Creative destruction in local markets

Jaap H. Abbring and Jeffrey R. Campbell

Introduction and summary

Competition from entrepreneurs with innovative business strategies continually forces established firms to either keep up with their younger counterparts or exit. Many firms fail to adapt to new competitive conditions. The consequent failure of unprofitable firms and their replacement by new firms is a familiar aspect of competition. Because a firm's failure frees the labor and capital it employed for use at a more profitable entrant, this process may be described as *creative destruction*. Although there are costs associated with creative destruction, such as the lost labor of temporarily unemployed workers, it benefits an economy in the long run by moving productive resources into more profitable uses.

If there are no potential rivals to challenge a few dominant producers, then creative destruction must halt. Indeed, recent history provides many prominent examples of large firms that dominate their markets without substantial fear of new competition. Such market dominance can arise by default from the absence of potential competitors or from established firms' efforts to discourage entry. Dominant firms might discourage the entry of new rivals by building excess capacity to commit to fierce price competition or by introducing otherwise unprofitable brands to fill product niches. If dominant firms routinely deter entry, then the economy loses the benefits of creative destruction.

Although firms with market power might have the potential to reduce creative destruction, there is little systematic evidence that they do so. In this article, we examine empirically whether market power is associated with reduced creative destruction, using sales data from Texas bars' and restaurants' alcohol tax returns. Bars and restaurants differ greatly from well-known dominant firms in other sectors of the economy, but they may dominate their relatively small geographic and product niche. Although there are many restaurants in Houston, the market for a particular variety of food and drink in a particular neighborhood may be small. An advantage of examining creative destruction among bars and restaurants is that there are many geographically segmented markets in our sample. Thus, we can move past the compilation of anecdotes about a small number of very large firms and establish a statistical regularity about a large number of smaller firms.

We group producers into market areas on the basis of their locations. These market definitions are undoubtedly too broad, because they do not incorporate any information about the variety and substitutability of producers' products. Hence, we consider the market areas in our analysis to be aggregates of markets that are smaller but more economically meaningful. For example, there might be separate markets for Chinese, French, and Italian restaurants in the river-walk area of San Antonio. We measure market power using the sum of firms' squared market shares, the Herfindahl-Hirschman Index of sales concentration (HHI). This has a desirable aggregation property—if all economically meaningful markets within a market area have the same sales, then the market area's HHI equals the markets' average HHI divided by the number of markets. Thus, although the *levels* of market areas' HHIs will not reflect the concentration of their constituent markets, a *comparison* of two market areas' HHIs can indicate which of the two has more concentrated constituent markets if they have the same number of economically meaningful markets.

Jaap H. Abbring is a fellow of the Royal Netherlands Academy of Arts and Sciences (KNAW) at Free University Amsterdam and a research fellow of the Tinbergen Institute, Amsterdam. Jeffrey R. Campbell is a senior economist at the Federal Reserve Bank of Chicago and a faculty research fellow of the National Bureau of Economic Research (NBER). *The authors are grateful to Craig Furfine and Victor Stango for their thoughtful comments. The National Science Foundation supported this research through grant SES-0137048 to the NBER.*

Our analysis uses observations from over 400 market areas. We find that more concentrated market areas, in which producers presumably exercise more market power, exhibit *more* creative destruction. That is, the hypothesis that producers use their market power to stabilize industry structure finds no support from our observations. Instead, market power apparently magnifies creative destruction. Determining whether this magnification is economically beneficial or representative of other industries awaits our future research.

In the next section, we summarize previous research related to ours. We then discuss our data source and our measures of creative destruction and concentration. Following that, we present our analysis of the relationship between these two market characteristics.

Related literature

In a market with few substantial competitors, strategic considerations can directly impact the rate of creative destruction. Many authors have demonstrated that, in theory, a monopolist may act to prevent its replacement by a potential entrant. For example, Dixit (1980) showed that an incumbent monopolist might invest in excess capacity to deter a potential entrant with a credible threat of fierce competition. In general, concentration of sales among a few firms may endow those firms with the ability to stabilize the industry structure in a way that is favorable to them. Gort's (1963) finding that firms in concentrated manufacturing industries have relatively stable market shares supports this hypothesis. The present article provides additional evidence on firms' ability to suppress creative destruction using their market power.

Our research builds upon many previous empirical studies that document the relationship between productivity and creative destruction. In the U.S. economy, the rate of creative destruction is large. Dunne, Roberts, and Samuelson (1988) report that approximately 40 percent of manufacturing plants operating in a given year cease production within five years. A similar number of new plants replace them in that time, so these shutdowns are associated with very little net loss of manufacturing capacity. Instead, the large rates of creative destruction apparently reflect the reallocation of capacity to more efficient producers of more desirable products. Using similar data from four manufacturing industries, Bartelsman and Dhrymes (1998) show that productivity growth at incumbent plants contributes very little to aggregate productivity growth. Instead, aggregate productivity growth largely reflects the replacement of incumbent plants with relatively more productive entrants. Campbell (1998) shows that drops in the plant failure rate in manufacturing precede drops in plant entry and aggregate productivity; and he builds a competitive model economy in which these patterns reflect fluctuations in the quality of the ideas embodied in new producers. These and other studies point to creative destruction as a vital source of productivity growth.

In this article, we measure creative destruction in local markets using a panel of Texas bars' and restaurants' March alcohol tax returns. We measure annual sales creation as the sum of all sales gains at establishments that entered or increased sales over the year. Similarly, sales destruction is the sum of all sales losses at establishments that exited or decreased sales. The sum of the two is sales reallocation, our measure of creative destruction. Davis, Haltiwanger, and Schuh (1996) (hereafter DHS) developed these measures of creative destruction and applied them to job flows within the U.S. manufacturing sector. They consistently find that job reallocation substantially exceeds manufacturing's net job creation. Approximately one in ten manufacturing jobs is destroyed each year, and the number of jobs created each year nearly equals this, resulting in a relatively small annual job loss for the sector as a whole.

