Market Power and the Cross-Industry Behavior of Prices Around a Business Cycle Trough

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ABSTRACT

Our paper examines the behavior of prices in a large number of highly-disaggregated industries around the trough of the business cycle. We conclude that the degree to which prices are pro- or counter-cyclical differs between business cycle peaks and business cycle troughs, and that the cyclical behavior of prices varies substantially across industries. We also observe a tendency for industry prices to rise immediately following a business cycle trough. In general, we accept a market power explanation for that observation: either oligopolists pricing above marginal cost take advantage of a cyclical tendency for demand functions to grow more inelastic in the early stages of a boom or else interfirm coordination becomes more effective after a trough. From the behavior of prices as a recession ends and a boom begins, our paper also identifies a set of industries likely on average to be exercising market power.

Market Power Explanations and the Cross-Industry Behavior of Prices Around a Business Cycle Trough

Jonathan B. Baker and Peter A. Woodward[1]

I. Introduction

A large economic literature seeks to identify market power from the response of prices and output to demand and cost shocks. Many researchers, both microeconomists and macroeconomists, have focused particularly on the response of prices to business cycle fluctuations.[2] This research problem is often framed in terms of analyzing whether prices respond to cyclical variation in cost and demand, and, if not, whether the exercise of market power accounts for observed price rigidities.

Much of this literature explores the behavior of prices and price-cost margins over the

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[1]Federal Trade Commission, and Antitrust Division, U.S. Department of Justice, respectively. The views expressed are not necessarily those of the Federal Trade Commission or any individual Commissioner, or those of the Justice Department. The authors are grateful to Matt Shapiro; seminar participants at the Department of Justice, Johns Hopkins, and Northwestern; and the Tuck Associates Program of Dartmouth's Amos Tuck School. Bruce Allen, Mike Duffy, Cathy Reinig, and Jo Steele provided valuable research assistance.

[2]Other researchers identify market power from the response of prices to industry-specific cost and demand shocks (see generally Baker & Bresnahan (1992)), or from the cyclical variation of variables other than price (Hall (1988)).

business cycle.[3] Many authors find that prices exhibit procyclical behavior (e.g. Bils, 1987), and seek to explain that result in terms of cyclical regularities in cost, demand and oligopoly behavior. The most common explanation is that price-cost margins behave procyclically in concentrated industries (e.g. Domowitz, Hubbard & Petersen, 1986a, 1986b, 1987);[4] indeed, Schmalensee (1989a) calls this observation a stylized fact. Margins, in turn, may fluctuate over the business cycle because of cyclical variation in the elasticity of demand in many industries (Shapiro, 1988) or because the effectiveness of firm coordination varies over the business cycle. In contrast with explanations for the procyclical behavior of prices based on the behavior of margins, Bils (1987) contends that prices increase during booms because short-run marginal cost is strongly procyclical in many industries.

Whether prices actually behave procyclically, however, is far from settled. Domowitz, Hubbard & Petersen (1987) find countercyclical pricing in high-margin producer good industries. They interpret this result as reflecting the tendency of such industries to experience price wars during booms. Similarly, Morrison (1993) finds negative correlations between markups and capacity utilization, although she also observes that markups appear to decline

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[3]Although we follow the literature in working with readily available price indices, this common practice has been criticized. Stigler & Kindahl (1970) and Warner (1990) emphasize the role of
measurement problems with the available price data in explaining observed price rigidities. Carlton (1989) and Blinder (1991) show how looking solely to price fluctuations can overstate the significance of price rigidities when competition occurs in multiple dimensions (including delivery lags).

[4]Other evidence for procyclical margins not relying on price behavior is offered by Hall (1988), Domowitz, Hubbard & Petersen (1988), and Schmalensee (1989b).

during recessions. Kydland & Prescott (1990) show that the aggregate price level moves countercyclically.

Our paper brings two innovations to the task of making market power inferences from the cyclical behavior of prices. First, we distinguish the cyclical behavior of prices in stages of the business cycle, primarily focusing on price behavior around business cycle troughs. In contrast, previous studies have concentrated on the behavior of prices throughout the entire cycle. Second, we employ highly disaggregated price data. In particular, we employ data disaggregated to the two-, four-, five-, seven- and nine-digit SIC industry level in order to allow for cyclical variation in relative prices across sectors of the economy.

We find that the cyclical behavior of prices differs between business cycle peaks and business cycle troughs. This difference is consistent with our view that price fluctuations often have different causes in different stages of the cycle: rising marginal costs are likely the most important determinant of price variation around peaks,[5] and market power effects are likely the most important determinant of price fluctuations around troughs. We also observe some tendency for disaggregated prices to rise immediately following a business cycle trough.

In those industries experiencing rising industry prices around business cycle troughs, we find that the price increases do not appear to result from marginal cost increases, that prices tend to rise in concentrated industries, and that certain industries systematically experience price increases across recessions. These results are consistent with either of two market power

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[5]Bils (1987) and Bresnahan & Suslow (1989a, 1989b) document the effect on prices of sharply rising marginal costs associated with the approach of output to capacity constraints.

explanations for rising industry prices over troughs: oligopolists pricing above marginal cost may be able to take advantage of a cyclical tendency for demand functions to grow more inelastic in the early stages of a boom, or else interfirm coordination may become more effective after a trough.

II. The Importance of Disaggregating Prices

This section demonstrates that aggregate price series mask substantial variation across disaggregated industries, including differing patterns of cyclical behavior. This observation suggests that industry-specific factors are important determinants of the cyclical behavior of prices.

A. Inter-Industry Price Variation

Our data on prices are taken from the monthly Producer Price Indexes[6] (PPI), and are not seasonally adjusted. These data include prices for two-, four-, five-, seven- and nine-digit SIC industries, 1948 to 1990. We deflate the disaggregated series by the aggregate PPI on the view that variation in the economy-wide price level can be attributed to macroeconomic forces

[6]All tables, graphs, and empirical work in this paper involving prices take these from the PPI.

unrelated to industry-specific changes in demand, cost, or oligopoly behavior.[7] A large number of industries are represented. For example, the 1982 PPI series includes 208 four-digit industries and 288 five-digit industries.

The most distinctive feature of our data is the great variation in price movemements across individual industries, after controlling for aggregate price level fluctuations. This feature is immediately evident in Figure 1, which depicts the cyclical behavior of (deflated[8]) prices in the four-digit industries within the two-digit chemicals industry (SIC 28).

[INSERT FIGURE 1 HERE]

[INSERT FIGURE 2 HERE]

The figure illustrates price changes between January 1982 and December 1984, a three year time period around a business cycle trough. Each price index has been normalized to equal one at the November 1982 trough.

As Figure 1 suggests, there is a great deal of variation in the prices of the four-digit industries within each two-digit industry. This is demonstrated in Table 1, which shows the generally low correlation of four-digit industry prices within each two digit industry during the period between January 1982 and December 1984.

[INSERT TABLE 1 HERE]

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[7]In contrast, Fair (1993) treats the economy-wide price level as a good proxy for the price of a close demand substitute for every disaggregated good in the economy.

[8]Figure 2 exhibits the aggregate (economy-wide) behavior of prices between January 1982 and December 1984. Seasonally adjusted prices rose approximately 5% between January 1982 and December 1984. After seasonal adjustment, aggregate prices rose at a less rapid rate after the trough than before.

This conclusion is also supported by the summary statistics, also reported in Table 1, from the following OLS regression:

(1) $P_t/\bar{P}_t = ß_0 + ß_1(P_t^*/\bar{P}_t) + \varepsilon_t$

In equation (1), P_t refers to a four-digit industry, P_t^* refers to the corresponding two-digit industry aggregate, and $\bar{P}_t$ is the economy-wide average PPI. This equation typically gives an R^2 value of about 0.42, indicating that there is substantial inter-industry variation in pricing.[9]

B. The Cyclical Behavior of Disaggregated Prices

To examine the cyclical behavior of prices in our disaggregated data, we adapt a methodology employed by Kydland and Prescott (1990) with aggregate prices. Kydland and Prescott correlated the time series of detrended aggregate output with a detrended contemporaneous price index, and with the same price index shifted to lag or lead the quantity index. Using aggregate data over the postwar period, they found that lagged prices have the highest correlation with output fluctuations. They concluded that aggregate prices behave countercyclically. Applying a similar methodology to our disaggregated data, we find substantial cross-industry differences in the cyclical behavior of prices, and substantial within-industry differences across different stages of the cycle (peaks vs. troughs).

To identify cross-industry variation in the cyclical behavior of prices, we correlate the

[9]Similarly, Clarke (1986) finds that firms within a four-digit SIC code are no more alike than randomly-selected industries in sales fluctuations, profit rates, or stock price fluctuations.

seventeen (detrended) two-digit price series with the (detrended) economy-wide industrial production index over the sample period 1948 to 1990.[10] Each row of Table 2 reports the correlation of aggregate output with eleven time series created by leading and lagging a specific two-digit industry's prices up to five months.

[INSERT TABLE 2 HERE]

The highest correlation coefficient in each row is indicated by an asterisk.

For fourteen of the seventeen industries, we replicated what Kydland & Prescott found in aggregate data: on average, aggregate output changes lead price changes. Although output is the most highly correlated with a price at least four months in the future in most of these industries (nine), there is substantial variation across industries in the degree of procyclicality. Price changes lead output changes in only three industries.

