Disaggregate Evidence on U.S. Price Stickiness and Implications for Sticky-Price Macro Models*

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Abstract

The assumption of widespread price stickiness is a feature of many modern macroeconomic models aimed at explaining both movements in domestic variables, such as employment, real output, and the price level, and changes in international variables, such as the trade balance, the current account, and exchange rates. Nevertheless, relatively little work has been done to evaluate whether price stickiness is truly an important feature of real-world product markets. In this paper, we use the methodology applied at the aggregate level by Gali and Gertler (1999) to analyze price and cost data for U.S. industries at the 6-digit NAICS level. Our estimates indicate that industries with estimated periods of price adjustment of at least 6 quarters generate no more than 20 percent of the total sales of the industries we analyze. In contrast, industries with estimated price adjustment speeds of less than a year account for at least two-thirds of all sales. Estimates derived from empirical analysis that restrict the discount factor to reasonable levels imply that industries accounting for more than 45 percent of all sales in the industries we analyze have estimated price adjustment intervals of less than 2 quarters. Our conclusion is that disaggregate U.S. data provide at least as much support in favor of relatively high price flexibility as for they do for the assumption of widespread price stickiness that lies at the core of many modern macroeconomic theories.

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1. Introduction

Fashions that take hold of the field of macroeconomics share important characteristics with the economy its practitioners seek to understand: approaches that are in vogue exhibit cycles with varying frequencies and amplitudes. During the 1960s, theories based on assumptions of widespread wage and price stickiness dominated the landscape. The new classical macroeconomics that emerged in the 1970s challenged the preeminence of these Keynesian theories, and by the mid-1980s real-business-cycle theories assuming widespread price flexibility received a considerable portion of macroeconomists' attention. Beginning in the early 1990s, however, a Keynesian counter-revolution occurred [see, for instance, Gordon (1990), Mankiw (1990), and Mankiw and Romer (1991a, b)], and by the conclusion of the 1990s sticky-price theories had regained much of their luster. Today, price stickiness is a fundamental building block of numerous theories (for a review, see Woodford, 2003) aimed at explaining both movements in domestic variables, such as employment and real output, and changes in international variables, such as the trade balance and the current account.

There has, as we discuss below, been empirical work seeking to determine whether real-world data might be consistent with the implications of macroeconomic theories with inflexible product prices. There has been very little work, however, to determine whether the most influential approaches to testing the reasonableness of micro-based models of price stickiness support the underlying assumption of widespread price rigidities at the micro level. Instead, leading studies in the literature examine only aggregate data. We find this quite surprising given that so many modern macroeconomic models consider economies populated with representative producers that establish an array of product prices that are fixed in the short run, which in most models is commonly taken to be the current period of analysis.

Are most product prices really sticky? Bils and Klenow (2004) have addressed this question by studying the frequency of price adjustments for 123 categories of consumer goods and services. Their answer is that most prices in fact change relatively frequently, with about half of prices changing roughly every four or five months. Although they find that the prices of certain services and what they call "processed" physical goods adjust more slowly, their overall results offer relatively little support for sticky-price models.

In this paper, we also examine microeconomic data for the United States. In contrast to Bils and Klenow, however, we examine industry-level data on firm prices and costs, and we employ the empirical methodology proposed by the highly influential study by Gali and Gertler (1999). Nevertheless, our conclusions are broadly similar to those of Bils and Klenow. Overall, we find that across the industries to which we are able to apply the Gali-Gertler-style approach, no more than 20 percent of total sales are generated by industries with estimated periods of price adjustment of 6 quarters or more. When the discount factor is restricted to reasonable values, industries accounting for more than 45 percent of all sales in the industries we analyze have estimated price adjustment intervals of less than 2 quarters. In all empirical approaches we consider, including an unrestricted analysis that produces estimates of industry-specific discount factors, at least two-thirds of total sales of the industries we consider are generated by industries with estimated price adjustment speeds of less than one year.

Thus, while our analysis offers some degree of support for models that seek to explain macroeconomic phenomena using models hinging on price inflexibilities, it casts considerable doubt on the relevancy of theories that presume *all* prices are sticky. The industry-level data we examine suggest that the majority of U.S. product prices adjust within six months to one year. Our estimates indicate that firms take well over a year to adjust some product prices, but firms take considerably less than a year to change prices of at least as many products. Applying the Gali-Gertler (1999) approach to U.S. industry-level data, therefore, provides at least as much support for the assumption of price flexibility as for the assumption of price stickiness.

In the next section, we review the extent to which modern macroeconomics has hitched its wagon to the price-stickiness assumption, even though econometric evidence about the predictions of sticky-price models has been mixed and empirical support for this key assumption has been lacking. In section 3, we explain how we apply Gali and Gertler's (1999) methodology for measuring the degree of price stickiness to U.S. industry-level data, in which we are able to utilize actual industry cost data rather than the labor-income-share proxy they employ in their analysis of aggregate U.S. data. Section 4 summarizes our empirical results. In section 5 we discuss the implications of our analysis for modern macroeconomic theory.

2. The Sticky-Price Assumption: Theory and Evidence

The origins of today's sticky-price macroeconomic theories are Taylor's (1980) and Calvo's (1983) initial work incorporating staggered contracts into linear models that appealed to quadratic loss functions as approximations to "consumer surplus" measures [e.g., Aizenman and Frenkel (1985) and Horowitz (1987)]. Based on the roadmap first provided by Blanchard and Kiyotaki (1987), the preponderance of modern sticky-price macro models begin with micro-foundations based on decision-making by optimizing agents, a mode of analysis that in a dynamic, general-equilibrium context rules out equilibria in which agents make decisions at any point that turn out to be inconsistent with long-term or lifetime budget constraints. In order to generate short-run non-neutralities consistent with real-world data, the literature has revealed that there is a large range of factors from which a macroeconomic theorist might choose. These include nominal wage stickiness, asset portfolio rigidities and liquidity constraints, real wage rigidities, and product-price inflexibility. The latter source of non-neutralities has received most attention in the currently predominant New Keynesian literature, which emphasizes models in which monopolistically competitive producers (which often double as consumers) set the prices of imperfectly substitutable goods.

Thus, in most New Keynesian sticky-price models, Taylor- and Calvo-type price contracting or menu costs are presumed to induce producers to leave prices unchanged over

short-run intervals. Agents that function as producer-consumers possess identical intertemporal utility functions, in which the present value of an individual's utility depends positively on a constant-elasticity-of-substitution (CES) index of the differentiated goods produced by all individuals in the economy, positively on real money balances, and negatively on work effort the individual devotes to productive activities, which in turn depends on the demand for the individual's product. Each model, of course has its own special features; among many recent examples are Chari *et. al.*, (2000), Erceg et al. (2000), and Dotsey and King (2001). In an open economy setting, the Obstfeld-Rogoff (1995a,b) "redux" model, which Canzoneri, *et. al.* (2002) have referred as the new "Workhorse Model" of open economy macroeconomics, builds on this sticky-price, dynamic optimizing approach. Obstfeld and Rogoff assume that the law of one price holds for consumer price indexes, but failure of product prices to adjust fully to exchange-rate variations or other external or internal shocks results in terms-of-trade variations and incomplete pass-through effects that induce violations of the law of one price for national output deflators [see, for instance, Sarno (2001), Lane (2001), and VanHoose (2004)]. Short-run product-price inflexibilities faced by representative agents ultimately cause actual output of an open economy to differ from the efficient level, so that policies inducing changes in aggregate demand at a national level have the potential to improve both domestic and global welfare in a world with interdependent economies.

Early work exploring whether there is, indeed, widespread price stickiness in real-world economies focused on prices of magazines sold at newsstands, of specific transactions for certain products, or of items listed in catalogs [see, for instance, Cecchetti (1986), Carlton (1986), and Kashyap (1995)] or considered survey evidence on the frequency of price adjustment (Blinder, 1991). As pointed out by Caplin and Spulber (1987), however, it may be problematic to infer widespread evidence of price stickiness from data limited to only a few specific industries. This perhaps helps to explain why much of the subsequent literature has focused on conducting empirical tests of price stickiness via analysis of macroeconomic data. Kandil (1994), for instance, sought to directly test for price stickiness by examining the response of inflation to

unanticipated changes in real output. Using a test of aggregate price inflexibility that involves generating a generalized-method-of-moments estimator for a McCallum (1978)-style price-level adjustment parameter, Dutkowsky (1996) found that the null hypothesis of complete price flexibility at an economy-wide level could be conclusively rejected. More recently, Eichenbaum and Fisher (2003) use aggregate data to test restrictions implied by the Calvo (1983) pricing framework and conclude that there "is little evidence against the restrictions implied by the Calvo sticky price model" (p. 41). Using a different approach, Sbordone (2002) finds that accounting for sticky prices in a theory of firm pricing aids in fitting a theory of price-level determination to actual empirical data. In the context of the new open economy macroeconomics perspective, Bergin (2003) considers Australian, Canadian, and United Kingdom data and uses maximum likelihood procedures to estimate and test alternative flexible- and fixed-price models of a small open economy. Overall, Bergin obtains mixed results, although in some respects the sticky-price approach receives more support than alternatives. In contrast, Kollman (2005) calibrates a two-country dynamic general-equilibrium model to aggregate U.S. and European data and concludes that a flexible-price variant of the model explains exchange-rate and GDP variability at least as well as a version based on the assumption of widespread price stickiness.

Aside from the effort by Roberts *et. al.* (1994) to explore whether aggregate and industry-level data exhibit sluggish adjustment, relatively little work has been done to examine whether there is evidence of economy-wide price stickiness at the industry level. Recently, Davis and Hamilton (2004) find some evidence of price stickiness in the gasoline industry, although they conclude that such stickiness arises from strategic behavior instead of the menu-cost explanations that lie behind the Calvo model commonly employed in macroeconomic models. In addition, Bils and Klenow (2004) examine the frequency of price changes in disaggregate data for a broad range of U.S. consumer products. In contrast to work with aggregate data that provides at least qualified support for macroeconomic theories based on product price inflexibilities, these authors find meager evidence of sticky prices. After dividing products into

"flexible-price" and "sticky-price" categories, Bils and Klenow conclude that for both sets of goods, actual inflation is much more volatile and less persistent than implied by standard models developed from the assumption of widespread price inflexibility.

Some of the most recent work examining disaggregate evidence regarding price stickiness has focused on consumer and producer price indexes in Europe [see, for instance, Stahl (2004), Sabbatini et al. (2004), Dias et al. (2004), and Alvarez et al. (2004)]. Common conclusions of this work are that there is considerable heterogeneity in the degree of price stickiness across industries, that prices of services appear to be somewhat slower to adjust than prices of physical commodities, and that prices of capital equipment and other investment goods tend to be more sticky than prices of consumer goods. Furthermore, they generally find evidence of much less price rigidity in disaggregate data than have been suggested by influential studies of aggregate data.

The most prominent of these studies are Gali and Gertler (1999) and Gali, Gertler, and Lopez-Salido (2001), which obtain results providing greatest support for the Calvo-style micro-based model of price stickiness. In the basic Calvo model, an individual firm has a fixed probability $1-\theta$ of adjusting its price at any given time, so that the average level of prices evolves as the linear combination, $p_t = \theta p_{t-1} + (1-\theta)\, p_t^*$, where $p_t^* = (1-\beta\theta)\sum_{k=0}^{\infty} (\beta\theta)^k\, E_t\{mc_{t+k}^n\}$ is the optimal price, in which β is the subjective discount factor and *mc* denotes nominal marginal cost. Gali and Gertler (1999) and Gali, Gertler, and Lopez-Salido (2001) interpret p_t as an aggregate price index—in their empirical work, the GDP deflator—and use this specification to develop an estimation equation relating contemporaneous inflation to current real marginal cost and discounted expected future inflation. They utilize this empirical formulation, together with a measure of the labor-income share of output as a proxy for real marginal cost, to estimate the underlying parameters of the framework. These include estimates of the parameter θ, which implies an estimate of the average time that prices are fixed, given by $1/(1-\theta)$. Their aggregate

parameter estimates imply a relatively lengthy average price adjustment interval, typically at least 6 quarters in the case of U.S. and European data.

Woodford (2003, p. 185) concludes that the empirical results obtained by Gali and Gertler (1999) and related contributions by Sbordone (2002) and others provide "persuasive evidence for price stickiness of at least roughly the sort implied by the Calvo pricing model." Numerous theoretical contributions to the burgeoning sticky-price literature likewise appeal to the lengthy estimated price adjustment intervals forthcoming from applications of the Gali-Gertler empirical methodology as justification for the assumption of generalized price stickiness.

Nevertheless, the literature applying the Gali-Gertler-style empirical approach to testing New Keynesian sticky-price theories has focused attention solely on specific measures of price changes and marginal cost (see Gwin and VanHoose, 2004). This body of work also has considered only aggregate data, in spite of the fact that the bulk of modern sticky-price models begin with the *firm-level* assumption of temporarily fixed product prices. To date, no consideration has been given to whether application of the Gali-Gertler methodology would provide empirical support for this assumption at the level of individual industries, even though it is the market interactions among firms in various industries that actually do or do not give rise to widespread price stickiness in the real-world economy.

3. Empirical Approach and Data

The Gali-Gertler application of the Calvo price-setting model assumes that all producers interact in a single, imperfectly competitive market. In actuality, of course, modern economies contain numerous industries, within which producers face competition from other sellers offering the closest substitutes for their products. It is arguably more natural, therefore, to contemplate applying the Calvo pricing approach industry by industry rather than at a purely aggregate level of analysis. This is the approach we follow in this paper.

The data appendix shows specific descriptions of and sources for our data, which, following Gali and Gertler (1999), we utilize to estimate the nonlinear structural equation,

$\{\pi_{i,t}\}z_{i,t} = \left\{\frac{(1-\theta_i)(1-\beta_i\theta_i)}{\theta_i} mc_{i,t} + \beta_i E_t[\pi_{i,t+1}]\right\} z_{i,t}$, where industry *i* inflation $\pi_{i,t} = p_{i,t} - p_{i,t-1}$, $E_t[\pi_{i,t+1}]$ is expected inflation for industry *i* at time *t+1*, and $z_{i,t}$ is a vector of instrumental variables dated time *t-1* or before to control for potential endogeneity. We also estimate but do not report the full version of Gali and Gertler's New Keynesian Phillips Curve (NKPC) model given by $(\pi_{i,t})z_{i,t} = \left\{\frac{(1-\omega_i)(1-\theta_i)(1-\beta_i\theta_i)}{\phi_i} mc_{i,t} + \frac{\theta_i\beta_i}{\phi_i} E_t[\pi_{i,t+1}] + \frac{\omega_i}{\phi_i}\pi_{i,t-1}\right\} z_{i,t}$ where $\phi_i = \theta_i + \omega_i[1-\theta_i(1-\beta_i)]$, $\pi_{i,t-1}$ is lagged price inflation, and $(1-\omega_i)$ is the fraction of firms that are forward looking in the sense of the Calvo model with the remainder being backward looking firms that use rules of thumb to set prices based on historical price behavior. We find little difference in our key results if we include lagged price inflation in the NKPC model.

The Calvo pricing model applies to the prices charged by individual producers, so our measures of industry prices are derived from industry producer price index (PPI) data. In contrast to Gali and Gertler, who test the aggregate implications of the Calvo model using GDP-deflator inflation as a measure of the economy-wide rate of price change, we use the percentage change in the industry PPI to test whether Calvo-style price stickiness appears to be empirically important in industry-level data.

Gali and Gertler use the percentage deviation of the labor-income share from its mean value as a proxy for the percentage deviation of real marginal cost from its steady-state value. They acknowledge that the labor-income share is not an exact measure of real marginal cost, which is the case only under restrictive assumptions consistent with identical Cobb-Douglas technologies and an economywide, competitive market for labor. Deviation of real-world technologies and labor markets from these assumptions may bias their estimate of θ in an upward direction.

As noted by Wolman (1999), a wide range of behaviors of marginal cost are possible under broader assumptions about factor markets and technology. Wolman suggests that "more refined estimates of marginal cost" than the labor-income share should be investigated.

