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Judith A. Chevalier, David S. Scharfstein

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Liquidity Constraints and the Cyclical Behavior of Markups

By JUDITH A. CHEVALIER AND DAVID S. SCHARFSTEIN*

During business-cycle expansions, wages appear to rise relative to output prices.¹ This fact is easy to square with real-business-cycle models which are based on the assumption that labor is more productive during expansions. But it is inconsistent with standard business-cycle theories based on aggregate demand fluctuations. In these models, fixed technology and diminishing returns imply that labor becomes less productive as output rises. Thus, in an expansion, wages should fall relative to output prices.

Julio Rotemberg and Michael Woodford (1991, 1992) argue that imperfect competition can help to reconcile aggregate-demand theories of business cycles with observed procyclical real wages. If firms compete more aggressively during expansions, reducing the markup of price over marginal cost, the real wage can be driven up even if labor's marginal product falls.

[†]*Discussants:* R. Glenn Hubbard, Columbia University; Robert Gertner, University of Chicago; Owen Lamont, Princeton University.

*Graduate School of Business, University of Chicago, Chicago, IL 60637, and Sloan School of Management, Massachusetts Institute of Technology, Cambridge, MA 02139, respectively. We owe a special thanks to Julio Rotemberg for many very helpful discussions. This research was supported by a grant from the National Science Foundation, the IFSRC at MIT, a Sloan Foundation Research Fellowship (Scharfstein) and the Centel Foundation/Robert P. Reuss Faculty Research Fund at the Graduate School of Business, University of Chicago (Chevalier).

¹See Robert Barsky et al. (1994) for evidence of procyclical real wages using individual panel data. Studies based on aggregate data typically fail to show procyclical real wages. Barsky et al. show that this is because less-skilled workers enter the labor force during booms.

Countercyclical markups can therefore induce procyclical real wages.

The difficult issue is understanding why markups would be countercyclical. Rotemberg and Garth Saloner (1986) and Rotemberg and Woodford (1991, 1992)—hereafter referred to as RSW—claim that markups are countercyclical because it is harder for oligopolistic firms to sustain collusive prices during booms. When current demand is high relative to future demand, the incentive for any firm to cut its price rises because it becomes more valuable to capture current sales than to maintain collusion in the future. RSW present evidence that markups are indeed more countercyclical in more concentrated industries (where collusion can be more easily sustained).

While this finding is consistent with countercyclical collusion, it is also consistent with any other theory in which imperfect competition induces firms to compete more aggressively during booms. In this paper, we analyze an alternative theory of countercyclical markups based on imperfect competition and capital-market imperfections. This theory has been suggested by Bruce Greenwald et al. (1984), Nils Gottfries (1991), and Paul Klempner (1993). We present some preliminary evidence in an effort to distinguish this explanation from countercyclical collusion.

I. Outline of the Theory

The starting point for our analysis is the idea that capital-market imperfections constrain the ability of firms to raise external financing. This could be because outside investors are not well informed about the firm's assets or investment opportunities, as Stewart Myers and Nicholas Majluf (1984)

have argued. Or, it could be because investors fear that managers will not use funds efficiently, as Michael Jensen and William Meckling (1976) have argued. In either case, firms will tend to cut investment when internally generated funds are in short supply.

There is considerable evidence that capital market imperfections do constrain investment, particularly during recessions. Steven Fazzari et al. (1988) have shown that firms which appear to face greater difficulty raising external funds are more prone to cut capital investment when cash flow is low. Mark Gertler and R. Glenn Hubbard (1988) have shown that this effect is most pronounced during recessions, when cash flow and collateralizable asset values are also low. Papers by Takeo Hoshi et al. (1991, 1993) establish similar results for Japan. Gertler and Simon Gilchrist (1994) and Anil Kashyap et al. (1994) have shown that during recessions the most liquidity-constrained firms are also the most likely to cut inventory investment.