To study the degree of procyclicality of prices at different stages of the business cycle, we repeat these correlations with data limited to a five month window on either side of six NBER postwar troughs: April 1958, February 1961, November 1970, March 1975, July 1980 and November 1982. These results, reported in Table 3, nearly reverse the pattern observed over the entire cycle.

[INSERT TABLE 3 HERE]

Price changes now lead quantity changes by four or five months for five two-digit industries. In

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[10]Because inflation is a major component of the price trend, detrending makes it unnecessary to deflate prices. We are grateful to Finn Kydland and Edward Prescott for sharing their detrending algorithm with us.

all but one of the remaining industries, price is most highly correlated with roughly contemporaneous quantity (no more than two periods away).

We perform a similar analysis of the degree of procyclicality of prices around six NBER peaks: August 1957, April 1960, December 1969, November 1973, January 1980, and July 1981. These results, reported in Table 4, are closer to what was observed over thc cntire business cycle. [INSERT TABLE 4 HERE]

Around peaks, as with the overall sample, price changes tend to lag output changes. In seven industries, price changes lag output changes by five months, and in another seven industries prices move roughly contemporaneously with output (most highly correlated with quantity no more than two months away). Only in three industries, do price changes lead output changes significantly.

The comparison of Table 2 with Table 3 and Table 4 demonstrates the distinct cyclical behavior of prices during troughs -- in comparison to the behavior of prices both around peaks and throughout the entire cycle. Both over the cycle and around peaks, price changes lag quantity changes by five months (the maximum observable in our analysis) in a large number of industries. In striking contrast, during troughs price changes lag quantity changes by more than one month in only one industry. Moreover, in twelve of seventeen industries, the degree of procyclicality of prices in the sample as a whole (Table 2) is closer to that observed when the data is limited to the period around peaks (Table 4) than to that observed around troughs (Table 3), and in three more the peak data and trough data are equally close in degree of procyclicality to the overall data. Thus, the distinct procyclical behavior of prices around

troughs is masked in the overall data, which primarily reflects the countercyclical behavior of prices around peaks.

III. Interpreting the Cyclical Behavior of Disaggregated Prices: Theory

To interpret the cyclical behavior of prices, we adopt an analytic framework proposed by Bresnahan (1982). Although the framework takes a static partial equilibrium perspective, we have included expected future output in the demand and supply functions to reflect intertemporal substitution by buyers or sellers in response to anticipated cyclical economic fluctuations.

Industry demand at time t is

$$(2) \qquad P_t = f(Q_t, y_t, Q^e) + v_t$$

where P is the market price, Q is quantity sold, y represents a vector of demand shift variables such as income, Q^e represents expected future quantity, $f(Q_t, y_t, Q^e)$ is the demand function, and v is a random shock to demand. From (2), industry marginal revenue takes the form

$$(3) \qquad MR_t = f(Q_t, y_t, Q^e) + v_t + f_q Q_t$$

where f_q denotes the output derivative of demand. Industry marginal cost is given by

$$(4) \quad MC_t = c(Q_t, w_t, Q^e) + u_t$$

where $c(Q_t, w_t, Q^e)$ is the cost function, w is a vector of factor prices, and u is a random cost shock. Firms in the industry will set perceived marginal revenue to marginal cost, so their behavior will be described by the intersection of the quasi-supply function (5) with the demand

function (2).

(5) $P_t = \Theta_t(P_t\text{-}MR_t) + c(Q_t,w_t,Q^e) + u_t$

$= \Theta_t(-f_qQ_t) + c(Q_t,w_t,Q^e) + u_t$

In equation (5), Θ_t indexes the oligopoly solution concept. If Θ is equal to 1, the firms are behaving like a monopolist (equating marginal revenue with marginal cost). If Θ is equal to 0, the firms are behaving competitively (equating price with marginal cost). Other forms of oligopoly behavior will lead to values of the parameter between 0 and 1. The expression $-f_qQ_t$ is related to the elasticity of industry demand.[11] Equation (5) implies that an industry's price fluctuates with variation in marginal cost, the elasticity of market demand,[12] and oligopoly behavior. Accordingly, for prices to change systematically over the business cycle, one of these three components must vary cyclically.

A. Explanations for Procyclical Price Behavior

An industry's prices might behave procyclically, rising at business cycle peaks or declining at troughs, for several reasons. First, in many industries, increases in marginal cost will lead price to rise in the neighborhood of a business cycle peak, when production nears full

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[11]The industry demand elasticity e is defined such that $1/e = -f_qQ_t/P_t$.

[12]So long as $\Theta > 0$ in equation (5), prices will rise as demand grows less elastic and fall as demand grows more elastic, holding constant the oligopoly solution concept and marginal cost. Proof: For two time periods 0 and 1, assume that $MC_0 = MC_1 \equiv MC$. Equation (5) then implies $P_1(1 - \Theta_1/e_1) = MC = P_0(1 - \Theta_0/e_0)$. It is evident that if $\Theta_0 = \Theta_1$ (for $\Theta > 0$), then $P_1 > P_0$ if and only if $e_1 < e_0$ (that is, price rises if and only if demand grows less elastic).

capacity for many firms. Marginal cost is high at high output levels because firms pay overtime rates to labor, expand operations at less efficient plants, and otherwise pay a high price to meet demand. (Bils, 1987; Bresnahan & Suslow, 1989b).[13] In contrast, excess capacity is common and overtime payments are reduced in the months surrounding a cyclical trough.

Second, demand might grow more elastic around a trough, leading to a reduction in an industry's price-cost margin if the firms are exercising some market power. For example, the demand for some consumer products might be elastic at troughs, if buyers limit consumption in order to build a reserve of savings against the threat of job loss.

Third, a number of models of oligopoly behavior imply that firms will have difficulty coordinating during recessions. For example, large negative demand shocks may induce firms to act competitively for a time, before returning to cooperative pricing. (Green & Porter, 1984) This story suggests that industry prices will be higher after a trough than before, because negative demand shocks causing competitive pricing are less likely to occur in a recovery period than during a recession. Similarly, when demand shocks have positive serial correlation, firms will likely find it more difficult to collude during recessions than during booms. During recessions the foregone profits from inducing competitive pricing will be relatively low, so, holding the level of demand constant, price will be lower when demand is declining than when it

[13]Even if capacity is added in discontinuous (lumpy) increments, or firms build inventory to smooth production in anticipation of predictable fluctuations in demand, marginal cost would likely be low on average during troughs. Because firms would plan to add capacity and produce at full capacity when demand is both high and likely to increase, excess capacity would be the greatest, and marginal cost the lowest, during periods of low or declining demand.

is rising (Haltiwanger & Harrington, 1991).[14]

These oligopoly models provide a clear prediction about the variation in industry markup around a recessionary trough: oligopolies exercising market power are more likely to obtain a higher average markup during the early stage of a boom than during the final stage of a bust. Just before the trough of a recession, unexpected demand shocks will typically be negative, so coordinating firms will revert frequently to competitive pricing. In contrast, just after the trough unexpected demand shocks will typically be positive, so oligopolists playing a non-cooperative supergame will more likely achieve cooperative pricing.[15]

B. Explanations for Countercyclical Price Behavior

Other theories about the cyclical behavior of marginal cost, the elasticity of demand, and oligopoly behavior suggest instead that prices should fall at business cycle peaks or rise at troughs. First, marginal cost might rise during recessions if producers systematically forego scale economies during troughs in response to demand declines. For example, firms may prefer

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[14]Similarly, when consumers bear significant switching costs, and cyclical demand variations primarily reflect changes in the demand per consumer (rather than fluctuation in the number of new buyers), firms may behave more competitively in troughs. Here firms lower prices in order to build market share when it is cheapest to do so, in anticipation of raising prices to locked-in buyers in the ensuing boom. (Klemperer, 1992 §4.5)

[15]The limited empirical evidence favors the view that when coordination is not a dominant strategy over the entire business cycle, episodes of static collusive behavior more often break down during busts than booms (Porter, 1983, 1985; Suslow, 1988; Baker, 1989; Baker, Johnston & Woodward, 1990).

to keep employment high when demand and production are low, in order to avoid losing permanently those workers trained in firm-specific production techniques. Consistent with this story, average manufacturing hours are strongly procyclical (Bils, 1987). Thus, to the extent firms adopt a production technology that penalizes output declines from optimal scale, marginal cost would tend to rise systematically during recessions.[16]

Second, demand might grow more inelastic at troughs, leading producers exercising some market power to raise price. For example, demand for some consumer products might be inelastic at troughs if liquidity-constrained consumers are out of the market and those not constrained have the most inelastic demand. Or, consumers may spend less effort on search for the lowest price at times when they are buying less, such as during recessions (see Barsky and Warner (1993)), making demand more inelastic around troughs. Demand might also be inelastic during recessions for products whose buyers bear significant switching costs, if most customers in the market at troughs are old customers who cannot switch to substitutes without penalty (Klemperer, 1992 §4.5). Demand for intermediate goods might be the most inelastic in the early stages of a boom, if recognized as such, as firms seek to build inventories in anticipation of high future demand.[17]

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[16]Two theories of macroeconomic fluctuations also suggest that firms would may to have lower production costs in booms than recessions. Hall (1991) contends that agglomeration economies may outweigh congestion diseconomies during booms. Supply-side theories of macroeconomic fluctuations, such as real business cycle models (Prescott 1986), may also generate this prediction.

