5	57.2	82.7	19.7	114.3
59. Misc.	505.3	2.4	75.5	81.9	56.6	84.0	18.9	113.2
Source: Tabulations from the Census of Retail Trade								

Table 8: Decomposition of Labor Productivity Growth						
Measure	Weight	Overall Growth	Within Share	Between Share	Cross Share	Net Entry Share
1987-92						
Productivity (per hour)	Manhours	5.00	0.07	0.79	-1.14	1.28
Productivity (per worker)	Employment	4.79	0.05	0.83	-1.19	1.31
1992-97						
Productivity (per hour)	Manhours	6.48	0.35	0.63	-0.97	0.99
Productivity (per worker)	Employment	5.85	0.31	0.70	-1.07	1.06
1987-97						
Productivity (per hour)	Manhours	11.43	0.16	0.24	-0.39	0.98
Productivity (per worker)	Employment	10.57	0.14	0.27	-0.42	1.01
Source: Tabulations from the Census of Retail Trade.						

Table 9: Correlation Between Plant-Level Productivity, Output, and Input Growth (Continuing Establishments)					
Measure	Productivity (per hour)	Productivity (per worker)	Output	Employment	Manhours
1987-92					
Productivity (per hour)	1.000				
Productivity (per worker)	.998	1.000			
Output	.617	.618	1.000		
Employment	-.329	-.330	.538	1.000	
Manhours	-.331	-.328	.539	.998	1.000
1992-97					
Productivity (per hour)	1.000				
Productivity (per worker)	.998	1.000			
Output	.556	.556	1.000		
Employment	-.431	-.433	.508	1.000	
Manhours	-.436	-.433	.506	.998	1.000
1987-97					
Productivity (per hour)	1.000				
Productivity (per worker)	.997	1.000			
Output	.572	.574	1.000		
Employment	-.289	-.290	.618	1.000	
Manhours	-.289	-.285	.620	.997	1.000
Source: Tabulations from the Census of Retail Trade.					

Table 10: Output Shares and Relative Labor Productivity							
Measure	Weight	Shares		Relative Productivity			
		Exiting Estabs. (t-k)	Entering Estabs. (t)	Exiting Estabs. (t-k)	Entering Estabs. (t)	Continuing Estabs. (t-k)	Continuing Estabs. (t)
Panel A: 1987-92							
Productivity (per hour)	Manhours	0.28	0.30	0.74	0.96	1.00	0.98
Productivity (per worker)	Employment	0.28	0.30	0.74	0.96	1.00	0.98
Panel B: 1992-97							
Productivity (per hour)	Manhours	0.25	0.29	0.70	0.95	1.00	1.01
Productivity (per worker)	Employment	0.25	0.29	0.71	0.94	1.00	1.00
Panel C: 1987-97							
Productivity (per hour)	Manhours	0.45	0.49	0.78	1.01	1.00	1.02
Productivity (per worker)	Employment	0.45	0.49	0.78	1.00	1.00	1.01
Source: Tabulations from the Census of Retail Trade.							

Table 11: Regression Results Concerning Net Entry, 1987-97

Panel A: Differences Between Continuing, Entering and Exiting Establishments

Measure	Exit Dummy in 1987 (β)	Entry Dummy in 1997 (δ)	1997 Year Effect (ν)	F-test on β=δ (p-value)
Labor Productivity (per hour)	-0.228 (0.001)	-0.001 (0.001)	0.011 (0.001)	0.0001
Labor Productivity (per worker)	-0.223 (0.001)	-0.002 (0.001)	0.005 (0.001)	0.0001

Panel B: Regression Results Distinguishing Between Entering Cohorts

Measure	Entry Dummy in 1997 interacted with Dummy for 1987-92 Cohort (η)	Entry Dummy in 1997 interacted with Dummy for 1992-97 Cohort (μ)	F-test on $\eta = \mu$ (p-value)
Labor Productivity (per hour)	0.041 (0.001)	-0.033 (0.001)	0.0001
Labor Productivity (per worker)	0.041 (0.001)	-0.035 (0.001)	0.0001

Notes: Results in panel A are based upon regression of pooled 1987 and 1997 data with dependent variable the measure of productivity (in logs) and the explanatory variables including four-digit industry effects, year effects, an exit dummy in 1987 and an entry dummy in 1997. The results in panel B use the same specification but interact the entry dummy with entering cohort dummies. In panel B, the exit dummy and year effect dummy are not shown as they are the same as in panel A. All results are weighted regressions with hours weights in labor productivity per hour regressions and employment weights in labor productivity per worker regressions. Standard errors in parentheses.