Liquidity constraints can also affect pricing behavior because pricing decisions, like investment and inventory decisions, are intertemporal in nature; current price affects both current and future profits. Since prices are chosen to maximize the present discounted value of profits, prices could be above or below the level that maximizes short-run profits. If intertemporal considerations lead prices to be above the single-period profit-maximizing level (as is true in the collusive oligopoly models of RSW), then a firm can increase its short-run profits by cutting its price. Thus, we might expect to see liquidity-constrained firms cutting prices in recessions in order to generate internal funds for investment and debt service. Liquidity constraints would therefore tend to dampen the countercyclical markups predicted by RSW's collusive-oligopoly model or even make markups procyclical.

On the other hand, if intertemporal considerations lead price to be *below* the single-period profit-maximizing level, then a firm can increase its profits in the short run by raising its price. In this case, we would expect to see liquidity-constrained firms increasing prices in recessions in order to

generate internal funds for investment and debt service. Liquidity constraints tend to make prices countercyclical.

Therefore, capital-market imperfections combined with any model of multiperiod product-market competition in which firms keep prices below the short-run profit-maximizing level will generate countercyclical markups. One class of models with this feature is the "switching cost" model of Klemperer (1987) and Joseph Farrell and Carl Shapiro (1988). In these models, customers face a cost of switching to a different supplier. Thus, in any period, firms trade off the benefits of charging a low price to attract first-time buyers against the gains of charging a high price to "locked-in" customers for whom it is costly to switch suppliers. The basic prediction of these models is that firms charge prices below the single-period profit-maximizing level in order to build a base of locked-in customers; they invest in valuable market share by keeping prices down.

Thus, just as firms cut investment in plant, equipment, and inventories when they are cash-constrained, they will cut investment in market share by raising the markup. Since firms are more likely to be cash-constrained during recessions, we should see markups rising during recessions. A more formal model of this idea which incorporates both switching costs and liquidity constraints is presented in Chevalier and Scharfstein (1994).

There is reason to believe, based on recent studies, that liquidity constraints can affect pricing behavior in the way we have just described. Gordon Phillips (1995) shows that in industries in which a substantial number of firms undertook leveraged buy-outs (thereby increasing the extent to which they were liquidity-constrained) prices tended to rise following the leveraged buy-outs.² Chevalier (1995) studies the pricing behavior of supermarket chains after they undertook leveraged buyouts in the late 1980's. That study finds that, in local areas

²In the one industry out of four where prices fell, one of the main competitors was unleveraged.

where leveraged supermarket chains had a large market share, prices rose relative to local areas where leveraged chains had a small market share.

Finally, in Chevalier and Scharfstein (1994) we examine the pricing behavior of supermarket chains during the most recent recession. We find that leveraged chains raised their prices relative to less-leveraged chains during this period. In addition, less-leveraged chains tended to raise prices in markets where leveraged chains had a large market share. Since prices are typically thought of as strategic complements, this suggests that liquidity constraints affect not only the constrained firm, but also unconstrained competitors.

One of the strengths of these studies is that they focus on particular industries and avoid the well-known difficulties of making industry comparisons. However, it is also a weakness of these studies from a macroeconomic perspective because it is difficult to know whether these effects are pervasive. In the next section, we examine whether the effects of liquidity constraints aggregate to manufacturing industries at the two-digit SIC-code level.

II. Empirical Approach and Results

The theory predicts that liquidity-constrained firms should raise markups, cut capital expenditures, and cut inventories during cyclical downturns. In this section, we examine whether markups are more countercyclical in industries with a greater proportion of liquidity-constrained firms. We also examine whether capital expenditures and inventories are more procyclical in liquidity-constrained industries.

In order to measure the cyclicalities of industry markups, we use Rotemberg and Woodford's (1991) measures of the correlation of log detrended industry markups with log detrended GNP. These measures are calculated for 20 manufacturing industries at roughly the two-digit SIC-code level.³ The

markup measure is not simply the operating margin in each of the industries. This measure tends to be procyclical because there are fixed costs of production. The Rotemberg-Woodford markup measure tries to adjust for this effect by estimating the extent of fixed costs in each of the industries.⁴

