MARKET SELECTION, REALLOCATION, AND RESTRUCTURING IN THE U.S. RETAIL TRADE SECTOR IN THE 1990S

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Abstract —The U.S. retail trade sector underwent a massive restructuring and reallocation of activity in the 1990s with accompanying technological advances. Using a data set of establishments in that sector, we quantify and explore the relationship between this restructuring and reallocation and labor productivity dynamics. We find that virtually all of the labor productivity growth in the retail trade sector is accounted for by more productive entering establishments displacing much less productive exiting establishments. The productivity gap between low-productivity exiting single-unit establishments and entering high-productivity establishments from large, national chains plays a disproportionate role in these dynamics.

I. Introduction

THE retail trade sector underwent a massive restructuring and reallocation of economic activity in the 1990s. Retail businesses changed their ways of doing business with intensive adoption of advanced information technology, including everything from improvements in inventory control to the introduction and widespread use of scanners and rapid credit card processing technologies. Structural changes occurred with entering establishments from large multiunit national firms displacing single-establishment firms. In this paper we measure this restructuring and reallocation and its contribution to productivity growth in the U.S. retail trade industry by exploiting rich, newly developed establishment- and firm-level data from the U.S. Bureau of the Census.[1] The micro business data in the Census of Retail Trade permit us to track the activity and performance of every retail location in the country and tie each establishment to whether it is a single-unit establishment and firm or part of a large, national chain.

The information technology revolution has had an enormous impact on the retail trade sector. Adoption of systems that electronically link cash registers to scanners and credit card processing machines have allowed establishments to increase services and sales without increasing personnel (Sieling, Friedman, & Dumas, 2001). Widespread adoption of electronic scanners has meant that managers are able to change prices relatively costlessly (as in *high-low* pricing, where a price alternates between its regular level and its sale level) and to more easily track the success of their pricing strategies for individual items (Nakamura, 1998). The scanners also allow improved inventory and sales tracking. Computerization has enabled large retailers to adopt *lean retailing* practices of closely tracking of inventory levels so that they can keep them at a cost-saving minimum (Levinsohn & Petropoulos, 2001). The McKinsey Global Institute (2001) attributes much of the drive to adopt new technologies and organization practices in retail trade to the influence of one company, Wal-Mart. McKinsey finds that the competitive pressure of Wal-Mart encouraged other retailers to adopt its technological and organizational best practices. This influence was felt throughout the retail trade sector because Wal-Mart competes with retailers across many categories, including general merchandise stores, drugstores, apparel stores, and grocery stores (Basker, 2005). The retail trade sector has also become more concentrated over time, with the four-firm concentration ratio increasing from 5.2% in 1987 to 6.8% in 1992 and increasing further in 1997 (Bureau of the Census (1990, 1995)).

According to official Bureau of Labor Statistics (BLS) statistics, the retail trade sector exhibited robust labor productivity growth over the 1990s (approximately 14% over a 10-year horizon). This labor productivity growth could reflect common productivity gains shared by all or most businesses in the sector, so that reallocation dynamics are not particularly important. The models that underlie this view are the standard representative firm models of productivity growth. Alternatively, reallocation dynamics may be vital for productivity growth if new technologies or business methods (including new IT capital) can only be implemented by new businesses or if this implementation is inherently a noisy process with much trial and error (and associated success and failure). Under this alternative view, it may be that the reallocation of outputs and inputs from

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[1] A large related literature has focused on the connection between micro and aggregate productivity growth, including: (a) for the United States: Baily, Hulten, and Campbell (1992), Bartelsman and Dhrymes (1998), Dwyer (1998, 1997), Foster, Haltiwanger, and Krizan (2001), Foster, Haltiwanger, and Syverson (2005), and Olley and Pakes (1996); (b) for other countries: Aw, Chen, and Roberts (2001), Bartelsman, Scarpetta, and Schivardi (2003), Disney, Haskel, and Heden (2003), Haskel and Khawaja (2003), Levinsohn and Petrin (1999), Liu and Tybout (1996), Griliches and Regev (1995), Roberts and Tybout (1997), and Tybout (1996). Bartelsman and Doms (2000) provide an excellent review of the literature. Virtually all of the literature has focused on the manufacturing sector. Establishment location and ownership structure, which play a critical role in retail trade, are arguably less important in (at least) some sectors in manufacturing. For retail trade, there has been much less study of the microdata. One exception is Campbell and Lapham (2004), who investigate the important role of changes in the number of establishments by location in response to shocks in accounting for the dynamics of U.S. retail trade industries.

less productive to more productive businesses is a vital component of the productivity growth of the industry.

The models that underlie the basic idea that reallocation should be productivity-enhancing emphasize frictions associated with adjustment (including entry and exit) and idiosyncratic shocks. The models most relevant for the current analysis are those that emphasize the role of entry and exit. Three key assumptions of these models are relevant for the current analysis: (i) the presence of frictions associated with entry of an establishment; (ii) entering establishments have some (or perhaps complete) advantage in adopting new business methods; (iii) incumbent businesses are subject to idiosyncratic productivity shocks.[2] The key prediction that emerges is that market selection via entry and exit will play a critical role in productivity growth as low-productivity exiting establishments will be displaced by more productive entering establishments. Of course, the open empirical questions are whether the reallocation and productivity dynamics are quantitatively important and, to the extent they are, what are the driving forces underlying these dynamics.

One challenge in using establishment-level data to study productivity dynamics is that our measures of productivity are relatively crude at the micro level. We follow the BLS official measure of labor productivity, which is typically measured as gross output per worker. Indeed, the microdata we use on gross revenue are precisely the source data that the BLS uses for its measures of labor productivity in the retail trade sector. However, an additional challenge of using establishment-level data as opposed to industry-level data is that for most sectors we do not observe establishment-level prices. As has been emphasized in the recent literature, this implies that the typical measure of productivity using establishment-level data is really a measure of real revenue per unit of input using an industry-level deflator rather than physical output per unit of input.[3] If there is price homogeneity within narrowly defined sectors or if within-sector price heterogeneity reflects quality differences, then the real revenues per unit of input measures are appropriate. Alternatively, price differences across establishments in the same sector might reflect differences in market power and markups. Such factors should still matter for market selection (after all, selection should be on profitability, not productivity per se), but the interpretation of the contribution of market selection to productivity dynamics becomes more complicated to measure. In this paper, we partially address these issues by examining a retail trade industry for which we have establishment-level price data: restaurants.