Examining industry-level data is one approach to generating a more direct measure of marginal cost. Toward this end, we develop a measure of average variable cost using Standard & Poor's *Compustat* database for publicly traded U.S. companies. The *Compustat* database is a compilation of financial data from quarterly and annual SEC filings by over 10,000 firms in 1,075 6-digit NAICS industries. Quarterly individual (i) firm revenue ($R_{i,t}$) and cost of goods sold ($VC_{i,t}$) for the time (t) period 1st Quarter 1967 to 2nd Quarter 2003 are available from this database.

The lack of availability of data for privately held companies is not a significant limitation for many of the 24 2-digit NAICS sectors of the U.S. economy classified by the U.S. Census Bureau. A comparison of 1997 sales from *Compustat* to the 1997 Economic Census shows that most, if not all, of sales are accounted for by publicly held companies in Mining (sector 21), Utilities (22), Manufacturing (31-33), Retail Trade (45), Transportation and Warehousing (48-49), Information (51), and Finance and Insurance (52) sectors. Publicly held companies account for about half of sales in Retail Trade (44); Professional, Scientific and Technical Services (54); and Administrative and Support and Waste Management and Remediation Services (56). Only between 10 and 20 percent of sales are made by publicly held companies in Construction (23); Wholesale Trade (42); Real Estate and Rental and Leasing (53); Management of Companies and Enterprises (55); Educational Services (61); Health Care and Social Assistance (62); Arts, Entertainment and Recreation (71); and Other Services (81). The 1997 Economic Census does not report aggregated sector sales for the remaining sectors Agriculture, Forestry, Fishing and Hunting (11), Management of Companies and Enterprises (55), Accommodation and Food Services (72), and Public Administration (91).

The significant limitation to an industry-level study of pricing is the availability of U.S. price data. The Bureau of Labor Statistics (BLS) only collects price data for sixteen sectors including Mining (21); Utilities (22); Manufacturing (31-33); Retail Trade (44-45); Transportation and Warehousing (48-49); Information (51); Finance and Insurance (52); Real Estate and Rental and Leasing (53); Professional, Scientific and Technical Services (54);

Administrative and Support and Waste Management and Remediation Services (56); Health Care and Social Assistance (62); and Accommodation and Food Services (72). Of these 16 sectors, the BLS only has significant historical price data for ten sectors including Mining (21); Utilities (22); Manufacturing (31-33); Transportation and Warehousing (48-49); Information (51); Professional, Scientific and Technical Services (54); and Health Care and Social Assistance (62). With the exception of Health Care and Social Assistance (62), the data from *Compustat* is widely representative of the ten sectors for which price data are available. Thus, the fact that *Compustat* is limited to publicly held companies is not a binding constraint in a study of industry pricing behavior.

Of the 1,075 6-digit NAICS industries covered by *Compustat*, 76 industries have no financial data after 1993, and 224 industries have no data after 2000. Most of the discontinued industry series were a result of reclassification of firms to a more appropriate and/or finer NAICS industry classification. *Compustat* does not keep records of reclassifications, so we were forced to drop these 300 industries from the study. The remaining 775 industries had $3,053,123,000,000 in sales in the 1st Quarter of 2001.

Of the 775 industries from the *Compustat* database with actual sales in 2001, only 244 could be matched to a BLS PPI series with sufficient observations for the analysis. These 244 industries accounted for $843,068,000,000 in sales in the 1st Quarter of 2001.

Industry total revenue is the sum of the N individual firm revenues: $R_t = \sum_{i=1}^{N} R_{i,t}$. Industry total variable cost is the sum of the N individual firm cost of goods sold: $VC_t = \sum_{i=1}^{N} VC_{i,t}$. Industry average variable cost (AVC_t) is derived as $P_t \frac{VC_t}{R_t} = P_t \frac{AVC_t \times Q_t}{P_t \times Q_t} = AVC_t$ where P_t is the industry PPI. Our proxy for marginal cost is the instrumented percentage change in this average-variable-cost measure. Following the Gali and Gertler framework, our set of industry instrumental variables ($z_{i,t}$) includes four lags of industry inflation, industry average variable

cost, the output gap, the long-short interest rate spread, wage inflation, and commodity price inflation.

Our proxy of marginal cost as the *growth rate* of average variable cost contrasts with Gali and Gertler, who, even though they acknowledge that using the growth rate greatly improves fit, consider the percentage deviation of real unit labor cost from its steady-state value. In our application of their methodology to industry-level data, the only practical approach is to use the growth rate, because there is no industry level input price deflator that can be used to calculate real average variable cost from its nominal value. By considering the growth rate of average variable cost, our approach parallels that of Lown and Rich (1997), who augmented traditional Phillips-curve estimation with aggregate data using the growth rate of nominal unit labor costs.

Our resulting measure of industry unit cost has at least two distinct advantages over the use of unit labor costs (or labor share) in the Gali-Gertler methodology. First, we utilize a measure of costs developed *directly* from industry-level data instead of a broad measure of labor costs derived from aggregate labor income shares. Second, our measure of industry cost includes *all* variable inputs instead of labor alone.

4. Results

We considered three approaches to implementing the Gali-Gertler estimation procedure for NAICS 6-digit industries. In our initial approach, we used Gali and Gertler's unrestricted nonlinear structural equation to estimate β and θ jointly using industry-level data on contemporaneous prices and costs and following Gali and Gertler's methodology for measuring expected inflation using the instrumented rate of change in the GDP deflator. We do not attempt to report the hundreds of point estimates we obtained, although they are contained in an appendix that is available from the authors.

For 38 industries accounting for about 6.1 percent of all industries' sales in 2001, the implied price adjustment intervals were negative, implying an obvious mismatch of these

industries with the structural model. We excluded from further analysis both these industries and 39 other industries with implied adjustment times exceeding 40 quarters. This "outlier" group of industries, which accounted for 14 percent of all industries sales, had estimated adjustment times averaging 353 quarters; including them in the analysis would have boosted the unweighted average adjustment time across industries to more than 75 quarters. We did investigate further as to why the NKPC model provided such a poor fit for these 77 industries. Augmented Dickey Fuller tests support that the price and cost inflation series are both stationary. Nevertheless, there appear to be discrepancies in the behavior of the price and cost level series for 74 of the 77 industries that do not fit the NKPC model. Augmented Dickey Fuller tests do not allow us to reject the null hypothesis of a unit root in the price level series for all of the 244 industries. Prices are likely an I(1) process in all cases. We can, however, reject the null hypothesis of a unit root for costs for 74 of the 77 industries that do not fit the NKPC model. The cost level series for these 74 industries appear to be I(0) processes. It thus appears that the NKPC model does not fit well for industries where the level of prices and costs are either converging or diverging (likely due to some environmental factor that is not accounted for in the NKPC model). The remaining 3 industries are Cigarette Manufacturing, in which prices appear to increase exponentially, and the Cutting Tool and Machine Tool Accessory Manufacturing and Industrial Truck, Tractor, Trailer and Stacker Machinery Manufacturing industries, in which there is unusually large variance in the cost series.

A summary of the results for the remaining 167 industries, which accounted for 79.9 percent of all industries' sales in 2001, appears in column (1) of Table 1. As indicated in column (1), the *unweighted* average price adjustment period emerging from the individual estimates for these 167 industries was about 11.9 quarters, or nearly 3 years. The standard deviation of estimated adjustment periods was almost as long, at about 10.8 quarters. Eighty-seven of these industries had estimated price adjustment periods of at least 6 quarters, and 78 of these had average estimated speeds of price adjustment of at least 8 quarters. These industries, which included average price adjustment intervals of 20.3 and 17.7 quarters, respectively. They

accounted, however, for only 16.8 percent and 11.4 percent, respectively, of the aggregate 2001 sales of the 167 industries. A total of 41 industries had estimated price adjustment speeds of less than one year, with an average estimated price adjustment interval of 2.8 quarters. These 41 industries generated more than 70 percent of the total 2001 sales of the 167 industries. Finally, column (1) of Table 1 reports the weighted average interval of price adjustment for the industries, using each industry's share of the 167 industries' total 2001 sales as weights. This weighted average of just over 5 quarters is much lower than the unweighted mean, which emphasizes the relatively dispersed and, in terms of sales of the various industries, skewed distribution of estimated adjustment times.

[Table 1 Goes Here]

As indicated in column (1), the average estimated discount factor β for the 167 industries is only 0.39. This value is well below what would normally be regarded as a "reasonable" level, and it arises from the fact that the estimated quantitative responses of industry prices to expected inflation are very small in most industries. Responses to variations in average variable costs are generally much more important determinants of industry-level prices.

There is considerable cross-industry variation in estimated inflation responses in the unrestricted framework, as indicated by the fact that the standard deviation of β estimates across the 167 industries is 0.25. To address this issue, we conducted restricted estimations with a preset value for the discount factor. Some aggregative empirical sticky-price studies, such as Sbordone (2002), assume that agents do not discount the future. Others impose values ranging from 0.95 to 0.99. Gali and Gertler obtain estimates from aggregate data in the vicinity of 0.95 to 1.00. Following Gwin and VanHoose (2004), we applied the Gali-Gertler methodology to a panel of all NAICS 6-digit industries, which yielded an estimated discount factor very close to 0.95. We proceeded to conduct nonlinear estimations at the industry level in which we imposed the restriction $\beta = 0.95$. Naturally, for higher β values, firms discount the future less and are less

willing to leave prices unchanged for longer intervals, which we verified held true in our restricted estimations by also re-estimating the model for all industries with $\beta = 0.99$. Thus, we regard the results reported with the restriction $\beta = 0.95$ as those giving a greater benefit of the doubt to a sticky-price interpretation of the industry data. The results obtained from both sets of restricted industry-level estimations are summarized in columns (2) and (3) of Table 1.

For the estimations with β preset at 0.95, the fit of the model for 57 industries was very poor and yielded negative estimated price adjustment intervals. We also excluded as outliers 7 industries with estimated price adjustment periods exceeding 40 quarters, or more than two standard deviations above the mean. The remaining 180 industries accounted for just over 86 percent of the total 2001 sales of the original 248 industries. The average estimated intervals between price adjustments were shorter than for the unrestricted estimation: an unweighted average of about 7.3 quarters and a sales-weighted average of just over 4.8 quarters. There were 77 industries with estimated price adjustment periods of at least 6 quarters, at an average length of 12.1 quarters, and these industries accounted for 20 percent of aggregate sales. Among this set of industries, 50 had estimated average price adjustment speeds of at least 8 quarters. The average for this latter group was 14.9 quarters, and together this group generated just under 15 percent of sales. Nevertheless, 64 industries with more than a 66 percent combined share of total sales had price adjustment times shorter than a year, at an average duration of 2.8 quarters. Of these, 10 industries (including petroleum and natural gas producers) accounting for close to 48 percent of total sales of the 180 industries were estimated to adjust their prices, on average, every 1.8 quarters.

Column (3) of Table 1 depicts the results of estimations for the case in which β is restricted to a value of 0.99. In this instance, the Gali-Gertler procedure failed to produce good fits for 57 industries and thereby yielded negative estimated price adjustment intervals, but only 4 industries were outliers with estimated price adjustment speeds more than two standard deviations above the mean. Naturally, imposing the $\beta = 0.99$ restriction reduced both the unweighted and weighted average estimated price adjustment intervals across all industries, to

6.7 quarters and 4.3 quarters, respectively. (The average estimated speeds of price adjustments in certain cases did not decline, however, because with $\beta = 0.99$ the Gali-Gertler methodology better fit those industries and yielded positive, and relatively lengthy, estimates for price adjustment intervals.) Other key implications are analogous to those forthcoming from the analysis for the case in which β was restricted to 0.95.

Figure 1 displays unweighted average price adjustment times by broad, 2-digit NAICS industry groupings in which at least three industries were considered by our analysis. These encompass mining, manufacturing, and transportation. Clearly, average estimated intervals between price adjustments for different industry groupings vary across estimation approaches. The only broad industry grouping for which estimated price adjustment intervals are consistently relatively longer than those of other categories is the metals-machinery-electrical (33) category.

[Figure 1 Goes Here]

Figure 2 displays a breakdown of unweighted average estimated price adjustment intervals at the 3-digit NAICS level for industry sub-groupings within manufacturing industries. At this narrower industry classification level, it is still true that estimated speeds of price adjustment vary considerably across estimation procedures. Apparel, metals, machinery, and transportation equipment manufacturing all consistently yield relatively lengthy—roughly 2 years—average estimated periods between price changes. Leather and petroleum and coal manufacturing uniformly exhibit speedier estimated price adjustments of slightly over a year or less.

[Figure 2 Goes Here]

From a more general standpoint, what can a macroeconomist take away from these results? First, studies using aggregate price data and labor-income-share proxies, such as Gali and Gertler (1999), Gali, Gertler, and Lopez-Salido (2001), and McAdam and Willman (2003),

may significantly overestimate the overall degree of price rigidity in real-world economies. Second, although there is evidence of relatively high price stickiness—at least 6 quarters—in industries that account for between 16.8 and 21.7 percent total sales by U.S. industries that we consider, our estimates indicate that industries generating at least 66 percent of sales have price adjustment periods of less than one year. Results from our restricted estimations indicate that for industries accounting for 47.8 percent of aggregate sales, prices are quite flexible, adjusting in less than 2 quarters. Finally, industry costs in numerous industries not included in our analysis follow I(0) processes that fail to mesh with the I(1) prices of these industries, so that the NKPC is simply a very poor fit for a large number of U.S. industries.

Our analysis indicates that, if anything, macroeconomic theories aimed at explaining the variables such as the U.S. price level, inflation, employment, and output probably should assume that the economy is populated by a *mix* of industries, including both sticky-price and flexible-price producers. One certainly cannot draw an inference from our results that a typical U.S. resident faces widespread price stickiness. Our results and those of Bils and Klenow show that models based on this assumption are not well supported by the data.

5. Implications and Conclusions

Perhaps the most reasonable interpretation of the industry-level results reported in this paper is that theoretical assumptions of either widespread price flexibility or widespread price stickiness are equally difficult to defend. Using aggregate data, Gali and Gertler found that U.S. producers typically take at least 6 quarters to adjust the prices of their products. According to our application of the Gali-Gertler methodology, however, industries accounting for no more than 22 percent of total sales in our sample of industries take 6 quarters or more to adjust their prices. Indeed, we have concluded that on *average*, when industries' relative shares of sales are taken into account, firms have price adjustment intervals that are at least 1 to 2 quarters shorter. Indeed, our results indicate that firms in industries accounting for two-thirds or more of total

sales take no more than a year to adjust their prices, and industries generating as much as close to half of total sales take less than 2 quarters to implement price changes.

In our view, these results indicate that Gali and Gertler's application of their empirical methodology to GDP-deflator inflation and using the labor-income-share to proxy for firms' real marginal costs probably introduced a strong upward bias into estimated price adjustment intervals. Our implementation of the same approach at the industry level using actual cost data has yielded estimated speeds of price adjustment across all U.S. industries that are generally faster than Gali and Gertler obtained from aggregate price data and a labor-income-share measure of real marginal cost.

There is, of course, a longstanding positivist argument that the fundamental basis for judging the reasonableness of a theory should be whether actual data support the theory's predictions rather than its assumptions. Nevertheless, we regard this paper's focus on the empirical relevance of the sticky-price assumption as a basic check on the reasonableness of this assumption. It is well known that macroeconomic data are subject to aggregation, measurement, identification, and simultaneity problems that considerably complicate determining appropriate tests of a model's predictions. Thus, testing the core assumption of sticky prices at the industry level provides evidence concerning the overall empirical worthiness of theories adopting the assumption that prices are everywhere inflexible. Based on our empirical results, we conclude that the sticky-price assumption of many widely used macroeconomic theories lacks a strong empirical foundation.

As pointed out two decades ago by Blinder and Mankiw (1984), divergent conclusions both in favor of and against the relevance of alternative theories can arise because no one theory is consistent with every portion of a nation's economy. These authors showed that in a nation containing sectors with varying degrees of wage and price stickiness, analysis of aggregate data might well mislead econometric researchers into concluding that empirical evidence is broadly supportive of one macroeconomic theory or broadly inconsistent with another, when in fact different parts of the economy simultaneously accord with opposing theories. The recent

analysis by Altissimo et al. (2004) of the mismatch of relatively meager disaggregate price stickiness with the literature suggesting aggregate inflation persistence provides some evidence in support of the Blinder-Mankiw perspective.

