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7 Do "Shortages" Cause Inflation?

Owen Lamont

7.1 Introduction

Policymakers and the media frequently state that inflation is in some way caused or preceded by shortages. For example, consider the following report on testimony by Federal Reserve Board chairman Alan Greenspan: "'At some point you really do run into restraints. . . . And the way you know that is that deliveries on materials begin to slow down, shortages begin to pop up, and you have all sorts of collateral indications that the system is running into shortages.' . . . The worry of Mr. Greenspan and other economists is that such tightness, if it persists, will eventually bring on inflation pressures" (*Wall Street Journal*, April 6, 1995, 2). This paper tests the hypothesis that shortages in goods and service markets cause inflation.

To test this hypothesis, one needs both a definition of the word "cause," and a measure of shortages. For causality I use Granger causality, so that I test whether observing shortages can assist in forecasting future inflation, given past inflation.

A measure of shortages is more problematic, since shortages by definition cannot be observed from price and quantity. One way to empirically estimate shortages is through the methods in Quandt (1988) and Fair and Jaffee (1972),

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which involve estimating a latent variable model using structural demand-and-supply equations. Another is to look at the "collateral indications" alluded to by Greenspan, which include vendor delivery speeds and measures of unfilled orders.

I attempt instead a frontal attack on the problem of observing shortages. I construct a new measure of shortages, namely the frequency with which the word "shortage" (or variants thereof) appears on the front page of the *Wall Street Journal* (*WSJ*) or the *New York Times* (*NYT*), two national daily newspapers. The basic idea is that, unlike the econometrician, the *WSJ* and *NYT* are able to observe and report on shortages that affect the national economy.

I proceed as follows. Section 7.2 very briefly reviews the intellectual pedigree of the idea of connection between inflation and shortages. Section 7.3 describes the method used to create the measure of shortages, and describes its univariate properties. Section 7.4 tests whether the shortage measure is statistically related to inflation, using a variety of specifications and types of data. I find that, using this measure, shortages are strongly positively correlated with, and strongly Granger-cause, monthly inflation. It appears that this measure of shortages captures information not found in other traditional measures of tightness and other variables and specifications designed to predict inflation. Section 7.5 concludes.

7.2 Shortages and Inflation: Theory

The connection between shortages and inflation has both theoretical history and some current interest.

An equilibrium price vector clears all markets. If for some reason prices do not immediately adjust to changes in demand or supply, markets do not clear: there are shortages or surpluses of goods. Textbook expositions of general equilibrium theory in the absence of a Walrasian auctioneer, for example Varian (1984), discuss the possibility that prices adjust according to a *tâtonnement* process: $dp/dt = G(z(p))$, where p is the price vector, $z(p)$ is a vector of excess demand, and G is some sign-preserving function of excess demand.

Macroeconomists are also interested in the possibility of sticky prices (e.g., Ball and Mankiw 1994b; Blanchard and Kiyotaki 1987; Blinder 1991; Mankiw 1985). If prices don't adjust, either quantities adjust or markets don't clear. Most recent work on the microfoundations of sticky prices has focused on the first possibility, that quantities adjust. For example, the models in Mankiw (1985) and Blanchard and Kiyotaki (1987) have firms who increase quantities and leave nominal prices fixed when faced with an increase in the money supply. The second possibility, that markets don't instantaneously clear, has received increasingly less attention as New Keynesian microfoundations for sticky prices have replaced older fixed-price assumptions. Blanchard and Fischer (1989) report that interest in disequilibrium dynamics peaked in the late 1970s.

For shortages to occur, it is necessary but not sufficient that prices be sticky; quantities must also be sticky. The traditional aim of sticky-price models has been to show that nominal variables, such as money, can have real effects. But if quantities are sticky, it is no longer clear that nominal money has real effects. It presumably depends whether quantities or prices adjust faster to disequilibria.