[17]On the other hand, demand for durable consumer goods and capital goods sold to producers may increase when buyers anticipate higher future prices and decline when they anticipate lower future prices in ways that smooth price variation and purge prices of any

Third, one important oligopoly supergame model predicts that cooperative pricing is least likely during booms. High demand periods may increase firm gains to defecting from a cartel, leading to counter-cyclical pricing (Rotemberg & Saloner, 1986).[18]

C. Propagation of Procyclical or Countercyclical Price Variation

Another source of cyclical variation in an industry's marginal cost, which can generate cyclical behavior of price, is the transmission of price changes from one industry to other industries selling substitutes or complements in demand, including industries that use the first industry's product as an input.[19] In our data, price increases are most likely to propagate when one industry buys the output of another. If the price of gold, for example, rises as a boom commences, the price of gold jewelry will tend to rise also, especially if the input accounts for a significant share of the variable costs of downstream production.[20] Through this mechanism, both procyclical and countercyclical price variation can spread.

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cyclical component.

[18]A similar cyclical pattern in oligopoly pricing could arise if firm seek to reduce the volatility of reported earnings, perhaps because of financial market imperfections such as bankruptcy costs or credit rationing. Such firms may raise prices in troughs and lower them in booms. (Klemperer, 1992 §4.6)

[19]Upstream products and downstream products are typically complements in demand.

[20]We cannot examine this process systematically for the industries we study because we lack an appropriate input-output table. For efforts along these lines, see Shea (1993) and Fair (1993).

III. Empirical Analyses of the Cyclical Behavior of Prices

A. The Behavior of Disaggregated Prices Around the 1982 Business Cycle Trough

We begin our description of the cyclical behavior of disaggregated prices with an examination of price movements around the 1982 business cycle trough. Because coverage of industries in the producer price indexes has expanded over time, the focus on a recent trough enlarges the sample substantially beyond the number of industries whose price behavior can be examined over multiple recessions, the subject of the next section.

1. Industries Exhibiting Large Price Changes

Table 5 reports the distribution of real (deflated) price changes in the eleven months before the November 1982 trough and the two years after.

[INSERT TABLE 5 HERE]

Most of the industries in our sample do not experience even 5% real price changes over the one and two year pre-trough periods reported in the table. Yet of those industries that do experience significant price changes, especially during the two years following the trough, many more experience steeply rising prices than experience steeply declining prices. We thus find some tendency for industry prices to rise immediately following a business cycle trough.

To examine why industries with steeply rising post-trough prices are more common than industries with steeply falling prices, we look at the identity of the industries exhibiting large price changes. Table 6 lists four-digit industries for which the deflated post-trough price rose or fell by more than 10% over the next one or two years.

[INSERT TABLE 6 HERE]

Industries were selected by comparing price in November 1982, the NEBR trough, with price in November 1983 and November 1984. The list of industries suggests that the bias in favor of higher prices is not a statistical artifact of common causes affecting pricing in similar industries; the industries experiencing price increases are perhaps more diverse than those experiencing declines.

We next examine whether the industries listed in Table 6 that increased price did so in response to increases in the price of inputs. We find that industries experiencing large price increases did not on average experience greater increases in either wage rates or the cost of raw materials than industries that did not raise price. To determine whether higher wages are the source of the observed price increases, we examine industries in which the labor cost share of total variable cost exceeded 20%, according to the 1982 Census of Manufactures. For those industries, we find that neither average hourly earnings nor overtime levels increased more than the average increase for all manufacturing industries.

Similarly, we examine input prices for those industries in which materials inputs (at the five- to six-digit SIC code level) account for more than 10% of total delivered materials costs, according to the 1982 Census Industry Surveys. On average 2.1 such inputs were identified

for each industry (ignoring catch-all input aggregates). Producer price indexes were available for 28% of those inputs. In only one case can we fairly attribute the vast majority of a price increase to higher input prices: the price of leather tanning rose 7% in one year following the trough largely because the price of cattle hides rose 38% during that year. In a second industry, wood pallets, a significant portion of the 4% (one year) and 13% (two years) price increase can be attributed to an 18% increase (over both one and two years) in the price of hardwood lumber. In the remaining thirteen instances in which input prices were available, however, the observed input prices rose far less than the corresponding output prices or else the input prices declined.[21] We conclude that increases in input prices are unlikely to explain the bulk of the observable price rises.

We cannot immediately reject another cost-related explanation for the price increases identified in Table 6. If output grew rapidly after the trough, or if industry demand was growing rapidly and was largely not influenced by the business cycle, prices may have risen because the individual industry approached a capacity constraint even though the rest of the economy had barely left the recessionary trough. But it is implausible that this explanation fits more than a handful of the industries in the table. Indeed, it is difficult to identify any industry in the list likely to have been facing explosive demand growth sufficient to cause industry capital to be fully

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[21]Even when a specific material input with a rapidly rising price accounts for most of total materials cost, as was true for leather tanning, the input accounts for a lower share of firm variable costs (because the latter cost also includes labor and energy). In order for the input price increase to explain most of the output price change, therefore, the input price must increase by substantially more than the output price.

utilized shortly after the commencement of the boom.

It is not surprising that cost increases largely fail to explain the price increases observed in the first year or two following a business cycle trough. Outside of business cycle peaks, most industries are likely to experience roughly constant returns to scale for normal fluctuations in output,[22] either because the firms find it best to adopt a production technology that does not strongly penalize output variations from efficient scale or because they smooth production in response to anticipated demand variation. Because cost explanations for the price increases in the industries listed in Table 6 are implausible, we believe that in most cases the observed price increases reflect the exercise of market power.[23] Market power explanations are of two sorts. Either demand grows less elastic (in an industry exercising some market power), or interfirm cooperation improves (while industry demand is not perfectly elastic). The next section explains our nonparametric method of controlling for changes in demand elasticity, in order to identify industries which tended to grow more cooperative as the boom began.

2. Industries with Increasing Margins as the Boom Began

We next develop a second list of industries characterized by rapid price increases

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[22]One exception: oil services industries may have experienced capacity constraints while the rest of the economy was mired in the two post-oil shock recessions of the late 1970s.

[23]Four-digit SIC industries are likely in general to be sufficiently free of competition from substitute products sold by other industries to permit the exercise of market power. Pittman and Werden (1989) and Werden (1988) conclude that the minimum agglomeration of products necessary to permit successful collusion is even narrower than four-digit industries.

following the 1982 recession. These industries are selected through a criterion that identifies, on average, industries exercising market power. For each industry in our sample, we identify a reference month six months prior to the trough and a matching month from the two years following the trough. The matching month is chosen such that industry sales are close to their level during the reference month. If, as we believe, firms generally experience constant returns to scale in the neighborhood of a trough and input prices generally do not fluctuate enough to affect prices significantly in the neighborhood of a trough,[24] then an increase in price between the reference month and the matching month reflects the exercise of market power. With cost-based explanations excluded as generally implausible, a price increase has two explanations: it may reflect increased cooperation as the boom begins, or it may reflect more steep industry demand given some level of industry cooperation. In either case, the industry exercises market power.

This interpretation may be clarified by assuming that the inverse demand function (2) has a constant elasticity form:

(6) $P = \alpha Q^{\beta} Y^{\tau} e^{v}$

The quasi-supply function (5) then reduces to

(7) $P_t = (MC_t + u_t)/(1+\Theta_t \beta_t)$

Denoting the before- and after-trough time periods with the subscripts 0 and 1, respectively,

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[24]The method of identifying the matching month ensures that output in the matching month does not dramatically exceed output around the trough, thereby also reducing the possibility that cost increases associated with a rapid increase in capacity utilization explain price increases in our data.

and assuming that the matching month is chosen to equate quantity with the reference month ($Q_0 = Q_1 \equiv Q$) and that marginal cost does not change over the trough ($MC_0 = MC_1 = MC$), the change in price has the following interpretation:

(8) $P_1 - P_0 = [(MC+u_1)/(1+\Theta_1\beta_1)] - [(MC+u_0)/(1+\Theta_0\beta_0)]$

Equation (8) shows that the systematic increases in price (not arising from variation in the random variables u_t) will reflect either more inelastic demand ($|\beta|$ rises) or more cooperative behavior (Θ rises).[25]

This interpretation is not sensitive to the functional form of demand. With quantity matching and constant marginal cost, and the more general demand function (2), the quasi-supply function (5) implies:

(9) $P_1 - P_0 = Q(-f_q^1\Theta_1 + f_q^0\Theta_0)$

In equation (9), f_q^1 and f_q^0 represent, respectively, the slopes of the post and pre-trough demand curves. In this framework, two interpretations of a price rise are worth noting. If price increases from the reference month to the matching month ($P_1 > P_0$), then cooperation is greater post-trough ($\Theta_1 > \Theta_0$) as long as the demand curve does not grow steeper after the trough (as long as $|f_q^0| \geq |f_q^1|$). In the alternative, if price increases from the reference month to the matching month ($P_1 > P_0$), then demand grows steeper ($|f_q^1| > |f_q^0|$) as long as cooperation does not decline after the trough (as long as $\Theta_0 \geq \Theta_1 > 0$). Thus, if marginal cost is constant, either demand grows steeper while market power is being exercised ($\Theta > 0$), or the degree of