The paper proceeds as follows. The data used for our empirical analysis are described in section II. In section III, we demonstrate that the retail trade sector exhibits two of the necessary ingredients for reallocation dynamics to play an important role: substantial productivity dispersion between establishments in the same narrowly defined sector, and a high pace of within-sector reallocation. We quantify the contribution of reallocation dynamics to productivity growth in our decompositions presented in section IV. We find that virtually all of the productivity growth in the retail trade sector over the 1990s is accounted for by more productive entering establishments displacing much less productive exiting establishments.

The dominant role of net entry leads us to focus on providing an anatomy of the net entry effects in section V. We explore two key issues in that section. First, there has been much popular press discussing the demise of single-retail-establishment firms and the increasing presence of large, national retail chains. We find that the dominant role of net entry is associated with the entry of more productive establishments that are part of large, national firms displacing the much less productive exiting establishments that are single-unit establishments. Our results suggest that the enormous restructuring of the retail trade sector toward large, national chains has been at the core of the productivity gains in the retail trade sector. Second, over a ten-year horizon, the contribution of net entry may reflect both selection effects and post-entry learning effects. That is, establishments that enter might be immediately more productive than the establishments they are displacing, or it may take time for the productivity gap to widen or emerge. We find evidence that both selection and post-entry learning contribute significantly to the contribution of net entry.

As a robustness check and also to explore variation in patterns across industries, we report the results of conducting some of the key empirical exercises for a selected set of industries in section VI. One of the industries we consider is restaurants, for which we can construct measures of establishment-level prices. In section VII, we provide some limited evidence on the relationship between the labor productivity dispersion we observe with measures of business-level capital intensity and capital mix. We conclude in section VIII with a discussion of how the retail trade results differ from those from the literature on U.S. manufacturing.

II. Data Description

The empirical analysis in this paper uses data from the Census of Retail Trade (CRT). The Census Bureau conducts a survey of retail trade establishments every five years, collecting data on establishments concerning the kind of business, physical location, sales in dollars, and employment for the pay period including March 12. Thus it is possible to construct measures of labor productivity, but it is not possible to measure multifactor productivity.[4] Differ-

[2] See Aghion and Howitt (1994) and Caballero and Hammour (1994) for vintage models of entry that have these essential features and predictions.

[3] See, for example, Melitz (2000), Katayama, Lu, and Tybout (2003), Syverson (2004), and Foster, Haltiwanger and Syverson (2005), and Eslava et al. (2004).

[4] In section VII, we provide some analysis from a relatively small survey of retail trade businesses in 1992 to provide some perspective on these issues.

ences in labor productivity across businesses might reflect a variety of factors, including differences in capital intensity (as well as the quality of capital), labor quality, and/or multifactor productivity.[5] Our index of establishment-level labor productivity (LP_{et}) is similar to that used in the literature and is given by the log difference in establishment-level real gross output and establishment-level labor input (total hours). We define real gross output as nominal sales deflated by BLS four-digit industry deflators. We construct man-hours at the establishment level by multiplying establishment employment by the industry average of hours as measured by BLS.[6]

Our empirical analysis uses data from 1987, 1992, and 1997 because these are the years for which we are able to link establishments over time. On average there are approximately 1.5 million establishments in the retail trade sector, employing close to 20 million workers and generating close to $2 trillion in sales for these three census years. Because the CRT data have not been extensively used and our methodology is based on aggregating microdata, it is helpful to compare the productivity measures based on the Census data with those officially published by BLS. We find that our overall average productivity growth rates are quite similar and that the correlation between the BLS and Census industry-level productivity growth rates is quite high (0.80) [for more details see Foster, Haltiwanger, and Krizan (2006)].

The unit of observation in the CRT is the *establishment,* which is defined as a physical location at which economic activity is occurring. We can link the establishments in our data to their parent firms. In the analysis that follows, we find it helpful at times to distinguish between entering establishments of *new* firms (typically single-unit entrants) and entering establishments of *continuing* firms. In a like manner, we distinguish between exiting establishments of *exiting* firms (again, typically single units) and exiting establishments that belong to *continuing* firms. This ability to bring in the information of the parent firms also permits us to develop measures of the nature of the parent firm. Accordingly, in what follows, we distinguish establishments belonging to four types of firms: one-establishment firms (*single firms*), multiunit firms that operate in a single state (*local firms*), multiunit firms that operate in two to five states (*regional firms*), and multiunit firms that operate in more than five states (*national firms*).

[5] In the longer working paper version of this paper Foster, Haltiwanger, and Krizan (2006), we explore the conceptual relationship between measures of labor productivity and total factor productivity. We point out that even in a frictionless environment labor productivity will be highly correlated with total factor productivity differences if overhead labor is present. We think that, given the typically small size of retail trade establishments and the nature of the production process (for example, stores need to stay open for a consistent number of hours), overhead labor is likely quite important in retail trade.

[6] Using the CRT raises a host of measurement issues and imposes limitations on our measures of labor productivity. In the longer working paper version of this paper and in closely related prior work, we discuss these measurement issues at length and provide robustness analysis along a number of dimensions (see Foster et al., 2006).

III. Productivity Dispersion and Reallocation

In this section, we present basic facts about the shape and evolution of the distribution of productivity across businesses and of the pace of the reallocation of outputs and inputs. We begin by characterizing the differences in labor productivity across businesses within the same narrowly defined industry. For this purpose, we examine the percentiles of the hours-weighted labor productivity distribution across businesses after removing four-digit industry fixed effects. The standard deviation and the interquartile range of this distribution are very large and stable: the standard deviation is approximately 0.54 and the interquartile range approximately 0.57 for all three years.

We begin our analysis of the dynamics of establishment-level productivity by examining the transition of individual businesses in the overall distribution of productivity over the 1987–1997 period. In each of the years under consideration, we classify establishments into quintiles of the hours-weighted labor productivity distribution. We combine this information into a transition matrix. We can thus look forward or backward, in terms of where the establishments in 1987 end up or where the establishments in 1997 came from. Because we have removed four-digit industry effects from each year, the quintiles should be interpreted as capturing relative productivity *within* the four-digit industry.

