Does Market Concentration Promote or Reduce New Product Introductions? Evidence from US Food Industry

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Abstract

This study analyzes the relationship between market concentration and new product introductions using an extensive annual panel data set covering the period 1983 to 2004 from the US processed food industry. We test the new theory, which argues that new product introductions are influenced by the anticipation of future mergers. The evidence suggests that market concentration increases new product introductions and product introductions spur subsequent mergers in the US processed food industry. Hence it provides evidence in support of the anticipatory mergers theory.

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1. Introduction

Wide range of product variety in consumer goods has become a hallmark of economic progress. The effect of market structure on product variety has drawn the attention of economists for a long time. In an extensive theoretical literature on the effect of market concentration on product variety, predictions are conflicting. The empirical evidence is sparse with little agreement across studies. In this study we analyze the effect of market concentration on product variety[1] using data from US processed food industries. We test a new theoretical prediction that provides an alternative explanation for the surge of new product introductions. Additionally, we employ an extensive annual panel data and account for potential endogeneity of market concentration that distinguish our study from the prior empirical studies on the US food industry

In the extant theoretical literature on market structure and product variety, one strand of models suggest that more competitive (less concentrated) industries introduce more new products as firms seek to create market niches in the product space, essentially eroding rents with a high degree of product variety (e.g., Salop, 1979; Raubitschek, 1987). This theory views new product introduction as a competitive tool and predicts that market concentration is inversely related with product variety.

Another theory argues that markets threatened by potential entry, incumbent firms introduce an increased variety of products that are close in product space in order to crowd the market (Schmalensee, 1978; Lancaster, 1979; Eaton and Lipsey, 1979). This conjecture, known as the 'spatial preemption' theory, thus implies that firms preempt

[1] Product variety is a net result of product introductions and product failures i.e. Product variety = Existing products + New Product Introductions – Product Failures. Our study focuses on number of new product introductions (NPI). We assume that the NPI are proportional to the product variety, hence we can test the theoretical predictions of the models that are based on product variety.

spatial entry by product proliferation that blocks profitable niches. In contrast a protected concentrated market can provide incentives for firms to restrict product variety in order to optimize the economies of scale. Hence the spatial preemption theory implies that a contestable market would introduce more new products than a protected concentrated market. This would again imply a negative relationship between market concentration and product variety. Since, there is a tradeoff between gains from economies of scale and gains from serving consumers' preference for variety, the welfare implications of the theoretical models are sensitive to the assumptions about economies of scale and demand specifications (Lancaster, 1990) [2].

Innes (2006)[3] provides a new perspective about the product introduction decisions of firms and its relationship with market concentration. This theory argues that under a given antitrust regime (that defines the maximum permissible market concentration), where mergers determine the resulting market concentration, anticipation of merger and the consequent level of profit provide incentives for fringe firms to enter and introduce new products. Thus it implies a positive relationship between product variety and concentration as product introductions are expected to increase mergers that lead to increase in market concentration.

In sum, whether market concentration promotes or reduces product variety is an empirical question. However the empirical literature on this issue is scarce. Studies have been conducted to analyze the effect of market concentration on product introduction or product variety using data from the US food (Connor, 1981; Zellner, 1989; Roder,

[2] The evolution of the theoretical literature analyzing the implication of different market structures on product variety and their welfare implications are well summarized by Lancaster (1990).

[3] The main objective of the paper is to compare the flexible manufacturing versus inflexible manufacturing production process and analyze the welfare implications where anticipation of mergers influences the entry and product introduction decisions of the firms.

Herrmann and Connor, 2000), radio-broadcasting (Berry & Waldfogel, 2001) and music industries (Alexander, 1997). These studies have yielded a variety of results. While some studies find that higher market concentration increases product variety, others show that higher concentration reduces product variety[4]. Hence it is evident that there is little agreement in the empirical literature regarding the relation between market concentration and product variety.

This disagreement could be attributed to differences in industry specific characteristics. Yet surprisingly, the results are varied even for studies on the same industry, the US food industry. This is more likely to be attributable to the data and methodological issues. We analyze these issues and address the potential problems in the empirical literature by estimating the effect of market concentration on new product introduction using an extensive annual panel dataset for the period 1983-2004 for US processed food industries while accounting for the endogeneity of market concentration.

The US processed food industry has some special characteristics that provide an interesting avenue to explore the relationship between market concentration and product variety. A typical supermarket sells thousands of processed food products, several thousand new products are introduced every year, and the food processing industry is getting increasingly concentrated (Sexton, 2000) [5].