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[25]This interpretation assumes that $1+\Theta\beta > 0$. That is, if demand is highly inelastic, then the oligopoly solution concept is very competitive.

cooperation (market power) rises ($\Theta_1 > \Theta_0$).[26] In both cases, market power is exercised ($\Theta_1 > 0$).[27]

Of the two possibilities--changes in shape of the demand function or changes in the degree of cooperation, we conjecture that our quantity-matching assumption makes the latter the more likely interpretation during the period surrounding a business cycle trough. Regardless of the way an industry's demand elasticity varies over the business cycle, the elasticity is unlikely to change asymmetrically in the neighborhood of the trough, as the bust ends and the boom begins. That is, if demand grows more elastic (say) as output declines toward the trough, we conjecture that demand will generally grow less elastic at a similar rate as the boom begins.[28] If this conjecture is correct, industries in which price rises around a business cycle trough while

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[26]Both interpretations of a price increase given quantity matching are consistent with the idea that the price rise emerges from an outward shift in demand, a sensible assumption for interpreting price changes observed as a boom commences. To see that demand likely shifts outward, assume a linear demand function and constant marginal cost. If the solution concept parameter is held constant, a rise in price requires that the demand function grows steeper and its intercept rises. If instead the slope of the demand function is held constant, a price increase implies both that the solution concept parameter rises and that the demand intercept increases. (Had we instead adopted price matching, we would have looked for quantity reductions to identify the exercise of market power. Such observations would be predicated on inward shifts in demand, the opposite of what we expect to observe in the early stages of a boom.)

[27]Although this nonparametric procedure does not permit us to separate the parameters of the demand function from the solution concept parameter, we can, under the maintained hypothesis that marginal cost is constant, identify changes in a function that is a multiple of the solution concept parameter. In consequence, we can identify when $\Theta > 0$.

[28]Asymmetric expectations provide the most plausible rationale for expecting the demand elasticity to change asymmetrically around the trough. Yet, although rising economic activity must eventually lead firms to conclude that a recession has ended, it is difficult to see why expectations of future demand would change in the early stages of a boom, before output has risen above the recessionary level reached (say) six months before the trough.

quantity does not are not only on average industries in which market power is being exercised; they are also on average industries in which the degree of cooperation increases as the boom begins.

To implement our quantity-matching algorithm, we must first choose a date for the trough. One possibility is to assume that the business cycle trough occurred in the identical month for every industry, the NEBR date of November 1982. We choose instead to identify the trough endogenously with industry output data, in order to ensure that we have truly found a trough. Another implementation issue involves identifying the matching month. We might have chosen that month over the next two years in which the quantity sold was closest to the quantity sold in the reference month. We preferred to select the month in which sales first rose above the quantity sold during the reference month, in order to keep the matching month close to the trough.[29]

In order to apply this algorithm, we must have quantity data corresponding to our price data. Our output information, the Industrial Production indexes reported by the Federal Reserve, is reported in broader aggregates than the price data, often much broader.[30] In consequence, the applicability of our quantity matching technique frequently turns on the assumption that each narrowly-defined industry output measure we cannot observe follows a

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[29]Although the four possibilities implicit in these choices yield virtually the same set of industries, we used the "endogenous trough" definition combined with the "first crossing" definition of the matching
month, since these definitions are the closest to our view of the business cycle.

[30]In an appendix, we report the correspondences we employ between industrial production indexes and price indexes.

similar cyclical pattern to the more broadly defined measure in which it is nested.

Table 7 reports four- and five-digit SIC industries for which the (deflated) price in the matching month exceeds by more than 5% the price in the reference month.[31]

[INSERT TABLE 7 HERE]

In some industries, sales never rise in the post-trough period to equal the quantity sold in the reference month; these industries have been excluded from the sample. As with the previous list of industries experiencing price increases around the trough, we found little evidence that wage increases or increases in the price of inputs account for any significant part of the observed industry price increase.

The industries listed in Table 7 most likely exercised market power as the boom began. While we cannot be certain that these price changes do not reflect cost increases, it is likely that the listed industries contain a far greater concentration of industries exercising market power than would a random sample of industries for which price indexes are available. And, if our conjecture about demand elasticities is correct, they are on average industries in which the degree of cooperation increased as the boom began.

B. Consistent Price Patterns Across Recessions

Some industries consistently exhibit price increases in the early stages of a boom. This

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[31]Because we impose quantity matching, the price rises we observe are typically smaller than those reported in Table 6.

section identifies such industries and investigates their characteristics.

1. Industries with Increasing Margins as the Boom Begins

If either oligopoly behavior or the slope of demand functions varies predictably over the business cycle for many industries, and if many industries have not changed significantly in market structure during the last several decades, we should observe some industries exhibiting consistent patterns of steep price increases during recessions. The sample we used to study whether this conjecture holds incorporates 177 four-, five-, seven- and nine-digit industries for which consistent price and output data was available over the 1958, 1961, 1970, 1975, and 1982 recessions.[32] We identify reference and matching months in the same way here as for our study of the 1982 trough.

Table 8 reports those products which exhibited a (real) price increase in at least five of the six recessions studied.

[INSERT TABLE 8 HERE]

We interpret this list as collecting industries more likely than most to have experienced the exercise of market power. These industries experienced cooperative pricing as booms began, or else they exercised a constant degree of market power while typically experiencing steeper demand as booms began.

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[32]We excluded the 1948 and 1954 recessions because most of the output series begin in 1954.

The industries reported in Table 8 are distributed across two-digit industries far differently from their distribution across the entire sample of 177 firms. The most over-represented two-digit industries include Stone, Clay and Glass Products; Fabricated Metal Products; Nonelectrical Machinery; and Electrical Machinery. The most under-represented two-digit sectors include Food and Primary Metals.

Our interpretation of equation (9) suggests that systematic price increases around troughs in particular industries are indicative of market power. One alternative hypothesis is that price increases in one recession are randomly distributed among industries, and that the industries reported as experiencing price increases in multiple recessions do so at random. We tested this hypothesis by comparing the expected distribution of price increases under the hypothesis of randomness with the observed distribution, and rejected the alternative of randomness at a 5% significance level.

2. The Elasticity of Output as the Boom Begins

We compared the industries identified through our quantity-matching methodology with those selected using a different though related method of identifying industries likely on average to exercise market power. The alternative algorithm selects those industries with the lowest price elasticity of output -- the ratio of the percentage change in output to the percentage change in price -- during the first six months following a business cycle trough.

To interpret the price elasticity of output, we assume that during the period just

following the trough, firms experience constant returns to scale, input prices do not increase, and neither the degree of industry cooperation nor the slope of industry demand changes. These assumptions are consistent with the idea that in the early months of a boom, the dominant influence on price and output in most industries is most likely an exogenous economy-wide increase in demand. Under these assumptions, the price elasticity of output can be interpreted as the elasticity of quasi-supply, and it equals the ratio of the demand elasticity to the oligopoly solution concept parameter.[33]

Accordingly, we interpret a high price elasticity of output during the first six months of a boom as suggesting either that demand is elastic (e large), or the industry behaves competitively (Θ near zero). In contrast, if output is not responsive to changes in price when demand is shifting out, either demand is inelastic or industry behavior is far from competitive.

Over the sample of industries with price data covering six postwar recessions since 1958, we compared the list of industries previously identified through the quantity-matching methodology with a set of industries exhibiting a consistently low price elasticity of output.[34] The overlap between the resulting set of industries and those listed in Table 8 (derived over the same sample using our quantity-matching technique) appears greater than would occur by

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[33]To show this, we differentiate the partial equilibrium system (2) and (5) with respect to a demand shift variable y, and we impose the restrictions $C_q = \Theta_q = \Theta_y = f_{qq} = f_{qy} = 0$ to derive the following equation: $[(dQ/dy)/(dP/dy)][P/Q] = e/\Theta$.

[34]For each industry in our sample for which the necessary data was available, we compute the average output elasticity over the six months following the NEBR trough date. We require that both price and quantity increase over this period. An industry was identified as having a consistently low price elasticity of output if the elasticity fell between 0 and 10 for at least three of the six postwar recessions since 1958.

chance.[35] We conclude that the output elasticity methodology and the quantity-matching methodology select for the same industry characteristics. This observation suggests the difficulty of disentangling the two market power explanations for the increase in prices as a boom began -- a more inelastic demand curve for industries currently exercising market power, and greater coordination.

C. Characteristics of Industries Exercising Market Power

To the extent the industries that increase prices over recessions are on average more likely to exercise market power than most, as we have argued, we can learn from their characteristics about the structural features of industries likely to perform poorly. In this section, we focus on two characteristics: industry concentration and import penetration. We find a positive association between price increases over troughs and concentration. We also find that industries in which prices increase over troughs tend to be free from import competition. We conducted this analysis with data from the 1982 recession.

1. Concentration

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[35]The unconditional probability of an industry appearing in Table 8 is 13% (22/166), while the probability of an industry appearing in Table 8 given that it also has a consistently low price elasticity of output is 23% (7/30).

We evaluate whether price increases over troughs correlate with concentration for a sample of 496 industries for which four-firm concentration ratios were reported in the 1982 Census of Manufactures.[36] The association between high concentration and high price change is strong. For the subsample for which price rose by at least 6% between the reference month and the matching month, the mean four-firm concentration ratio is 59.6%. For the sample as a whole, the mean concentration ratio is 46%. This difference in means seems substantial, although we cannot perform a valid significance test because price changes are correlated in related industries, so our observations are not independent.