The most striking feature of the transition matrix, as shown in table 1, is the large role of entry and exit. For any quintile in 1987, the most likely outcome is exit (see the row percentages, which are the top numbers in each cell). For any quintile in 1997, the most likely origin is entry (see the column percentages which are the bottom italicized numbers in each cell). Interestingly, entrants arrive uniformly throughout the productivity distribution. In contrast, exits are concentrated in the businesses with low productivity in 1987. For example, 70.3% of businesses in the lowest quintile in 1987 did not survive until 1997; in contrast, only 39.2% of businesses in the highest quintile in 1987 did not survive until 1997.

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 26.5% chance of staying in the top quintile in 1997, but only a 4.9% chance of moving to the bottom quintile. Likewise, businesses in the lowest quintile in 1987 had a 12.8% chance of staying in the lowest quintile in 1997, but only a 2.8% chance of moving to the highest quintile.

It is evident from table 1 that there is considerable turnover of businesses and associated reallocation of labor input across establishments. To examine these issues more directly, table 2 presents estimates of the gross expansion and contraction rates of employment and output for 1987–1997. The rates of output and employment expansion (contraction) are measured as the weighted average of the growth rates of expanding (contracting) establishments, including the contribution of entering (exiting) establish-

TABLE 1.—MATRIX OF RELATIVE PRODUCTIVITY IN 1987 AND 1997

Establishment Group	Quintile 1 (1997)	Quintile 2 (1997)	Quintile 3 (1997)	Quintile 4 (1997)	Quintile 5 (1997)	Exits	Row Total
Quintile 1 (1987)	12.8	6.5	4.2	3.4	2.8	70.3	11.9
	11.0	*5.6*	*3.6*	*2.9*	*2.3*	*28.0*	
Quintile 2 (1987)	11.6	15.3	10.2	6.7	4.1	52.1	12.0
	10.1	*13.3*	*8.9*	*5.7*	*3.4*	*20.9*	
Quintile 3 (1987)	8.3	15.0	16.1	11.8	6.3	42.5	12.2
	7.4	*13.4*	*14.2*	*10.3*	*5.3*	*17.4*	
Quintile 4 (1987)	6.6	10.7	15.2	17.3	10.9	39.3	12.5
	6.0	*9.7*	*13.7*	*15.3*	*9.3*	*16.3*	
Quintile 5 (1987)	4.9	6.4	8.3	14.8	26.5	39.2	13.2
	4.7	*6.2*	*7.9*	*13.9*	*23.9*	*17.4*	
Entrants	22.0	18.7	18.8	19.1	21.4		38.2
	60.9	*51.8*	*51.8*	*51.9*	*55.9*		
Column Total	13.8	13.8	13.9	14.0	14.6	29.9	100.0

Notes: Weighted by hours. Quintile 1 is the lowest productivity, quintile 5 is the highest. For each pair of quintile combinations, the top number in each cell shows the percentage of establishments in quintile A in 1987 that end up in quintile B in 1997 (row percentage) and the bottom number in each cell (in italics) shows the percentage of establishments in quintile B in 1997 that came from quintile A in 1987 (column percentage).

ments, using the methodology of Davis, Haltiwanger, and Schuh (1996).[7] The pace of gross output and employment expansion and contraction is extremely large over the ten-year horizon. Expanding establishments have yielded a gross rate of expansion of 69.2% for employment and 71.5% for output; contracting establishments yielded a gross rate of contraction of 54.6% for employment and 45.5% for output over 1987–1997. Entry and exit are important components of the expansion and contraction rates. Establishment entrants account for 84% of the employment expansion and 80% of the gross output expansion. Establishment exits account for 82% of the employment contraction and 79% of output contraction. Retail trade gross flows are approximately 50% larger than those in manufacturing, with a higher share of the flows accounted for by entry and exit [comparing the results here with those in Foster, Haltiwanger, and Krizan (2001)].

Table 2 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 that is in excess of that required to accommodate the net expansion of the sector. Following Davis et al. (1996), excess reallocation rates for the entire retail trade sector can be decomposed into within- and between-sector effects. We find 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 are primarily among producers in the same four-digit industry. This finding is especially noteworthy in that there are large differences in the net growth rates across four-digit industries. However, these are dwarfed by the pace of reallocation within the individual four-digit industries.

Given the very large rates of establishment entry and exit, it is of interest to know how much of the entry and exit of establishments reflects entry and exit of *firms* as opposed to entry and exit of *establishments* for continuing firms.[8] Thus table 2 also shows the share of total creation from new establishments due to new firms and the share of total destruction from exiting establishments due to exiting firms. The share of job creation due to establishment entry from new firms is greater than half, but establishment entry from continuing firms is clearly an important contributing factor. On the exit side, exiting firms account for three-quarters of the job destruction from exiting establishments, but again exiting establishments of continuing firms play a nontrivial role. We can quantify the overall contribution of reallocation across establishments within firms by decomposing excess reallocation into within-firm and between-firm components. For this purpose, we consider not only the reallocation due to entry and exit but also reallocation among continuing establishments. The last row of table 2 shows that roughly 20% of excess reallocation is due to the reallocation of employment across establishments within firms.[9]

[7] This methodology defines establishment-level growth rates as the change divided by the average of the base- and end-year values. 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 establishments.

[8] Jarmin, Klimek, and Miranda (2004) focus on *firm* entry and exit in retail trade and find that the entry and exit rates of firms are substantially larger in retail trade than in manufacturing. However, they include firm diversification in their definition of entry, and so their results are not directly comparable to ours.

[9] We use the same form of the decomposition used to decompose excess reallocation into within- and between-industry components. That is, we measure within-firm excess reallocation for each firm as the sum of within-firm creation and destruction less the absolute value of the net growth rate of the firm. We aggregate this across firms with appropriate employment or output weights. We measure the between-firm component as the sum of the deviations of each firm's absolute net growth rate and the overall absolute net growth rate. See Davis et al. (1996) for further details of this methodology. Doms, Jarmin, and Klimek (2004) decompose employment changes into those accounted for by continuing firms and by net entry of firms. Because they decompose net employment and use a different definition of firm, their results are not directly comparable with

TABLE 2.—GROSS REALLOCATION OF OUTPUT AND INPUTS FOR 1987–1997

Measure	Employment	Real Output
Gross reallocation rates:		
Expansion rate	69.2	71.5
Contraction rate	54.6	45.5
Net flows	14.6	26.0
Excess reallocation	109.2	91.0
Shares of reallocations:		
Expansion due to entrants	0.84	0.80
From entering firms	0.60	0.55
Contraction due to exits	0.82	0.79
From exiting firms	0.75	0.75
Fraction of excess reallocation:		
Within industry	0.96	0.98
Within firm	0.18	0.20