The bars and restaurants we consider display even larger rates of annual sales creation and destruction. Our sample covers the period from 1995 through 2001. In a typical year, sales destruction accounts for between 10 percent and 15 percent of total industry sales, and sales creation equals over 20 percent of industry sales. Hence, Texas bars' and restaurants' alcohol sales grew between 6 percent and 10 percent per year, while sales reallocation always exceeded 30 percent of sales.

Our empirical analysis also follows a great deal of work examining how the structure of an industry influences the conduct of its producers and its economic performance. The studies contained in Weiss (1990) exemplify this research, which takes the configuration of firms in a market as a measure of its structure and uses this to explain variation across markets in firms' prices and profits. The HHI is a common measure of market structure in this work. However, it is difficult to say unequivocally that a high HHI indicates a lack of competition. Peltzman (1977) among others noted that a market might be highly concentrated because the most efficient firm can charge less than its rivals can for the same good. In this case, a high HHI reflects the proper operation of competition. Our finding that sales reallocation is greater in market areas with higher HHIs suggests that high concentration does not typically arise from the persistent competitive success of one or a few firms.

Bars and restaurants serve local markets. In areas with larger populations, more firms can operate and break even. Thus, we expect concentration to be high in less-populated areas.[1] The wide variation in population density across Texas is an important source of variation in market areas' measured HHIs, so this article also builds on previous work that examines the effects of changes in population on local service industries. Bresnahan and Reiss (1990) examine how the population of isolated rural towns determines the number of active automobile dealers. If incumbent monopolists can raise the cost of rivals' entry, then the lowest population that can support two firms should be more than twice the population sufficient to induce a firm to enter as a monopolist. In fact, their estimates of rivals' entry costs are very close to the entry costs of monopolists, indicating little if any entry deterrence. Campbell and Hopenhayn (2004) show that larger U.S. cities have larger retail producers, including restaurants. This is what we expect to see if competitors in large markets have little market power, because they must sell more at a smaller markup to recover their fixed costs. Our results reinforce Bresnahan and Reiss's finding of no entry deterrence, and they also suggest that larger markets' heightened competition leads to *less* creative destruction.

Texas alcohol tax returns

The state of Texas collects a 14 percent tax on the sale of alcohol for on-premises consumption. Alcohol license holders file monthly tax returns, and the Texas Alcoholic Beverage Control Board (TABC) makes information on these returns publicly available. For each bar or restaurant, this information includes the tax paid, its street address and trade name, and separate identification numbers for its alcohol license and the owner. Using the street addresses and alcohol license identification numbers, we have linked the tax returns for a given restaurant or bar together to form individual establishment histories. Following the standard definition used by the U.S. Census Bureau, we define an establishment as a physical location in which alcohol is served. Hence, if a restaurant or bar's owner sells it but the new owner continues its operation without substantial interruption, tax returns from the previous and new owners all belong to the same establishment. We refer to this data set as the TABC panel, and we explore other features of individual establishments' histories in Abbring and Campbell (2003).

Although we observe the establishments' sales each month, we focus here on annual changes in sales based on their March tax returns.[2] As we noted above, the TABC panel displays substantial creative destruction.

TABLE 1

Establishment counts in March 2000

	Survivors	Death	Total
Incumbents	4,990	444	5,434
Births	596	146	742
Total	5,586	590	6,176

Table 1 provides one perspective on the pace of creative destruction among the TABC panel's establishments. For March 2000, it reports the number of operating establishments and classifies them according to past and future operation. If the establishment paid no tax in the previous March, it is a *birth*. Otherwise, it is an *incumbent*. If the establishment pays no tax in the following March it is a *death*, and otherwise it is a *survivor*.

There were 6,176 establishments filing alcohol tax returns in March 2000. Of these, 12 percent did not pay tax in the previous March and 9.6 percent did not pay tax in the next March. The rate of death among those establishments that are births, 19.7 percent, is double the overall rate of death. This mimics many previous findings from manufacturing industries that the likelihood of business failure declines with age.

Births are new establishments that have yet to accumulate either experience or a stable clientele, so we expect them to be smaller than the average incumbent.

TABLE 2

Alcohol sales in March 2000

Incumbents		Survivors	
Median	IQR	Median	IQR
$133,618	$213,457	$136,118	$216,936

Births		Deaths	
Median	IQR	Median	IQR
$86,775	$171,914	$65,259	$117,914

Similarly, we expect deaths to be less successful and smaller than survivors. Table 2 reports the median and interquartile range (IQR) of establishments' March alcohol sales for all four groups of establishments. Exactly half of the establishments have sales at or below the median, and the IQR is defined as the length of the interval that excludes the largest and smallest 25 percent of establishments. As such, it measures the dispersion of establishments' sizes. The mean and standard deviation, which are more familiar measures of central tendency and dispersion, largely reflect the sizes of a few very large firms. By construction, the median and IQR are invariant to changes in the sizes of the largest and smallest firms.

The median incumbent is 54 percent larger than the median birth, and the median survivor is more than twice as large as the median death. Although these differences are expected, their magnitudes are large. Because deaths embody business ideas that have been tried and shown to be wanting while births are largely untested, it is not surprising that the median birth is 35 percent larger than the median death. The last notable feature of table 2 is the substantial heterogeneity in establishment size. Not all establishments are born equal. The IQR of births' sales is nearly twice the median. The IQR of deaths' sales is smaller than this but still sizable. Incumbents' IQR is substantially larger than that of births, so apparently establishment heterogeneity increases as a birth cohort ages. This could reflect firm-specific shocks to either cost or the popularity of its product variety. In either case, such shocks should substantially impact the rate of creative destruction.