Table 9 demonstrates that the relationship between price changes and concentration obtains throughout the sample.

[INSERT TABLE 9 HERE]

The industries we studied were ordered by price changes, and formed into deciles. The table reports the mean concentration ratio for each decile. An association between higher price increases and higher levels of concentration is evident, with the exception that the industries experiencing the largest price declines had a higher than average degree of concentration.

The association between concentration and recessionary price increases remains when

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[36]The reported concentration ratios are for four- and five-digit industries, so we limited our attention to these. We excluded from our sample a small number of industries with likely local or regional geographic markets, because within them the Census concentration ratio will likely be misleadingly low. We also excluded a small number of industries that on average use a particular input intensively, because output prices in these industries will be extremely sensitive to input price fluctuations.

the sample is stratified into two-digit industries. Table 10 reports reference to matching month price change and the four-firm concentration ratio for four- and five-digit industries, both averaged within each two-digit industry.

[INSERT TABLE 10 HERE]

The last column shows that the correlation is positive between these two variables in 13 of 19 two-digit industries. If industries having ten or fewer four- and five-digit industries are excluded, the correlation is positive in 10 of 13 industries. Although we cannot test the statistical significance of these associations because the observations within industries are not independent, the positive relationship between price change and concentration appears strong.

2. Import Competition

The industries identified in Table 7 as likely on average to exhibit the exercise of market power based on price increases over recessionary troughs have a second structural characteristic: on average they are free from import competition. We reached this conclusion by analyzing the import market shares, reported in Table 11, for the eighteen industries for which we were able to determine import penetration out of the sixty industries in Table 7.

[INSERT TABLE 11 HERE]

Most of these industries had very small import shares; in twelve of eighteen, import penetration was less than 5% of the market. Only three had import shares of more than the overall

manufacturing average of 11.1%. The correlation of price increases with low import penetration is consistent with the view that foreign competition tends to make domestic industries more competitive.

D. Comparison with Other Methods of Identifying Industries Exercising Market Power

We compared the industries we identified as on average likely to be exercising market power with the lists of industries exercising market power derived independently by two other authors in order to evaluate our view that industries raising price around troughs are likely exercising market power. We chose these two studies for an intensive comparison because each classifies industries at the four-digit SIC level. The results are mixed: we find substantial overlap between our results and the results of applying one of these different methodologies, but no significant overlap between our results and the results of applying the second method.

Shepherd (1981, 1982) evaluates the market power exercised in all four-digit SIC industries (approximately four hundred fifty[37]) in 1980 from studying firm market shares, concentration ratios, entry barriers, pricing behavior, profitability, and innovation.[38] He

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[37]We are grateful to Geoffrey Shepherd for providing this estimate of the number of industries he analyzed.

[38]Although Shepherd takes pricing behavior into account in making his classifications, his subjective analysis is largely based on factors other than the behavior of prices during recessions. We therefore treat his methodology as employing information independent of the data we study.

classifies one hundred eighteen of those industries as not competitive, describing five as controlled by a dominant firm and the remaining one hundred thirteen as "tight" oligopolies. We compared this list of industries with the four digit industries included in Table 7 as likely to have been exercising market power in 1980 based upon the relative behavior of price and quantity during the 1982 recession, and reject at a 5% level the hypothesis that the two methods of selecting industries are independent; we found more overlap than would be predicted by chance.[39] This conclusion increases the plausibility of the view that both methods in fact identify industries exercising market power.

In contrast, Lebow's (1991) ranking of industries according to market power is unrelated to the rank ordering derived from our price increase series.[40] The absence of a

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[39]Of the sixty-four four-digit industries Shepherd identifies as non-competitive, eight of those industries appear in our list of eleven industries exhibiting market power. We identify many less industries as likely settings for the exercise of market power than does Shepherd, for two reasons. First, we in effect employ a tougher standard for identifying poor industry performance than he does. Second, our method may be more difficult to satisfy than his because we identify market power through finding cases in which market power increased as a boom began; Shepherd also seeks to identify market power in industries in which the degree of its exercise does not change over the business cycle. On the other hand, virtually all the industries Shephard identifies as not competitive are classified by him as "tight" oligopolies. Because such industries would be the most likely to vary markups cyclically in response to variation in the elasticity of market
demand, one might have expected to see significant overlap between the two lists of industries exercising market power.)

[40]Lebow created two price-cost margin series for four hundred forty-six four-digit industries over the years 1958 to 1984. One series was derived using the procyclicality of total factor productivity, following Hall (1988). The second margin series was constructed from Lebow's econometric estimates of marginal cost (through the simultaneous estimation of a translog cost function and an associated factor demand equation for labor and materials). We are grateful to David Lebow for sharing these series with us.

relationship could be explained if there are many industries with both high margins and margins that do not vary over the business cycle. Such industries would be ranked highly by Lebow, but would not be ranked highly by our approach to the extent our method detects changes in the level of market power.

IV. Concluding Comment

This paper emphasizes a market power explanation for the procyclical behavior of particular industry prices around business cycle troughs. Either firms increase cooperation as booms begin, or demand functions grow steeper as booms begin while firms exercise some market power over the whole period around the trough. The focus on pricing around business cycle troughs exploits the idea that when an industry's price rises around the trough of a recession, the price increase is unlikely to be explained by rising input prices or binding capacity constraints. If so, the pricing experience of industries around the troughs of recessions may be an indicator of the exercise of market power.[41]

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[41]It is worth noting that not every exercise of market power calls for antitrust intervention. For example, if fixed costs are high and marginal costs low, we might expect to observe $\Theta > 0$ in a free-entry equilibrium during at least some stages of the business cycle. Here, an above-cost price would reflect quasi-rents necessary to cover fixed costs. Such industries exercise what an economist would call market power, without the market power necessarily constituting an antitrust problem. Nevertheless, the set of industries increasing prices around a business cycle trough might be a useful starting point for antitrust enforcers seeking to target a group of industries for more intensive investigation.

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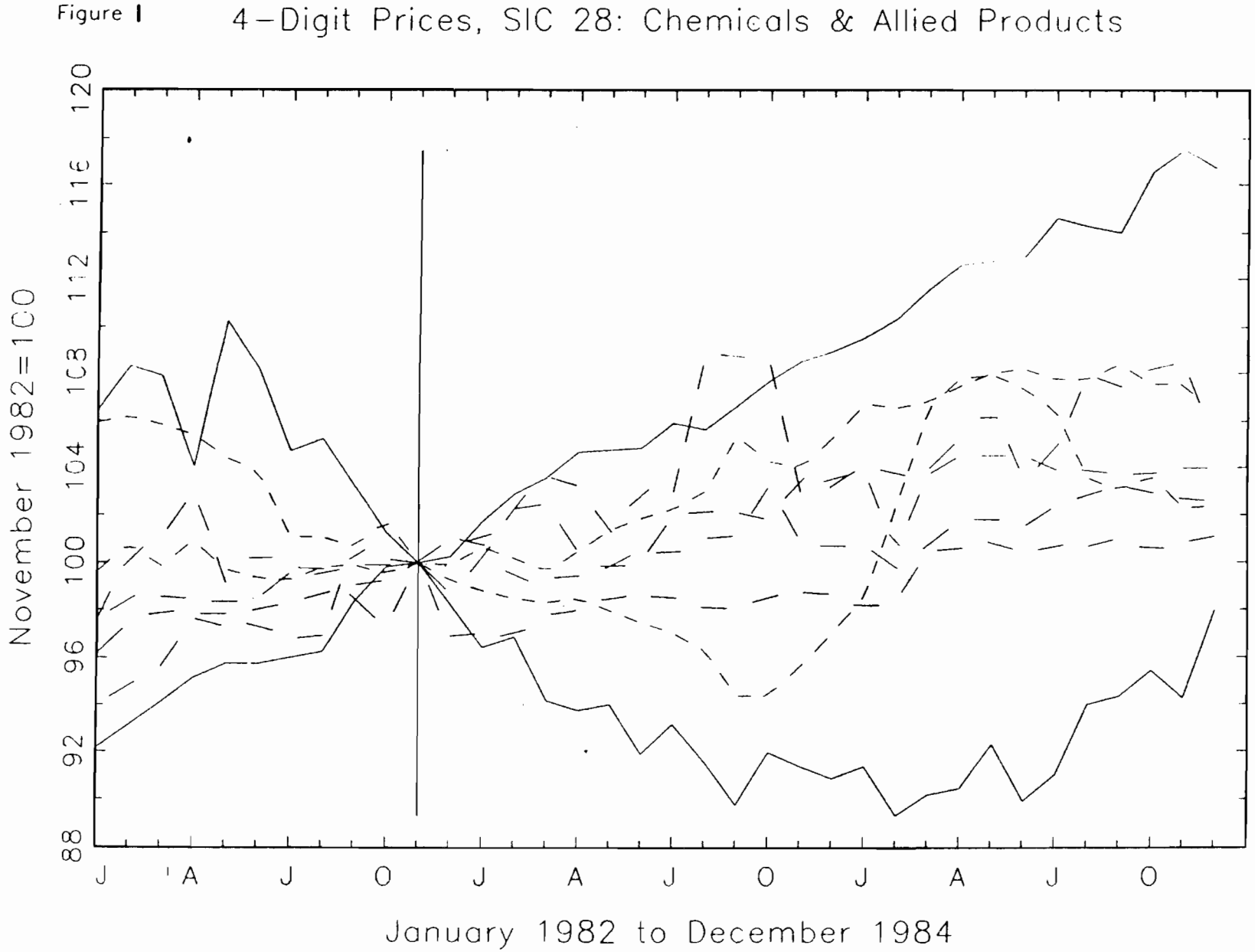
Figure 1