TABLE 3.—DECOMPOSITION OF LABOR PRODUCTIVITY GROWTH FOR 1987–1997

Measure	
Labor Productivity Growth:	
Productivity growth (%)	11.43
Shares of productivity growth:	
Within share	0.16
Between share	0.24
Cross share	−0.39
Net entry share	0.98
Entrants' share	0.54
From continuing firms	0.37
From entering firms	0.17
Exiters' share	0.45
From continuing firms	0.03
From exiting firms	0.42

IV. Productivity Decompositions

The large differences in productivity across businesses in the same sector and the large within-sector reallocation rates motivate our analysis of the connection between the reallocation dynamics and aggregate productivity dynamics. To quantify the importance of such reallocation to productivity dynamics, we begin with a simple accounting decomposition of productivity dynamics in each four-digit industry. Our decomposition of the change in industry labor productivity (LP_{it}) allows us to consider the roles of changing shares of economic activity at the plant level (s_{et}) versus changing productivity at the establishment level (LP_{et}). Specifically, our decomposition is the following:[10]

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

where C denotes continuing establishments, N denotes entering establishments, and X denotes exiting establishments. The first term in this decomposition represents a within-establishment component based on establishment-level changes, weighted by initial shares in the industry. The second term represents a between-establishment component that reflects changing shares, weighted by the deviation of initial establishment productivity from the initial industry index. The third term represents a cross term 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 establishments, respectively.

If industry-level productivity growth is primarily driven by productivity improvements shared by most or all establishments (or even more generally by the average establishment), then the within effect should dominate. Alternatively, if new business methods (including capital deepening) that lead to productivity improvements can only be adopted by new establishments, then the net entry terms should dominate. Continuing establishments may contribute positively to industry productivity growth through reallocation if implementation of new business methods involves experimentation and associated adjustment and economic activity is then reallocated to establishments that successfully adopted new business methods.

We apply the decomposition in equation (1) at the four-digit level. For this purpose, we use the labor input (total hours) share weights. We report the results for the average industry and/or control for four-digit industry effects. Following Baily et al. (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 of the labor productivity growth decomposition are shown in table 3. Reallocation effects account for the majority of changes in labor productivity growth. The within-establishment contribution is less than 20% for the ten-year change. In considering the role of reallocation effects, though the between-establishment contribution is positive and significant, the contribution of net entry is enormous, accounting for virtually all of the overall change. The large positive contribution of the net entry term is due about equally to contributions from entry and exit. Interestingly, the positive contribution of entry is mostly coming from entering establishments of continuing firms. In contrast, the large contribution of exit is mostly coming from exiting establishments of exiting firms.

The sign of the cross term reflects a negative covariance between labor productivity and employment changes. The

ours. In their paper they explore the role of information technology investment on the growth and productivity dynamics of firms.

[10] A growing literature explores alternative forms of this decomposition; see Foster et al. (2001) for a survey and for further discussion. Although subtle and important measurement issues are associated with the alternative decompositions, for this application we have found that the dominance of net entry is a pervasive finding across all such decompositions.

offsetting nature of the between and cross terms 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 decreasing within-establishment returns. The negative cross term is also consistent with the view that downsizing has been productivity-enhancing over this period for continuing establishments. In sum, the average establishment exhibited modest productivity growth over the period, reallocation played a dominant role primarily due to net entry (and also because economic activity was reallocated toward more productive establishments), and establishments that downsized tended to exhibit increases in productivity.

V. The Anatomy of Net Entry Effects

The results reported in section IV make clear that entry and exit dynamics dominate productivity growth for the retail trade sector. We provide a richer picture of the role of net entry by exploring two of its key features. First, we explore the role of single-unit establishments versus large national chains in the observed contribution of net entry. Second, because the decompositions measure the net entry effect over a multiyear horizon, the contribution of net entry potentially reflects both selection and post-entry learning effects. By selection effects, we mean the gap between the productivity of an exiting establishment and an entering establishment right after it enters. By post-entry learning effects, we mean the growth in productivity at a more rapid rate for recent entrants than for more mature incumbents.

A. National Chains versus Single Units

To begin, we consider a simple regression analog of table 3 to quantify the net entry effects in a regression context. That is, we consider a simple regression of (the log of) labor productivity on a set of dummies indicating whether the establishment exited between 1987 and 1997 (*YRDEA87*) or entered between 1987 and 1997 (*YRBIR97*), a year effect to control for average differences in productivity across the two years (*YR97*), and four-digit industry dummies (not reported) using the pooled data.[11] The omitted group is 1987 continuing establishments, so care must be taken to interpret the coefficients accordingly.[12] The specification is given by

[11] 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 analogs of earlier tables.

[12] In particular, care must be taken when interpreting the coefficient on the entry dummy. This coefficient shows how entering establishments compare to incumbents, *abstracting* from the overall productivity growth from 1987 to 1997. In order to compare entrants in 1997 with the incumbents in 1987, one must also consider the year effects, because entering plants in 1997 are also part of the average growth effect being captured by the year dummy.

TABLE 4.—NET ENTRY REGRESSION RESULTS FOR 1987–1997

Variable		
Base Model		
Exiting establishments (β)	−0.228	*0.001*
Entering establishments (δ)	−0.001	*0.001*
End year (υ)	0.011	*0.009*
Model with Interactions with Chain Type:		
Continuing establishments in base year (α):		
Local (α^L)	0.109	*0.002*
Regional (α^R)	0.183	*0.002*
National (α^N)	0.241	*0.002*
Continuing establishments in end year (λ):		
Local (λ^L)	−0.015	*0.003*
Regional (λ^R)	−0.036	*0.003*
National (λ^N)	−0.015	*0.002*
Exiting establishments (β):		
Single (β^S)	−0.209	*0.001*
Local (β^L)	−0.077	*0.002*
Regional (β^R)	−0.009	*0.003*
National (β^N)	0.019	*0.002*
Entering establishments (δ):		
Single (δ^S)	−0.041	*0.001*
Local (δ^L)	0.087	*0.002*
Regional (δ^R)	0.193	*0.002*
National (δ^N)	0.247	*0.002*
End year (υ)	0.021	*0.001*

All specifications control for four-digit industry dummies. Standard errors in italics. Coefficients in the top panel represent productivity differences with continuing establishments in 1987. Coefficients in the bottom panel represent productivity differences with single-unit continuing establishments in 1987.

$$P_{et} = \psi + \beta \cdot YRDEA87_{et} + \delta \cdot YRBIR97_{et} + \phi_i \sum_{i=1}^{63} Industry_{iet} + \upsilon \cdot YR97_{et} + \epsilon_{et}. \quad (2)$$

The results of this regression, shown in the top panel of table 4, show that exiting establishments have significantly lower productivity than continuing establishments ($\beta < 0$); entering establishments in 1997 have lower labor productivity than continuing establishments in 1997 ($\delta < 0$) but higher labor productivity than continuing establishments in 1987 ($\delta + \upsilon > 0$); and establishments in 1997 have significantly higher productivity than establishments in 1987 ($\upsilon > 0$). The *F*-test (unreported) on the difference between entering and exiting establishments is highly significant.