Although we have focused on the year 2000, the features of tables 1 and 2 that we emphasize characterize every year of our sample. These are high birth and death rates, incumbents and survivors' large sizes relative to births and deaths, and substantial size heterogeneity that increases as a birth cohort ages.

Measuring creative destruction

Although birth and death rates provide one perspective on creative destruction, they do not capture the ongoing reallocation of production among incumbent survivors that is concomitant with increasing establishment heterogeneity. DHS suggest a simple measure of creative destruction based on decomposing the net growth of an industry into contributions by growing and shrinking firms. Although they apply their methodology to observations of establishments' employment decisions, it can be applied to the sales data we have without modification. We begin by measuring the growth rate of an industry's sales between two periods as the change in sales divided by the average sales in the two periods. If we use S_t to denote total industry sales in March of year t, then this is

$$NET_t = 2\times\frac{S_t - S_{t-1}}{S_t + S_{t-1}}.$$

Here, we follow Davis, Haltiwanger, and Schuh (1996) and refer to this as *net* sales growth. Similarly, the growth rate of an individual establishment is

$$g_{it} = 2\times\frac{s_{it} - s_{it-1}}{s_{it} + s_{it-1}}.$$

In this definition i is the index of the establishment, and s_{it} is the sales of establishment i in March of year t.

Standard growth rate measures place either of the two periods' sales in the denominator. Instead, the denominators of NET_t and g_{it} are the average of the two periods' sales. For values of S_t or s_{it} near zero, this deviation from the standard definition of a growth rate matters little. However, the standard growth rate measures handle establishment births and deaths poorly, because their denominators must equal zero in one of these two cases. In contrast, g_{it} is always well defined. If establishment i is a birth, then $s_{it-1} = 0$ and $g_{it} = 2$; and if establishment i is a death from year $t - 1$, then $s_{it} = 0$ and $g_{it} = -2$. Finally, if establishment i is an incumbent, then $-2 < g_{it} < 2$. We use NET_t to measure industry growth rates because it equals the size-weighted average of g_{it}, where size is measured with $(s_{it} + s_{it-1})/2$.

With these definitions in hand, we can decompose NET_t into the weighted sum of growth rates for all establishments that grew or entered minus the weighted sum of growth rates for all shrinking and exiting establishments.

$$NET_t = \sum_{i=1}^{N_t} w_{it}\times g_{it}\times I\{g_{it}>0\} - \sum_{i=1}^{N_t} w_{it}\times |g_{it}|\times I\{g_{it}<0\}.$$

Here, N_t is the number of establishments that produce in March of either t or $t - 1$, $w_{it} = (s_{it} + s_{it-1}) / (S_t + S_{t-1})$ is a weight proportional to the average of establishment i's size in the two years, and $I\{\bullet\}$ is an indicator function that equals one if the condition in brackets is true. The first term on the right-hand side is the weighted sum of growth rates for all establishments that grew or entered between t and $t - 1$. Following DHS, we call this the *sales creation rate* and denote it with POS_t, for "positive." Similarly, the second term on the right-hand side is minus the weighted sum of growth rates for all shrinking or exiting establishments. This is the *sales destruction rate*, and we denote it with NEG_t for "negative." With this notation, we can express NET_t as $POS_t - NEG_t$. DHS propose using the sum of the sales creation and destruction rates as a measure of reallocation. This is $SUM_t = POS_t + NEG_t$. It is the sum of the absolute values of establishments' growth rates.

If an industry's establishments are identical and remain so always, then $SUM_t = |NET_t|$ and either POS_t or NEG_t equals zero. With simultaneous birth and death and heterogeneity across establishments, SUM_t will generally exceed $|NET_t|$ and both POS_t

TABLE 3

Sales creation, destruction, growth, and reallocation rates

Year	POS	NEG	NET	SUM	POSB	NEGD	SUMBD
1995	23.3	19.4	3.9	42.7	14.3	8.9	23.2
1996	22.5	16.7	5.8	39.2	12.9	9.2	22.1
1997	17.3	17.3	0.0	34.6	10.0	6.2	16.1
1998	20.2	14.2	6.0	34.4	10.4	6.1	16.6
1999	21.4	14.6	6.8	36.0	12.1	6.9	18.9
2000	22.9	11.1	11.7	34.0	10.4	4.9	15.3
2001	22.2	11.6	10.5	33.8	10.6	5.6	16.2
Average	21.4	15.0	6.4	36.4	11.5	6.8	18.3

and NEG_t will be positive. When applying these definitions to manufacturing establishments' employment changes, DHS found that the rate of job reallocation greatly exceeded the rate of job growth's absolute value, even for narrowly defined (four-digit standard industrial classification) industries.

By definition, these measurements associate creative destruction with the expansion and contraction of individual plants. One might consider a broader definition that also includes the reallocation of sales (or jobs) within an establishment. If a shift in sales from beer to wine within a given establishment contributes to sales reallocation, then these measures miss this and underestimate creative destruction. Of course, measurement of this definition of sales reallocation is infeasible with only observations of establishments' total sales. However, previous experience measuring creative destruction suggests that adopting this more expansive definition of sales reallocation would add little to our analysis, even if it were feasible. Using Dutch employment data that matches workers to specific jobs, Hamermesh, Hassink, and van Ours (1996) find that accounting for simultaneous job creation and destruction within employers changes the standard job reallocation measure very little.