4-Digit Prices, SIC 28: Chemicals & Allied Products
November 1982=100
88
92
96
100
104
108
112
116
120
J
A
J
O
J
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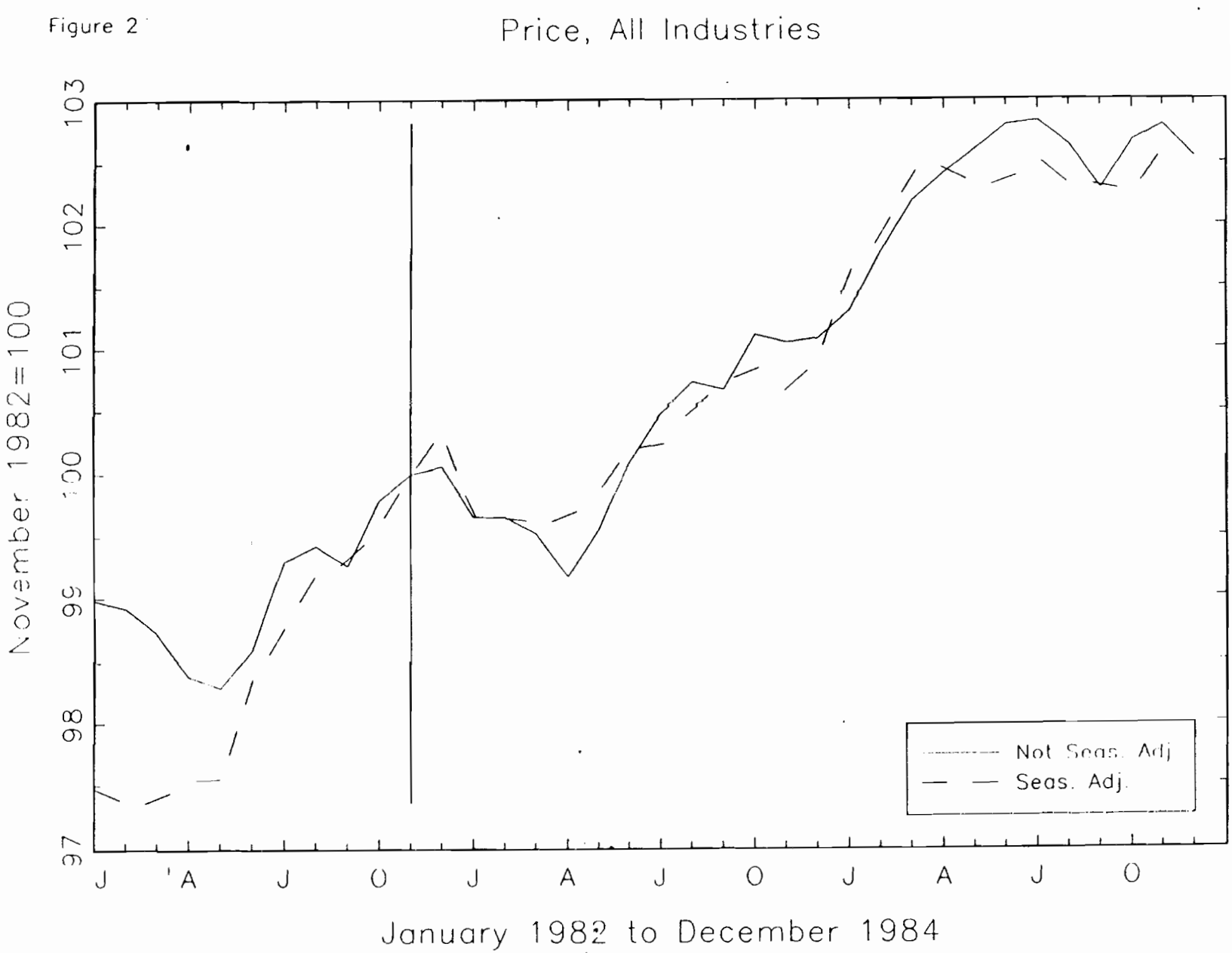
January 1982 to December 1984

Figure 2


Price, All Industries
November 1982=100
97
98
99
100
101
102
103
J
A
J
O
J
A
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O
J
A
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O
January 1982 to December 1984
Not Seas. Adj
Seas. Adj.

TABLE 1

Price Dispersion Within 2-Digit Industries

	INDUSTRY	Number of Industries	Mean Correlation Coefficient	Mean 2-Digit R-Squared
20	Food and Kindred Products	24	0.06	0.15
21	Tobacco Manufactures	3	0.69	0.57
22	Textile Mill Products	13	0.42	0.41
23	Apparel and Other Textile Products	14	0.24	0.10
24	Lumber and Wood Products	7	0.44	0.42
25	Furniture and Fixtures	6	0.41	0.59
26	Paper and Allied Products	6	0.58	0.42
27	Printing and Publishing	3	0.99	0.98
28	Chemicals and Allied Products	12	0.22	0.20
29	Petroleum Refining	4	0.11	0.51
30	Rubber and Plastic Products	4	0.26	0.25
31	Leather and Leather Products	5	0.28	0.40
32	Stone, Clay and Glass Products	16	0.41	0.73
33	Primary Metals	17	0.36	0.33
34	Fabricated Metal Products	14	0.09	0.28
35	Nonelectrical Machinery	23	0.47	0.43
36	Electrical Machinery	21	0.40	0.56
37	Transportation Equipment	3	0.41	0.33

Sample: Monthly Data, January 1982 to December 1984.
Not Seasonally Adjusted

Table 2: Correlations of 2-Digit Detrended Prices with Detrended Output in the Postwar Period

Correlation of Qt with Pt+i

Industry	i=-5	i=-4	i=-3	i=-2	i=-1	i=0	i=+1	i=+2	i=+3	i=+4	i=+5
20	0.02	0.07	0.15	0.2	0.23*	0.11	0.03	0	0.03	0.03	0.01
21	-0.15	-0.2	-0.21	-0.14	-0.11	-0.16	-0.16	-0.15	-0.08	0.03	0.04*
22	-0.02	0.07	0.14	0.22	0.29	0.33	0.35	0.36*	0.35	0.32	0.27
23	-0.15	-0.09	-0.04	0.06	0.12	0.15	0.18	0.24	0.26	0.32	0.33*
24	0.33	0.34	0.38	0.43*	0.41	0.31	0.16	0.03	-0.03	-0.04	0
25	-0.3	-0.28	-0.26	-0.19	-0.09	-0.05	-0.04	0.01	0.07	0.14	0.16*
26	-0.21	-0.22	-0.22	-0.12	0	0.06	0.09	0.15	0.18	0.27	0.34*
28	-0.2	-0.18	-0.16	-0.11	-0.04	0	0.04	0.06	0.07	0.11	0.18*
29	-0.03	0.01	0.06	0.09	0.1	0.09	0.07	0.09	0.11*	0.1	0.05
30	-0.21	-0.17	-0.11	-0.03	0.06	0.12	0.16	0.18	0.18	0.17	0.19*
31	0.14	0.17	0.19	0.24	0.29*	0.29	0.26	0.23	0.19	0.16	0.16
32	-0.14	-0.09	-0.11	-0.03	0.03	-0.03	-0.07	-0.06	-0.03	0.06	0.11*
33	-0.18	-0.13	-0.06	0.06	0.18	0.22	0.23*	0.22	0.19	0.21	0.22
34	-0.32	-0.29	-0.23	-0.15	-0.05	0	0.03	0.07	0.1	0.15	0.17*
35	0	0.02	0.03	0.04	0.06	0.08	0.1*	0.09	0.05	0.01	0.03
36	-0.26	-0.27	-0.25	-0.2	-0.13	-0.08	-0.03	0	0.05	0.13	0.18*
37	-0.09	0.05	-0.04	-0.2	-0.26	-0.2	0	0.22*	-0.01	0.17	0.05

Output series is aggregate Industrial Production Index.