To explore the role of national chains versus single-unit establishments, we interact the right-side variables in equation (2) with a dummy variable that measures whether the parent firm is a single unit or a multiunit firm that operates locally (one state), regionally (two to five states), or nationally (more than five states), as well as an indicator of whether the establishment is a continuing establishment or not.[13] The specification of the modified empirical model is given by

[13] The distribution of the number of establishments (revenue shares) across the various chain types is follows: singles 64% (41%), locals 12% (14%), regionals 5% (9%), and nationals 19% (35%).

$$P_{et} = \psi + \alpha \cdot CONT_e \cdot CHAIN_e + \lambda \cdot CONT_e \cdot CHAIN_e \cdot YR97_{et} + \beta \cdot YRDEA87_{et} \cdot CHAIN_e + \delta \cdot YRBIR97_{et} \cdot CHAIN_e + \upsilon \cdot YR97_{et} + \phi_i \sum_{i=1}^{63} Industry_{iet} + \epsilon_{et}, \quad (3)$$

where *CHAIN* is the dummy variable for single-unit, local, regional, and national chains, and *CONT* is a dummy variable for continuing plants. The lower panel of table 4 shows the results for this specification. The coefficients reported are the difference in productivity relative to single-unit continuing establishments in 1987 (controlling for industry effects). Again, care must be taken when interpreting the coefficients from this regression.

For continuing establishments, multiunits have a large productivity advantage over single units ($\alpha^{L,R,N} > 0$), and this is especially true for establishments belonging to a national chain. The year effects ($\upsilon + \lambda$) are small for all groups, indicating that the typical continuing retail establishment had on average modest changes; these year effects are slightly positive for continuing single units, local multiunits, and national-chain multiunits, and are slightly negative for regional multiunits. Among exiting establishments, the least productive are the single units and the most productive are those affiliated with a national chain. Among entering establishments, the establishments associated with a national chain have a very large productivity advantage relative to single unit incumbents. Entering establishments associated with increasingly larger scope firms, have increasing productivity advantages ($\delta^S < \delta^L < \delta^R < \delta^N$).

Comparing the single-unit with the national-chain effects indicates that the productivity gain from the displacement of a single-unit establishment by a national-chain establishment in the same industry yields enormous productivity gains over this period (the gap is over 45 log points even after controlling for year effects: compare β^S and δ^N). This finding implies that the displacement of single-unit establishments by national-chain establishments is associated with large productivity gains in the retail trade industry. It is also interesting to compare continuers and entrants for national-chain establishments. Continuing national-chain establishments in 1997 have lower productivity (by approximately 2 log points) than entering national-chain establishments in 1997 (compare $\alpha^N + \lambda^N$ and δ^N). The finding that *entering* national-chain establishments have productivity that is higher than *continuing* national-chain establishments raises questions about how national chains obtain productivity growth over time. We turn to the question of disentangling these effects further in the next section.

B. Post-entry Learning Effects versus Selection Effects

We next examine the dynamics of entering cohorts to distinguish between selection effects and post-entry learning effects. To accomplish this, we take advantage of the fact that we also observe all establishments in 1992. This allows us to examine productivity dynamics over the 1992–1997 period for the 1987–1992 entering cohort and to distinguish between exiters and survivors.[14] We classify establishments as those that enter between 1987 and 1992 but do not survive to 1997 (*ENTDEA*), those that enter between 1987 and 1992 and survive (*SURV92* and *SURV97*), and all other deaths (*OTHDEA*), which in this case reflects deaths of more mature establishments. To begin this part of the investigation, we initially suppress *CHAIN* effects, so the specification is given by

$$P_{et} = \psi + \alpha \cdot ENTDEA_{et} + \gamma \cdot OTHDEA_{et} + \delta \cdot YRBIR97_{et} + \theta \cdot SURV92_{et} + \lambda \cdot SURV97_{et} + \phi_i \sum_{i=1}^{63} Industry_{iet} + \upsilon \cdot YR97_{et} + \epsilon_{et}. \quad (4)$$

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

The top panel of table 5 shows the results for this regression. Establishments that entered between 1987 and 1992 and then exited are significantly less productive in 1992 than continuing incumbents in 1992 (that are not from that entering cohort, that is, $\alpha < 0$). Of exiting establishments, those that entered between 1987 and 1992 are less productive in 1992 than other exiting establishments ($\alpha < \gamma$) (*F*-test is highly significant). The exiting establishments from this entering cohort are also less productive in 1992 than the surviving members of this cohort ($\alpha < \theta$) (*F*-test is highly significant). These findings are consistent with selection effects that operate for both mature establishments and recent entrants. The especially low productivity of exiting establishments that are recent entrants suggests selection effects are particularly relevant for young establishments.

The surviving members of the entering 1987–1992 cohort are more productive than incumbents even upon entry ($\theta >$

[14] The shorter time period might possibly affect the patterns of the results. However, in results reported in the longer working-paper version of this paper, we have estimated equation (2) for the shorter time period and obtain the same patterns.

TABLE 5.—SELECTION AND LEARNING EFFECTS: REGRESSION RESULTS

Specification	Exit Dummy in 1992 for Entering Cohort (α)	Exit Dummy in 1992 for Other Exiting Estabs. (γ)	Survival Dummy in 1992 for Entering Cohort (θ)	Survival Dummy in 1997 for Entering Cohort (λ)
Selection effects	−0.324	−0.274	0.029	0.049
	0.002	*0.001*	*0.001*	*0.001*
Chain type:				
Single	−0.316	−0.262	0.028	0.012
	0.002	*0.002*	*0.002*	*0.002*
Local	−0.113	−0.140	0.015	0.015
	0.004	*0.003*	*0.003*	*0.003*
Regional	−0.202	−0.045	−0.024	0.084
	0.006	*0.004*	*0.004*	*0.004*
National	−0.018	−0.046	0.036	0.080
	0.004	*0.003*	*0.002*	*0.002*

All specifications have four-digit industry and year effects. Chain type has the same additional controls as in table 4. Standard errors in italics.