Another means of transferring resources between producers is the outright sale of entire establishments from one producer to another. When constructing establishment histories, we ignore such business transfers, so our measures of creative destruction do not reflect them. In this respect, our analysis follows DHS and others who have largely focused on reallocation between establishments rather than between firms. Our reason for doing so is simple: Many apparent business transfers reflect corporate reorganizations, such as the incorporation of a sole proprietorship, which has no practical consequences for the establishment's operation. To the extent we ignore economically significant sales reallocation between firms, our measures understate the true rate of creative destruction.

For each year of our sample excluding the first, table 3 reports the rates of sales creation, destruction, growth, and reallocation for the state of Texas as a whole. In addition, it reports the portion of sales creation due to establishment births, the portion of sales destruction accounted for by establishment deaths, and the portion of sales reallocation accounted for by both births and deaths. We denote these with $POSB_t$, $NEGD_t$, and $SUMBD_t$. For all of these statistics, the table's final row reports average values across years.

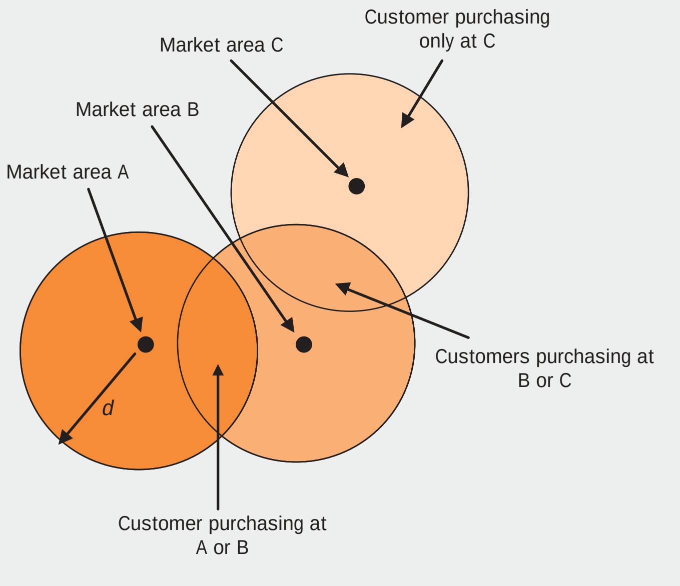
As with DHS's measures of job reallocation, the rates of sales reallocation vastly exceed the net growth rate of total industry sales. In 1997, alcohol sales contracted very slightly, while the sales creation and destruction rates both exceeded 17 percent. In the year of greatest sales growth, 2000, the sales reallocation rate equals nearly three times the rate of sales growth. In an average year, the rate of sales reallocation is 36.4 percent. This greatly exceeds the average job reallocation rate for the U.S. manufacturing sector measured by DHS, 19.4 percent.[3] A comparison of the average values of SUM_t with those of $SUMBD_t$ indicates that establishment births, establishment deaths, and the expansion and contraction of surviving incumbents all contribute substantially to sales reallocation. In an average year, births and deaths account for approximately half of sales creation and destruction. Births and deaths play a much more prominent role in creative destruction for this industry than they do in the U.S. manufacturing sector. DHS report that manufacturing establishment births account for 15.5 percent of annual job creation and manufacturing establishment deaths account for 22.9 percent of annual job destruction.[4] The expansion and contraction of surviving incumbents accounts for the remainder of job reallocation.

Measures of concentration

We now consider the measurement of concentration in the local markets of our sample. To do so, we

FIGURE 1

Competition across three market areas



must first define both "concentration" and "market," neither of which is inherently unambiguous.

We consider a market area to be a particular zip code, and we measure concentration using both producers located within that zip code and those located nearby. The HHI for a given zip code's market area is constructed using sales of all establishments within 15 miles. To measure the distance between two zip codes, we use location data from the U.S. Census.

Figure 1 illustrates this measurement for an isolated city with three market areas, labeled A, B, and C. For simplicity, suppose that all of a market area's producers are located at its central point. We suppose that consumers are willing to travel no more than $d = 7.5$ miles to consume alcohol, so the circles around each market area contain all consumers that could purchase at those areas. The circles around A and B intersect, so some consumers could purchase in either market area. The producers located in B are potential competitors to those located in A, so it is appropriate to include them in the calculation of the HHI for market area A. For the same reason, the producers in B should also be included when calculating the HHI for market area C. Establishments in B face competition from both A and C, so all three markets' producers are included when calculating the HHI for market area B.

To summarize, the *HHI* for a given zip code z in year t is

$$HHI_{zt} = \sum_{i=1}^{N} I\{d(z_i, z) \le 15\} \times \left(\frac{S_{it}}{S_{zt}}\right)^2,$$

where S_{zt} is the total sales of alcohol at all zip codes within 15 miles of z, z_i is the zip code of establishment i, and $d(z_i,z)$ is the distance between that establishment's zip code and z. If the effective radius of competition for bars and restaurants is more or less than 15 miles, then our measure of the HHI will respectively exceed or fall short of the true measure. By construction, our measure of the HHI includes all establishments that sell alcohol, but some of their relevant competitors may serve only food and soft beverages. If so, then our measure of the HHI overstates concentration.

When considering the legality of proposed mergers, the Department of Justice and the Federal Trade Commission consider a market with an HHI less than 1,000 to be "unconcentrated." We restrict our sample to market areas with average HHI (over the years of our sample) less than 1,000, because these contain the vast majority of bars and restaurants in Texas. Although our sample market areas' HHIs indicate that the markets are very competitive, we have not segmented our observations further on the basis of cuisine or quality. Hence, we believe that a market area's HHI should be interpreted as merely reflective of the HHIs of its more concentrated and economically meaningful constituent markets.