Our interpretation of the fruits of our empirical analysis, and those of Bils and Klenow, is that the United States may be a good example of a Blinder-Mankiw-type economy. Surprisingly little work has been done to develop theories concerning the behavior of agents in "multisector" economies, in which sectors differentially conform to the assumptions of alternative macroeconomic theories [exceptions include Duca (1987), Duca and VanHoose (1991, 2000, 2001), and Waller (1992)]. One reason for this state of affairs may be that, either by nature or training, macroeconomists are oriented toward proving or disproving narrow theories of the entire economy instead of broader models that admit the possibility that more than one theory may apply to individual sectors. Another reason may be that it is simply easier to develop dynamic, optimizing, general-equilibrium theories—which for good or ill is currently the minimum standard many researchers have in mind for an acceptable macroeconomic theory—in which agents face either completely flexible or inflexible prices. Contemplating how to generate separating equilibria with full, partial, or no price flexibility among various groups of producers certainly would prove to be a daunting task in a fully utility-based, dynamic, general-equilibrium theory.

Nevertheless, our empirical results using disaggregated U.S. industry data indicate that assuming that agents in model economies confront either fully flexible prices or completely sticky prices is probably grossly at odds with the facts. Overall, our results offer at best mixed support in U.S. data for the commonly adopted assumption that a broad range of producers hold prices fixed for intervals sufficiently lengthy to have important macroeconomic consequences. Extending the Gali-Gertler approach to industry-level data provides evidence that firms taking 6 or more quarters to adjust their prices account for only a fraction of the sales of all industries, with firms in industries generating the bulk of sales taking no more than one year to adjust their prices. The mixed extent of price flexibility across real-world industries may well call for the

development of theories that account for these heterogeneous responses across industries. Theories based on assumptions of an identical degree of price responsiveness by all producers are unlikely to adequately capture the realities of a modern, diverse economy.

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Data Appendix

Compustat is a subscription service that is described in-depth at http://www.compustat.com.

Producer price index industry data are publicly available from the Bureau of Labor Statistics (BLS) of the U.S. Department of Labor at http://www.bls.gov/ppi. Of the 775 6-digit NAICS industries from the *Compustat* database with actual sales in 2001, only 244 could be matched to a BLS PPI series with sufficient observations for the analysis. The remaining 531 industries could not be included in the study because:

- 266 industries were not listed in the BLS PPI database.
- 145 industries have no PPI data in the current BLS PPI series files.
- The collection of PPI data for 13 industries was started in 2003 or later by the BLS.
- The product definition of 45 industries was too broad for a reasonable match to a PPI series. (18 industries were classified by *Compustat* with a higher level NAICS sub-sector definition that has no clearly discernable product. 16 industries were classified as "miscellaneous" industry definitions. 11 industries were classified as "other" industry definitions.)
- 62 industries had 48 quarters or less of PPI data available, too little data for an appropriate fit in a Nonlinear Least Squares analysis of the model.

The Implicit Price Deflator is publicly available from the "Major Sector Productivity and Costs Index" of the BLS at http://www.bls.gov/lpc/home.htm. The data are for "Sector 8500 Nonfarm Business."

GDP data is publicly available from the Bureau of Economic Analysis of the U.S. Department of Commerce at http://www.bea.gov. We calculate the output gap as quadraticly detrended GDP.

The long-short interest rate spread is calculated as the difference between the 10-Year Treasury Constant Maturity Rate and the 3-Month Treasury Bill: Secondary Market Rate.

Interest rate data is publicly available from the FRED II Database maintained by the Federal Reserve Bank of St. Louis at http://research.stlouisfed.org/fred2/.

Table 1

	(1) Unrestricted Estimation Mean $\beta = 0.39$ (79.9% of all industries' sales)	(2) Restricted: $\beta = 0.95$ (86.3% of all industries' sales)	(3) Restricted: $\beta = 0.99$ (86.2% of all industries' sales)
Unweighted mean price adjustment time for all industries	11.9 quarters	7.3 quarters	6.7 quarters
Standard deviation for all industries	10.8 quarters	6.2 quarters	5.3 quarters
Industries with price adjustment intervals of at least 8 quarters	78 industries 11.4% of sales Mean = 20.3 Qtrs.	50 industries 14.8% of sales Mean = 14.9 Qtrs.	44 industries 15.2% of sales Mean = 14.2 Qtrs.
Industries with price adjustment intervals of at least 6 quarters	87 industries 16.8% of sales Mean = 17.7 Qtrs.	77 industries 20.0% of sales Mean = 12.1 Qtrs.	71 industries 21.7% of sales Mean = 11.5 Qtrs.
Industries with adjustment intervals less than 4 quarters	41 industries 70.2% of sales Mean = 2.8 Qtrs.	64 industries 66.2% of sales Mean = 2.8 Qtrs.	64 industries 66.2% of sales Mean = 2.7 Qtrs.
Industries with adjustment intervals less than 2 quarters	2 industries 1.1% of sales Mean = 1.9 Qtrs.	10 industries 47.8% of sales Mean = 1.8 Qtrs.	10 industries 47.8% of sales Mean = 1.8 Qtrs.
Weighted average adjustment time for all industries (2001 sales as weights)	5.1 quarters	4.8 quarters	4.3 quarters

Figure 1

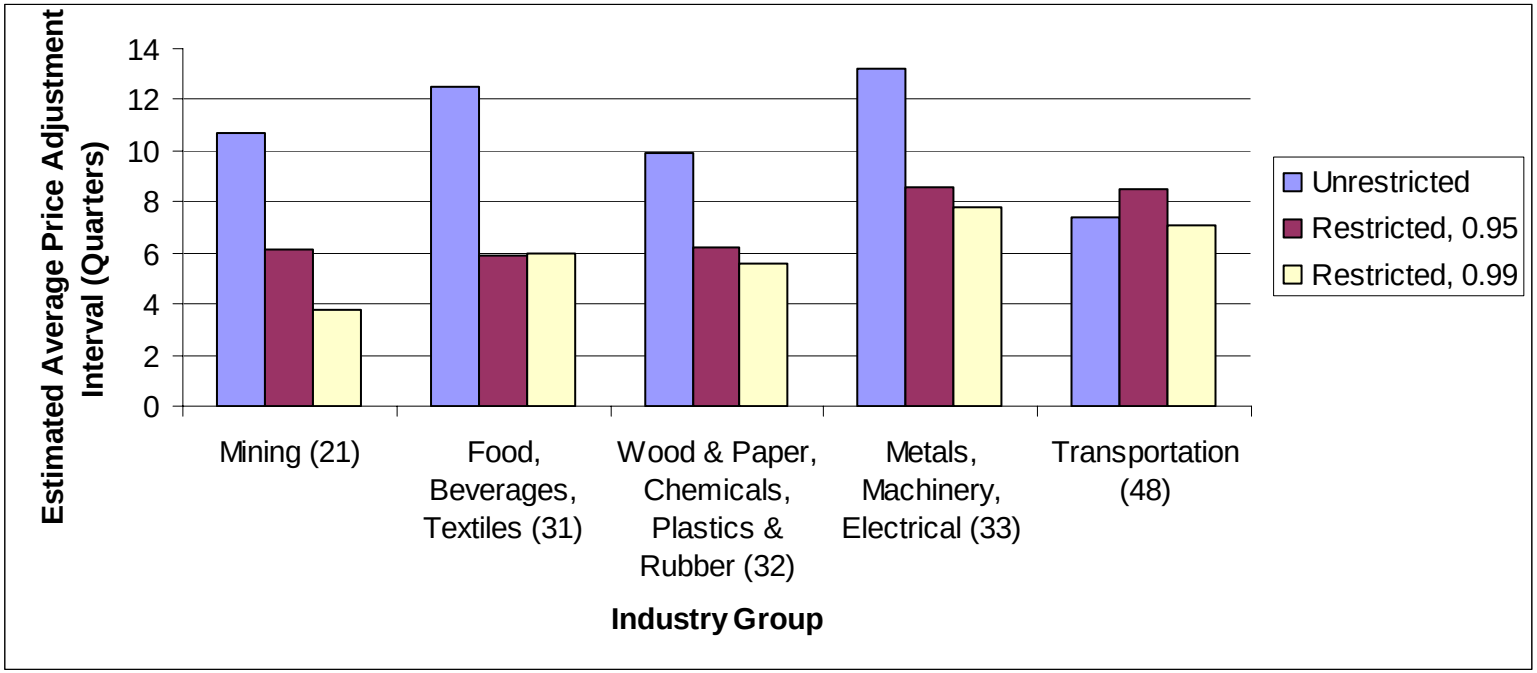
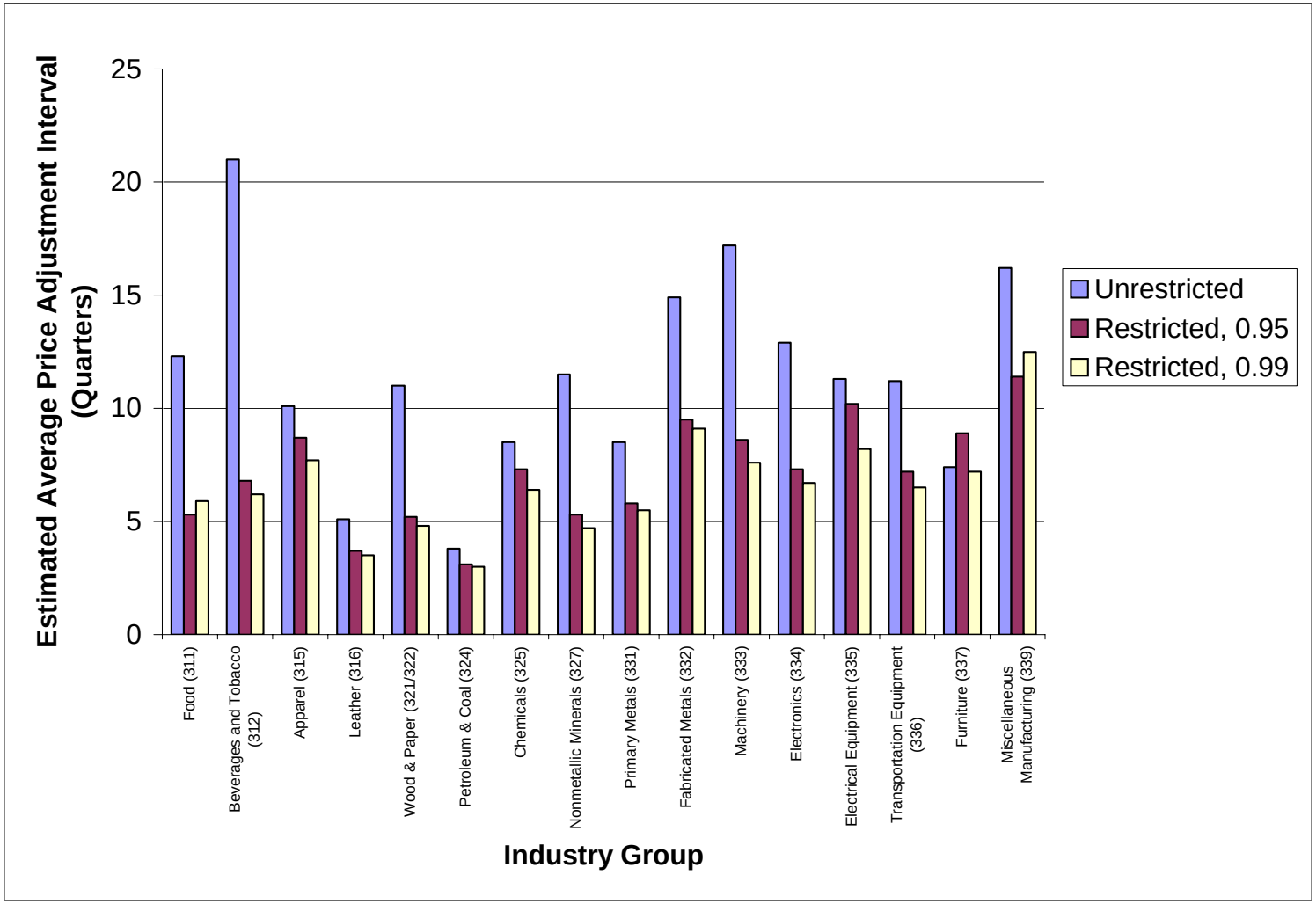

Estimated Average Price Adjustment Interval (Quarters)
14
12
10
8
6
4
2
0
Mining (21)
Food, Beverages, Textiles (31)
Wood & Paper, Chemicals, Plastics & Rubber (32)
Metals, Machinery, Electrical (33)
Transportation (48)
Industry Group
Unrestricted
Restricted, 0.95
Restricted, 0.99

Figure 2


Estimated Average Price Adjustment Interval (Quarters)
25
20
15
10
5
0
Food (311)
Beverages and Tobacco (312)
Apparel (315)
Leather (316)
Wood & Paper (321/322)
Petroleum & Coal (324)
Chemicals (325)
Nonmetallic Minerals (327)
Primary Metals (331)
Fabricated Metals (332)
Machinery (333)
Electronics (334)
Electrical Equipment (335)
Transportation Equipment (336)
Furniture (337)
Miscellaneous Manufacturing (339)
Industry Group
Unrestricted
Restricted, 0.95
Restricted, 0.99

This appendix is NOT intended for publication, it is provided as reference material for reviewers.

Appendix to Accompany "Disaggregate Evidence on U.S. Price Stickiness and Implications for Sticky-Price Macro Models"

Unrestricted Beta: Results for Industries Reported in Table 1, Column (1)