Table 3: Correlations of Detrended 2-Digit Prices with Detrended Output in the Postwar Period Around NBER Troughs

	Correlation of Qt with Pt+i										
Industry	i=-5	i=-4	i=-3	i=-2	i=-1	i=0	i=+1	i=+2	i=+3	i=+4	i=+5
20	0.18*	0.06	-0.07	-0.17	-0.19	-0.2	-0.1	0.01	0.05	0.14	0.08
21	-0.08	0.07	0.13	0.18*	0.13	0.2	0.08	0.04	-0.17	-0.16	-0.17
22	0.43*	0.4	0.3	0.22	0.11	-0.01	-0.06	-0.1	-0.12	-0.12	-0.11
23	0.21	0.25	0.26	0.36*	0.36	0.2	0.15	0.05	0.02	0	-0.02
24	-0.13	-0.34	-0.35	-0.29	-0.2	-0.1	-0.04	0.01	0.02*	-0.01	-0.13
25	0.09	0.12	0.17	0.25*	0.22	0.15	0.1	0.11	0.08	0.07	0.1
26	0.14	0.22	0.31	0.45	0.48*	0.39	0.32	0.19	0.06	0.05	0.05
28	0.05	0.13	0.16	0.23	0.33	0.35*	0.31	0.24	0.13	0.11	0.07
29	0.16	0.21	0.26	0.28*	0.22	0.1	-0.09	-0.23	-0.25	-0.22	-0.12
30	0.13	0.14	0.15	0.17	0.2	0.18*	0.15	0.11	0.07	0.06	0.07
31	0.16*	0.08	-0.06	-0.1	-0.03	0	0.06	0.01	-0.06	-0.11	-0.14
32	0.01	0.06	0.11	0.22	0.3	0.29	0.34*	0.24	0.08	0.07	-0.02
33	0.37*	0.29	0.24	0.32	0.34	0.31	0.29	0.2	0.05	0.05	0.09
34	0.08	0.11	0.17	0.29	0.35	0.36*	0.31	0.23	0.2	0.2	0.23
35	0.03	0.04	0.05	0.08	0.1	0.14	0.16*	0.15	0.12	0.11	0.09
36	-0.03	0.02	0.07	0.16	0.22*	0.2	0.14	0.09	0.08	0.13	0.15
37	0.1	0.31*	0.11	0.24	0.15	0.02	-0.06	-0.01	-0.08	-0.18	-0.13

Output series is aggregate Industrial Production Index.

Table 4: Correlations of Detrended 2-Digit Prices with Detrended Output in the Postwar Period Around NBER Peaks

	Correlation of Qt with Pt+i										
Industry	i=-5	i=-4	i=-3	i=-2	i=-1	i=0	i=+1	i=+2	i=+3	i=+4	i=+5
20	-0.16	-0.18	-0.16	-0.15	-0.09	-0.16	-0.2	-0.13	-0.02	0.05	0.11*
21	-0.24	-0.26	-0.23	-0.19	-0.17	-0.1	-0.01	0.13*	-0.1	-0.26	-0.23
22	0.2	0.21	0.2	0.22*	0.21	0.16	0.18	0.18	0.14	0.14	0.13
23	0.05	0.08	0.05	0.14	0.18*	0.08	0.09	0.13	0.09	0.16	0.17
24	0.19*	0.03	-0.03	0.01	0.06	0.05	-0.03	-0.03	0.07	0.14	0
25	-0.17	-0.17	-0.12	0.01	0.02	-0.04	-0.08	-0.07	-0.07	-0.03	0.04*
26	-0.18	-0.1	-0.07	0.02	0.12	0.08	0.06	-0.03	-0.06	0.08	0.18*
28	-0.08	-0.07	-0.08	-0.07	-0.01	0*	0	-0.05	-0.1	-0.09	-0.06
29	-0.03	-0.06	0.05	0.21	0.27*	0.16	-0.06	-0.24	-0.24	-0.18	-0.13
30	-0.08	-0.08	-0.11	-0.09	-0.02	0.05	0.06	0.05	0.06	0.08	0.11*
31	0.23	0.26*	0.21	0.2	0.17	0.05	0.03	0	0	0.05	0.06
32	-0.15	-0.15	-0.13	0.01	0.13	0.1	0.18	0.19*	-0.06	-0.1	-0.12
33	0.03	0.02	-0.02	0.02	0.05	0	0.01	-0.01	-0.01	0.06	0.16*
34	0.04	0.05	0	0.01	0.01	-0.01	-0.01	-0.06	-0.06	0	0.08*
35	0	-0.02	-0.03	-0.04	-0.04	0.01	0.09	0.1	0.07	0.07	0.11*
36	-0.09	-0.12	-0.08	0.02	0.06*	0.01	0	-0.04	-0.03	0.02	0.02
37	0.15	0.42*	0.19	0.28	0.09	-0.15	-0.17	-0.03	-0.18	-0.26	-0.32

Output series is aggregate Industrial Production Index.

TABLE 5

THE DISTRIBUTION OF LARGE INDUSTRY PRICE CHANGES AROUND THE 1982 BUSINESS CYCLE TROUGH

Percent Change in Price	January 1982-November 1982.	November 1982-November 1983.	November 1982-November 1984.
Decreases			
-10% or more	5	6	6
-5% or more	18	20	19
Increases			
+5% or more	19	32	50
+10% or more	2	9	19

Number of four-digit SIC industries is 208.
Data is deflated, not seasonally adjusted.

TABLE 6

FOUR DIGIT INDUSTRIES EXPERIENCING LARGE PRICE INCREASES AND DECREASES

INDUSTRIES		PERCENT CHANGE IN PRICE NOVEMBER 1982 TO	
SIC NUMBER	PRODUCT	November 1983	November 1984
2018	Poultry and Egg Processing	14	10
2044	Rice Milling	13	7
2048	Prepared Animal Feeds (excluding Pet Food)	23	2
2091	Canned and Cured Seafoods	13	-2
2131	Chewing & Smoking Tobacco	9	16
2253	Knit Outerwear	9	11
2448	Wood Pallets and Skids	4	13
2492	Particleboard	8	10
2611	Pulp Mills	1	10
2631	Paperboard Mills	5	16
2653	Corrugated & Solid Fiber Boxes	0	11
2711	Newspaper Publishing	8	14
2721	Periodicol Publishing	6	11
2834	Pharmaceutical Preparations	7	14
3111	Leather Tanning & Finishing	7	12
3275	Gypsum Products	20	25
3333	Primary Zinc	13	6
3334	Primary Aluminum	11	0
3341	Secondary Nonferrous Metals	12	1
3353	Aluminum Sheet, Plate and Tube Products	9	11
3482	Small Arms Ammunition	19	23
3641	Electric Lamps	9	10
3644	Noncurrent-carrying Wiring Devices	3	11
3648	Lighting Equipment, N.E.C.	0	12
3671	Electron Tubes	3	24
2066	Chocolate & Cocoa Products	-19	-11
2074	Cottonseed Oil Mill Products	-49	-12
2077	Animal Fats & Oils	-21	1
2079	Shortening & Cooking Oils	-28	-9
2095	Coffee	-11	-11
2911	Petroleum Refining	-10	-16
3211	Flat Glass	0	-11
3331	Primary Copper	-6	-12

TABLE 7: LARGE REAL PRICE INCREASES USING MATCHED OUTPUTS

SIC NUMBER	PRODUCT	% Change in Price
2011 4	Fresh and Frozen Pork	5
2011 6	Processed and Cured Pork	14
2013 0	Sausage and other Prepared Meats	8
2013 6	Sausage Pork	14
2013 7	Sausages	7
2018 3	Turkeys	12
2067 0	Chewing Gum or Gum Base	7
2067 1	Chewing Gum	6
2087 3	Soft Drink Bases	7
2092 4	Frozen Packaged Shellfish	10
2436 3	Specialty Softwood Plywood	5
2436 5	Softwood Plywood Sheathing	5
2647 1	Sanitary Napkins and Tampons	8
2711 0	Newspaper Publishing	6
2711 7	Advertising	7
2721 3	Business Periodicals	10
2731 1	Textbook Publishing	5
2813 5	Nitrogen Gas	8
2831 2	Vaccines, Toxoids and Antigens	6
2834 0	Pharmaceutical Preparations	8
2834 1	Prescription Pharmaceutical Preparations	7
2834 2	Non-Prescription Pharmaceutical Preparations	6
3111 5	Leather Tanning: Rough, Crust and Wet Blue	22
3331 0	Primary Copper	9
3331 2	Refined Copper	5
3333 0	Primary Zinc	9
3339 3	Primary Nonferrous Metals, ex. aluminum and copper	9
3341 5	Precious Metals	65
3356 0	Nonferrous Metal Forming	22
3356 3	Precious Metal Mill Shapes	65
3433 5	Steel Heating Boilers	6
3482 0	Small Arms Ammunition	7
3499 1	Safes and Vaults	7
3499 2	Collapsible Tubes	13
3499 3	Metal Strapping	7
3519 4	Automotive Diesal Engines	5
3523 5	Farm Harvesting Machinery	6
3523 6	Farm Haying Machinery	8
3554 3	Papermill Machinery	5
3555 1	Lithographic Printing Presses	7
3576 7	Scale and Balance Accessories	5
3581 2	Automatic Merchandising Machinas Parts	8
3585 4	Refrigarator and Heating Compressors	6
3613 4	Fuses, Equipment, Under 2300 Volts	7
3621 2	Intagral Motors and Generators	9
3631 3	Gas Household Units and Parts	6
3671 0	Electron Tubes	13
3671 1	Receiving Electronic Tubes, except Cathode Ray	15
3671 3	Transmitting and Power Tubes	6
3676 3	Variable Resistors	6
3676 5	Fixed Resistors	5
3711 2	Trucks, Truck Tractors, and Chassis	7
3822 1	Building Environment Controls	6
3825 1	Electrical Integrating Instruments	11
3841 1	Surgical and Medical Instruments	5
3911 0	Jewelry	17
3911 1	Platinum and Gold Jewelry	20
3914 2	Metal Flatware and Carving Sets	24
3915 0	Jewelers' Materials	6
3915 1	Jewelers' Findings and Materials	17