0). Moreover, for the entering cohort, we observe significant increases in productivity over the five years ($\theta < \lambda$) (*F*-test is highly significant), even though we control for overall year effects. This pattern implies the surviving entering cohort exhibits more rapid productivity growth than more mature surviving incumbents over this same period. That is, these results are consistent with post-entry learning-by-doing effects playing a nontrivial and statistically significant role.

We further decompose these selection and learning-by-doing effects by considering the type of parent firm. The results are shown in the lower panel of table 5. In selection effects, it is the low productivity of exiting single unit establishments, both recent entrants and more mature establishments, that dominates. We find positive and statistically significant post-entry learning effects for regional and national multiunit firms ($\theta < \lambda$), but do not find post-entry learning effects for local multiunit firms ($\theta = \lambda$). On the other hand, single units exhibit evidence of modest negative post-entry learning effects ($\theta > \lambda$).

VI. Results for Selected Industries[15]

In all of the results presented thus far, we have controlled for industry effects but have not explored the variation in the productivity and reallocation dynamics across industries. In this section, we explore the results for four selected industries: department stores, miscellaneous general merchandise stores (hereafter *general stores*), catalog and mail-order houses (hereafter *catalog houses*) and restaurants. We selected the first three industries because they exhibited especially robust productivity growth over this period and because anecdotal and descriptive evidence suggests that they experienced substantial structural change over this period. We selected the restaurant industry because it is one of the few industries for which we can construct an establishment-level price measure [see Foster, Haltiwanger, and Krizan (2006) for details of measurement]. With that in hand, we can measure labor productivity using an establishment-level price index and thus examine the patterns of productivity and reallocation dynamics using a measure of physical labor productivity.

Department stores has approximately 11,000 establishments from 300 firms generating 200 billion dollars in sales on average over the census years in this study. This industry has shifted toward larger mass merchandise stores over this period, which often means the increased use of self-service operations (Sieling et al., 2001). *General stores* includes warehouse clubs, catalog showrooms, and similar discount houses. There are approximately 12,000 establishments from 5,000 firms in this industry, generating 50 billion dollars in sales on average over the years in our study. 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 because they offer low prices on a wide range of goods, and management of inventories is especially critical for them. In fact, Sieling et al. (2001) attribute much of the productivity growth in general stores to advances in computer technologies. Dumas (1997) notes that warehouse clubs in particular exhibited rapid growth and changes in size, merchandise mix, and services provided. The *catalog house* industry has an average of approximately 8,000 establishments that form approximately 7,000 firms generating 40 billion dollars in sales over the study period. This industry is of particular interest in that new e-commerce retail businesses were classified in this industry during this period and the IT revolution may have substantially changed its business practices via changes in telecommunications and computer technologies. One study finds that 95% of all catalog companies also sold on the Internet (see Sieling et al., 2001).

[15] The results by industry in this section are an abbreviated version of the more complete results by industry that are reported in the longer working-paper version of this paper (Foster, Haltiwanger, & Krizan, 2006). The main point of this section is that the basic patterns we have reported for the average industry largely hold when examining specific industries, but not surprisingly the quantitative implications vary considerably across industries. When we consider the additional empirical exercises in prior sections (such as the role of national chains), we find our results are robust in this same fashion. For example, the productivity gap between exiting single-unit establishments and entering national-chain establishments in general stores is almost 115 log points.

TABLE 6.—NET ENTRY REGRESSIONS FOR SELECTED INDUSTRIES

Industry	Exit Dummy in Beginning Year (β)	Entry Dummy in Ending Year (δ)	Ending Year (υ)
Department stores	−0.198	−0.015	0.141
	0.007	*0.006*	*0.005*
General stores	−0.527	0.236	−0.209
	0.015	*0.015*	*0.016*
Catalog houses	−0.025	0.093	0.325
	0.020	*0.020*	*0.022*
Restaurants:			
Revenue labor productivity	−0.177	−0.034	−0.043
	0.004	*0.004*	*0.004*
Physical labor productivity	−0.197	−0.072	−0.038
	0.006	*0.005*	*0.006*

Standard errors in italics.

Restaurants are establishments primarily engaged in serving prepared food and beverages in which waiters take orders from seated customers. Approximately 191,000 restaurants accounted for over 100 billion dollars in sales produced by over 3 million paid employees in 1997, according to the CRT. Labor productivity for eating places declined 0.4% annually on average over 1990–1995, and then increased 0.7% anually over 1995–1999, as measured by the BLS. Sieling et al. (2001) attribute part of the increase in labor productivity in the latter part of the decade to the "growing use of [point of sale] terminals and small computer systems—especially in table service restaurants—which speed up service and reduce labor requirements" (p. 9). In the exercises below, we use the roughly one-third of the restaurants in the CRT that have price data. In unreported exercises, we find that though these restaurants are slightly different from the full sample of restaurants (for example, they tend to be larger), the results of our exercises are qualitatively the same where comparisons are possible.

The results from the basic net entry regressions [equation (2)] for these selected industries are shown in table 6. For *department stores,* incumbents exhibited substantial within-establishment productivity growth, exiting establishments are much less productive than incumbents, and entering establishments are slightly less productive than incumbents. For *general stores,* incumbents exhibited substantial negative productivity growth, entering establishments are much more productive than incumbents, and exiting establishments are much less productive than incumbents. The productivity gap between entering and exiting establishments for general stores is enormous, almost 80 log points. For *catalog houses,* incumbents exhibited very robust within-establishment productivity growth, entering establishments are more productive than incumbents, and exiting establishments are slightly less productive than incumbents. For *restaurants,* whether or not we use revenue-based productivity (with an industry-level price deflator) or physical productivity, we find that the gap between entering and exiting establishments is approximately 12 to 14 log points. For restaurants, the negative year effect shows that incumbents exhibited negative productivity growth over this period, but the net entry effect apparently was a positive offsetting effect.