Naics	Description	Sales	Constant	t-stat	Beta	t-stat	Theta	t-stat	1/(1-Theta)
322130	Paperboard Mills	5323.407	-0.065	-0.335	0.063	1.422	0.460	45.867	1.852
331411	Primary Smelting and Refining of	2337.061	-0.405	-0.987	0.109	2.485	0.490	39.220	1.962
311611	Animal (except Poultry) Slaughte	11201.012	0.054	0.734	-0.011	-0.745	0.504	113.773	2.015
211112	Natural Gas Liquid Extraction	2497.000	-0.903	-0.925	0.021	0.404	0.521	32.479	2.087
324110	Petroleum Refineries	302099.830	-0.904	-2.514	0.067	2.169	0.533	62.252	2.143
311613	Rendering and Meat Byproduct P	63.634	1.012	1.777	-0.093	-1.949	0.535	41.415	2.153
325211	Plastics Material and Resin Manu	11635.519	0.067	0.285	0.060	1.213	0.553	45.802	2.237
311612	Meat Processed from Carcasses	58.253	0.145	0.847	0.129	2.906	0.561	41.435	2.278
331221	Rolled Steel Shape Manufacturin	826.938	0.542	3.033	0.300	5.289	0.561	31.469	2.279
325181	Alkalies and Chlorine Manufactu	470.256	0.120	0.222	0.385	5.283	0.564	22.854	2.294
325311	Nitrogenous Fertilizer Manufactu	1543.052	0.440	0.858	0.158	2.952	0.570	36.055	2.324
331315	Aluminum Sheet, Plate, and Foil	6375.942	0.043	0.177	0.244	4.079	0.571	33.139	2.333
331312	Primary Aluminum Production	544.400	-0.150	-0.436	0.221	3.747	0.573	35.057	2.342
311822	Flour Mixes and Dough Manufac	112.417	-0.037	-0.230	0.334	5.656	0.584	32.372	2.405
211111	Crude Petroleum and Natural Gas	25405.234	-1.055	-0.665	0.177	2.168	0.591	20.514	2.445
311615	Poultry Processing	1229.297	0.723	2.435	-0.110	-2.097	0.594	39.659	2.466
331421	Copper Rolling, Drawing, and Ex	1370.879	0.001	0.006	0.004	0.092	0.604	44.499	2.528
311812	Commercial Bakeries	1403.370	0.670	2.535	-0.189	-3.123	0.607	27.523	2.543
335312	Motor and Generator Manufactur	1049.534	0.059	0.631	0.495	9.116	0.623	36.151	2.651
213111	Drilling Oil and Gas Wells	3592.698	-1.005	-1.795	0.554	6.151	0.627	13.737	2.681
325100	Basic Chemical Manufacturing	2068.998	-0.574	-1.463	0.359	4.042	0.635	19.942	2.738
311920	Coffee and Tea Manufacturing	750.307	-0.091	-0.209	0.080	1.214	0.643	29.524	2.800
325182	Carbon Black Manufacturing	395.000	-0.551	-1.151	0.177	2.452	0.653	27.362	2.883
333992	Welding and Soldering Equipmer	2668.212	0.379	1.798	0.312	4.973	0.654	34.529	2.886
331111	Iron and Steel Mills	16114.495	0.280	1.372	0.418	7.365	0.657	31.914	2.912
325212	Synthetic Rubber Manufacturing	737.936	0.372	1.504	0.318	5.380	0.664	36.200	2.974
316110	Leather and Hide Tanning and Fi	9.373	1.073	2.904	0.069	0.957	0.669	27.073	3.018
322214	Fiber Can, Tube, Drum, and Simi	851.621	0.462	3.603	0.444	6.810	0.677	29.703	3.094
481111	Scheduled Passenger Air Transpo	43091.860	-1.164	-1.925	0.105	0.971	0.696	20.443	3.293
321113	Sawmills	733.609	-1.032	-2.045	0.060	0.564	0.699	12.150	3.327
483211	Inland Water Freight Transportati	200.714	1.433	1.931	0.164	1.225	0.700	12.688	3.329
212234	Copper Ore and Nickel Ore Minin	447.087	0.969	0.779	0.443	3.754	0.701	13.277	3.346
335311	Power, Distribution, and Specialty	804.227	0.151	1.192	0.563	9.911	0.711	32.178	3.465
311421	Fruit and Vegetable Canning	977.964	0.533	3.567	0.466	7.520	0.716	30.352	3.524
327320	Ready-Mix Concrete Manufacturi	263.405	-0.494	-3.429	0.426	7.376	0.730	38.603	3.698
213112	Support Activities for Oil and Ga	4735.386	0.017	0.037	0.243	2.118	0.732	12.766	3.732
311221	Wet Corn Milling	51.889	-0.712	-1.838	0.106	1.142	0.732	28.952	3.732
482111	Line-Haul Railroads	16150.242	0.015	0.119	0.618	9.642	0.737	28.581	3.802
333132	Oil and Gas Field Machinery and	2108.798	-0.046	-0.326	0.802	18.056	0.742	24.246	3.872
327125	Nonclay Refractory Manufacturir	277.165	-0.007	-0.044	0.436	6.330	0.744	32.462	3.911
324191	Petroleum Lubricating Oil and Gr	64.215	0.376	1.978	0.181	2.075	0.745	32.031	3.928
315191	Outerwear Knitting Mills	616.474	0.644	4.409	0.459	7.568	0.769	35.630	4.321
332611	Spring (Heavy Gauge) Manufactu	199.250	0.051	0.650	0.793	18.653	0.769	31.905	4.333
311422	Specialty Canning	1581.000	0.754	5.753	0.427	6.767	0.771	38.095	4.374
333995	Fluid Power Cylinder and Actuat	237.626	0.496	1.401	-0.345	-2.930	0.773	19.835	4.400
325510	Paint and Coating Manufacturing	3296.536	-0.110	-1.056	0.476	5.120	0.774	24.651	4.417
325520	Adhesive Manufacturing	322.345	0.173	1.306	0.383	4.095	0.775	24.372	4.450
316211	Rubber and Plastics Footwear Ma	3609.543	0.101	0.842	0.252	2.828	0.777	28.922	4.481
322110	Pulp Mills	325.934	1.189	0.796	0.575	4.328	0.777	10.244	4.490
327420	Gypsum Product Manufacturing	1428.098	-0.166	-0.495	0.489	7.286	0.780	27.556	4.544
327993	Mineral Wool Manufacturing	1067.000	0.172	1.700	0.424	5.035	0.780	26.931	4.551
335932	Noncurrent-Carrying Wiring Dev	106.567	0.429	1.832	0.610	8.452	0.782	24.360	4.597

337910	Mattress Manufacturing	1311.908	0.191	2.253	0.424	7.122	0.784	47.449	4.635
337214	Office Furniture (except Wood) M	507.089	0.178	1.560	0.186	1.973	0.785	24.038	4.641
327213	Glass Container Manufacturing	1526.140	-0.384	-1.886	0.450	6.470	0.785	25.742	4.652
113310	Logging	386.295	0.320	0.574	0.271	2.654	0.793	16.879	4.833
336213	Motor Home Manufacturing	1003.986	0.441	5.428	0.478	4.762	0.800	18.410	5.007
333415	Air-Conditioning and Warm Air H	3439.694	-0.123	-2.049	0.822	15.479	0.800	23.436	5.009
331210	Iron and Steel Pipe and Tube Mar	395.973	0.502	2.293	0.512	7.928	0.802	32.296	5.041
339944	Carbon Paper and Inked Ribbon M	15.420	-0.504	-2.427	0.566	7.104	0.805	28.403	5.127
326211	Tire Manufacturing (except Retre	6958.948	0.231	2.067	0.716	10.587	0.806	22.473	5.145
511110	Newspaper Publishers	7389.081	0.311	0.880	0.444	4.847	0.806	22.713	5.151
324122	Asphalt Shingle and Coating Mat	101.215	0.515	2.313	0.432	5.724	0.809	32.208	5.235
323111	Commercial Gravure Printing	1597.272	-0.048	-0.347	0.164	1.523	0.811	25.130	5.284
334412	Bare Printed Circuit Board Manu	12738.667	-0.133	-1.239	0.270	1.706	0.825	11.366	5.718
335122	Commercial, Industrial, and Instit	380.430	0.221	1.837	0.169	1.754	0.826	34.760	5.734
332991	Ball and Roller Bearing Manufact	1842.096	0.287	1.885	0.658	10.895	0.827	27.480	5.777
334111	Electronic Computer Manufacturi	34743.993	-1.306	-2.114	0.443	3.004	0.829	12.562	5.850
333111	Farm Machinery and Equipment M	3611.326	0.095	0.795	0.748	13.712	0.834	24.333	6.030
332311	Prefabricated Metal Building and	412.007	-0.087	-0.602	0.490	4.859	0.837	17.148	6.149
311513	Cheese Manufacturing	112.885	-0.223	-0.397	0.017	0.142	0.839	18.556	6.212
313112	Yarn Texturizing, Throwing, and	328.592	0.199	1.088	0.374	3.937	0.840	22.221	6.233
325414	Biological Product (except Diagn	2711.121	0.214	0.713	0.251	1.970	0.842	27.292	6.316
311111	Dog and Cat Food Manufacturing	731.300	0.085	0.651	0.164	1.568	0.843	38.969	6.366
334414	Electronic Capacitor Manufacturi	538.698	0.215	0.821	0.707	11.256	0.844	27.534	6.398
325620	Toilet Preparation Manufacturing	4274.272	0.143	1.036	0.447	4.604	0.845	18.644	6.466
311312	Cane Sugar Refining	428.462	-0.179	-1.013	0.245	2.021	0.851	13.471	6.696
325613	Surface Active Agent Manufactur	179.715	0.345	2.333	0.469	4.440	0.853	23.990	6.781
321219	Reconstituted Wood Product Mar	64.674	-0.336	-0.456	0.040	0.258	0.853	20.575	6.788
325131	Inorganic Dye and Pigment Manu	518.439	-0.040	-0.244	0.761	9.630	0.856	12.647	6.927
336370	Motor Vehicle Metal Stamping	825.012	0.167	1.986	0.702	11.060	0.863	33.513	7.279
334413	Semiconductor and Related Devic	19791.752	-0.160	-1.461	0.705	12.652	0.863	33.440	7.312
333991	Power-Driven Handtool Manufac	1331.778	-0.328	-2.382	0.689	9.927	0.868	32.402	7.586
335212	Household Vacuum Cleaner Man	110.451	0.256	2.556	0.633	9.944	0.869	27.884	7.656
316213	Men's Footwear (except Athletic)	87.744	0.135	0.944	0.632	9.053	0.873	34.743	7.863
332111	Iron and Steel Forging	158.881	0.043	0.422	0.600	7.047	0.874	32.298	7.934
483111	Deep Sea Freight Transportation	524.162	0.175	0.242	0.303	2.313	0.875	19.502	7.978
334513	Instruments and Related Products	1565.447	0.240	2.504	0.383	4.053	0.876	37.969	8.086
331513	Steel Foundries (except Investme	99.208	0.094	0.554	0.525	3.940	0.879	25.617	8.290
315224	Men's and Boys' Cut and Sew Trc	1003.556	0.134	0.839	0.525	5.953	0.881	14.780	8.380
332212	Hand and Edge Tool Manufacturi	1220.642	0.050	0.447	0.469	5.008	0.883	36.405	8.556
337211	Wood Office Furniture Manufactu	320.804	0.229	2.539	0.439	5.218	0.884	47.562	8.640
334417	Electronic Connector Manufactur	1129.560	-0.007	-0.059	0.657	8.066	0.889	13.840	8.989
334516	Analytical Laboratory Instrument	2196.713	0.175	1.573	0.201	1.775	0.900	35.759	9.958
315223	Men's and Boys' Cut and Sew Shi	115.172	0.165	1.514	0.630	9.643	0.900	33.291	10.009
212221	Gold Ore Mining	2733.565	0.777	1.283	0.471	4.449	0.902	28.499	10.181
311511	Fluid Milk Manufacturing	2.632	0.427	1.123	0.003	0.031	0.905	56.612	10.527
315222	Men's and Boys' Cut and Sew Sui	141.157	0.331	3.004	0.667	9.592	0.905	32.591	10.556
333293	Printing Machinery and Equipme	203.689	0.050	0.517	0.755	13.892	0.906	37.517	10.671
333210	Sawmill and Woodworking Mach	673.692	0.526	4.380	0.190	1.739	0.906	20.655	10.680
334416	Electronic Coil, Transformer, and	57.479	-0.086	-0.931	0.734	9.665	0.909	33.844	10.977
315192	Underwear and Nightwear Knittir	314.200	-0.266	-1.930	0.615	8.861	0.909	27.615	10.986
333912	Air and Gas Compressor Manufac	3570.672	0.195	1.543	0.337	3.114	0.911	34.753	11.251
511120	Periodical Publishers	1146.962	-0.393	-1.431	0.486	5.088	0.912	28.036	11.408
327992	Ground or Treated Mineral and E	42.455	0.043	0.371	0.255	2.332	0.913	44.548	11.492
332213	Saw Blade and Handsaw Manufac	119.100	-0.017	-0.119	0.740	11.196	0.914	19.926	11.590
337122	Nonupholstered Wood Household	560.567	0.211	2.230	0.754	11.653	0.914	17.544	11.590
336412	Aircraft Engine and Engine Parts	7189.020	0.099	0.587	0.310	2.706	0.914	32.919	11.614
335224	Household Laundry Equipment M	978.417	0.028	0.310	0.829	12.947	0.914	17.567	11.627
332322	Sheet Metal Work Manufacturing	84.628	0.012	0.101	0.737	9.483	0.916	33.566	11.934
336211	Motor Vehicle Body Manufacturi	2536.144	0.232	2.255	0.402	3.926	0.918	36.596	12.254

335991	Carbon and Graphite Product Ma	49.179	-0.368	-0.782	0.579	3.507	0.925	11.619	13.352
333512	Machine Tool (Metal Cutting Typ	513.269	0.117	0.991	0.867	17.298	0.926	11.270	13.590
312140	Distilleries	421.900	0.246	1.595	0.507	6.247	0.929	47.744	14.041
325312	Phosphatic Fertilizer Manufacturi	520.100	-0.116	-0.193	0.346	4.132	0.930	38.358	14.236
336311	Carburetor, Piston, Piston Ring, a	8.655	0.253	2.060	0.845	15.885	0.931	25.883	14.467
335211	Electric Housewares and Household	539.487	0.036	0.491	0.278	2.755	0.932	58.795	14.788
325612	Polish and Other Sanitation Good	1850.886	0.189	2.465	0.480	4.969	0.933	48.854	14.823
332994	Small Arms Manufacturing	134.464	1.333	6.491	-0.021	-0.188	0.933	67.877	14.930
321992	Prefabricated Wood Building Ma	103.157	0.080	0.437	0.430	3.790	0.935	20.710	15.403
336991	Motorcycle, Bicycle, and Parts M	891.118	0.382	5.699	0.275	2.486	0.939	54.503	16.312
339911	Jewelry (except Costume) Manuf	72.296	0.287	0.925	0.613	6.631	0.939	22.110	16.369
315225	Men's and Boys' Cut and Sew Wo	564.600	0.000	0.004	0.545	5.477	0.939	18.068	16.474
331112	Electrometallurgical Ferroalloy P	61.078	-0.201	-0.315	0.445	3.433	0.941	10.729	17.080
334515	Instrument Manufacturing for Me	1788.196	0.380	3.477	0.185	1.561	0.942	31.615	17.298
322215	Nonfolding Sanitary Food Contai	23.290	0.998	2.853	-0.008	-0.067	0.945	45.750	18.059
339941	Pen and Mechanical Pencil Manu	30.192	0.205	1.062	0.350	3.113	0.945	53.651	18.254
486110	Pipeline Transportation of Crude	128.794	-0.378	-0.676	0.285	1.951	0.946	38.427	18.649
312111	Soft Drink Manufacturing	6551.793	0.581	3.206	-0.015	-0.134	0.950	35.523	19.851
332812	Metal Coating, Engraving (except	94.742	0.220	2.481	0.219	1.915	0.950	59.149	19.997
332721	Precision Turned Product Manufa	5.555	0.186	2.897	0.636	6.825	0.951	46.187	20.384
311823	Dry Pasta Manufacturing	14.180	0.416	1.845	-0.108	-0.767	0.952	64.340	20.710
333131	Mining Machinery and Equipmen	268.052	-0.046	-0.492	0.952	30.780	0.953	27.451	21.149
333613	Mechanical Power Transmission	41.349	0.081	0.651	0.343	3.196	0.955	56.257	22.013
333913	Measuring and Dispensing Pump	121.239	0.015	0.133	0.271	2.348	0.955	56.899	22.134
332321	Metal Window and Door Manufa	401.221	0.490	3.465	0.638	9.850	0.956	43.884	22.817
322211	Corrugated and Solid Fiber Box M	1237.227	-0.418	-1.065	0.647	7.585	0.956	39.406	22.848
334514	Totalizing Fluid Meter and Count	41.710	0.111	0.759	0.334	2.749	0.957	27.529	23.015
334411	Electron Tube Manufacturing	17.479	0.274	1.187	0.446	4.107	0.958	25.814	23.534
322212	Folding Paperboard Box Manufac	650.009	-0.020	-0.128	0.636	5.137	0.958	15.173	23.563
333291	Paper Industry Machinery Manuf	58.900	-0.118	-1.059	0.453	3.277	0.958	35.657	23.822
332813	Electroplating, Plating, Polishing,	78.127	0.339	3.415	0.389	3.338	0.958	41.859	23.835
332116	Metal Stamping	46.156	0.131	1.964	0.749	9.821	0.958	52.099	23.978
332722	Bolt, Nut, Screw, Rivet, and Was	502.815	0.174	2.622	0.642	7.049	0.959	27.307	24.481
325611	Soap and Other Detergent Manuf	10286.352	0.211	1.648	0.281	2.482	0.960	38.223	24.910
339114	Dental Equipment and Supplies M	264.934	0.443	1.798	0.052	0.411	0.960	39.963	25.003
311313	Beet Sugar Manufacturing	242.855	-0.001	-0.003	0.561	5.460	0.962	27.961	26.250
311225	Fats and Oils Refining and Blend	19.046	-0.054	-0.122	0.379	3.674	0.962	49.527	26.258
332996	Fabricated Pipe and Pipe Fitting M	488.051	0.024	0.180	0.688	8.388	0.963	48.944	27.258
334517	Irradiation Apparatus Manufactur	131.807	0.064	0.753	0.421	2.590	0.964	39.484	27.693
333911	Pump and Pumping Equipment M	1977.303	0.365	2.809	0.416	3.744	0.964	39.477	27.942
212325	Clay and Ceramic and Refractory	80.941	0.253	2.199	0.232	1.811	0.965	30.155	28.358
327310	Cement Manufacturing	2237.249	-0.523	-2.127	0.372	4.679	0.966	62.778	29.014
312120	Breweries	3749.289	-0.178	-0.938	0.100	0.877	0.966	53.104	29.095
327211	Flat Glass Manufacturing	680.548	-0.011	-0.066	0.640	8.510	0.967	21.605	29.944
325413	In-Vitro Diagnostic Substance Ma	260.813	0.020	0.107	0.463	4.552	0.968	33.512	30.829
212312	Crushed and Broken Limestone M	74.427	0.186	1.452	0.022	0.198	0.969	109.922	32.416
311230	Breakfast Cereal Manufacturing	3163.100	-0.131	-0.846	0.741	8.971	0.970	27.869	33.177
314110	Carpet and Rug Mills	1670.044	0.250	2.154	0.192	1.393	0.971	19.567	34.257
333996	Fluid Power Pump and Motor Ma	21.541	0.277	1.740	0.256	1.707	0.972	31.211	36.230
335931	Current-Carrying Wiring Device	772.715	-0.003	-0.039	0.638	6.859	0.973	31.337	37.440
323110	Commercial Lithographic Printing	4211.202	0.035	0.374	0.720	8.672	0.973	14.082	37.696
333314	Optical Instrument and Lens Man	476.798	0.091	0.766	0.107	0.649	0.975	49.793	39.686
333612	Speed Changer, Industrial High-S	4.906	0.246	1.658	0.350	3.174	0.975	65.691	39.952
331524	Aluminum Foundries (except Die	1.113	0.099	0.440	0.530	3.571	0.975	42.033	40.421
311411	Frozen Fruit, Juice, and Vegetable	10.338	0.372	1.432	0.318	2.911	0.975	30.812	40.480
311211	Flour Milling	119.460	-0.203	-0.120	0.413	1.970	0.975	17.107	40.771