[4] Connor (1981), Zellner (1989) and Berry & Waldfogel (2001) depict a positive effect and Alexander (1997) and Roder, Herrmann & Connor (2000) find a negative effect of market concentration on product variety.

[5] www.fmi.org and Progressive Grocer's 60th Annual Report (1993) provides statistics on the number of processed food product carried by the supermarkets. Figure 1 depicts the trend new product introductions.

2. Methodological Issues

The theories on the effect of market concentration on product variety, discussed above, suggest that the new product introductions can either promote competition or deter spatial entry. Hence for the purpose of empirical estimation of the effect of market concentration on product variety, it implies that market concentration is endogenous as market concentration gets affected by product introductions. Empirical evidence also suggests endogeneity of market concentration as an explanatory variable for product introduction. Zellner's (1989) study shows that new products introductions and market concentration have significant positive effects on each other in a simultaneous equations system[6]. Geroski and Pomroy (1990) show that product variety affect the evolution of market concentration using data from UK manufacturing industries. Hence the empirical studies should test for potential endogeneity of market concentration while explaining product variety. Failure to account for the endogeneity of market concentration can produce biased results. With the exception of Zellner (1989), all the other studies on food industry treat market concentration as exogenous.

The theories and the empirical evidence from Geroski and Pomroy's (1990) study suggest a dynamic relationship between industry concentration and product variety. Hence a panel data set is more appropriate to analyze the interactive relation between these two variables of interest. Yet, all the empirical studies on the food industry, with the

[6] This study on US food industry belongs to the structure-conduct-performance (SCP) strand of literature and focuses on the use of advertising as a substitute strategic tool for new product introductions. The cross sectional analysis based on new products introductions data for 1977-78, used a simultaneous equations system with advertising intensity, price-cost margin, concentration, and new product introductions as jointly endogenous.

exception of Roder, Herrmann & Connor (2000), examine the relationship using cross-section data.

We utilize an extensive annual panel data for the period 1983-2004 and account for endogeneity of market concentration. These features distinguish our study from the prior empirical work on the US food industry. Zellner (1989) accounted for endogeneity of market concentration but used cross section analysis. Roder, Herrmann and Connor (2000) study a panel of new product introductions in USA from 1988-1994. However, in this study, the potential endogeneity of concentration has not been accounted for and concentration measures for five years out of the seven-year study period are imputed using data from two years of Census of Manufacturers.

In addition to addressing the methodological issues, we test the new theory of product introduction in anticipation of future mergers (Innes, 2006) by analyzing the impact of product introduction on subsequent mergers in the food industry.

3. Data

We use annual data on new product introductions (NPI hence forth) in the USA, classified by various categories of processed food[7]. The data used in this study covers the period 1983 to 2004. The number of new product introductions have been used to proxy for product variety in the different segments of processed food industry in USA.

The food processing companies, like other manufacturing companies, are classified by SIC codes to identify their industry segments[8]. Using annual firm level data from Compustat, we compute annual industry level (identified by 4-digit SIC codes)

[7] Data Source: Various issues of 'The Food Institute Report'
[8] The detailed description of the SIC codes were obtained from http://www.osha.gov/pls/imis/sic_manual.display?id=13&tab=group

measures on sales, capital expenditure, value of property plants and equipments and R&D expenditure. Compustat contains annual operating data on companies listed on the major US stock exchanges and it does not include the private (non-listed) companies. Since the publicly traded companies are the market leaders accounting for majority of market sales, R&D and capital expenditure, our measures of these variables may not be exhaustive, but they provide adequate aggregated industry level (represented by the various food categories presented in Table 1) measures that represent the heterogeneity across the different segments of the processed food industry, which we need for the purpose of this study. We match the industry data to different product categories corresponding to the new product introduction categories based on the SIC codes. We grouped some categories of food introductions together to be able to map them to the industry data. Large multi-product companies (such as Unilever and Nestle) that produce a large veriety of processed food posed a challenge for classification into specific segments of processed food industry. We used the annual reports of such companies to carefully allocate their financial data to different food categories based on the share of revenue coming from the different processed food segments.

Using the annual sales data, we construct the following alternative market concentration measures that have been widely used in the literature[9]:

Herfindahl Index (HI): $H = \sum (s_i^2)$ with $i=1,2,\ldots,N$

Four firm concentration index (CI4): $CI_4 = \sum (s_i^2)$ with $i=1,2,3,4$ where the firms are ranked in descending order of their market share.