TABLE 8

FREQUENT PRICE INCREASES USING MATCHED OUTPUTS: 6 POSTWAR RECESSIONS

INDUSTRIES			RECESSION TROUGH: PERCENT CHANGE IN PRICE							# OF
SIC NUMBER		PRODUCT	1958	1961	1970	1975	1980	1982	MEAN	INCR.
2844	P	Toilet Preparations	1	1	0	1	3	1	1	6
3221	131	Glass Containers for Food	8	3	8	10	2	1	5	6
3423	P	Hand & Edge Tools	5	2	3	7	1	3	4	6
3423	114	Screw Drivers	4	2	0	4	3	2	3	6
3533	362	Oil & Gas Field Equipment - Packers	9	9	5	23	2	8	9	6
2011	63101	Ham: Process & Cured (not canned)	8	3	-14	5	2	18	4	5
2077	21111	Animal Meat, Meat & Bone Meal	32	19	3	15	-8	1	10	5
2084	11421	Red Wine: Generic, Semi-generic, Proprietary	13	1	0	-2	5	1	3	5
2511	331	Wood Dining Room Chairs	2	2	1	2	1	0	1	5
2511	351	Wood Buffets & Servers, Dining Room	-1	1	1	2	0	1	1	5
3221	117	Liquor Glass Containers	5	0	9	8	2	-1	4	5
3251	11101	Building or Common Brick	0	1	3	9	-3	3	2	5
3261	111	China & Earthenware Lavatories	-1	0	2	10	3	2	3	5
3312	324	Blackplate - Tin Mill Products	3	-1	8	13	1	3	4	5
3423	111	Pliers	3	5	1	7	3	-1	3	5
3423	321	Files	-2	1	0	4	2	3	1	5
3433	313	Gas Fired Cast Iron Heating Boilers	0	0	5	8	2	1	2	5
3523	0	Farm Machinery & Equipment	0	1	2	12	0	4	3	5
3523	316	Planting Equipment	1	2	5	13	-3	4	4	5
3523	90083	Farm Machinery & Equipment Parts	-1	2	3	3	2	8	3	5
3532	P	Mining Machinery & Equipment	8	2	1	31	1	0	8	5
3562	417	Mounted Ball Bearings	3	1	4	17	4	-4	4	5
3566	0	Speed Changers, Industrial Highspeed Orives & Gears	0	3	2	8	1	-1	2	5
3566	228	Speed Reducers Small - Low Speed Centers	5	1	7	35	4	-1	8	5
3613	P	Switchgear and Switchboard Apparatus	1	-1	5	8	3	2	3	5
3621	0	Electric Motors & Generators	0	-5	2	18	1	7	3	5
3622	P	Industrial Controls	5	0	7	12	-4	3	4	5
3622	11201	Noncombination, Full Voltage Starters 1000 v. or less	8	0	8	14	-4	4	5	5
3622	113	AC Contactor 1000V or less	4	0	7	14	-4	1	4	5
3861	P	Photographic Equipment & Supplies	1	2	0	3	15	1	3	5

TABLE 9

THE RELATIONSHIP BETWEEN PRICE CHANGE AND CONCENTRATION, BY PRICE INCREASE

Decile	Price Ratio Range	Mean Price Ratio	Four Firm Concentration Ratio
1	795-950	908	47
2	951-978	966	39
3	979-993	987	44
4	994-1000	997	43
5	1001-1006	1003	44
6	1007-1014	1011	44
7	1015-1022	1019	50
8	1023-1033	1028	49
9	1034-1056	1045	47
10	1057-1670	1114	59

Concentration values are taken from the 1982 Census of Manufactures.

TABLE 10

THE RELATIONSHIP BETWEEN PRICE CHANGE AND CONCENTRATION, BY INDUSTRY

INDUSTRY		Mean % Change	Mean Concentration Ratio	Number of 4-Digit Industries	Correlation Coefficient
20	Food and Kindred Products	-0.9	49	67	.068
21	Tobacco Manufactures	-0.6	58	1	
22	Textile Mill Products	-1.7	45	32	.028
23	Apparel and Other Textile Products	1.6	29	24	.065
24	Lumber and Wood Products	-1.8	30	21	.052
25	Furniture and Fixtures	1.5	27	10	-.009
26	Paper and Allied Products	-1.6	47	16	.599
27	Printing and Publishing	5.5	33	5	.345
28	Chemicals and Allied Products	-1	55	33	.223
29	Petroleum Refining	-9.2	36	6	-.249
30	Rubber and Plastic Products	0.4	54	11	-.584
31	Leather and Leather Products	1.6	35	7	-.408
32	Stone, Clay and Glass Products	0.7	42	18	.189
33	Primary Metals	2.1	51	45	-.057
34	Fabricated Metal Products	1.3	39	42	.404
35	Nonelectrical Machinery	2	48	78	.455
36	Electrical Machinery	1.3	59	46	.067
37	Transportation Equipment	2.1	44	7	.854
38	Instruments	4.8	57	8	.115
39	Misc. Manufactures	4.1	49	21	-.078

Concentration values are taken from the 1982 Census of Manufactures.

TABLE 11
THE SHARE OF IMPORTS IN A SAMPLE OF HIGH PRICE INCREASE INDUSTRIES

SIC #	PRODUCT	IMPORT SHARE US SHIPMENTS
20114	FRESH AND FROZEN PORK	2.88%
20116	PROCESSED AND CURED PORK	0.10%
20670	CHEWING GUM OR GUM BASE	1.46%
28312	VACCINES, TOXDIDS AND ANTIGENS	15.24%
28340	PHARMACEUTICAL PREPARARTIONS	0.25%
33330	PRIMARY ZINC	43.55%
34991	SAFES AND VAULTS	5.19%
34992	COLLAPSIBLE TUBES	4.11%
35194	AUTOMOTIVE DIESEL ENGINES	3.76%
35235	FARM HARVESTING MACHINERY	0.41%
35236	FARM HAYING MACHINERY	7.54%
35812	AUTOMATIC MERCHANDISING MACHINE PARTS	8.41%
35854	REFRIGERATOR AND HEATING COMPRESSORS	0.00%*
36710	ELECTRON TUBES	0.00%*
38251	ELECTRICAL INTEGRATING INSTRUMENTS	0.57%
38411	SURGICAL AND MEDICAL INSTRUMENTS	3.50%
39110	JEWELRY	0.72%
39142	METAL FLATWARE AND CARVING SETS	27.32%
	OVERALL MANUFACTURING	**11.10%**

*CLOSE TO ZERO

The data used to generate this table was found in two sources. Domestic production data was taken from The Census of Manufactures, Industries Series - 1982. Table 6A (Product and Product Classes - Quantity and Value of Shipments by all producers: 1982 and 1977). In order to obtain the corresponding import numbers, SIC-based data from this early date had to be 'translated' into the appropriate code, in this case TSUSA(Tariff Schedule-United States of America) numbers. This was done with the use of US Foreign Trade Statistics, Classification and Cross Classifications, 1980. Usually, a single 5 digit SIC product(s) consisted of several different TSUSA codes. The TSUSA numbers were found using COMPRO, an on line system which reports various trade statistics for US trading partners. The overall percentage of imports/domestic products was derived from Business Statistics: 1961-1988. Domestic production was found on page 11, listed as "Shipments-Manufacturing Sales". The quantity of imports was found on page 81 under "Value of Imports".

APPENDIX: Correspondence Between the Price and Quantity Indices

Industrial Production Index Code	Description	Corresponding Producer Price Index Codes
20100	Meat Products	2011-2018,
20220	Cheese	2022
20230	Concentrated Milk	2023, 2026
20240	Frozen Desserts	2024
20300	Canned and Frozen Foods	2032-2038,
20400	Grain Mill Products	2043-2048
20410	Flour	2041
20500	Bakery Products	2051-2067
20701	Fats and Oils	2074-2079
20820	Beer and Ale	2082-2083
20840	Wine and Brandy	2084
20850	Liquors	2085
20860	Soft Drinks	2086
20901	Coffee and Misc. Foods	2091-2099
21110	Cigarettes	2111
21211	Cigars	2121
21000	Tobacco Products	2131
22100	Cotton Fabrics	2211
22210	Synthetic Fabrics	2221
22333	Fabrics	2231
22510	Hosiery	2251-2252
22590	Knit Garmets	2253-2258
22600	Fabric Finishing	2261-2262
22700	Carpeting	2272
22809	Yarn & Misc.	2281-2298
23000	Apparel Products	2311-2396
24000	Lumber and Products	2411-2421
24300	Millwork and Plywood	2431-2439
24309	Lumber Products	2448-2449, 2492
24500	Manufactured Homes	2451-2452
25100	Household Furniture	2511-2515
25900	Fixtures and Office Furn.	2521-2522
26000	Paper and Products	2611-2655
27000	Printing and Publishing	2711-2731
28000	Chemicals and Products	2812-2899
29000	Petroleum Products	2911-2992
30000	Rubber and Plas. Products	3011-3079
31000	Leather and Products	3111-3172
32000	Clay, Glass, and Stone Prods.	3211-3296
33129	Iron and Steel	3312
33000	Primary Metals	3315-3369

34000	Fabricated Metal Products	3411-3498
35000	Nonelec. Mach.	3511-3592
36000	Elec. Machinery	3612-3694
37100	Motor Vehicles and Parts	3711-3715
37000	Transportation Equip.	3732
38000	Instruments	3822-3873
39000	Misc. Manufactures	3911-3999