Unrestricted Beta: Outliers Not Reported in Table 1

Naics	Description	Sales	Constant	t-stat	Beta	t-stat	Theta	t-stat	1/(1-Theta)

212100	Coal Mining	385.784	0.217	0.853	0.158	1.164	0.999	24.259	1295.505
212313	Crushed and Broken Granite Min	300.831	-0.202	-0.501	0.145	0.800	0.990	32.196	97.762
311320	Chocolate and Confectionery Ma	2718.066	0.792	2.749	0.044	0.348	0.991	61.289	109.975
311520	Ice Cream and Frozen Dessert Ma	279.617	0.343	2.218	0.184	1.654	0.982	104.470	54.584
312130	Wineries	729.644	0.436	2.723	0.122	1.021	0.985	69.854	64.539
314121	Curtain and Drapery Mills	8.053	0.482	3.248	0.051	0.404	0.976	33.394	41.708
315233	Women's and Girls' Cut and Sew	67.123	-0.146	-1.223	0.562	5.423	0.990	41.819	96.129
323117	Books Printing	54.190	0.120	0.978	0.530	5.065	0.981	74.750	52.956
325314	Fertilizer (Mixing Only) Manufac	0.018	-0.493	-2.026	0.386	3.297	0.995	323.331	211.878
325412	Pharmaceutical Preparation Manu	73558.656	0.157	0.924	0.650	7.554	0.983	31.175	58.466
325910	Printing Ink Manufacturing	5.528	0.404	2.061	0.530	3.904	0.988	90.853	86.778
327215	Glass Product Manufacturing Ma	426.895	0.246	2.788	0.316	2.734	0.986	28.504	70.296
331512	Steel Investment Foundries	631.600	0.114	0.762	0.615	6.811	0.978	12.523	46.301
331522	Nonferrous (except Aluminum) D	66.556	0.128	1.026	0.342	2.064	0.992	38.935	128.161
332211	Cutlery and Flatware (except Prec	1828.985	0.309	1.286	0.082	0.668	0.993	59.875	144.732
332431	Metal Can Manufacturing	3935.129	0.244	1.006	0.579	8.142	0.990	103.551	102.179
332912	Fluid Power Valve and Hose Fitti	1864.414	0.321	1.852	0.167	0.996	0.993	26.399	135.318
332993	Ammunition (except Small Arms)	17.010	0.229	1.361	0.301	2.327	0.993	116.938	147.739
333292	Textile Machinery Manufacturing	1.720	0.188	2.269	0.265	1.439	1.000	3295.030	6765.900
333311	Automatic Vending Machine Ma	7.817	0.063	0.830	0.482	3.694	0.996	272.697	254.952
333414	Heating Equipment (except Warn	8.106	0.351	3.127	0.436	4.271	0.982	57.769	56.885
333993	Packaging Machinery Manufactu	121.020	0.400	2.992	0.110	0.746	0.996	136.271	238.772
334415	Electronic Resistor Manufacturin	564.570	0.367	2.616	0.434	4.788	0.990	23.597	99.596
335313	Switchgear and Switchboard App	145.358	0.243	1.722	0.310	2.556	0.996	38.669	229.326
335314	Relay and Industrial Control Man	1285.547	0.173	1.388	0.476	4.204	0.980	23.627	49.783
336212	Truck Trailer Manufacturing	307.310	0.274	2.072	0.489	4.094	0.977	23.336	43.458
336411	Aircraft Manufacturing	13342.450	0.269	1.663	0.496	4.311	0.982	28.007	54.330
336510	Railroad Rolling Stock Manufact	871.357	0.063	0.694	0.586	5.812	0.981	26.187	52.129
337121	Upholstered Household Furniture	914.381	0.137	2.083	0.820	14.017	0.979	27.339	46.837
337124	Metal Household Furniture Manu	39.718	0.397	2.796	0.293	1.772	0.996	65.460	229.911
339112	Surgical and Medical Instrument	4740.362	0.210	2.087	0.178	1.519	0.994	33.989	162.795
339113	Surgical Appliance and Supplies	2953.485	0.432	3.039	0.264	2.282	0.988	55.165	85.781
339932	Game, Toy, and Children's Vehic	1537.332	-0.581	-3.412	0.621	8.189	0.979	18.955	47.936
339993	Fastener, Button, Needle, and Pin	70.439	0.229	2.407	0.403	3.407	0.999	42.721	1684.069
486910	Pipeline Transportation of Refine	1268.508	0.183	1.531	0.153	1.192	0.992	252.904	131.872
511191	Greeting Card Publishers	451.475	0.772	2.373	0.152	1.031	0.985	74.807	65.111
532120	Truck, Utility Trailer, and RV (R	2006.466	-0.370	-1.252	0.114	0.735	0.976	35.309	41.567
561510	Travel Agencies	821.669	-0.945	-1.679	0.236	1.598	0.993	106.253	137.682

Unrestricted Beta: Poor Fits, Negative Estimated Price Adjustment Intervals Not Reported in Table 1

Naics	Description	Sales	Constant	t-stat	Beta	t-stat	Theta	t-stat	1/(1-Theta)
212210	Iron Ore Mining	28.800	-0.335	-1.578	0.568	5.328	1.021	30.124	-48.351
212322	Industrial Sand Mining	0.521	0.182	0.929	0.162	1.181	1.008	197.815	-133.316
311311	Sugarcane Mills	10.676	0.641	0.805	0.136	0.893	1.024	44.077	-41.502
311412	Frozen Specialty Food Manufactu	72.604	-0.087	-0.992	0.521	4.841	1.003	60.360	-360.881
311821	Cookie and Cracker Manufacturir	138.961	0.168	1.081	0.500	4.793	1.012	38.746	-81.759
312221	Cigarette Manufacturing	24317.288	1.823	5.347	0.246	2.569	1.062	30.532	-16.002
314911	Textile Bag Mills	1.153	0.316	1.435	0.323	2.382	1.011	274.318	-90.440
316212	House Slipper Manufacturing	35.658	0.012	0.051	0.271	2.044	1.013	58.253	-75.211
316214	Women's Footwear (except Athle	113.885	0.165	1.381	0.657	9.139	1.092	14.755	-10.871
316991	Luggage Manufacturing	192.090	-0.008	-0.050	0.210	1.085	1.008	26.939	-125.141
316993	Personal Leather Good (except W	19.981	0.135	1.099	0.384	3.195	1.033	62.176	-30.630
321991	Manufactured Home (Mobile Hor	1105.181	0.213	2.829	0.866	16.631	1.042	2.602	-23.575
325222	Noncellulosic Organic Fiber Man	305.572	-0.131	-0.826	0.433	4.408	1.102	18.285	-9.845
325411	Medicinal and Botanical Manufac	185.585	0.099	0.539	0.512	4.886	1.033	34.776	-29.940
326291	Rubber Product Manufacturing fo	387.581	0.059	0.767	0.549	4.375	1.001	35.332	-904.977
327122	Ceramic Wall and Floor Tile Mar	69.934	-0.389	-0.815	0.573	4.677	1.022	9.615	-45.606
331511	Iron Foundries	2152.223	0.037	0.219	0.788	13.258	1.017	49.189	-59.869
332811	Metal Heat Treating	11.185	0.113	1.872	0.287	2.064	1.000	71.148	-2824.859

332911	Industrial Valve Manufacturing	1.395	0.351	3.226	0.368	2.305	1.008	168.986	-131.423
333294	Food Product Machinery Manufa	20.566	0.171	1.714	0.569	5.586	1.001	184.009	-1107.420
333313	Office Machinery Manufacturing	5238.966	0.216	2.015	0.031	0.229	1.000	407.692	-9009.009
333515	Cutting Tool and Machine Tool A	38.600	0.137	1.645	0.467	4.156	1.001	69.183	-974.659
333611	Turbine and Turbine Generator S	0.080	-0.020	-0.160	0.787	9.211	1.005	207.770	-207.684
333922	Conveyor and Conveying Equipn	13.930	0.232	2.896	0.425	3.958	1.013	88.590	-76.805
333924	Industrial Truck, Tractor, Trailer,	821.822	0.147	2.127	0.669	7.716	1.056	9.953	-17.940
333994	Industrial Process Furnace and O	7.166	0.206	2.166	0.496	5.003	1.003	125.208	-365.631
334613	Magnetic and Optical Recording	88.280	-0.683	-2.288	0.179	1.076	1.007	49.578	-145.096
335121	Residential Electric Lighting Fixt	64.608	0.061	0.600	0.736	7.555	1.096	6.051	-10.400
335222	Household Refrigerator and Hom	3243.738	-0.141	-1.421	0.454	3.781	1.003	54.314	-323.625
335911	Storage Battery Manufacturing	789.695	0.209	1.424	0.253	2.196	1.000	222.442	-2732.240
335912	Primary Battery Manufacturing	9.709	0.222	1.044	0.283	2.467	1.001	86.569	-1140.251
336321	Vehicular Lighting Equipment M	19.923	0.000	0.003	0.456	3.966	1.040	18.754	-25.285
336611	Ship Building and Repairing	4197.853	0.609	5.880	0.156	1.253	1.018	71.150	-54.177
336612	Boat Building	13.686	0.530	3.817	0.111	0.931	1.011	118.599	-93.240
339115	Ophthalmic Goods Manufacturing	784.017	0.124	1.580	0.401	3.390	1.010	96.649	-101.061
339931	Doll and Stuffed Toy Manufactur	811.555	-0.165	-1.085	0.701	8.317	1.195	0.000	-5.134
339950	Sign Manufacturing	285.671	0.143	1.247	0.398	3.513	1.012	97.602	-86.408
511130	Book Publishers	3967.372	1.662	10.770	-0.083	-0.724	1.005	134.612	-218.436
515112	Radio Stations	1852.189	0.852	2.756	-0.085	-0.568	1.037	28.377	-27.393

Beta = 0.95: Results for Industries Reported in Table 1, Column (2)

Naics	Description	Sales	Constant	t-stat	Theta	t-stat	1/(1-Theta)
311611	Animal (except Poultry) Slaughte	11201.012	-1.223	-3.001	0.378	25.961	1.608
331411	Primary Smelting and Refining of	2337.061	-1.118	-1.122	0.403	18.260	1.676
211112	Natural Gas Liquid Extraction	2497.000	-0.783	-0.310	0.404	15.278	1.676
311812	Commercial Bakeries	1403.370	-0.704	-1.204	0.405	16.582	1.681
324110	Petroleum Refineries	302099.830	-1.454	-1.321	0.435	22.695	1.768
311613	Rendering and Meat Byproduct P	63.634	3.034	1.332	0.436	10.568	1.774
211111	Crude Petroleum and Natural Gas	25405.234	0.583	0.234	0.437	19.446	1.776
311612	Meat Processed from Carcasses	58.253	-0.220	-0.676	0.456	24.293	1.839
311615	Poultry Processing	1229.297	2.143	2.939	0.478	15.621	1.915
325311	Nitrogenous Fertilizer Manufactu	1543.052	-3.135	-3.522	0.486	18.563	1.945
316110	Leather and Hide Tanning and Fi	9.373	0.711	1.195	0.511	19.378	2.043
322130	Paperboard Mills	5323.407	-0.570	-1.353	0.516	14.321	2.067
331421	Copper Rolling, Drawing, and Ex	1370.879	-0.826	-1.889	0.523	19.718	2.095
331221	Rolled Steel Shape Manufacturing	826.938	0.272	1.045	0.532	18.324	2.138
311920	Coffee and Tea Manufacturing	750.307	-0.020	-0.029	0.539	17.319	2.171
325181	Alkalies and Chlorine Manufactu	470.256	-0.089	-0.118	0.539	14.229	2.171
325211	Plastics Material and Resin Manu	11635.519	-0.075	-0.152	0.558	15.665	2.262
483211	Inland Water Freight Transportati	200.714	3.037	3.243	0.560	9.585	2.273
331315	Aluminum Sheet, Plate, and Foil	6375.942	-0.357	-0.963	0.565	16.424	2.299
212234	Copper Ore and Nickel Ore Mini	447.087	1.933	1.360	0.576	14.393	2.356
325182	Carbon Black Manufacturing	395.000	-0.570	-0.730	0.580	14.275	2.379
333995	Fluid Power Cylinder and Actuat	237.626	-0.764	-1.160	0.583	7.833	2.396
481111	Scheduled Passenger Air Transpo	43091.860	-1.682	-1.818	0.587	11.783	2.419
331111	Iron and Steel Mills	16114.495	-0.081	-0.317	0.602	22.412	2.512
331312	Primary Aluminum Production	544.400	-0.530	-1.041	0.611	15.561	2.568
213111	Drilling Oil and Gas Wells	3592.698	-1.133	-1.774	0.612	10.165	2.578
325100	Basic Chemical Manufacturing	2068.998	-1.183	-2.395	0.612	12.051	2.580
333992	Welding and Soldering Equipmer	2668.212	0.115	0.396	0.614	19.879	2.592
323111	Commercial Gravure Printing	1597.272	0.097	0.514	0.615	22.623	2.601
311822	Flour Mixes and Dough Manufac	112.417	0.000	0.001	0.619	15.995	2.623
213112	Support Activities for Oil and Ga	4735.386	-0.179	-0.315	0.621	8.887	2.639
322214	Fiber Can, Tube, Drum, and Simi	851.621	-0.076	-0.554	0.629	20.346	2.693
311513	Cheese Manufacturing	112.885	0.813	1.050	0.630	11.966	2.702
325212	Synthetic Rubber Manufacturing	737.936	-0.160	-0.479	0.632	20.052	2.720
113310	Logging	386.295	-0.694	-1.034	0.644	13.009	2.810