In short, in comparing the results across these industries, a robust finding is that the productivity gap between entering and exiting establishments is large and statistically significant. However, in some industries the gap is driven more by entering establishments being much more productive than incumbents, whereas in others it is driven more by exiting establishments having especially low productivity. In addition, across industries there is substantial variation in the pace of productivity growth of incumbents and also substantial quantitative variation in the productivity gap between entering and exiting establishments. We also find preliminary evidence (for restaurants) that the substantial contribution of net entry to productivity growth is robust to controlling for establishment-level prices.

VII. Capital Intensity and Capital Mix

A limitation of our results is that we cannot separate the movements in labor productivity into changes in capital intensity, labor quality, or multifactor productivity because of data constraints imposed by relying on the CRT. As noted in section II, the CRT does not include questions about capital or other inputs other than labor. There are, however, periodic surveys of businesses in retail trade conducted by Census that ask about capital stocks and expenditures and that can be integrated into the CRT. Though these surveys are not sufficiently rich in scope and coverage to be integrated into the analysis of entry and exit dynamics above, we have integrated the data from one of the surveys conducted in 1992 to look briefly at patterns of capital intensity and mix.

The Business Expenditure Survey, conducted in 1992, collects information on the book value of capital as well as capital equipment expenditures in total and by categories, such as computers. Using these data, we construct two capital measures for a sample of establishments: capital intensity, measured as the dollar value of capital per worker, and computer investment intensity, measured as the share of total equipment investment expenditures accounted for by computers. The book value of capital is adjusted to a real capital stock using a two-digit capital stock deflator using the approach used in Abowd et al. (2005). In as much as it is only a sample, we construct weights to make the results nationally representative and comparable to the analysis in the prior sections [following the methodology in Abowd et al. (2005)]

Table 7 presents the results of some simple tabulations showing the variation in capital per worker and computer investment intensity, by quintiles of the labor productivity distribution and by chain-type status. We find that establishments in the top quintiles of productivity have higher capital per worker and computer investment intensity than establishments in the lowest quintiles. We also find that single-unit establishments are much less capital-intensive than

TABLE 7.—CAPITAL INTENSITY AND COMPUTER INVESTMENT INTENSITY

	Capital Per Worker ($ per worker)	Computer Investment Intensity (Shares)
Quintiles of productivity distribution:		
Bottom	16,603	0.090
Second	17,354	0.092
Third	20,621	0.121
Fourth	24,349	0.106
Top	25,489	0.181
Chain type:		
Single	16,216	0.355
Local	22,082	0.256
Regional	24,969	0.112
National	24,384	0.094

establishments from large national chains, but their computer investment intensity is actually higher than that of national chains.

These simple cross-sectional tabulations should be viewed as only suggestive, but they provide prima facie evidence that some of the variation in labor productivity in general and variation across single units and national chains is associated with differences in capital intensity and capital mix. These findings, in view of the large differences in labor productivity and the interaction of those differences with net entry and with single units versus national chains, suggest that our understanding of labor productivity dynamics in retail trade would be significantly enhanced by surveys of capital for retail trade businesses that permitted tracking the behavior of entering and exiting establishments.

VIII. Concluding Remarks

The evidence that we have presented in this paper suggests that aggregate productivity dynamics in retail trade are driven by the reallocation of inputs and outputs from less productive to more productive establishments. Specifically, our main findings can be summarized as follows. Retail trade businesses exhibit continuous large-scale reallocation of output and labor across establishments within the same narrowly defined industries. Much of the reallocation is accounted for by entry and exit of establishments, but a substantial fraction of the between-establishment reallocation is due to within-*firm* reallocation. Retail trade businesses in the same four-digit industry exhibit large productivity differences, and for continuing businesses these differences are highly persistent. New establishments enter at roughly equal rates across the distribution of labor productivity, but exiting establishments are disproportionately from the lowest percentiles of the labor productivity distribution.

When we decompose industry-level productivity growth into reallocation and within-establishment effects, we find that net entry accounts for virtually all of the labor productivity growth in retail trade. Exiting establishments are substantially less productive than incumbents (by approximately 25%), and entering establishments exhibit about the same productivity as incumbents at the point of entry. Further investigation from tracking cohorts of entrants shows that these entry and exit dynamics are closely linked. For any new cohort, many of the new establishments fail, and those that fail are substantially less productive than incumbents. For successful entrants, we find that they exhibit more rapid productivity growth in the first five years after entry than incumbents over that same period, suggesting learning by doing. We refine these findings by examining the ownership structure of the entering and exiting establishments. We find a very large gap between the productivity of entering establishments of national chains and the productivity of exiting single-unit establishments. Much of the contribution of net entry to overall productivity growth is associated with the displacement of single-unit establishments by the entry of highly productive establishments from national chains.

Comparing our results with analogous results for U.S. manufacturing yields a number of qualitative similarities but some stark quantitative differences.[16] U.S. retail trade establishments are much smaller and much more volatile than U.S. manufacturing establishments, having reallocation rates of outputs and inputs that are roughly 50% higher. Moreover, entry and exit of establishments plays a much larger role in retail trade. Within-sector productivity dispersion across establishments is greater in manufacturing than retail; for example, the interquartile range of log labor productivity in manufacturing is approximately 85 log points, compared to 57 log points for retail trade. This pattern of lower reallocation and greater dispersion in manufacturing makes sense, given the presumably higher adjustment costs in manufacturing (for example, higher barriers to entry given minimum efficient scale). However, we also find that the productivity gap between entering and exiting establishments is larger in retail trade than in manufacturing (in retail trade the gap is approximately 23 log points, whereas in manufacturing the gap is approximately 8 log points). Putting these pieces together, over a ten-year horizon, net entry accounts for approximately 30% of industry-level productivity growth for the average manufacturing industry but approximately 100% of industry-level productivity growth for the average retail trade industry. In short, reallocation dynamics are an important part of the story of productivity growth in U.S. manufacturing, and in retail trade they are the whole story over the 1990s.

REFERENCES

Abowd, John, John Haltiwanger, Julia Lane, Kevin McKinney, and Kristin Sandusky, "Technology and Skill: An Analysis of within and between Firm Differences," Cornell University mimeograph (2005).

Aghion, Philippe and Peter Howitt, "Growth and Unemployment," *Review of Economic Studies* 61:3 (1994), 477–494.

[16] These comparisons use the results for U.S. manufacturing in Foster et al. (2001).

Aw, Bee Yan, Xiaomin Chen, and Mark Roberts, "Firm-Level Evidence on Productivity Differentials and Turnover in Taiwanese Manufacturing," *Journal of Development Economics* 66 (2001), 51–86.