[9] Roder, Herrmann and Connor, 2000; Alexander, 1997; Zellner, 1989; Connor, 1981

Our final dataset comprises annual data on new product introductions, industry concentration indices, number of firms, sales, sales growth and capital intensity measures for nine segments (see Table 1) of the processed food industry for the twenty-two year period 1983 to 2004.

4. Empirical Estimation Strategy and Results

A. The Effect of Market Concentration on New Product Introductions

The first objective of the study is to analyze the effect of market concentration on new product introduction. Apart from market concentration, the prior empirical literature has used market size (sales), market growth (sales growth) and number of firms as important determinants of product introduction. We employ the following model to estimate the effect of market concentration on new product introduction:

$$NPI_{it} = \alpha + \beta C_{it} + \gamma X_{it} + \varepsilon_{it}$$

where

NPI_{it} = new product introductions in the food industry *i* in year *t*

C_{it} = concentration index in food industry *i* in year *t*

X_{it} = exogenous variables that includes sales, sales growth, number of firms, R&D intensity[10], capital intensity in food industry *i* in year *t*; and time variant economy wide variables representing the demand factors like share of food expenditure in disposable income, proportion of food expenditure in incurred on food away from home.

The above model is estimated with the two alternative measures of market concentrations – HI and CI4. We have two sets of estimates – one set treats the market

[10] The data on R&D expenditure available from Compustat is the total R&D expenditure that includes expenditure on both product and process R&D. Hence it is not the exact measure of R&D investment for product introduction.

concentration as exogenous while the other allows the market concentration to be endogenous.

Identification Strategy: We seek to identify market concentration with an instrument that is constructed by the interaction of total number of mergers in the US economy with segment specific capital asset intensity in processed food industry. The ratio of net property, plant and equipments to annual sales provides the measure of capital asset intensity that varies across the different segments of the processed food industry as well as over time. The US mergers represent a pure time series variable i.e. has only time variations and hence is expected to help in identifying the temporal variation. The capital asset intensity measure that varies across the processed food industry segments as well as time is expected to help in identifying temporal as well as cross-sectional variations in market concentration. Hence our instrumental variable, an interaction of a time variant variable with a cross-section cum time variant variable, is a potentially good instrument to identify market concentration in our panel data model.

Since, merger waves in an economy affects mergers across all the sectors, hence we expect overall trend of mergers in the US economy to affect the mergers in the US processed food industry and hence the market concentration in the various segments as well. At a first glance one might expect this variable to get affected by NPIs as the anticipatory mergers theory argues that NPIs occur in anticipation of future mergers in the specific industry. However, the fact that the processed food industry is a very small proportion of the US economy, rules out the possibility of NPIs in food industry influencing overall mergers in the economy through its influence on mergers in the processed food industry. Hence we can argue that aggregate US mergers can affect NPIs in food industry only through the channel of food industry market concentration. Turning to capital asset intensity, one might argue that capital intensity can affect NPI as a more capital intensive industry might facilitate incremental product introductions or a more capital intensive industry might be indicative of high cost of introducing new products. In either case, the premise that capital intensity can potentially influence NPI is addressed in our model by controlling for an annual measure of capital expenditure intensity (annual capital expenditure to sales ratio). This measure of capital intensity represents the annual (variable) expenditure to maintain the capital as opposed to the capital asset intensity that represents investments in capital (fixed) assets that acts as barrier to entry and hence influences market concentration. Hence controlling for the capital expenditure intensity controls for the channel through which capital asset intensity can have any influence on NPI and thus capital asset intensity can be used as a component of the instrument for market concentration.

Results: We assess the strength of the instrument(s) using the F test in the first stage regression of concentration index on all exogenous variables in our model. As reported in table 4a, the magnitudes of the test statistic are greater than 10[11], which imply that instrument(s) perform very well in explaining market concentration.

The test for first order auto-correlation (Table 4b) revealed the existence of serial correlation. Table 4c presents the fixed effect estimates for models with exogenous as well as endogenous treatment of concentrations where the estimation procedures account

[11]A good instrument is expected to have F statistic of 10 or higher in the first stage as the weak instrument bias (1/1-F) is an inverse function of the F statistic and an acceptable benchmark of this weak instrument bias is approximately10% or less.

for non-spherical disturbances. The models with exogenous and endogenous concentration have been estimated by GLS and GMM methods respectively[12].

The results indicate that the market concentration increases product introductions. One percent increase in HI (CI4) leads to approximately 1.5 (1.3) percent increase in NPI. The estimates also depict that number of firms and R&D intensity increase new product introductions. The result that market concentration has a positive effect on new product introductions provides evidence in support of the anticipatory mergers theory. We proceed to test the channel through which this positive effect comes into play i.e. the effect of NPIs on subsequent mergers.