322110	Pulp Mills	325.934	1.542	0.955	0.651	12.481	2.865
311221	Wet Corn Milling	51.889	-1.475	-2.559	0.657	13.540	2.914
327320	Ready-Mix Concrete Manufacturi	263.405	-1.186	-7.611	0.664	26.112	2.979
315191	Outerwear Knitting Mills	616.474	0.372	2.151	0.669	29.885	3.020
327993	Mineral Wool Manufacturing	1067.000	0.026	0.218	0.669	22.747	3.024
311421	Fruit and Vegetable Canning	977.964	0.218	1.253	0.673	20.292	3.062
327125	Nonclay Refractory Manufacturir	277.165	-0.416	-2.129	0.677	22.524	3.097
321113	Sawmills	733.609	-2.383	-3.652	0.678	5.328	3.107
337214	Office Furniture (except Wood) M	507.089	-0.334	-2.627	0.682	13.367	3.148
335122	Commercial, Industrial, and Instit	380.430	-0.240	-1.687	0.683	22.248	3.154
316211	Rubber and Plastics Footwear Ma	3609.543	-0.133	-0.864	0.686	16.799	3.183
325620	Toilet Preparation Manufacturing	4274.272	-0.149	-1.031	0.699	17.684	3.327
324191	Petroleum Lubricating Oil and Gr	64.215	-0.214	-0.857	0.701	14.521	3.343
483111	Deep Sea Freight Transportation	524.162	0.268	0.307	0.708	15.702	3.419
327420	Gypsum Product Manufacturing	1428.098	-0.505	-1.313	0.713	19.700	3.487
325520	Adhesive Manufacturing	322.345	-0.236	-1.672	0.714	14.694	3.495
335312	Motor and Generator Manufactur	1049.534	-0.293	-2.830	0.714	17.804	3.501
327213	Glass Container Manufacturing	1526.140	-0.976	-4.465	0.722	17.012	3.597
335932	Noncurrent-Carrying Wiring Dev	106.567	0.202	0.810	0.723	20.520	3.605
311422	Specialty Canning	1581.000	0.272	1.886	0.727	22.363	3.662
335311	Power, Distribution, and Specialty	804.227	-0.061	-0.428	0.727	19.004	3.665
333132	Oil and Gas Field Machinery and	2108.798	-0.217	-1.579	0.729	21.235	3.684
337910	Mattress Manufacturing	1311.908	-0.181	-1.940	0.731	27.532	3.718
313112	Yarn Texturizing, Throwing, and	328.592	0.028	0.127	0.736	14.502	3.785
325414	Biological Product (except Diagn	2711.121	-0.468	-1.294	0.738	14.676	3.820
311511	Fluid Milk Manufacturing	2.632	0.828	1.399	0.740	24.376	3.852
332311	Prefabricated Metal Building and	412.007	-0.375	-2.557	0.747	12.742	3.958
336213	Motor Home Manufacturing	1003.986	0.235	2.994	0.748	11.784	3.961
311111	Dog and Cat Food Manufacturing	731.300	-0.289	-1.686	0.750	17.030	3.992
324122	Asphalt Shingle and Coating Mat	101.215	0.350	1.308	0.754	18.723	4.066
331210	Iron and Steel Pipe and Tube Mar	395.973	0.120	0.493	0.759	20.164	4.157
325510	Paint and Coating Manufacturing	3296.536	-0.481	-5.564	0.764	13.389	4.229
334516	Analytical Laboratory Instrument	2196.713	-0.354	-3.487	0.765	18.519	4.260
511110	Newspaper Publishers	7389.081	-1.426	-7.631	0.766	12.928	4.268
331513	Steel Foundries (except Investme	99.208	-0.138	-0.791	0.770	26.009	4.345
334513	Instruments and Related Products	1565.447	-0.190	-2.444	0.773	23.741	4.410
334412	Bare Printed Circuit Board Manu	12738.667	0.005	0.041	0.776	5.276	4.455
339944	Carbon Paper and Inked Ribbon M	15.420	-0.363	-1.550	0.777	17.627	4.475
332611	Spring (Heavy Gauge) Manufactu	199.250	0.000	0.004	0.777	24.266	4.483
337211	Wood Office Furniture Manufactu	320.804	-0.232	-3.929	0.786	32.005	4.682
312111	Soft Drink Manufacturing	6551.793	-0.725	-5.162	0.789	12.694	4.743
327992	Ground or Treated Mineral and E	42.455	-0.435	-3.802	0.791	22.973	4.781
322215	Nonfolding Sanitary Food Contai	23.290	0.304	0.637	0.792	16.435	4.798
336211	Motor Vehicle Body Manufacturi	2536.144	-0.184	-2.326	0.793	25.422	4.826
333991	Power-Driven Handtool Manufac	1331.778	-0.641	-5.495	0.794	34.004	4.856
339114	Dental Equipment and Supplies M	264.934	-0.816	-3.567	0.795	16.095	4.871
332111	Iron and Steel Forging	158.881	-0.021	-0.189	0.796	26.939	4.891
333210	Sawmill and Woodworking Mach	673.692	0.125	0.938	0.796	8.903	4.895
511120	Periodical Publishers	1146.962	-1.590	-11.669	0.796	21.224	4.903
325131	Inorganic Dye and Pigment Manu	518.439	-0.135	-0.817	0.798	12.249	4.957
336412	Aircraft Engine and Engine Parts	7189.020	-0.549	-3.655	0.802	16.975	5.063
332994	Small Arms Manufacturing	134.464	0.428	1.602	0.806	20.872	5.166
335211	Electric Housewares and Household	539.487	-0.083	-0.932	0.807	31.544	5.173
334413	Semiconductor and Related Devic	19791.752	-0.050	-0.439	0.807	29.127	5.181
336370	Motor Vehicle Metal Stamping	825.012	0.089	1.019	0.808	29.192	5.209
335991	Carbon and Graphite Product Mar	49.179	-0.441	-0.869	0.809	10.193	5.236
335212	Household Vacuum Cleaner Man	110.451	0.133	1.263	0.810	20.605	5.259
332991	Ball and Roller Bearing Manufact	1842.096	-0.057	-0.393	0.814	17.449	5.365
332212	Hand and Edge Tool Manufacturi	1220.642	-0.371	-4.193	0.814	20.751	5.367

334414	Electronic Capacitor Manufacturi	538.698	0.100	0.359	0.815	20.117	5.406
333415	Air-Conditioning and Warm Air H	3439.694	-0.174	-3.044	0.815	17.649	5.417
212221	Gold Ore Mining	2733.565	1.136	1.651	0.820	16.777	5.558
333912	Air and Gas Compressor Manufac	3570.672	-0.358	-3.651	0.822	16.311	5.633
482111	Line-Haul Railroads	16150.242	-0.235	-1.857	0.825	13.326	5.721
316213	Men's Footwear (except Athletic)	87.744	-0.133	-0.935	0.827	23.332	5.789
321219	Reconstituted Wood Product Mar	64.674	-0.703	-0.699	0.830	5.490	5.887
486110	Pipeline Transportation of Crude	128.794	-1.340	-2.112	0.830	18.024	5.899
333913	Measuring and Dispensing Pump	121.239	-0.515	-5.706	0.832	27.245	5.942
315222	Men's and Boys' Cut and Sew Sui	141.157	0.133	1.259	0.834	27.431	6.032
332812	Metal Coating, Engraving (excep	94.742	-0.010	-0.093	0.834	24.256	6.034
511191	Greeting Card Publishers	451.475	-0.212	-0.647	0.834	37.708	6.035
336991	Motorcycle, Bicycle, and Parts M	891.118	0.162	2.290	0.836	23.345	6.091
334517	Irradiation Apparatus Manufactur	131.807	0.000	0.000	0.836	32.624	6.093
339941	Pen and Mechanical Pencil Manu	30.192	-0.468	-2.652	0.843	26.182	6.353
311313	Beet Sugar Manufacturing	242.855	0.062	0.183	0.843	22.921	6.369
315223	Men's and Boys' Cut and Sew Shi	115.172	0.015	0.130	0.843	22.451	6.387
332912	Fluid Power Valve and Hose Fitti	1864.414	-0.301	-2.184	0.844	9.931	6.422
312120	Breweries	3749.289	-0.901	-4.198	0.850	16.231	6.681
333111	Farm Machinery and Equipment M	3611.326	-0.083	-0.730	0.851	14.848	6.724
325612	Polish and Other Sanitation Good	1850.886	0.016	0.208	0.853	26.694	6.811
325413	In-Vitro Diagnostic Substance Ma	260.813	-0.439	-2.441	0.855	19.292	6.898
333911	Pump and Pumping Equipment M	1977.303	-0.079	-0.755	0.857	20.315	7.015
212312	Crushed and Broken Limestone M	74.427	-0.723	-7.753	0.860	28.448	7.161
326211	Tire Manufacturing (except Retre	6958.948	0.182	1.563	0.860	11.518	7.167
312140	Distilleries	421.900	-0.179	-1.184	0.861	24.865	7.209
332322	Sheet Metal Work Manufacturing	84.628	-0.052	-0.414	0.863	30.000	7.300
334416	Electronic Coil, Transformer, and	57.479	-0.171	-1.877	0.865	26.887	7.435
311211	Flour Milling	119.460	-0.820	-0.435	0.868	8.310	7.572
311411	Frozen Fruit, Juice, and Vegetabl	10.338	0.051	0.170	0.869	11.959	7.622
311520	Ice Cream and Frozen Dessert Ma	279.617	-0.147	-0.851	0.869	36.013	7.632
314110	Carpet and Rug Mills	1670.044	0.239	1.582	0.870	5.807	7.665
532120	Truck, Utility Trailer, and RV (R	2006.466	-0.361	-0.929	0.870	9.649	7.682
315192	Underwear and Nightwear Knittir	314.200	-0.591	-4.516	0.873	14.924	7.870
333613	Mechanical Power Transmission	41.349	-0.504	-6.019	0.873	21.095	7.890
325611	Soap and Other Detergent Manufa	10286.352	-0.053	-0.365	0.874	12.969	7.920
333314	Optical Instrument and Lens Man	476.798	0.285	1.961	0.875	13.422	8.010
335224	Household Laundry Equipment M	978.417	-0.018	-0.204	0.880	16.012	8.364
312130	Wineries	729.644	-0.017	-0.087	0.881	18.312	8.432
333996	Fluid Power Pump and Motor Ma	21.541	-0.228	-1.605	0.883	9.765	8.549
311225	Fats and Oils Refining and Blend	19.046	-0.246	-0.472	0.884	18.608	8.645
332811	Metal Heat Treating	11.185	-0.095	-1.932	0.886	27.079	8.792
339911	Jewelry (except Costume) Manufa	72.296	0.220	0.665	0.887	12.164	8.889
212313	Crushed and Broken Granite Min	300.831	-1.568	-4.798	0.888	8.409	8.931
333293	Printing Machinery and Equipme	203.689	-0.109	-1.202	0.888	24.375	8.934
315224	Men's and Boys' Cut and Sew Trc	1003.556	-0.237	-1.515	0.888	5.565	8.953
322211	Corrugated and Solid Fiber Box M	1237.227	-0.821	-2.044	0.894	24.988	9.403
334613	Magnetic and Optical Recording	88.280	-0.351	-0.976	0.894	13.654	9.414
331522	Nonferrous (except Aluminum) D	66.556	-0.039	-0.288	0.894	14.027	9.422
515112	Radio Stations	1852.189	1.774	4.549	0.894	5.215	9.438
325613	Surface Active Agent Manufactur	179.715	0.054	0.359	0.895	7.312	9.567
332721	Precision Turned Product Manufa	5.555	0.107	1.662	0.896	27.617	9.570
327310	Cement Manufacturing	2237.249	-1.523	-6.309	0.897	20.869	9.741
327215	Glass Product Manufacturing Mad	426.895	0.030	0.316	0.901	8.717	10.077
325312	Phosphatic Fertilizer Manufacturi	520.100	-1.236	-1.774	0.904	10.550	10.387
322212	Folding Paperboard Box Manufac	650.009	-0.090	-0.539	0.907	7.932	10.759
336311	Carburetor, Piston, Piston Ring, a	8.655	0.165	1.423	0.911	21.169	11.186
334515	Instrument Manufacturing for Me	1788.196	0.180	1.359	0.912	6.504	11.336
332996	Fabricated Pipe and Pipe Fitting M	488.051	-0.134	-1.007	0.912	30.878	11.353

332993	Ammunition (except Small Arms	17.010	-0.060	-0.321	0.914	34.397	11.582
333291	Paper Industry Machinery Manuf	58.900	-0.419	-5.032	0.914	11.659	11.641
332321	Metal Window and Door Manufa	401.221	0.192	1.404	0.915	21.178	11.800
323117	Books Printing	54.190	-0.112	-0.938	0.926	28.519	13.523
333414	Heating Equipment (except Warn	8.106	0.023	0.219	0.929	16.886	14.088
336510	Railroad Rolling Stock Manufact	871.357	-0.059	-0.645	0.930	10.428	14.352
331524	Aluminum Foundries (except Die	1.113	-0.156	-0.689	0.932	14.371	14.602
334514	Totalizing Fluid Meter and Count	41.710	-0.157	-0.967	0.934	5.867	15.102
311230	Breakfast Cereal Manufacturing	3163.100	-0.318	-2.252	0.936	15.516	15.742
325412	Pharmaceutical Preparation Manu	73558.656	-0.272	-2.160	0.937	13.757	15.892
332213	Saw Blade and Handsaw Manufac	119.100	-0.243	-1.965	0.943	7.519	17.697
511130	Book Publishers	3967.372	0.614	4.239	0.944	14.392	17.794
335931	Current-Carrying Wiring Device	772.715	-0.143	-1.859	0.944	11.817	17.862
332116	Metal Stamping	46.156	0.063	0.980	0.945	24.856	18.103
331112	Electrometallurgical Ferroalloy P	61.078	-0.485	-0.665	0.945	2.314	18.241
311320	Chocolate and Confectionery Mar	2718.066	0.351	0.948	0.945	7.698	18.333
315233	Women's and Girls' Cut and Sew	67.123	-0.255	-2.012	0.949	12.870	19.695
335313	Switchgear and Switchboard App	145.358	-0.323	-2.940	0.951	6.846	20.605
333131	Mining Machinery and Equipmer	268.052	-0.043	-0.509	0.953	28.165	21.312
325314	Fertilizer (Mixing Only) Manufac	0.018	-0.727	-2.570	0.957	65.266	23.305
332431	Metal Can Manufacturing	3935.129	-0.004	-0.016	0.958	29.394	23.835
337124	Metal Household Furniture Manu	39.718	0.250	1.523	0.959	10.194	24.191
325910	Printing Ink Manufacturing	5.528	0.357	1.649	0.959	22.649	24.212
333311	Automatic Vending Machine Mar	7.817	0.053	0.614	0.961	66.619	25.902
486910	Pipeline Transportation of Refine	1268.508	0.174	1.130	0.968	26.360	31.032
339113	Surgical Appliance and Supplies	2953.485	-0.202	-1.767	0.969	6.712	32.354
335912	Primary Battery Manufacturing	9.709	-0.106	-0.411	0.972	10.058	36.093

Beta = 0.95: Outliers Not Reported in Table 1

Naics	Description	Sales	Constant	t-stat	Theta	t-stat	1/(1-Theta)
311311	Sugarcane Mills	10.676	0.138	0.139	0.990	2.911	103.375
333292	Textile Machinery Manufacturing	1.720	-0.018	-0.241	0.997	209.088	353.245
333294	Food Product Machinery Manufac	20.566	-0.134	-2.137	0.988	29.256	80.866
333994	Industrial Process Furnace and O	7.166	-0.114	-1.572	0.988	16.646	80.403
337121	Upholstered Household Furniture	914.381	0.061	1.062	0.989	8.839	87.639
339993	Fastener, Button, Needle, and Pin	70.439	0.019	0.200	0.978	5.809	44.878
561510	Travel Agencies	821.669	-1.790	-2.728	0.984	9.147	62.172

Beta = 0.95: Poor Fits with Negative Estimated Price Adjustment Intervals Not Reported in Table 1