7.3 Data Construction

The data were constructed using the Nexis database of newspaper article abstracts for the *WSJ* and the *NYT*. The Nexis database had two main drawbacks. First, over the relevant time period it contained only abstracts, not the full text of articles. For an article to be included in the sample, "shortage" had to appear in either the abstract or the subject classification.[1] Second, the time period is fairly limited; the *WSJ* abstracts run from May 1973 to December 1994, while the *NYT* abstracts run from January 1969 to December 1994.[2]

Between May 1973 and December 1994, the word "shortage" appeared in 2,582 abstracted articles in the *WSJ*.[3] I limited my study to articles that appear on the front page of the newspaper, leaving 509 articles. Some of these articles reported on shortages in other countries (chiefly in the Soviet bloc and in third-world countries), and a very small portion reported on noneconomic shortages.[4] After removing articles that were not about shortages in the U.S. economy, a baseline sample of 433 articles remained.[5] I then created a monthly time series by counting the number of articles that occurred each month.[6] The *NYT* sample was derived similarly.

Table 7.1 shows summary statistics for both newspapers. Figure 7.1 shows the shortages measure derived from the *WSJ*.[7] It is immediately obvious from figure 7.1 that shortages were largely a phenomenon of the 1970s. Both the level of shortages and the variation fall markedly after 1980.

1. It appears as though the abstracts grew somewhat more verbose over time.

2. Unlike the *WSJ*, the *NYT* was inconsistently coded over this period. Abstracts were not available after 1980. Subjects were not available prior to 1973. Therefore, the *NYT* series is based on abstracts from 1969–73 and on subjects 1973–94. It did not appear that the slight change in series definition in January 1973 was a significant discontinuity, based on the overlap period of 1973–80.

3. More precisely, I searched for the eight-character string "shortage" so that the word "shortages" would also be found.

4. In general, the screening procedure erred on the side of inclusiveness. For example, shortages of blood, organs, and priests were all included. An example of article about noneconomic shortages was an article about hypoglycemia, described as a shortage of sugar in the blood.

5. Articles were judgmentally deleted if they were primarily about shortages in other countries (or, more rarely, about noneconomic shortages). These declines were clear-cut in articles about the Soviet Union, but somewhat arbitrary in dealing with articles about "world-wide shortages" and the Organization of Petroleum Exporting Countries.

6. I made the data monthly because standard measures of inflation are available at the monthly level. In principle, however, the times series could be daily (or, moving to electronic media such as the Dow Jones news tape, even hourly).

7. The complete data set is printed in the appendix.

Table 7.1 **Summary Statistics: Monthly Shortages, *WSJ* and *NYT***

	WSJ	*NYT*
Sample	73:5–94:12	69:1–94:12
Number of months	260	312
Mean	1.67	2.36
Maximum	19	48
Minimum	0	0
Standard deviation	2.63	5.68
Autocorrelation	0.70	0.75

Note: "Monthly shortages" is the number of articles containing the word "shortage" or "shortages" per month.

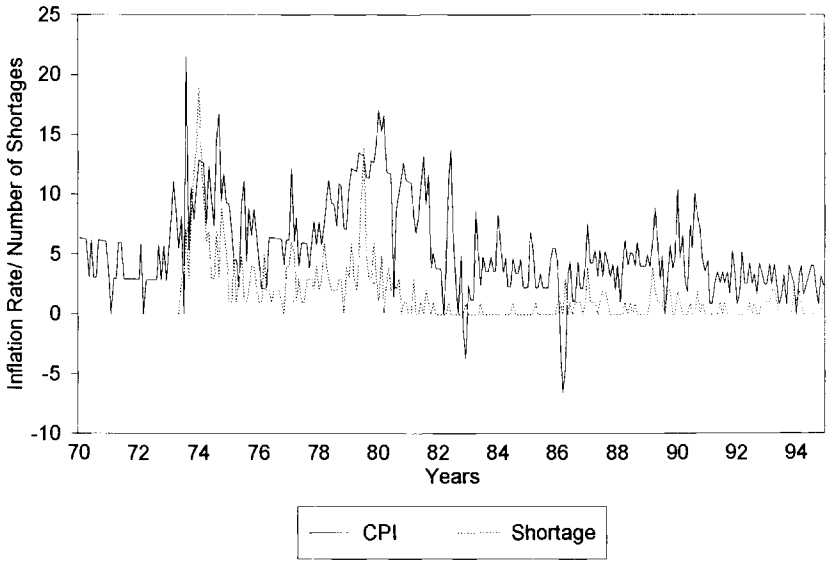

Fig. 7.1 Consumer price index inflation and *WSJ* shortages

The *WSJ* and *NYT* shortage series both appear to be stationary, since an augmented Dickey-Fuller test rejected the null hypothesis that there is a unit root.[8] There appeared to be no seasonal component in either shortage series.