We calculate the cyclicalities of capital expenditures and inventories using the Productivity Database which was compiled by Wayne Gray (1989) and is based on the Annual Survey of Manufactures and the Census of Manufactures. New capital spending and end-of-year inventories at the four-digit SIC-code level were deflated by the value of shipments price deflator for each four-digit industry. These deflators are from the Bureau of Labor Statistics and are included in the Productivity Database. We aggregated deflated capital expenditures and deflated end-of-year inventories to the two-digit SIC-code level. Our measure of the cyclicalities of capital expenditures in each industry is the correlation between log detrended capital expenditures and log detrended GNP over the period 1959–1989.⁵ Similarly, our measure of the cyclicalities of inventories in each industry is the correlation between log detrended inventories and GNP over the same period. The average correlation is 0.526 for capital expenditures and 0.474 for inventories. There are clearly alternative ways of measuring cyclicalities, but this is the closest analogue to Rotemberg and Woodford's (1991) measure of markup cyclicalities.

they separate industry 37 into 371 (motor vehicles) and the rest of industry 37 (other transportation equipment).

⁴In particular, they assume that profits net of fixed costs are zero in equilibrium. Using Robert Hall's (1988) measure of the average markup over time within an industry, they are able to back out a measure of fixed costs.

⁵The Rotemberg and Woodford (1991) measure of markup cyclicalities is calculated based on data from 1946–1986. Unfortunately, the Productivity Database does not go that far back.

³Rotemberg and Woodford (1991) provide industry markup data for two-digit SIC codes 20–36 and 38, but

Following Gertler and Gilchrist (1994), we use firm size as a proxy for the extent to which firms are liquidity-constrained because small firms are less likely to have access to external capital. Other measures of liquidity constraints, such as whether a firm has issued publicly traded debt (Kashyap et al., 1994), are highly correlated with firm size.⁶ Our measure of firm size is based on a sample of corporate income-tax filers reported in the *Statistics of Income* and published by the Internal Revenue Service (1967). We define a "small firm" as one with less than \$50 million in assets in 1967. For each of the industries, we calculate the share of sales in the industry accounted for by firms with less than \$50 million in assets. We use this year because it is in the middle of the sample period over which the markup was measured. Across all 20 industries, the average proportion of small-firm sales, which we call SMALL, is 0.460. Clearly, this definition of "small firms" is somewhat arbitrary. The regressions below were also estimated using cut-off assets for small firms of \$25 million and \$100 million and are robust to these other definitions.

Our model of markup cyclicity predicts that liquidity constraints make markups more countercyclical (or less procyclical) in markets that are imperfectly competitive. Obviously, firms in perfectly competitive markets cannot increase profits in the short run by raising prices. Thus, when we examine markup cyclicity, we regress the markup cyclicity measure on our proxy for liquidity constraints and the four-firm concentration ratio in the two-digit industry as of 1967. The four-firm concentration ratio data are in the Census of Manufactures and are also reported in Rotemberg and Woodford (1991).

In addition to estimating the extent to which markup cyclicity is related to

SMALL, we also estimate the extent to which capital expenditure and inventory cyclicity are related to SMALL. We do this for two reasons. First, the theory implies that these measures should be positively related. Second, we know from other studies that liquidity constraints tend to make capital expenditures and inventories more procyclical. If we find an effect here, it lends support to the use of SMALL as a proxy for liquidity constraints. In these regressions, we exclude the four-firm concentration ratio because there is no clear reason why the cyclicity of capital expenditures and inventories should be related to concentration.

Because the disturbances for a given industry may be correlated across regression equations, we estimate the three regression equations simultaneously using the "seemingly unrelated regressions" (SUR) methodology. If the disturbances for a given industry are indeed correlated across the three equations, there is an efficiency gain from using SUR rather than ordinary least squares separately for each equation.

The results for the SUR estimation are reported in Table 1. Consistent with Rotemberg and Woodford (1991), the first column indicates that industry markups are more countercyclical in more-concentrated industries. However, controlling for industry concentration, markups are more countercyclical in industries dominated by small firms. This effect is statistically significant at the 94-percent confidence level and is consistent with the view that liquidity-constrained firms raise markups during economic downturns in order to harvest locked-in demand. The effect is also quite large: evaluated at the means of all of the variables, a one-standard deviation increase in SMALL from 0.460 to 0.0721 would more than double the measure of markup countercyclicity from -0.161 to -0.351 .