Baily, Martin Neil, Charles Hulten, and David Campbell, "Productivity Dynamics in Manufacturing Establishments" (pp. 187–249), in M. Baily and C. Winston (Eds.), *Brookings Papers on Economic Activity: Microeconomics* (Washington: Brooking's Institution, 1992).

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

Bartelsman, Eric J., and Phoebus J. Dhrymes, "Productivity Dynamics: U.S. Manufacturing Establishments, 1972–86," *Journal of Productivity, Analysis* 9:1 (1998), 5–34.

Bartelsman, Eric J., Stefano Scarpetta, and Fabiano Schivardi, "Comparative Analysis of Firm Demographics and Survival: Micro-Level Evidence for the OECD Countries," OECD Economics Department working paper no. 348 (2003).

Basker, Emek, "Job Creation or Destruction?: Labor-Market Effects of Wal-Mart Expansion," this REVIEW, 87:1 (2005), 174–183.

Bureau of the Census, *1987 Census of Retail Trade, Subject Series, Establishment and Firm Size* (Washington: U.S. Government Printing Office, 1990).

Bureau of the Census, *1992 Census of Retail Trade, Subject Series, Establishment and Firm Size* (Washington: U.S. Government Printing Office, 1995).

Caballero, Ricardo, and Mohamad Hammour, "The Cleansing Effect of Recessions," *American Economic Review* 84:5 (1994), 1350–1368.

Campbell, Jeffrey, and Beverly Lapham, "Real Exchange Rate Fluctuations and the Dynamics of Retail Trade Industries on the U.S.–Canada Border," *American Economic Review* 94:4 (2004), 1194–1206.

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

Disney, Richard, Jonathan Haskel, and Yvla Heden, "Restructuring and Productivity Growth in U.K. Manufacturing," *Economic Journal* 113:489 (2003), 666–694.

Doms, Mark, Ron Jarmin, and Shawn Klimek, "Information Technology Investment and Firm Performance in U.S. Retail Trade," *Economics of Innovation and New Technology* 13:7 (2004), 595–614.

Dumas, Mark W., "Productivity Trends in Two Retail Trade Industries, 1987–95," *Monthly Labor Review* 120:7 (1997), 35–39.

Dwyer, Douglas, "Are Fixed Effects Fixed?" C.V. Starr Center for Applied Economics, New York University, working paper (1997).

Dwyer, Douglas, "Technology Locks, Creative Destruction, and Nonconvergence in Productivity Levels," *Review of Economic Dynamics* 1:2 (1998), 430–473.

Eslava, Marcela, John Haltiwanger, Adriana Kugler, and Maurice Kugler, "The Effect of Structural Reforms on Productivity and Profitability Enhancing Reallocation: Evidence from Colombia," *Journal of Development Economics* 75:2 (2004), 333–371.

Foster, Lucia, Haltiwanger, John, and C. J. Krizan, "Aggregate Productivity Growth: Lessons from Microeconomic Evidence," in Edward Dean, Michael Harper, and Charles Hulten (Eds.), *New Developments in Productivity Analysis* (Chicago: University of Chicago Press, 2001).

Foster, Lucia, John Haltiwanger, and C. J. Krizan, "Market Selection, Reallocation, and Restructuring in the U.S. Retail Trade Sector in the 1990s," Center for Economic Studies working paper (2006).

Foster, Lucia, Haltiwanger, John, and Chad Syverson, "Reallocation, Firm Turnover, and Efficiency: Selection on Productivity or Profitability?" NBER working paper no. 11555 (2005).

Griliches, Zvi, and Haim Regev, "Productivity and Firm Turnover in Israeli Industry: 1979–1988, "*Journal of Econometrics* 65:1 (1995), 175–203.

Haskel, Jonathan, and Naveed Khawaja, "Productivity in UK Retailing: Evidence from Micro Data," CeRiBA draft paper (2003).

Jarmin, Ron S., Shawn Klimek, and Javier Miranda, "Firm Entry and Exit in the U.S. Retail Sector, 1977–1997," Center for Economic Studies working paper no. 04-17 (2004).

Katayama, Hajime, Shihua Lu, and James Tybout, "Why Plant-Level Productivity Studies Are Often Misleading, and an Alternative Approach to Inference," NBER working paper no. 9617 (2003).

Levinsohn, James, and Amil Petrin, "When Industries Become More Productive, Do Firms?: Investigating Productivity Dynamics," NBER working paper no. 6893 (1999).

Levinsohn, Jim, and Wendy Petropoulos, "Creative Destruction or Just Plain Destruction?: The U.S. Textile and Apparel Industries Since 1972," NBER working paper no. 8348 (2001).

Liu, Lili, and James R. Tybout, "Productivity Growth in Chile and Columbia: The Role of Entry, Exit and Learning" (pp. 73–103), in Mark Roberts and James R. Tybout (Eds.), *Industrial Evolution in Developing Countries: Micro Patterns of Turnover, Productivity and Market Structure* (New York: Oxford University Press for the World Bank, 1996).

McKinsey Global Institute, *U.S. Productivity Growth 1995–2000* (Washington, DC: McKinsey Global Institute, 2001).

Melitz, Mark, "Estimating Firm-Level Productivity in Differentiated Product Industries," Harvard University mimeograph (2000).

Nakamura, Leonard, "The Measurement of Retail Output and the Retail Revolution," Federal Reserve Bank of Philadelphia working paper no. 98–5 (1998).

Olley, G. Steven, and Ariel Pakes, "The Dynamics of Productivity in the Telecommunications Equipment Industry," *Econometrica* 64:6 (1996), 1263–1297.

Roberts, Mark, and James Tybout, "Producer Turnover and Productivity Growth in Developing Countries," *World Bank Research Observer* 12:1 (1997), 1–18.

Sieling, Mark, Brian Friedman, and Mark Dumas, "Labor Productivity in the Retail Trade Industry, 1987–99," *Monthly Labor Review* 124:12 (2001), 3–14.

Syverson, Chad, "Product Substitutability and Productivity Dispersion," this REVIEW, 86:2 (2004), 534–550.

Tybout, James R., "Heterogeneity and Productivity Growth: Assessing the Evidence" (pp. 43–72), in Mark Roberts and James R. Tybout (Eds.), *Industrial Evolution in Developing Countries: Micro Patterns of Turnover, Productivity, and Market Structure* (New York: Oxford University Press for the World Bank, 1996).