The *WSJ* is ex ante likely to be a more accurate measure of shortages for two reasons. First, as a business journal, it seems more likely to cover economically important shortages. Second, the *NYT* covers metropolitan news of the New

8. Using twelve monthly lags and a constant term, the t-statistic was $-4.65 < -2.89$ for the *WSJ* and $-4.11 < -2.89$ for the *NYT*.

York area, so that it is a more noisy measure of national shortages.[9] Therefore, in what follows, I shall focus primarily on the *WSJ* results.

The method used to construct the shortage measure did not require that the article stated that shortages existed; it merely counted the appearance of the word, whether used hypothetically, in past or future tense, positively or negatively, and so forth.

I attempted to systematically classify *WSJ* shortages by product. About 40% of the *WSJ* shortages were energy related, 25% were labor related, and 7% were food related. Many of the shortages in the 1970s were petroleum related. The highest value of the *WSJ* shortage measure was nineteen in January 1974. Of these nineteen articles, eighteen were about shortages of energy and other petroleum-related products (the nonenergy article was about a shortage of paper). The next highest was July 1979, with fourteen articles. Of these fourteen, eleven were about shortages of energy and petroleum products (the other three were about shortages of shepherds, shortages of groceries due to a truckers' strike, and shortage of conversion equipment to convert from oil to gas heat). In the 1980s, in contrast, more of the shortages were related to labor. Of the four articles in March 1989, all were about shortages of workers (with one article on a shortage of produce workers, one on a shortage of service workers, and two on a shortage of nurses).

Attempts to gather other text-based measures of excess demand were not successful, since related words appeared far less frequently than the 1.67 monthly appearances of "shortage" in the *WSJ*. Synonyms for "shortage" that might indicate positive excess demand seemed rare; for example, the word "bottleneck" appeared a grand total of 3 times (or 0.01 times per month) in the *WSJ*.

Antonyms for "shortage" that might indicate negative excess demand were also relatively rare in the *WSJ*. In an economic context for the United States, "surplus" appeared only 0.29 times per month and "glut" appeared only 0.15 times per month. The vast majority of the "surplus" articles referred to a trade surplus or a budget surplus. I conclude from this that either surpluses and gluts of goods and services do not often occur in the U.S. economy, or the *WSJ* does not find them newsworthy. If gluts do not occur but shortages do, it may indicate that price adjustment is asymmetric.[10]

9. This is especially the case in the latter half of the sample, when there are very few nationally important shortages. Prior to 1982 the *NYT* and *WSJ* series are highly correlated; after 1982 they are essentially uncorrelated. For example, all of the five shortages in August 1985 *NYT* relate to local shortages in New York City.

10. See Ball and Mankiw (1994a) for one reason that price adjustment might be asymmetric. Note, however, that Ball and Mankiw's asymmetry cannot explain this pattern: they find with trend inflation, prices should be sticky downward, so we would expect to see gluts, not shortages.

7.4 Results

I examined two properties of the shortage measures. First, I tested whether shortages are contemporaneously correlated with inflation. Second, I examined whether shortages have predictive power for future inflation. In both cases I examined different subperiods, different levels of time aggregation, and different alternative models. Where possible, I tried to test the properties of the shortage measure in the context of previous empirical research on inflation.

7.4.1 Contemporaneous Correlation

Table 7.2 reports the coefficients and *t*-statistics from regressions of inflation on the shortage measure from the same period. The regressions also included lagged inflation, and a time trend. The results show that inflation is very strongly positively correlated with the shortage measure, at the monthly, quarterly, and annual level.

The coefficients from table 7.2 show the effect of an increase of one article per month on the inflation rate in percentage. So the first entry on the first line shows that if the *WSJ* increases the front-page appearance of the word "shortage" by one article per month, we would expect to see annualized consumer price index (CPI) inflation rise by about 0.32 percentage points.