The results for capital expenditures, reported in the second column of Table 1, are also consistent with the theory and indicate that capital expenditures are more procyclical in liquidity-constrained industries. The relationship is statistically significant at the 90-percent confidence level.

⁶Another possible, and seemingly more direct, measure of liquidity constraints is industry leverage. However, this measure is problematic because leverage is endogenous. To use leverage, we would first have to model optimal capital structure.

TABLE 1—MARKUPS, CAPITAL EXPENDITURES, INVENTORIES, AND LIQUIDITY CONSTRAINTS

Independent variables	Markup cyclicity	Capital expenditure cyclicity	Inventory cyclicity
Four-firm concentration	-1.731** (0.502)	—	—
SMALL	-0.730† (0.361)	0.531† (0.302)	0.346 (0.361)
Constant	0.865* (0.345)	0.282† (0.159)	0.315 (0.190)
Number of observations:	20	20	20
R ² :	0.259	0.149	0.049

Notes: The three columns report the results of seemingly unrelated regression (SUR) with three different dependent variables: a measure of markup cyclicity; a measure of capital expenditure cyclicity; and a measure of inventory cyclicity. SMALL is the fraction of sales in an industry accounted for by firms with assets under \$50 million in 1967. Standard errors are given in parentheses.

†Statistically different from zero at the 10-percent level.

*Statistically different from zero at the 5-percent level.

**Statistically different from zero at the 1-percent level.

The results for inventories are weaker. While the inventories regressions suggest that inventories are more procyclical in industries dominated by small firms, as the theory predicts, the effect is not statistically significant at standard confidence levels. Part of the difficulty may stem from inadequate modeling of the lag structure of inventory investment. In a downturn, inventories should increase in the short run in response to an unexpected fall in demand even if firms later disinvest in inventories (see Gertler and Gilchrist, 1994). This issue will be addressed more thoroughly in future research.

The use of the SUR estimation methodology allows us to test the joint hypothesis that the prominence of small firms in an industry affects the cyclicity of markups, capital expenditures, and inventories. The *F*-test of this hypothesis rejects the null hypothesis of no small-firm effect at the 90-percent confidence level.

One possible criticism of our methodology is that the correlations of industry markups, capital expenditures, and inventories with GNP could differ across industries simply because the comovement of industry demand with the business cycle differs across industries and these differences are somehow correlated with SMALL. While industry demand is not measurable, it is generally more cyclical in industries producing durable goods. Thus, as a crude proxy for the cyclicity of industry demand, we repeated the SUR specifications presented in Table 1, but including a dummy variable for durable-goods industries. This improved the fit of the regressions but did not perturb the magnitude or significance of the estimated coefficients of SMALL.

While our results support the notion that markups are countercyclical, they are inconsistent with the RSW explanation of countercyclical markups. Since markups are above the short-run profit-maximizing level in their model, they would predict that the presence of liquidity-constrained firms would lead to a decrease in markups during a recession. Thus, according to RSW, there should be a positive coefficient of SMALL, in contrast to what we find. Therefore, our results lend support to the view that across a wide range of industries the mode of competition is one in which firms compete for market share due to customer switching costs rather than one in which there is oligopolistic collusion.

III. Concluding Remarks

In this paper, we have presented evidence that markups tend to be more countercyclical in industries that have a greater proportion of liquidity-constrained firms. Of course, these results should be interpreted cautiously for several reasons: they depend on comparisons across industries; they rely on highly aggregated measures of industries; and the validity of the markup measure is difficult to assess.

An alternative approach is to examine the pricing behavior of firms within particular, narrowly defined, industries. One can compare the pricing behavior of liquidity-

constrained firms to that of non-liquidity-constrained firms within the industry. In addition to avoiding inter-industry comparisons, this approach sidesteps measuring marginal cost if one is willing to assume that the shock to marginal cost is the same across firms in the same industry (or at least is uncorrelated with whether a firm is liquidity-constrained). Thus, changes in firm-level prices can serve as a reliable proxy for changes in the markup. In future work, we plan to take this approach.

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