Table 12: Regression Results Concerning Net Entry, Subperiods				
Measure	Exit Dummy in Beginning Year (β)	Entry Dummy in Ending Year (δ)	End Year Effect (ν)	F-test on β=δ (p-value)
Panel A: 1987-1992				
Labor Productivity (per hour)	-0.266 (0.001)	-0.021 (0.001)	-0.019 (0.001)	0.0001
Labor Productivity (per worker)	-0.263 (0.001)	-0.023 (0.001)	-0.020 (0.001)	0.0001
Panel B: 1992-1997				
Labor Productivity (per hour)	-0.302 (0.001)	-0.057 (0.001)	0.006 (0.001)	0.0001
Labor Productivity (per worker)	-0.300 (0.001)	-0.057 (0.001)	0.000 (0.001)	0.0001
Notes: Results are based upon regression of pooled beginning year and ending year data. The dependent variable is the measure of productivity (in logs) and the explanatory variables include four-digit industry effects, year effects, and exit and entry dummies. All results are weighted regressions with hours weights in labor productivity per hour regressions and employment weights in labor productivity per worker regressions. Standard errors in parentheses.				

Table 13: Distinguishing Between Selection and Learning Effects for 1992-1997 Using 1987-92 Entering Cohort								
Measure	Exit Dummy in 1992 for Entering Cohort (α)	Exit Dummy in 1992 for Other Exiting Plants (γ)	Survival Dummy in 1992 for Entering Cohort (θ)	Survival Dummy in 1997 for Entering Cohort (λ)	1997 Year Effect (ν)	F-test on α = γ (p-value)	F-test on α = θ (p-value)	F-test on θ = λ (p-value)
Labor Productivity (per hour)	-0.324 (0.002)	-0.274 (0.001)	0.029 (0.001)	0.049 (0.001)	-0.000 (0.001)	0.0001	0.0001	0.0001
Labor Productivity (per worker)	-0.322 (0.002)	-0.272 (0.001)	0.029 (0.001)	0.049 (0.001)	-0.006 (0.001)	0.0001	0.0001	0.0001

Notes: Results are based upon regression of pooled 1992 and 1997 data with dependent variable the measure of productivity. The explanatory variables include four-digit industry effects, year effects, an entry dummy in 1997, the exit dummy interacted with whether the plant is in the 87-92 entering cohort, and a surviving dummy for the 87-92 entering cohort interacted with the year effects. All results are weighted regressions with hours weights in labor productivity per hour regressions and employment weights in labor productivity per worker regressions. Standard errors in parentheses.
Source: Tabulations from the Census of Retail Trade.

Table 14 : Gross Reallocation of Employment and Output, Selected Industries, 1987-97					
Measure	Creation (Expansion) Rate	Share of Creation (Expansion) Due to Entrants	Destruction (Contraction) Rate	Share of Destruction (Contraction) Due to Exits	Net Flows
Miscellaneous General Merchandise Stores					
Employment	79.1	83.1	54.5	85.1	24.6
Real Output	92.4	88.7	42.2	69.2	50.1
Catalog and Mail-Order Houses					
Employment	100.0	72.1	50.0	89.8	49.8
Real Output	129.5	75.0	32.8	93.0	96.7
Source: Tabulations from the Census of Retail Trade					

Table 15: Decomposition of Labor Productivity Growth -- Selected Industries, 1987-97						
Measure	Weight	Overall Growth	Within Share	Between Share	Cross Share	Net Entry Share
Miscellaneous General Merchandise Stores						
Productivity (per hour)	Manhours	22.9	-0.46	0.17	-0.13	1.42
Catalog and Mail Order-Houses						
Productivity (per hour)	Manhours	39.4	0.30	0.19	-0.15	0.65
Source: Tabulations from the Census of Retail Trade.						