The last row in table 7.2 puts the shortage measure into a simple empirical

Table 7.2 **Contemporaneous Correlation of Shortages and Inflation**

	WSJ Shortages		*NYT* Shortages	
	CPI	PPI	CPI	PPI
Monthly data	73:5–94:12		69:1–94:12	
	0.32	0.82	0.09	0.13
	(3.95)	(5.00)	(3.15)	(2.18)
Quarterly data	73:II–94:IV		69:I–94:IV	
	0.39	0.88	0.14	0.21
	(3.08)	(3.65)	(3.01)	(2.36)
Annual data	1973–94		1969–94	
	1.02	1.69	0.60	0.94
	(4.41)	(5.32)	(5.13)	(5.57)
Ball and Mankiw specification[a]				
		1973–89		1969–89
		0.95		0.50
		(4.35)		(3.71)

Notes: The table reports the coefficient and *t*-statistics (in parentheses) on the contemporaneous value of the shortage measure. All regressions include a constant term and one year of lagged dependent variables, but no lags of shortages; all regressions except the Ball-Mankiw specification include a time trend. The dependent variable is $100(\ln(P_t) - \ln(P_{t-1}))$ and is annualized.

[a]Current shortages put into the specification of Ball and Mankiw (1994a), table 4, column 2, which includes lagged annual inflation and ASYM10 (a measure of the asymmetry of price changes) on the right-hand side.

specification from Ball and Mankiw (1995), which includes as a regressor ASYM10, their measure of the asymmetry of relative price changes. The annual shortage measure survives the inclusion of Ball and Mankiw's variable.

7.4.2 Causality Tests

Table 7.3 reports Granger causality tests from shortages to CPI and producer price index (PPI) inflation. Panel A shows standard bivariate regressions and tests whether, given lagged inflation, lagged shortages help predict inflation. The results show that, beyond the shadow of a doubt, shortages Granger-cause inflation at a monthly frequency. At quarterly frequencies, the results are more ambiguous; shortages are significant in two out of four cases (and are near significant once). Finally, using annual data, last year's shortages appear to be mostly useless in forecasting this year's inflation, although we have at most twenty-five observations with which to test this hypothesis.

Panels B and C further explore the forecasting ability of shortages at the monthly level, using additional right-hand-side variables identified by previous researchers.[11] The table reports the *p*-value testing the proposition that shortages have predictive power for inflation in an equation that also includes these other control variables.

Panel B uses specifications from Bernanke (1990), who used interest rate variables to predict inflation. The first line shows the *p*-value for shortages in an equation that also includes lags of four different interest rate variables, including the federal funds rate (which captures the stance of monetary policy) and the slope of the yield curve (which captures inflationary expectations).[12] The second line shows the *p*-value from an equation including only the federal funds rate, which Bernanke found to be the single best predictor of inflation. Shortages are significant in seven out of these eight regressions, and near significant in the last; therefore shortages contain information about future inflation not present in interest rates.

Panel C uses specifications from Rotemberg, Driscoll, and Poterba (1991), who used various monetary aggregates, including the monetary base, M2, and their own proposed currency equivalent, CE-3. Shortages are significant eleven out of twelve times, so that it appears shortages contain information about monthly inflation that is not present in monetary aggregates in this period.

The main conclusion from table 7.3, then, is that shortages Granger-cause inflation at a monthly frequency, even conditional on other proposed predictors of inflation.

As shown in figure 7.1, shortages were dramatically less evident in the second half of the sample. The 1970s included two oil shocks and were a time of

11. I note that both Bernanke (1990) and Rotemberg, Driscoll, and Poterba (1991) used CPI inflation and did not investigate PPI inflation, so that their specifications might be more relevant for the CPI.