B. Testing the Anticipatory Mergers Theory

Using annual data on number of mergers in the processed food industry we test the hypothesis that NPI spurs subsequent mergers. This analysis covers the period 1991 to 2004[13]. Due to data limited data availability, the mergers analysis covers a subset of the time frame covered by the NPI analysis. This analysis is conducted using aggregated processed food industry data as well as data classified by various food segments. The classification of different food segments is also different for this part of the analysis as the classification of mergers data was different from the classification for NPI data available to us. The large number of mergers specified under diversified food categories posed a difficult problem for matching them adequately with the NPI categories. The

[12] The models with exogenous concentration have been estimated using 'xtgls' procedure in Stata taking into account panel level serial correlation and heteroskedasticity. The models with endogenous concentration have been estimated by two step GMM estimation procedure using the 'gmm' option with 'xtivreg2' in Stata that accounts for the endogeneity of concentration and adjusts for heteroskedasticity and autocorrelation as well as.

[13] Data Source: Various issues of 'The Food Institute Report'. Due to data limited data availability, the mergers analysis covers a subset of the time frame covered by the NPI analysis.

classifications used for the panel mergers analysis are specified in table 5b.[14] The following model specification was used to test the effect of lagged NPIs on mergers.

$$\text{Mergers}_{it} = \alpha + \beta \ \text{NPI}_{i,t-k} + \delta \ X + \varepsilon_t$$

where the subscript i denotes the aggregate food industry for the aggregate analysis and food industry segment i for the panel analysis.

Mergers_{it} : Number of mergers in the USA food processing industry i in the year t

$\text{NPI}_{i,t-k}$: Number of new product introductions in the USA food processing industry i in the year $t-k$.

X: contains different combinations of the following variables

- total number of mergers in the US economy[15] in the year t,
- number of firms in the food industry i in the year $t-k$.
- sales growth in the food industry i in the year $t-k$.

We tried sixteen variations of the model using different combinations of the above variables. We tried alternate values of k ranging between 1 and 7.

Results: The results of the aggregate analysis and the grouped analysis are presented in Table 6A and 6B respectively. The tests for autocorrelation do not reject the null of no serial correlation. The results correspond to OLS estimates for the aggregate models. In case of the panel analysis, the number of mergers is very small in several cases. Count data models can better handle the discrete nature of the dependent variable with small values. Hence we used Poisson estimation for the panel analysis of mergers.

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[14] This classification excludes the diversified mergers category. Hence it does not incorporate all the mergers that are included in the aggregate analysis. We attempted to allocate the diversified category of mergers to the categories corresponding to the NPIs based on the sales information of diversified (SIC 2000) firms. The adhoc allocation method did not yield any significant results. Since we do not have very strong faith in the allocation criteria we have refrained from presenting those results here.

[15] Data Source: Mergerstat Review

We performed the linear as well as negative binomial estimations for these models. The results were qualitatively similar[16]. Table 6B presents the random effects estimates for the panel data models as the Hausman statistic for FE vs RE failed to reject the null, indicating that random effects estimates are consistent and more efficient.

The estimates indicate that the NPI with lag 3 and 4 have statistically significant positive effect on mergers. This result is consistent across all the model specifications. According to the aggregate analysis a one percent increase in NPIs can increase mergers between 0.92 and 1.3 percent. The corresponding elasticity for the panel estimates ranges between 0.06 and 0.16. Thus the mergers analysis reveals that new product introductions positively affect subsequent mergers in the food industry. Hence it provides evidence in support of the mechanism through which the anticipatory mergers theory predicts a positive relationship between NPIs and market concentration.

5. Conclusion

This study provides important insight into the testing of theoretical predictions about the relationship between market concentration and product variety. The analysis highlights the fact that accounting for the endogeneity of market concentration plays a vital role in estimating the effect of market concentration on new product introductions. Our analysis based on the data of the food industry suggests that market concentration increases product introductions[17]. Number of firms and R&D intensity are also important factors that positively affect new product introductions. We also find that product

[16] In case of negative binomial, convergence could not be achieved in some of the model specifications and in case of the linear estimations the NPI lags were not significant for the last two models.