Table 16: Employment Shares and Relative Labor Productivity, Selected Industries, 1987-97							
Measure	Weight	Shares		Relative Productivity			
		Exiting Estabs. (t-k)	Entering Estabs. (t)	Exiting Estabs. (t-k)	Entering Estabs. (t)	Continuing Estabs. (t-k)	Continuing Estabs. (t)
Miscellaneous General Retail Stores							
Productivity (per hour)	Manhours	0.56	0.61	0.47	1.03	1.00	0.79
Catalog and Mail-Order Houses							
Productivity (per hour)	Manhours	0.58	0.61	0.98	1.42	1.00	1.33
Source: Tabulations from the Census of Retail Trade.							

Table 17: Regression Results Concerning Net Entry, Selected Industries, 1987-97				
Panel A: Differences Between Continuing, Entering and Exiting Establishments,				
Industry	Exit Dummy in 1987 (β)	Entry Dummy in 1997 (δ)	1997 Year Effect (ν)	F-test on β=δ (p-value)
Miscellaneous General Merchandise Stores	-0.527 (0.015)	0.236 (0.015)	-0.209 (0.016)	0.0001
Catalog and Mail-Order Houses	-0.025 (0.020)	0.093 (0.020)	0.325 (0.021)	0.0001
Panel B: Regression Results Distinguishing Between Entering Cohorts				
Industry	Entry Dummy in 1997 interacted with Dummy for 1987-92 Cohort (η)	Entry Dummy in 1997 interacted with Dummy for 1992-97 Cohort (μ)	F-test on η = μ (p-value)	
Miscellaneous General Merchandise Stores	0.400 (0.017)	0.072 (0.017)	0.0001	
Catalog and Mail-Order Houses	0.320 (0.025)	-0.082 (0.023)	0.0001	

Notes: Results in panel A are based upon regression of pooled 1987 and 1997 data with dependent variable the measure of productivity (in logs) and the explanatory variables including year effects, an exit dummy in 1987 and an entry dummy in 1997. The results in panel B use the same specification but interact the entry dummy with entering cohort dummies. In panel B, the exit dummy and year effect dummy are not shown as they are the same as in panel A. All results are weighted regressions with hours weights in labor productivity per hour regressions and employment weights in labor productivity per worker regressions. Standard errors in parentheses.

Table 18: Distinguishing Between Selection and Learning Effects for 1992-1997 Using 1987-92 Entering Cohort								
Industry	Exit Dummy in 1992 for Entering Cohort (α)	Exit Dummy in 1992 for Other Exiting Plants (γ)	Survival Dummy in 1992 for Entering Cohort (θ)	Survival Dummy in 1997 for Entering Cohort (λ)	1997 Year Effect (ν)	F-test on α = γ (p-value)	F-test on α = θ (p-value)	F-test on θ = λ (p-value)
Miscellaneous General Merchandise Stores	-0.416 (0.026)	-0.589 (0.024)	0.245 (0.019)	0.424 (0.019)	-0.278 (0.018)	0.0001	0.0001	0.0001
Catalog and Mail Order	-0.378 (0.028)	-0.392 (0.028)	0.295 (0.027)	0.329 (0.025)	0.218 (0.022)	0.0001	0.0001	0.0001

Notes: Results are based upon regression of pooled 1992 and 1997 data with dependent variable the measure of productivity. The explanatory variables include year effects, an entry dummy in 1997, the exit dummy interacted with whether the plant is in the 87-92 entering cohort, and a surviving dummy for the 87-92 entering cohort interacted with the year effects. All results are weighted regressions with hours weights in labor productivity per hour regressions and employment weights in labor productivity per worker regressions. Standard errors in parentheses.
Source: Tabulations from the Census of Retail Trade.