12. Fama (1990) and Mishkin (1990) also explore the use of the term structure to predict inflation.

Table 7.3 **Granger Causality Tests**

RHS Variable:	*WSJ* Shortages		*NYT* Shortages	
LHS Variable:	CPI	PPI	CPI	PPI
A. Bivariate Regressions[a]				
Monthly data	74:5–94:12		70:1–94:12	
	0.003	0.004	0.02	0.001
Quarterly data	74:II–94:IV		70:I–94:IV	
	0.20	0.001	0.07	0.01
Annual data	1974–94		1970–94	
	0.19	0.07	0.59	0.63
B. Bernanke Specification				
Monthly data	73:11–94:12		69:7–94:12	
4-RHS variables[b]	0.08	0.03	0.02	0.001
Fed funds only[c]	0.001	0.0001	0.01	0.0001
C. Rotemberg, Driscoll, and Poterba Specification[d]				
Monthly data	74:5–94:12		70:1–94:12	
MBASE	0.02	0.01	0.03	0.004
M2	0.001	0.01	0.01	0.0003
CE-3 (74:5–89:7)	0.01	0.11	0.01	0.001

Notes: the *p*-value tests the hypothesis that lagged shortages do not help predict inflation. All regressions include a constant term, trend, and lagged dependent variables.

[a]Each regression includes one year's worth of lagged dependent variables and lagged shortage variable.

[b]Following Bernanke (1990), table 5, model size 4, includes six-month lags of the federal funds rate, the six-month commercial paper rate, the spread between the long corporate bond rate and the ten-year treasury bond rate, and the spread between the federal funds rate and the ten-year treasury bond rate.

[c]Following Bernanke (1990), model size 1, includes six-month lags of the federal funds rate.

[d]Following Rotemberg, Driscoll, and Poterba (1991), table 6, includes twelve monthly lags of all variables. CE-3 is a version of Rotemberg et al.'s proposed monetary aggregate.

regulation of energy prices by the U.S. government. The disastrous experiment with price controls (1971–74) under the Nixon administration also occurred in this period, and led to widespread shortages (see Gordon 1984 for details).

One concern is, therefore, that the results in table 7.3 are driven either by the energy price shocks of the 1970s or by the Nixon price controls. I look next at these two issues.

7.4.3 Commodity Prices and Inflation

Since many of the shortages of the 1970s appear to have been oil related, it is important to test whether "shortages" just capture the "shortages" of oil. Table 7.4 explores the question of commodity price shocks and shortages. Is the shortage measure just a proxy for oil prices, or for the fact that oil prices in the United States were regulated during this period?

Panel A attempts to control for energy and food commodity price shocks by including lagged measures of commodity price shocks on the right-hand side,

Table 7.4 **Controlling for Commodity Shocks Using Commodity Prices and Other Measures of Inflation**

RHS Variable:	*WSJ* Shortages	
LHS Variable:	CPI	PPI
A. Controlling for Commodity Prices on RHS[a]		
	74:5–94:12	
PPI food, PPI fuel	0.01	0.01
	75:2–94:3	
Refiners' cost	0.01	0.06
	75:1–94:3	
Imported/domestic refiners' cost	0.02	0.16
B. Inflation Excluding Energy and Food on LHS[b]		
		76:2–94:12
PPI excluding energy		0.02
		74:5–94:12
PPI excluding energy and food		0.00
	74:5–94:12	
CPI excluding energy and food	0.00001	
C. Inflation Excluding Energy and Food, Controlling for Imported/Domestic Refiners' Cost on LHS[c]		
		76:2–94:3
PPI excluding energy		0.05
		75:1–94:3
PPI excluding energy and food		0.01
	75:1–94:3	
CPI excluding energy and food	0.00002	
D. Nonenergy Shortages on RHS[d]		
	74:5–94:12	
	0.05	0.08
E. Median CPI on LHS[e]		
	74:5–92:12	
CPI (mean)	0.004	
Median CPI	0.08	
Deviation (mean − median)	0.05	

Note: All regressions are monthly data as in table 7.3, panel A.

[a]Includes on the right-hand side lags of both PPI Fuel and PPI Food inflation, lags of the inflation rate of the refiner cost of imported oil, or lags of the ratio of the refiner cost of imported pertroleum to the refiner cost of domestic petroleum.

[b]Includes as left-hand-side variables different PPI and CPI inflation rates as calculated by the Bureau of Labor Statistics.

[c]Identical to panel B except that it includes lags of the imported/domestic refiner cost ratio as right-hand-side variables.

[d]Identical to table 7.3, panel A, except that it uses *WSJ* shortages excluding shortages of energy-related items.