Naics	Description	Sales	Constant	t-stat	Theta	t-stat	1/(1-Theta)
212100	Coal Mining	385.784	0.466	1.493	1.026	0.000	-38.490
212210	Iron Ore Mining	28.800	-0.524	-2.342	1.026	0.001	-38.493
212322	Industrial Sand Mining	0.521	-0.642	-3.886	1.026	0.000	-38.493
212325	Clay and Ceramic and Refractory	80.941	-0.081	-0.686	1.026	0.000	-38.493
311312	Cane Sugar Refining	428.462	-0.248	-1.169	1.026	0.000	-38.496
311412	Frozen Specialty Food Manufactu	72.604	-0.308	-4.199	1.026	0.001	-38.494
311821	Cookie and Cracker Manufacturir	138.961	-0.244	-1.780	1.026	0.001	-38.493
311823	Dry Pasta Manufacturing	14.180	-0.027	-0.089	1.026	0.000	-38.493
312221	Cigarette Manufacturing	24317.288	0.639	1.721	1.026	0.001	-38.496
314121	Curtain and Drapery Mills	8.053	-0.133	-0.830	1.026	0.000	-38.493
314911	Textile Bag Mills	1.153	-0.277	-1.242	1.026	0.005	-38.488
315225	Men's and Boys' Cut and Sew Wo	564.600	-0.175	-1.957	1.026	0.000	-38.496
316212	House Slipper Manufacturing	35.658	-0.515	-2.077	1.026	0.001	-38.497
316214	Women's Footwear (except Athle	113.885	-0.042	-0.369	1.026	0.002	-38.496
316991	Luggage Manufacturing	192.090	-0.022	-0.107	1.026	0.000	-38.496
316993	Personal Leather Good (except W	19.981	-0.179	-1.536	1.026	0.001	-38.491
321991	Manufactured Home (Mobile Hor	1105.181	0.144	2.306	1.026	0.000	-38.494
321992	Prefabricated Wood Building Ma	103.157	-0.212	-1.077	1.026	0.000	-38.494
323110	Commercial Lithographic Printin	4211.202	-0.072	-0.825	1.026	0.000	-38.491

325222	Noncellulosic Organic Fiber Man	305.572	-0.178	-0.960	1.026	0.000	-38.491
325411	Medicinal and Botanical Manufac	185.585	-0.151	-0.786	1.026	0.000	-38.497
326291	Rubber Product Manufacturing fo	387.581	-0.041	-0.536	1.026	0.001	-38.494
327122	Ceramic Wall and Floor Tile Mar	69.934	-0.559	-1.093	1.026	0.000	-38.500
327211	Flat Glass Manufacturing	680.548	-0.201	-1.202	1.026	0.001	-38.499
331511	Iron Foundries	2152.223	-0.145	-0.915	1.026	0.000	-38.494
331512	Steel Investment Foundries	631.600	-0.124	-0.854	1.026	0.000	-38.494
332211	Cutlery and Flatware (except Prec	1828.985	-1.047	-5.502	1.026	0.000	-38.494
332722	Bolt, Nut, Screw, Rivet, and Was	502.815	0.085	1.308	1.026	0.000	-38.491
332813	Electroplating, Plating, Polishing,	78.127	0.073	0.768	1.014	1.195	-69.580
332911	Industrial Valve Manufacturing	1.395	0.046	0.580	1.026	0.002	-38.497
333313	Office Machinery Manufacturing	5238.966	-0.118	-0.934	1.026	0.001	-38.493
333512	Machine Tool (Metal Cutting Typ	513.269	0.035	0.323	1.026	0.000	-38.496
333515	Cutting Tool and Machine Tool A	38.600	-0.132	-2.138	1.026	0.002	-38.496
333611	Turbine and Turbine Generator S	0.080	-0.124	-1.092	1.026	0.004	-38.491
333612	Speed Changer, Industrial High-S	4.906	-0.412	-4.077	1.026	0.001	-38.493
333922	Conveyor and Conveying Equipm	13.930	-0.010	-0.143	1.026	0.002	-38.499
333924	Industrial Truck, Tractor, Trailer,	821.822	0.054	0.813	1.026	0.001	-38.491
333993	Packaging Machinery Manufactu	121.020	-0.255	-2.921	1.026	0.002	-38.494
334111	Electronic Computer Manufacturi	34743.993	0.215	0.442	1.026	0.000	-38.493
334411	Electron Tube Manufacturing	17.479	0.148	0.570	1.026	0.000	-38.496
334415	Electronic Resistor Manufacturin	564.570	-0.044	-0.320	1.026	0.000	-38.493
334417	Electronic Connector Manufactur	1129.560	-0.214	-1.905	1.026	0.000	-38.497
335121	Residential Electric Lighting Fixt	64.608	-0.040	-0.425	1.026	0.001	-38.493
335222	Household Refrigerator and Hom	3243.738	-0.057	-0.519	1.026	0.001	-38.496
335314	Relay and Industrial Control Man	1285.547	-0.247	-2.991	1.026	0.000	-38.493
335911	Storage Battery Manufacturing	789.695	0.152	0.854	1.026	0.003	-38.490
336212	Truck Trailer Manufacturing	307.310	0.101	0.727	1.026	0.000	-38.496
336321	Vehicular Lighting Equipment M	19.923	-0.104	-0.633	1.026	0.000	-38.491
336411	Aircraft Manufacturing	13342.450	-0.228	-2.018	1.026	0.000	-38.494
336611	Ship Building and Repairing	4197.853	0.155	1.608	1.026	0.001	-38.496
336612	Boat Building	13.686	-0.289	-2.960	1.026	0.001	-38.493
337122	Nonupholstered Wood Household	560.567	0.030	0.397	1.026	0.000	-38.494
339112	Surgical and Medical Instrument	4740.362	-0.158	-1.504	1.026	0.000	-38.491
339115	Ophthalmic Goods Manufacturin	784.017	-0.050	-0.634	1.026	0.001	-38.499
339931	Doll and Stuffed Toy Manufactur	811.555	-0.296	-1.959	1.026	0.001	-38.494
339932	Game, Toy, and Children's Vehic	1537.332	-1.017	-6.968	1.026	0.000	-38.491
339950	Sign Manufacturing	285.671	-0.260	-2.810	1.026	0.000	-38.493

Beta = 0.99: Results for Industries Reported in Table 1, Column (3)

Naics	Description	Sales	Constant	t-stat	Theta	t-stat	1/(1-Theta)
311611	Animal (except Poultry) Slaughte	11201.012	-1.276	-3.010	0.373	25.186	1.596
211112	Natural Gas Liquid Extraction	2497.000	-0.778	-0.297	0.399	14.854	1.664
311812	Commercial Bakeries	1403.370	-0.753	-1.251	0.399	16.317	1.665
331411	Primary Smelting and Refining of	2337.061	-1.152	-1.111	0.399	17.662	1.665
211111	Crude Petroleum and Natural Gas	25405.234	0.668	0.260	0.430	19.104	1.754
324110	Petroleum Refineries	302099.830	-1.479	-1.292	0.430	21.928	1.755
311613	Rendering and Meat Byproduct P	63.634	3.111	1.318	0.433	10.236	1.762
311612	Meat Processed from Carcasses	58.253	-0.238	-0.705	0.451	23.598	1.822
311615	Poultry Processing	1229.297	2.197	2.919	0.473	15.193	1.898
325311	Nitrogenous Fertilizer Manufactu	1543.052	-3.316	-3.589	0.481	17.930	1.928
316110	Leather and Hide Tanning and Fi	9.373	0.695	1.135	0.504	19.023	2.014
331421	Copper Rolling, Drawing, and Ex	1370.879	-0.861	-1.908	0.519	19.081	2.077
322130	Paperboard Mills	5323.407	-0.592	-1.358	0.520	13.452	2.083
331221	Rolled Steel Shape Manufacturin	826.938	0.256	0.949	0.530	17.574	2.128
311920	Coffee and Tea Manufacturing	750.307	-0.017	-0.024	0.534	16.873	2.146
325181	Alkalies and Chlorine Manufactu	470.256	-0.104	-0.133	0.537	13.614	2.161
483211	Inland Water Freight Transportati	200.714	3.119	3.252	0.552	9.429	2.234
325211	Plastics Material and Resin Manu	11635.519	-0.081	-0.159	0.558	14.855	2.264

331315	Aluminum Sheet, Plate, and Foil	6375.942	-0.380	-0.991	0.564	15.626	2.296
212234	Copper Ore and Nickel Ore Mini	447.087	2.009	1.382	0.566	14.274	2.304
325182	Carbon Black Manufacturing	395.000	-0.571	-0.708	0.575	13.766	2.353
333995	Fluid Power Cylinder and Actuat	237.626	-0.803	-1.191	0.575	7.700	2.354
481111	Scheduled Passenger Air Transpo	43091.860	-1.707	-1.794	0.580	11.473	2.382
331111	Iron and Steel Mills	16114.495	-0.108	-0.410	0.597	21.640	2.481
323111	Commercial Gravure Printing	1597.272	0.104	0.540	0.605	22.397	2.530
213111	Drilling Oil and Gas Wells	3592.698	-1.146	-1.749	0.610	9.742	2.565
325100	Basic Chemical Manufacturing	2068.998	-1.224	-2.410	0.610	11.525	2.567
333992	Welding and Soldering Equipmer	2668.212	0.098	0.329	0.611	19.048	2.571
213112	Support Activities for Oil and Ga	4735.386	-0.190	-0.327	0.614	8.711	2.587
331312	Primary Aluminum Production	544.400	-0.551	-1.050	0.614	14.583	2.590
311513	Cheese Manufacturing	112.885	0.857	1.083	0.619	11.856	2.626
311822	Flour Mixes and Dough Manufac	112.417	0.003	0.012	0.622	14.945	2.646
322214	Fiber Can, Tube, Drum, and Simi	851.621	-0.118	-0.839	0.624	19.568	2.660
325212	Synthetic Rubber Manufacturing	737.936	-0.193	-0.563	0.630	19.142	2.701
113310	Logging	386.295	-0.754	-1.098	0.634	12.849	2.732
322110	Pulp Mills	325.934	1.580	0.959	0.638	12.501	2.760
311221	Wet Corn Milling	51.889	-1.511	-2.551	0.652	13.046	2.871
327320	Ready-Mix Concrete Manufactur	263.405	-1.238	-7.715	0.658	25.171	2.925
315191	Outerwear Knitting Mills	616.474	0.350	1.969	0.659	29.222	2.936
327993	Mineral Wool Manufacturing	1067.000	0.015	0.123	0.659	22.296	2.936
311421	Fruit and Vegetable Canning	977.964	0.192	1.074	0.669	19.472	3.019
327125	Nonclay Refractory Manufacturir	277.165	-0.448	-2.229	0.670	21.760	3.034
335122	Commercial, Industrial, and Instit	380.430	-0.264	-1.810	0.673	21.840	3.059
337214	Office Furniture (except Wood) M	507.089	-0.361	-2.771	0.675	13.001	3.074
321113	Sawmills	733.609	-2.444	-3.667	0.677	5.079	3.091
316211	Rubber and Plastics Footwear Ma	3609.543	-0.146	-0.928	0.679	16.289	3.111
325620	Toilet Preparation Manufacturing	4274.272	-0.172	-1.168	0.686	17.619	3.187
483111	Deep Sea Freight Transportation	524.162	0.274	0.307	0.695	15.607	3.274
324191	Petroleum Lubricating Oil and Gr	64.215	-0.245	-0.955	0.697	13.843	3.301
327420	Gypsum Product Manufacturing	1428.098	-0.535	-1.357	0.706	19.085	3.397
325520	Adhesive Manufacturing	322.345	-0.264	-1.829	0.708	14.129	3.421
335932	Noncurrent-Carrying Wiring Dev	106.567	0.176	0.690	0.714	19.999	3.496
327213	Glass Container Manufacturing	1526.140	-1.023	-4.577	0.715	16.431	3.509
311422	Specialty Canning	1581.000	0.235	1.587	0.722	21.324	3.595
333132	Oil and Gas Field Machinery and	2108.798	-0.263	-1.870	0.724	20.214	3.629
337910	Mattress Manufacturing	1311.908	-0.209	-2.179	0.725	26.253	3.637
313112	Yarn Texturizing, Throwing, and	328.592	0.016	0.071	0.726	14.172	3.645
311511	Fluid Milk Manufacturing	2.632	0.845	1.392	0.728	23.934	3.682
325414	Biological Product (except Diagn	2711.121	-0.507	-1.366	0.729	14.236	3.689
335312	Motor and Generator Manufactur	1049.534	-0.324	-3.035	0.730	15.526	3.697
335311	Power, Distribution, and Specialty	804.227	-0.083	-0.567	0.730	17.514	3.699
332311	Prefabricated Metal Building and	412.007	-0.400	-2.676	0.737	12.490	3.800
336213	Motor Home Manufacturing	1003.986	0.218	2.712	0.741	11.315	3.861
311111	Dog and Cat Food Manufacturing	731.300	-0.308	-1.751	0.741	16.410	3.864
324122	Asphalt Shingle and Coating Mat	101.215	0.337	1.229	0.748	17.895	3.961
334516	Analytical Laboratory Instrument	2196.713	-0.382	-3.681	0.753	18.171	4.052
331210	Iron and Steel Pipe and Tube Mar	395.973	0.085	0.342	0.754	19.205	4.059
331513	Steel Foundries (except Investme	99.208	-0.160	-0.895	0.756	25.639	4.104
511110	Newspaper Publishers	7389.081	-1.563	-8.188	0.761	12.288	4.177
334513	Instruments and Related Products	1565.447	-0.220	-2.764	0.762	23.137	4.202
325510	Paint and Coating Manufacturing	3296.536	-0.513	-5.789	0.762	12.481	4.204
334412	Bare Printed Circuit Board Manu	12738.667	0.013	0.105	0.770	5.020	4.349
339944	Carbon Paper and Inked Ribbon M	15.420	-0.348	-1.450	0.772	16.588	4.386
337211	Wood Office Furniture Manufact	320.804	-0.268	-4.422	0.775	31.141	4.438
312111	Soft Drink Manufacturing	6551.793	-0.779	-5.434	0.775	12.556	4.449
322215	Nonfolding Sanitary Food Contai	23.290	0.275	0.564	0.778	16.212	4.505
327992	Ground or Treated Mineral and E	42.455	-0.462	-3.950	0.778	22.498	4.511