[17] The number of new product introductions cannot distinguish between the quality of innovation i.e. improvement of a base product vis -a- vis a new base product. Hence in order to infer about the quality of innovation from this study, one will need to assume that there is one to one mapping between number of new product introductions and quality of innovations.

introductions spur subsequent mergers in the food industry. Hence positive relationship between market concentration and product introductions and positive effect of new product introductions on subsequent mergers provide evidence in support of the anticipatory mergers theory. Based on data compiled from various issues of 'The Food Institute Report' we found that new product introductions in the food industry are predominantly attributed to smaller firms as the top 20 firms introduced on an average about 15 percent of the total number of annual new products during the period 1999 to 2002 while the top 4 firms introduced only 5 percent of the new products. This anecdotal evidence further strengthens our conclusion that product introduction occurs in anticipation of mergers in the US processed food industry.

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Table 1: Description of New Products Introductions (NPI) Categories

NPI Category	Description
1	Processed Meat, Fish, Egg
2	Dairy Products
3	Desserts and Ice cream
4	Fruits and Vegetable Products, Condiments
5	Breakfast Cereals, Pet food
6	Bakery Food
7	Sugar, Confectionary, Snacks
8	Beverages
9	Meals, Side dishes

Table 2: Description of Variables

Variable name	Description
NPI	Number of New Product Introductions
HI	Herfindahl Index
CI4	Four Firm Herfindahl Index
N	Total number of firms
SALES	Annual Sales ($ mn)
SGR	Annual Sales Growth Rate
RNDI	Annual R&D expenditure to sales ratio
CAPEXI	Annual capital expenditure to sales ratio
CAPASI	Net Plant, Property and Equipment to sales ratio
MERGERS	Number of Mergers in the processed food industry
USMERGERS	Number of Mergers in the USA
FEXP	Food expenditure (% of disposable income)
FAFH	Food away from home (% of food expenditure)

Table 3: Summary Statistics of the Panel Data Set

Variable	Obs	Mean	Std.Dev.	Min	Max
NPI	198	1177.641	908.8555	37	4596
HI	198	0.248909	0.1199457	0.0718771	0.5194755
CI4	198	0.238468	0.1276649	0.027378	0.5177338
N	198	18.89899	11.70188	5	65
SALES	198	38281.54	32820.93	3265.568	195150.1
SGR	198	5.627515	18.91088	-47.74893	150.643
RNDI	198	0.006747	0.0043447	0	0.017762
CAPEXI	198	0.0470237	0.0159381	0.0166153	0.1365205
CAPASI	198	0.2684069	0.0710748	0.0839517	0.3821605
USMERGERS	198	4882.909	2877.563	1877	9783
FEXP	198	10.69318	0.806914	9.45	12.46
FAFH	198	38.73591	2.367526	34.97	43.27

Table 4a. Results from First-Stage Regressions

Endogenous Explanatory Variable -	(1) HI	(2) CI4
coeff of [CAPASI*USMERGERS]	-0.0000489	-0.0000532
	(0.000)	(0.000)
F stats for Instrument	21.78	21.87
	(0.0000)	(0.0000)
Partial R-sq for Instrument	0.1080	0.1083

Table 4b. Wooldridge test for autocorrelation in panel data

Model with -	*HI*	*CI4*
Test Stat	40.874	39.790
	(0.0002)	(0.0002)

Table 4c. New Product Introductions (NPI) Regressions

	Concentration is exogenous		Concentration is endogenous	
	(1) GLS	(2) GMM	(3) GLS	(4) GMM
HI	407.8791**		7,155.6489**	
	(0.041)		(0.017)	
CI4		443.4380**		6,530.2582**
		(0.022)		(0.016)
SALES	0.0052***	0.0053***	0.0055	0.0058
	(0.002)	(0.001)	(0.128)	(0.106)
SGR	0.5845	0.5887	-0.6607	-0.7189
	(0.198)	(0.195)	(0.742)	(0.719)
N	10.0211***	10.1839***	19.5874	17.9264
	(0.006)	(0.005)	(0.125)	(0.140)
RNDI	26,594***	26,208***	116,435***	114,322***
	(0.000)	(0.000)	(0.000)	(0.000)
FEXP	-52.6849	-54.3954	247.5589	240.1791
	(0.521)	(0.504)	(0.272)	(0.278)
FAFH	20.8455	20.5176	81.7665	80.4992
	(0.462)	(0.465)	(0.382)	(0.380)
CAPI	-498	-501	-5,662	-5,190
	(0.484)	(0.486)	(0.307)	(0.333)
Constant	0.7234		44.1283	
	(1.000)		(0.981)	

Number of Observations = 198; Number of NPI categories = 9

p values in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%; GLS and GMM estimates obtained using xtgls and xtivreg2 in Stata, account for first order serial correlation.