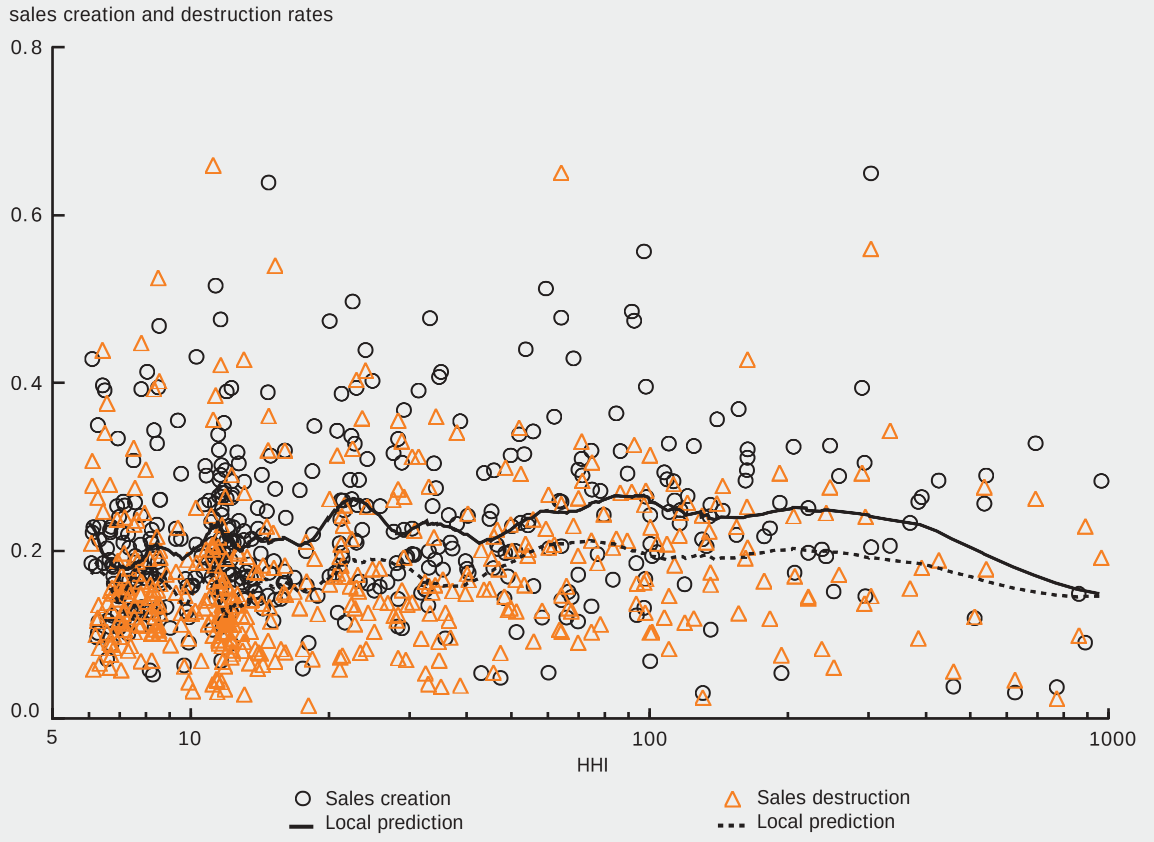
There were 444 zip codes in Texas in which alcohol was served in every year of our sample with average HHIs below 1,000. In our sample of market areas, the median HHI is extremely low, 15, and the interquartile range is 40. Hence, most of the market areas we consider display very little concentration if they are not segmented further on the basis of their product offerings.

The effects of concentration on creative destruction

With our measures of creative destruction and concentration in hand, we are now prepared to consider the relationship between them. For the 444 zip codes in our sample, we tabulated annual sales creation and destruction rates. Their tabulation includes only establishments located in that zip code. Figure 2 plots the averages of these sales creation and destruction rates over time (on the vertical axis) against the

FIGURE 2

Concentration and sales creation and destruction



logarithm of the zip code's average HHI. Each circle and triangle represent one zip code's average sales creation and destruction rates. To help visualize the relationships between these variables, the solid and dashed lines plot smoothed versions of the raw sales creation and destruction rates.[5]

Several features of the data immediately stand out in figure 2. First and foremost, there is tremendous variability of sales creation and destruction rates around their smoothed values. This is even after averaging the data over seven years, so apparently market-specific variables that we do not measure substantially impact the pace of sales reallocation. Second, the smoothed sales creation and destruction rates change with the HHI in very similar ways. The dashed plot of the smoothed sales destruction rates is approximately equal to the solid plot of the smoothed sales creation rates shifted down by 5 percentage points.

Third, sales creation and destruction vary systematically with the HHI. Increasing the HHI from 0 to approximately 100 increases the typical sales creation and destruction rates by approximately 5 percentage points. Although there are relatively few zip codes with HHIs greater than 100, it appears that increasing concentration further decreases these rates. If we measure the instability of an industry's structure with the sales reallocation rate, then the most stable industry structures are those with an HHI very close to zero.