336211	Motor Vehicle Body Manufacturi	2536.144	-0.215	-2.652	0.779	25.141	4.518
332611	Spring (Heavy Gauge) Manufactu	199.250	-0.013	-0.151	0.780	21.980	4.536
339114	Dental Equipment and Supplies M	264.934	-0.872	-3.736	0.780	15.991	4.542
333991	Power-Driven Handtool Manufac	1331.778	-0.689	-5.785	0.780	33.588	4.550
511120	Periodical Publishers	1146.962	-1.694	-12.186	0.782	21.054	4.578
332111	Iron and Steel Forging	158.881	-0.028	-0.249	0.783	26.303	4.615
325131	Inorganic Dye and Pigment Manu	518.439	-0.155	-0.922	0.784	12.142	4.635
333210	Sawmill and Woodworking Mach	673.692	0.104	0.763	0.784	8.684	4.637
336412	Aircraft Engine and Engine Parts	7189.020	-0.590	-3.840	0.790	16.607	4.761
335991	Carbon and Graphite Product Ma	49.179	-0.448	-0.868	0.792	10.212	4.817
335211	Electric Housewares and Househo	539.487	-0.090	-0.989	0.793	31.005	4.830
332994	Small Arms Manufacturing	134.464	0.391	1.429	0.794	20.360	4.857
334413	Semiconductor and Related Devic	19791.752	-0.032	-0.275	0.795	28.367	4.883
336370	Motor Vehicle Metal Stamping	825.012	0.076	0.856	0.797	28.342	4.916
335212	Household Vacuum Cleaner Man	110.451	0.118	1.093	0.799	19.941	4.980
332212	Hand and Edge Tool Manufacturi	1220.642	-0.406	-4.482	0.804	19.930	5.097
334414	Electronic Capacitor Manufacturi	538.698	0.081	0.284	0.808	18.972	5.218
212221	Gold Ore Mining	2733.565	1.166	1.659	0.808	16.279	5.222
332991	Ball and Roller Bearing Manufact	1842.096	-0.104	-0.702	0.811	16.123	5.284
333912	Air and Gas Compressor Manufac	3570.672	-0.394	-3.932	0.811	15.787	5.295
486110	Pipeline Transportation of Crude	128.794	-1.398	-2.157	0.816	17.717	5.443
333913	Measuring and Dispensing Pump	121.239	-0.546	-5.927	0.817	26.894	5.460
511191	Greeting Card Publishers	451.475	-0.261	-0.785	0.817	37.815	5.477
316213	Men's Footwear (except Athletic)	87.744	-0.167	-1.145	0.818	22.198	5.507
334517	Irradiation Apparatus Manufactur	131.807	-0.005	-0.052	0.819	32.743	5.525
315222	Men's and Boys' Cut and Sew Sui	141.157	0.105	0.974	0.820	26.978	5.562
332812	Metal Coating, Engraving (excep	94.742	-0.022	-0.210	0.820	23.792	5.564
333415	Air-Conditioning and Warm Air H	3439.694	-0.191	-3.258	0.822	15.398	5.621
336991	Motorcycle, Bicycle, and Parts M	891.118	0.149	2.060	0.823	22.754	5.640
311313	Beet Sugar Manufacturing	242.855	0.068	0.199	0.825	23.160	5.703
332912	Fluid Power Valve and Hose Fitti	1864.414	-0.333	-2.369	0.827	9.967	5.771
321219	Reconstituted Wood Product Mar	64.674	-0.719	-0.700	0.827	5.038	5.788
339941	Pen and Mechanical Pencil Manu	30.192	-0.513	-2.843	0.829	25.628	5.834
315223	Men's and Boys' Cut and Sew Shi	115.172	-0.004	-0.035	0.832	21.608	5.960
312120	Breweries	3749.289	-0.935	-4.268	0.836	15.939	6.089
325413	In-Vitro Diagnostic Substance Ma	260.813	-0.476	-2.600	0.838	19.263	6.174
325612	Polish and Other Sanitation Good	1850.886	0.002	0.020	0.840	25.875	6.258
333911	Pump and Pumping Equipment M	1977.303	-0.112	-1.051	0.841	20.136	6.306
212312	Crushed and Broken Limestone M	74.427	-0.762	-7.997	0.846	27.802	6.492
332322	Sheet Metal Work Manufacturing	84.628	-0.064	-0.500	0.849	29.301	6.621
312140	Distilleries	421.900	-0.217	-1.407	0.849	23.900	6.635
482111	Line-Haul Railroads	16150.242	-0.266	-2.049	0.850	10.188	6.678
311211	Flour Milling	119.460	-0.866	-0.451	0.851	8.279	6.712
311411	Frozen Fruit, Juice, and Vegetabl	10.338	0.031	0.100	0.853	11.835	6.787
311520	Ice Cream and Frozen Dessert Ma	279.617	-0.173	-0.979	0.853	35.639	6.793
334416	Electronic Coil, Transformer, and	57.479	-0.187	-2.010	0.854	25.821	6.832
314110	Carpet and Rug Mills	1670.044	0.238	1.543	0.855	5.680	6.878
532120	Truck, Utility Trailer, and RV (R	2006.466	-0.361	-0.909	0.855	9.470	6.878
333111	Farm Machinery and Equipment M	3611.326	-0.118	-1.018	0.857	12.643	7.001
333613	Mechanical Power Transmission	41.349	-0.543	-6.336	0.860	20.383	7.134
325611	Soap and Other Detergent Manuf	10286.352	-0.069	-0.463	0.860	12.587	7.142
333314	Optical Instrument and Lens Man	476.798	0.294	1.985	0.860	13.140	7.156
315192	Underwear and Nightwear Knittin	314.200	-0.629	-4.715	0.865	13.895	7.387
312130	Wineries	729.644	-0.038	-0.198	0.865	18.036	7.431
335224	Household Laundry Equipment M	978.417	-0.033	-0.371	0.866	15.666	7.473
332811	Metal Heat Treating	11.185	-0.107	-2.152	0.868	27.300	7.554
333996	Fluid Power Pump and Motor Ma	21.541	-0.257	-1.774	0.868	9.532	7.584
311225	Fats and Oils Refining and Blend	19.046	-0.260	-0.488	0.870	18.019	7.711
212313	Crushed and Broken Granite Min	300.831	-1.636	-4.908	0.871	8.314	7.777

515112	Radio Stations	1852.189	1.809	4.552	0.872	5.383	7.820
334613	Magnetic and Optical Recording	88.280	-0.334	-0.911	0.875	13.752	7.990
339911	Jewelry (except Costume) Manuf	72.296	0.212	0.631	0.875	11.627	8.028
331522	Nonferrous (except Aluminum) D	66.556	-0.050	-0.362	0.876	13.988	8.075
322211	Corrugated and Solid Fiber Box M	1237.227	-0.874	-2.137	0.878	24.416	8.225
326211	Tire Manufacturing (except Retre	6958.948	0.173	1.463	0.881	8.611	8.416
333293	Printing Machinery and Equipme	203.689	-0.142	-1.530	0.882	22.090	8.455
332721	Precision Turned Product Manufa	5.555	0.097	1.475	0.882	26.576	8.456
327310	Cement Manufacturing	2237.249	-1.592	-6.463	0.884	20.039	8.600
327215	Glass Product Manufacturing Ma	426.895	0.016	0.168	0.884	8.574	8.649
315224	Men's and Boys' Cut and Sew Trc	1003.556	-0.272	-1.705	0.890	4.684	9.114
322212	Folding Paperboard Box Manufac	650.009	-0.099	-0.581	0.893	7.585	9.387
332993	Ammunition (except Small Arms)	17.010	-0.078	-0.409	0.897	33.922	9.674
332996	Fabricated Pipe and Pipe Fitting M	488.051	-0.158	-1.166	0.897	29.922	9.685
325312	Phosphatic Fertilizer Manufacturi	520.100	-1.311	-1.842	0.898	9.383	9.778
336311	Carburetor, Piston, Piston Ring, a	8.655	0.132	1.115	0.899	19.769	9.940
333291	Paper Industry Machinery Manuf	58.900	-0.443	-5.214	0.903	10.793	10.320
332321	Metal Window and Door Manufa	401.221	0.154	1.104	0.903	19.834	10.330
334515	Instrument Manufacturing for Me	1788.196	0.170	1.255	0.905	5.792	10.502
325613	Surface Active Agent Manufactur	179.715	0.030	0.195	0.908	5.453	10.869
323117	Books Printing	54.190	-0.135	-1.101	0.911	27.458	11.205
333414	Heating Equipment (except Warn	8.106	-0.003	-0.027	0.914	16.109	11.678
336510	Railroad Rolling Stock Manufactu	871.357	-0.073	-0.777	0.915	10.015	11.765
331524	Aluminum Foundries (except Die	1.113	-0.180	-0.780	0.918	13.442	12.231
325412	Pharmaceutical Preparation Manu	73558.656	-0.329	-2.565	0.921	13.228	12.702
311230	Breakfast Cereal Manufacturing	3163.100	-0.354	-2.461	0.923	14.559	12.942
511130	Book Publishers	3967.372	0.574	3.882	0.926	14.059	13.584
334514	Totalizing Fluid Meter and Count	41.710	-0.175	-1.054	0.927	5.054	13.656
311320	Chocolate and Confectionery Ma	2718.066	0.332	0.879	0.931	7.181	14.568
335931	Current-Carrying Wiring Device	772.715	-0.161	-2.056	0.932	10.672	14.802
315233	Women's and Girls' Cut and Sew	67.123	-0.266	-2.062	0.934	12.146	15.164
335313	Switchgear and Switchboard App	145.358	-0.358	-3.199	0.936	6.468	15.620
332116	Metal Stamping	46.156	0.049	0.753	0.938	20.844	16.090
325314	Fertilizer (Mixing Only) Manufac	0.018	-0.744	-2.572	0.942	60.744	17.242
332431	Metal Can Manufacturing	3935.129	-0.031	-0.117	0.944	27.011	17.802
337124	Metal Household Furniture Manu	39.718	0.241	1.439	0.944	9.434	17.825
333131	Mining Machinery and Equipmer	268.052	-0.092	-1.072	0.945	24.055	18.027
325910	Printing Ink Manufacturing	5.528	0.352	1.595	0.946	20.389	18.361
333311	Automatic Vending Machine Ma	7.817	0.052	0.591	0.946	61.918	18.571
331112	Electrometallurgical Ferroalloy P	61.078	-0.508	-0.681	0.947	1.683	18.779
486910	Pipeline Transportation of Refine	1268.508	0.173	1.105	0.956	22.709	22.587
335912	Primary Battery Manufacturing	9.709	-0.126	-0.476	0.957	9.105	23.358
339113	Surgical Appliance and Supplies	2953.485	-0.239	-2.051	0.959	5.530	24.344
339993	Fastener, Button, Needle, and Pin	70.439	0.004	0.040	0.964	5.045	27.686
311311	Sugarcane Mills	10.676	0.113	0.112	0.965	3.335	28.745
332213	Saw Blade and Handsaw Manufac	119.100	-0.286	-2.274	0.966	3.601	29.066

Beta = 0.99: Outliers Not Reported in Table 1

Naics	Description	Sales	Constant	t-stat	Theta	t-stat	1/(1-Theta)
333292	Textile Machinery Manufacturing	1.720	-0.030	-0.395	0.992	97.992	120.751
333294	Food Product Machinery Manufac	20.566	-0.166	-2.598	0.975	23.389	39.895
333994	Industrial Process Furnace and O	7.166	-0.142	-1.924	0.974	13.796	38.146
561510	Travel Agencies	821.669	-1.837	-2.745	0.976	6.345	42.171

Beta = 0.99: Poor Fits with Negative Estimated Price Adjustment Intervals Not Reported in Table 1

Naics	Description	Sales	Constant	t-stat	Theta	t-stat	1/(1-Theta)
212100	Coal Mining	385.784	0.479	1.505	1.005	0.000	-198.531
212210	Iron Ore Mining	28.800	-0.544	-2.386	1.005	0.000	-198.452
212322	Industrial Sand Mining	0.521	-0.684	-4.063	1.005	0.002	-198.491

212325	Clay and Ceramic and Refractory	80.941	-0.100	-0.827	1.005	0.000	-198.491
311312	Cane Sugar Refining	428.462	-0.252	-1.166	1.005	0.000	-198.373
311412	Frozen Specialty Food Manufactu	72.604	-0.329	-4.408	1.005	0.001	-198.413
311821	Cookie and Cracker Manufacturir	138.961	-0.280	-2.008	1.005	0.000	-198.413
311823	Dry Pasta Manufacturing	14.180	-0.044	-0.140	1.005	0.000	-198.491
312221	Cigarette Manufacturing	24317.288	0.710	1.880	1.005	0.000	-198.531
314121	Curtain and Drapery Mills	8.053	-0.160	-0.981	1.005	0.000	-198.413
314911	Textile Bag Mills	1.153	-0.315	-1.378	1.005	0.009	-198.491
315225	Men's and Boys' Cut and Sew Wc	564.600	-0.192	-2.111	1.005	0.000	-198.531
316212	House Slipper Manufacturing	35.658	-0.546	-2.164	1.005	0.000	-198.491
316214	Women's Footwear (except Athle	113.885	-0.071	-0.606	1.005	0.001	-198.531
316991	Luggage Manufacturing	192.090	-0.022	-0.108	1.005	0.000	-198.570
316993	Personal Leather Good (except W	19.981	-0.202	-1.698	1.005	0.002	-198.570
321991	Manufactured Home (Mobile Hor	1105.181	0.111	1.749	1.005	0.001	-198.570
321992	Prefabricated Wood Building Ma	103.157	-0.235	-1.168	1.005	0.000	-198.373
323110	Commercial Lithographic Printin	4211.202	-0.091	-1.019	1.005	0.000	-198.491
325222	Noncellulosic Organic Fiber Man	305.572	-0.181	-0.959	1.005	0.000	-198.452
325411	Medicinal and Botanical Manufac	185.585	-0.174	-0.889	1.005	0.001	-198.570
326291	Rubber Product Manufacturing fo	387.581	-0.051	-0.654	1.005	0.001	-198.491
327122	Ceramic Wall and Floor Tile Mar	69.934	-0.577	-1.109	1.005	0.000	-198.570
327211	Flat Glass Manufacturing	680.548	-0.226	-1.325	1.005	0.001	-198.610
331511	Iron Foundries	2152.223	-0.190	-1.177	1.005	0.001	-198.531
331512	Steel Investment Foundries	631.600	-0.152	-1.029	1.005	0.000	-198.531
332211	Cutlery and Flatware (except Prec	1828.985	-1.110	-5.716	1.005	0.000	-198.295
332722	Bolt, Nut, Screw, Rivet, and Was	502.815	0.074	1.110	1.005	0.000	-198.452
332813	Electroplating, Plating, Polishing,	78.127	0.055	0.559	1.005	0.001	-198.413
332911	Industrial Valve Manufacturing	1.395	0.026	0.313	1.005	0.000	-198.531
333313	Office Machinery Manufacturing	5238.966	-0.133	-1.029	1.005	0.000	-198.491
333512	Machine Tool (Metal Cutting Typ	513.269	-0.005	-0.044	1.005	0.000	-198.531
333515	Cutting Tool and Machine Tool A	38.600	-0.154	-2.451	1.005	0.001	-198.491
333611	Turbine and Turbine Generator Se	0.080	-0.149	-1.293	1.005	0.004	-198.491
333612	Speed Changer, Industrial High-S	4.906	-0.456	-4.426	1.005	0.000	-198.570
333922	Conveyor and Conveying Equipm	13.930	-0.029	-0.392	1.005	0.000	-198.491
333924	Industrial Truck, Tractor, Trailer,	821.822	0.041	0.603	1.005	0.001	-198.531
333993	Packaging Machinery Manufactu	121.020	-0.287	-3.214	1.005	0.000	-198.491
334111	Electronic Computer Manufacturi	34743.993	0.335	0.676	1.005	0.000	-198.452
334411	Electron Tube Manufacturing	17.479	0.138	0.521	1.005	0.000	-198.610
334415	Electronic Resistor Manufacturin	564.570	-0.076	-0.541	1.005	0.000	-198.570
334417	Electronic Connector Manufactur	1129.560	-0.242	-2.121	1.005	0.000	-198.491
335121	Residential Electric Lighting Fixt	64.608	-0.059	-0.618	1.005	0.000	-198.491
335222	Household Refrigerator and Hom	3243.738	-0.050	-0.449	1.005	0.001	-198.570
335314	Relay and Industrial Control Man	1285.547	-0.283	-3.355	1.005	0.000	-198.413
335911	Storage Battery Manufacturing	789.695	0.149	0.820	1.005	0.003	-198.491
336212	Truck Trailer Manufacturing	307.310	0.085	0.607	1.005	0.000	-198.531
336321	Vehicular Lighting Equipment M	19.923	-0.112	-0.673	1.005	0.000	-198.570
336411	Aircraft Manufacturing	13342.450	-0.272	-2.361	1.005	0.001	-198.649
336611	Ship Building and Repairing	4197.853	0.132	1.343	1.005	0.000	-198.491
336612	Boat Building	13.686	-0.328	-3.295	1.005	0.001	-198.610
337121	Upholstered Household Furniture	914.381	0.038	0.644	1.005	0.001	-198.649
337122	Nonupholstered Wood Household	560.567	-0.007	-0.085	1.005	0.000	-198.570
339112	Surgical and Medical Instrument	4740.362	-0.177	-1.654	1.005	0.000	-198.491
339115	Ophthalmic Goods Manufacturin	784.017	-0.062	-0.781	1.005	0.002	-198.531
339931	Doll and Stuffed Toy Manufactur	811.555	-0.317	-2.069	1.005	0.001	-198.531
339932	Game, Toy, and Children's Vehic	1537.332	-1.070	-7.218	1.005	0.000	-198.373
339950	Sign Manufacturing	285.671	-0.289	-3.060	1.005	0.001	-198.452