Figure 1

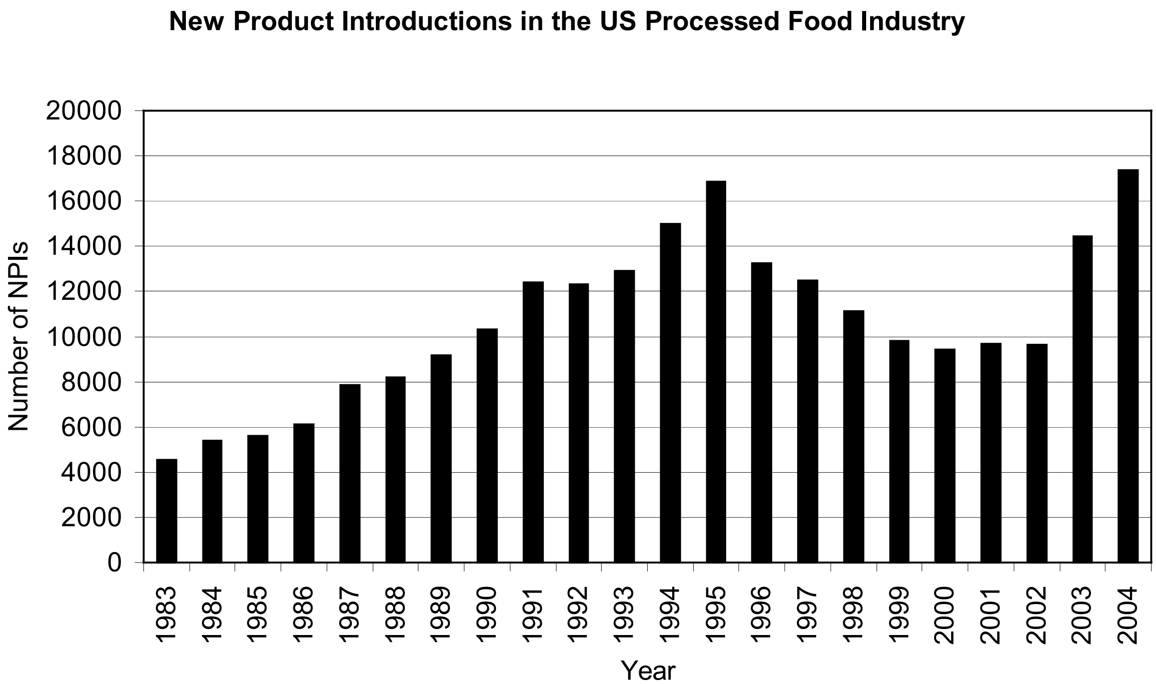

Figure 2

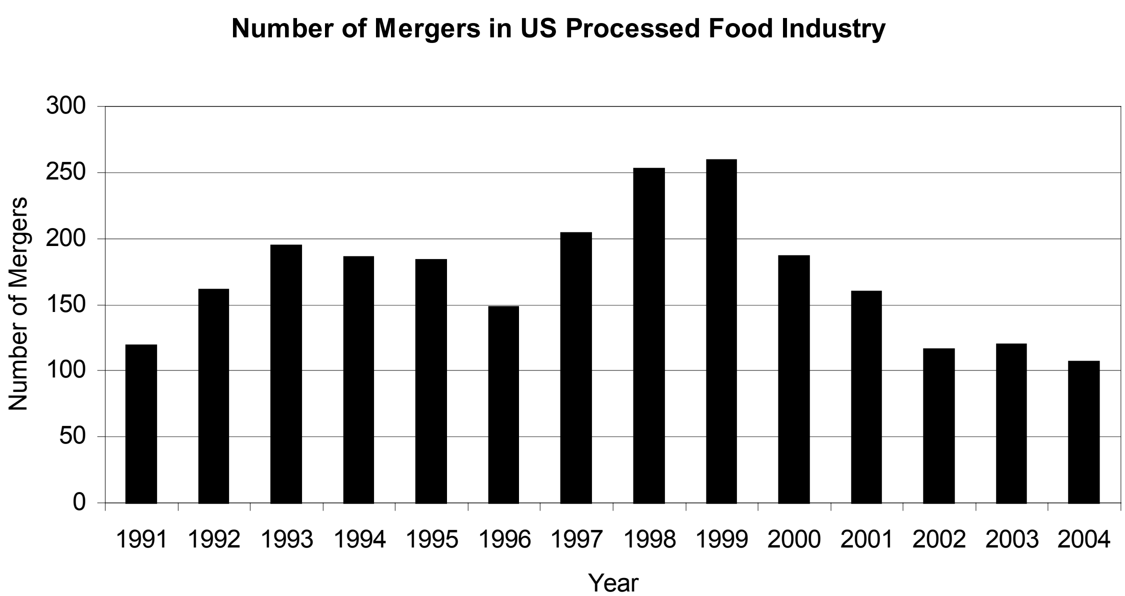

Table 5a. Summary Statistics of the Aggregate Data Set for Mergers Analysis

Variable	Obs	Mean	Std. Dev.	Min	Max
MERGERS	14	171.3571	48.00418	107	259
USMERGERS	14	6234.357	2902.305	1877	9783
N	14	166.2857	25.5717	112	202
NPI	14	13836.07	2881.003	10250	18982
SGR	14	3.126688	5.592123	-9.949106	11.42362

Table 5b. Description of Food Industry Categories for Mergers Analysis using Panel Data

NPI Category	Description
1	Processed Meat, Fish, Egg
2&3	Dairy Products
4	Fruits and Vegetable Products (from 1999)
6	Bakery Food
7	Sugar, Confectionary, Snacks
8	Beverages

Table 5c. Summary Statistics of the Panel Data Set for Mergers Analysis

Variable	Obs	Mean	Std. Dev.	Min	Max
MERGERS	76	16.30263	7.867265	2	35
N	76	23.47368	15.32447	8	65
NPI	76	1643.605	737.2679	453	3619
SGR	76	-.1504006	19.87226	-91.38361	46.24804

Table 6. Mergers Regressions

A. Aggregate Mergers Analysis (OLS estimates)

	(1) MERGERS	(2) MERGERS	(3) MERGERS	(4) MERGERS	(5) MERGERS	(6) MERGERS	(7) MERGERS	(8) MERGERS
NPILAG3	0.015		0.016		0.015		0.013	
	(4.95)***		(4.88)***		(4.44)***		(4.61)***	
NPILAG4		0.013		0.018		0.016		0.012
		(4.24)***		(5.70)***		(5.60)***		(3.99)***
USMERGERS			-0.002	-0.008				
			(0.78)	(2.57)**				
NLAG3					-0.054			
					(0.14)			
NLAG4						-0.828		
						(2.44)**		
SGRLAG3							2.642	
							(1.92)*	
SGRLAG4								3.403
								(1.44)
CONSTANT	-19.370	0.549	-14.565	-9.111	-12.713	100.597	-9.236	-4.684
	(0.49)	(0.01)	(0.36)	(0.27)	(0.20)	(1.88)*	(0.26)	(0.12)
Elasticity	1.113	.997	1.168	1.334	1.126	1.215	.986	.921