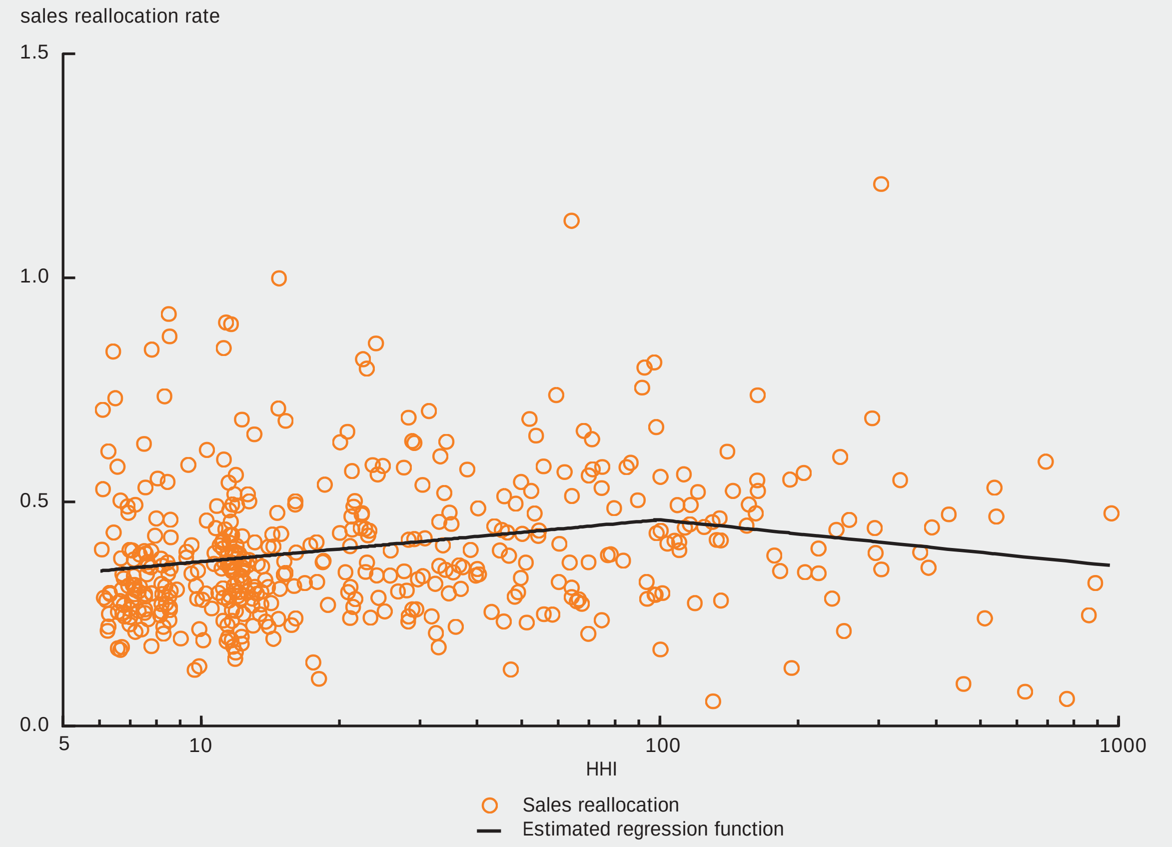
Although the smoothed sales creation and destruction rates in figure 2 are suggestive, their patterns may simply reflect remaining noise in the data. To measure the statistical significance of the relationship, we have estimated simple regression equations of the form

$$y_j = f(x_j, \beta) + u_j,$$

where y_j is the relevant sales statistic for market j, x_j is the logarithm of its HHI, u_j is an error term with an average value of zero, and $f(x_j, \beta)$ is the average value of y given x. This depends on the values of several unknown parameters, which we group together and denote with β. To estimate these parameters using the data at hand, we follow the usual least squares procedure. That is, we choose β to minimize the sum of

FIGURE 3

Sales reallocation and its estimated regression function



the squared differences between y_j and its predicted value, $f(x_j, \beta)$.

The simplest way of proceeding is to assume that $f(x,\beta) = \beta_0 + \beta_1 x$, so that the predicted values are a linear function of x. Figure 2 suggests that such a specification would be inappropriate for our data, because the effect of increasing concentration on job creation and destruction is apparently small if the HHI is already above 100. To evaluate the significance of this deviation from a linear regression line, we also estimate a regression function created by joining two lines together at an HHI of 100. The resulting specification for the regression function is

$$f(x,\beta) = \alpha + \delta_0 x + \delta_{100} I\{x > \ln 100\}(x - \ln 100).$$

The coefficient δ_0 gives the function's slope at the vertical axis and the coefficient δ_{100} gives the change in its slope as the HHI passes through 100.

Figure 3 plots the markets' average sales reallocation and the estimated regression function against the logarithm of the HHI. The relationship between the HHI and sales reallocation is as figure 2 leads us to expect.

For *POS*, *NEG*, *NET*, and *SUM*, table 4 reports the estimated slopes from the linear and piecewise linear regression functions. Beneath each slope is its estimated standard error.[6] By construction, the difference between the estimated slopes for *POS* and *NEG* equal the corresponding slopes for *NET*, while their sums equal those for *SUM*. For each slope, the final column reports the number of zip codes with an average HHI that falls into the interval over which it applies. For both sets of regressions, the table also reports the R^2 measure of fit.

Consider first the linear regression function's estimates. For *POS*, *NEG*, and *SUM*, the slope estimates are positive and greatly exceed their standard errors, indicating that they are statistically significant. The estimated slope coefficients for *POS* and *NEG* both equal half of the analogous estimate for *SUM*, 0.022. The regression predicts that the sales reallocation rate will equal 36 percent when the HHI is at its sample minimum, 6, and that this will rise to 42 percent when the HHI equals 100. As figure 2 suggests, the positive effect of concentration on sales reallocation increases sales creation and destruction equally. Another perspective on the same result is that concentration has no statistically or economically significant effect on sales growth.

The piecewise linear regression functions also show that sales creation, destruction, and reallocation are increasing with the HHI when it is below 100. Although the estimated slopes are much greater than their linear regression counterparts, their fitted values are quite similar. Sales reallocation is predicted to equal 35 percent and 46 percent, respectively, when the HHI equals 6 and 100. As with the simple linear regressions, sales creation and destruction contribute equally to the increase in sales growth, so there is again no effect on sales growth. For HHIs exceeding 100, the estimated slopes for sales creation and reallocation are negative and highly statistically significant. The estimated slope for sales destruction is also negative, but its magnitude is only half that of sales creation's slope and it is not statistically significant. A simple consequence of this is that the estimate of concentration's effect on net sales growth is negative and statistically significant. Apparently, increases in concentration that push the HHI above 100 either have no effect or a negative effect on creative destruction.

TABLE 4

Regression slopes

Interval	POS	NEG	NET	SUM	N
		Estimated slopes			
0<HHI<1,000	0.011	0.011	0.001	0.022	444
	(0.003)	(0.002)	(0.002)	(0.004)	
		Regression R^2			
	0.02	0.02	0.00	0.02	
		Estimated slopes			
0<HHI<100	0.023	0.018	0.005	0.041	384
	(0.003)	(0.003)	(0.003)	(0.005)	
100<HHI<1,000	–0.031	–0.014	–0.017	–0.045	60
	(0.009)	(0.009)	(0.007)	(0.016)	
		Regression R^2			
	0.04	0.03	0.00	0.04	

If the number of economically meaningful markets in a market area is 20 or more, then an HHI of 500 would correspond to all markets being served by monopolies. With an HHI of 1,000, half of the potential markets would have no active firms. Thus, the behavior of the estimated regression function may reflect changes of creative destruction within markets, as well as changes in the number of active markets. For this reason, we prefer to emphasize the positive effect of concentration on creative destruction for market areas with HHIs below 100.

To better understand the sources of the estimated relationship between concentration and creative destruction, we have also examined two decompositions of sales reallocation. The first separates sales reallocation due to births and deaths from that due to surviving incumbents, and the second divides sales reallocation into the portions due to establishments owned by small and large firms. We follow Dunne, Roberts, and Samuelson (1988) and DHS and define a small firm as one that controls a single establishment. Large firms control two or more establishments. With both of these decompositions, we estimate the same regression models as above using sales reallocation's components as the dependent variables. With either decomposition, the two components' estimated slopes must sum to the slope estimated for all sales reallocation.

Table 5 reports the estimated slopes and their standard errors for these two decompositions of sales reallocation. For reference, its first column repeats the estimates of the slopes of *SUM*'s regression function. Consider first the portion of *SUM* due to births and deaths. If the HHI is less than 100, then changes in births and deaths account for approximately half of the response of *SUM* to an increase in the HHI. The effect on births and deaths of further increasing the HHI is large, –0.018, but imprecisely estimated. The effect on surviving incumbents is much larger, –0.027, and it is statistically significant. Next, we turn to the second decomposition of *SUM*. If the HHI is less than 100, small firms account for nearly all of the response of *SUM* to a change in the HHI. For more concentrated markets, the point estimates indicate that establishments owned by small and large firms contribute equally to the decrease in *SUM*. The simple linear regressions' estimated slopes qualitatively resemble those from the piecewise linear regressions when the HHI is below 100. To summarize, the positive effect of concentration on creative destruction that we emphasize apparently reflects the expansion and contraction of establishments owned by small firms at all stages of their lives.

Robustness

To ensure that our results do not merely reflect the exclusion of relevant variables from the regressions,

TABLE 5

Regression slopes for sales reallocation and its components

Interval	All	Births and deaths	Surviving incumbents	Small firms	Large firms
0<HHI<1,000	0.022	0.012	0.011	0.021	0.001
	(0.004)	(0.003)	(0.002)	(0.004)	(0.002)
0<HHI<100	0.041	0.020	0.021	0.034	0.007
	(0.005)	(0.004)	(0.003)	(0.006)	(0.004)
100<HHI<1,000	–0.045	–0.018	–0.027	–0.024	–0.022
	(0.016)	(0.016)	(0.007)	(0.011)	(0.008)

we have also estimated two related specifications, which include additional industry characteristics. In one, we included the average sales growth of alcohol sales within 15 miles of the zip code. This accounts for the possibility that market areas with fast growth systematically display more or less creative destruction. Increases in this growth rate tend to increase sales creation and decrease sales destruction by equal amounts, so it has no substantial impact on sales reallocation. In the second, we included the fraction of the market's establishments that present themselves to the public as bars.[7] Increasing bars' market share tends to increase sales creation, destruction, and reallocation. This is particularly the case for sales reallocation due to births and deaths. However, none of the coefficients in tables 4 and 5 substantially change after including either of these two variables in the regressions.

For our final robustness check, we allowed the regressions' intercepts to vary across the counties. In this way, we allow for the effects of variation in counties' permissiveness towards alcohol consumption. The estimated slopes entirely reflect variation across zip codes in the same county. Our 444 zip codes are in 44 counties. Ten of these counties contain a single zip code in our sample, and so their observations contribute nothing to our estimates. For the simple linear regression estimates, the estimated coefficients are somewhat larger than those reported in table 4, but the pattern of significance is unchanged. For the piecewise linear regression functions, the slopes for low concentration levels are again somewhat greater. The regression functions' slopes when the HHI exceeds 100 are much smaller than those reported in table 4, and they are not statistically significant. The associated confidence intervals are wide enough to encompass regression functions with zero slopes and with constant slopes, so it is difficult to characterize the slopes precisely. Nevertheless, the results reinforce our decision to emphasize the positive relationship between concentration and creative destruction evident across market areas with lower values of concentration.