	(4.83)***	(4.15)***	(4.76)***	(5.55)***	(4.35)***	(5.46)***	(4.53)***	(3.92)***
Observations	14	14	14	14	14	14	14	14
R-squared	0.67	0.60	0.69	0.75	0.67	0.74	0.75	0.66
Breusch-Godfrey test for autocorrelation (H0: no serial correlation)								
LM stats	1.615	4.997	1.250	0.891	1.541	1.410	0.680	3.682
p-value	0.2038	0.0254	0.2635	0.3451	0.2144	0.2350	0.4096	0.0550

	(9) MERGERS	(10) MERGERS	(11) MERGERS	(12) MERGERS	(13) MERGERS	(14) MERGERS	(15) MERGERS	(16) MERGERS
NPILAG3	0.015		0.013		0.013		0.013	
	(4.46)***		(3.67)***		(3.79)***		(3.50)***	
NPILAG4		0.018		0.017		0.015		0.017
		(5.21)***		(4.61)***		(4.78)***		(4.18)***
NLAG3	0.748				0.140		0.229	
	(1.03)				(0.39)		(0.28)	
NLAG4		-0.333				-0.721		-0.357
		(0.46)				(1.90)*		(0.47)
USMERGERS	-0.007	-0.005	0.001	-0.007			-0.001	-0.004
	(1.29)	(0.77)	(0.29)	(1.93)*			(0.12)	(0.56)
SGRLAG3			2.940		2.809		2.628	
			(1.66)*		(1.87)*		(1.20)	
SGRLAG4				1.089		1.619		1.173
				(0.45)		(0.70)		(0.46)
CONSTANT	-96.700	34.407	-10.116	-9.794	-25.968	85.159	-35.753	36.917
	(1.08)	(0.34)	(0.27)	(0.28)	(0.46)	(1.44)	(0.35)	(0.35)
Elasticity	1.101	1.307	.949	1.276	.943	1.151	.959	1.241
	(4.37)***	(5.09)***	(3.63)***	(4.53)***	(3.74)***	(4.69)***	(3.46)***	(4.11)***
Observations	14	14	14	14	14	14	14	14
R-squared	0.72	0.76	0.76	0.75	0.76	0.75	0.76	0.76
Breusch-Godfrey test for autocorrelation (H0: no serial correlation)								
LM stats	0.797	1.067	0.706	0.803	0.721	1.026	0.731	0.921
p-value	0.3721	0.3016	0.4007	0.3703	0.3959	0.3110	0.3925	0.3372

Notes:
i. Absolute value of z statistics in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.
ii. Elasticity denotes elasticity of mergers with respect to NPI lag evaluated at their sample means.