Conclusion

In this article, we have considered the empirical relationship between market concentration, measured with the HHI, and creative destruction, measured with sales creation, destruction, and reallocation. We find that increasing a market area's concentration *increases* creative destruction. Thus, more concentrated market structures are the least stable in our dataset. Greater concentration primarily increases creative destruction among small firms, but it confers no apparent stabilization to their large competitors. This leads us to question oligopoly theory and competition policy based on the premise that market power confers the ability to stabilize an industry's structure.

Our findings call for further empirical and theoretical research on this topic. The outstanding empirical question is whether our results also characterize other retail and service industries or bars and restaurants in other states. The theoretical questions concern the structural origins of our findings. Decreasing concentration apparently decreases producer turnover. That is, competition endogenously creates "barriers to entry." We wish to determine whether this might reflect firms' strategic choices. Existing theories of creative destruction in competitive industries, such as Hopenhayn's (1992) and Fishman and Rob's (2003), are silent about the relationship between concentration and creative destruction. By their nature, models of perfectly competitive creative destruction assume that firms compete anonymously. We believe that the reconciliation of these theories with our observations will require dropping the anonymity assumption and instead explicitly modeling firms' strategic interactions.

NOTES

[1]Geographic variation in population density is not the only source of variation in concentration. If the diversity of tastes varies across local markets, then markets with a more diverse population may have a lower measured concentration because they demand a similar diversity of restaurants and bars. Additionally, many Texas counties are either "dry," prohibiting the retail sale of alcohol or "partially wet," prohibiting it in some areas or for some beverages. Whether a market area is partially wet or located near a partially wet or dry area can clearly influence concentration.

[2]By using the March tax return, we enhance the comparability of our results with those based on Economic Census records of mid-March employment, such as the *County Business Patterns*.

[3]See table 2.1 of DHS.

[4]See figure 2.3 of DHS.

[5]If y_j and x_j denote the average sales creation or destruction rate for market j and the logarithm of its HHI, then the smoothed series is defined as the estimated intercept from the regression equation $y_l = \alpha + \beta x_l + \varepsilon_l$. The estimation uses only the 10 percent of sample markets with HHIs closest to market j's and each market receives a weight proportional to the absolute difference between its HHI and market j's. These local predictions use only a small portion of the data and they display considerably more variance than ordinary linear regression estimates. The considerable variation of the local predictions for HHIs below 100 reflects this variance.

[6]We follow Conley (1999) and calculate standard errors that account for a systematic relationship between the variance of the regression function's disturbance term and the HHI (heteroskedaticity) and for correlation between the error terms of markets that are geographically close to one another (spatial correlation). Conley's (1999) estimator requires a choice of distance such that the regression function's disturbances from two markets farther apart than that distance are assumed to be uncorrelated. We chose 15 miles. These estimated standard errors are uniformly lower than those calculated under the assumption of uncorrelated disturbances across markets.

[7]To measure this, we follow Abbring and Campbell (2003) and examine the establishment's trade name for the presence of several words that indicate an emphasis on alcohol consumption and for the absence of several words that indicate substantial food service.

REFERENCES

Abbring, Jaap H., and Jeffrey R. Campbell, 2003, "A structural empirical model of firm growth, learning, and survival," Federal Reserve Bank of Chicago, working paper, No. 2003-11.

Bartelsman, Eric, and Phoebius Dhrymes, 1998, "Productivity dynamics: U.S. manufacturing plants, 1972–1986," *Journal of Productivity Analysis*, Vol. 9, No. 1, pp. 5–34.

Bresnahan, Timothy F., and Peter C. Reiss, 1990, "Entry in monopoly markets," *Review of Economic Studies*, Vol. 57, No. 4, pp. 531–553.

Campbell, Jeffrey R., 1998, "Entry, exit, embodied technology, and business cycles," *Review of Economic Dynamics*, Vol. 1, No. 2, pp. 371–408.

Campbell, Jeffrey R., and Hugo A. Hopenhayn, 2004, "Market size matters," *Journal of Industrial Economics*, forthcoming.

Conley, Timothy G., 1999, "GMM estimation with cross sectional dependence," *Journal of Econometrics*, Vol. 92, No. 1, pp. 1–45.

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

Dixit, Avinash, 1980, "The role of investment in entry deterrence," *The Economic Journal*, Vol. 90, No. 357, pp. 95–106.

Dunne, Timothy, Mark J. Roberts, and Larry Samuelson, 1988, "Patterns of firm entry and exit in U.S. manufacturing industries," *RAND Journal of Economics*, Vol. 19, No. 4, pp. 495–515.

Fishman, Arthur, and Rafael Rob, 2003, "Consumer inertia, firm growth, and industry dynamics," *Journal of Economic Theory*, Vol. 109, No. 1, pp. 24–38.

Gort, Michael, 1963, "Analysis of stability and change in market shares," *Journal of Political Economy*, Vol. 71, No. 1, pp. 51–63.

Hamermesh, Daniel S., Wolter H. J. Hassink, and Jan C. van Ours, 1996, "Job turnover and labor turnover: A taxonomy of employment dynamics," *Annales D'Economie et de Statistique*, Vol. 41/42, pp. 21–40.

Hopenhayn, Hugo A., 1992, "Entry, exit, and firm dynamics in long run equilibrium," *Econometrica*, Vol. 60, No. 5, pp. 1127–1150.

Peltzman, Sam, 1977, "The gains and losses from industrial concentration," *Journal of Law and Economics*, Vol. 20, No. 2, pp. 229–263.

Weiss, Leonard (ed.), 1990, *Concentration and Price*, Cambridge MA: MIT Press.