B. Merger Analysis using Panel Data (Poisson Estimation)

	(1) MERGERS	(2) MERGERS	(3) MERGERS	(4) MERGERS	(5) MERGERS	(6) MERGERS	(7) MERGERS	(8) MERGERS
npilag3	0.0003		0.0003		0.0002		0.0003	
	(4.24)***		(3.53)***		(2.59)***		(3.85)***	
npilag4		0.0002		0.0002		0.0002		0.0002
		(4.25)***		(3.39)***		(3.00)***		(3.76)***
usmergers			0.00002	0.0002				
			(1.61)	(1.26)				
nlag3					0.0202			
					(4.25)***			
nlag4						0.0136		
						(3.16)***		
sgrlag3							0.0061	
							(3.30)***	
sgrlag4								0.0061
								(2.85)***
Constant	2.3685	2.4303	2.2986	2.3801	2.0427	2.1959	2.3958	2.4523
	(13.60)***	(15.34)***	(13.05)***	(14.84)***	(10.82)***	(13.27)***	(14.30)***	(16.35)***
Elasticity	0.1574	0.1320	0.1379	0.1148	0.0998	0.0969	0.1412	0.1154
	(4.14)***	(4.14)***	(3.48)***	(3.34)***	(2.56)***	(2.96)***	(3.77)***	(3.68)***
Observations	76	76	76	76	76	76	76	76
Categories	6	6	6	6	6	6	6	6
Wooldridge test for autocorrelation in panel data								
H0: no first-order autocorrelation								
F stats	0.052	0.255	0.025	0.194	0.070	0.443	0.020	0.122
P value	0.8289	0.6353	0.8810	0.6783	0.8014	0.5350	0.8933	0.7410

	(9) MERGERS	(10) MERGERS	(11) MERGERS	(12) MERGERS	(13) MERGERS	(14) MERGERS	(15) MERGERS	(16) MERGERS
NPILAG3	0.0002		0.0002		0.0002		0.0001	
	(2.41)**		(2.83)***		(2.29)**		(1.92)*	
NPILAG4		0.0002		0.0002		0.0001		0.0001
		(2.64)***		(2.75)***		(2.52)**		(2.06)**
NLAG3	0.0195				0.0193		0.0174	
	(3.97)***				(4.07)***		(3.56)***	
NLAG4		0.0130				0.0140		0.0131
		(2.95)***				(3.29)***		(3.00)***
USMERGERS	0.00001	0.00001	0.00003	0.0002			0.00002	0.00001
	(0.54)	(0.57)	(2.40)**	(1.63)			(1.29)	(0.92)
SGRLAG3			0.0069		0.0058		0.0063	
			(3.74)***		(3.09)***		(3.31)***	
SGRLAG4				0.0064		0.0065		0.0067
				(3.03)***		(3.00)***		(3.09)***
CONSTANT	2.0290	2.1823	2.2930	2.3888	2.0843	2.2092	2.0545	2.1878
	(10.73)***	(13.16)***	(13.73)***	(15.78)***	(11.30)***	(13.85)***	(11.31)***	(13.75)***
Elasticity	0.0952	0.0905	0.1096	0.0922	0.0874	0.0799	0.0751	0.0692
	(2.39)**	(2.62)***	(2.80)***	(2.72)***	(2.27)**	(2.49)**	(1.91)*	(2.05)**
Observations	76	76	76	76	76	76	76	76
Categories	6	6	6	6	6	6	6	6
Wooldridge test for autocorrelation in panel data								
H0: no first-order autocorrelation								
F stats	0.055	0.385	0.000	0.061	0.029	0.267	0.011	0.179
P value	0.8233	0.5620	0.9871	0.8148	0.8720	0.6273	0.9207	0.6894

Notes:

i. Absolute value of t statistics in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

ii. The results are for random effects model.

iii. Elasticity denotes elasticity of mergers with respect to NPI lag evaluated at their sample means.