[e]Median CPI as calculated by Bryan and Cecchetti (1994). "Deviation" is the mean CPI inflation rate minus the median CPI inflation rate.

in addition to the shortage measure. The first row uses inflation rates for the PPI Food and PPI Fuel indices. These two indices are also used by Ball and Mankiw (1995) to control for commodity price shocks in their study of PPI inflation. The second row uses the inflation rate for the refiners' cost of imported petroleum. The third row uses the ratio of the refiners' cost of imported petroleum to the refiners' cost of domestic petroleum; this is a measure of the regulation-induced price distortion in U.S. oil markets.[13] If the shortage measure is merely a proxy for regulation-induced price distortion, we might expect the shortage measure to lose its explanatory power in the presence of this variable.

The shortage measure remains significant in four out of these six regressions, and near significant in a fifth. The shortage measure fares worse using the imported/domestic petroleum cost ratio, but here as elsewhere it still significantly Granger-causes CPI inflation. In summary, panel A shows that for monthly inflation the shortage measure contains information about future inflation that is not present in commodity price inflation, at least for CPI inflation. Shortages are not just a proxy for oil prices.

Panel B uses, as dependent variables, measures of so-called core inflation, which exclude the effects of food and energy prices.[14] The results clearly show that the shortage measure contains information about the course of future core inflation at the monthly level. At very high levels of significance the shortage measure Granger-causes inflation excluding food and energy.

Of course, panel B is not proof that the shortages are not a proxy for oil shocks, since presumably oil prices also lead core inflation. Therefore panel C uses core inflation as a dependent variable and the imported/domestic petroleum cost ratio as a control variable. The shortage measure passes this particular test with flying colors. In fact, excluding food and energy from the PPI *improves* the significance of shortages (after controlling for the imported/domestic petroleum cost ratio).

Another way to disentangle the effects of the energy-related shortages of the 1970s is to remeasure the shortage variable itself. Panel D uses as an explanatory variable "nonenergy" *WSJ* shortages, defined as with all shortages excluding those related to petroleum, gasoline, natural gas, and other energy-related materials (which total about 40% of the observations). Nonenergy shortages are significant in explaining CPI inflation, and marginal in explaining PPI inflation.

Bryan and Cecchetti (1994) have found that the weighted median inflation rate is a good measure of (their definition of) core inflation, in that median inflation is more closely related to money growth and is a good predictor of future inflation. Panel E documents the relationship between the shortage mea-

13. I thank Matthew Shapiro for suggesting this variable.

14. These indices are calculated for the Bureau of Labor Statistics, and are seasonally adjusted except for the PPI excluding fuel and food.

sure and Bryan and Cecchetti's median CPI inflation series. Shortages are more closely related to mean inflation than to median inflation; consequently, shortages are positively correlated with (and significantly Granger-cause) inflation's deviation from median. This result is consistent with the idea that shortages are a transitory, high-frequency phenomena.

7.4.4 Subsample Stability

If the empirical significance of the shortage measure is limited to the decade of the 1970s, then it will be hard to conclude that shortages are a generally important phenomenon, since we know price controls lead to shortages. Thus the stability of the relationship between shortages and inflation is of particular interest. Table 7.5 addresses two questions. First, is the inflation-shortage connection purely a product of the Nixon price controls? Second, is the inflation-shortage connection limited to the 1970s, when energy prices were regulated? This second question is another way of addressing the issues in table 7.4.

Table 7.5 examines the stability of the relationship between *WSJ* shortages and inflation in different subsamples. I examine Granger causality and contemporaneous correlations. For comparison, the last column reports Granger-causality tests for inflation over the same subperiods for the growth rate of the M2 monetary aggregate.

First, is the explanatory power of the shortage measure driven by the Nixon price controls? On this narrow question we have a definite answer from table 7.5. Limiting the sample to January 1976 to December 1994 (well after the Nixon price controls, which ended in 1974) does not affect the overall results. Shortages strongly Granger-cause inflation in the post-Nixon period.[15]

On the wider question of the 1970s, panel A shows that lagged shortages have predictive power for CPI and PPI inflation in the first half of the sample (1974–82) but not in the second (1983–1994). Like M2, the shortage measure is by this reckoning not a robust predictor of inflation in this period.[16]

The importance of these oil-shock years is a common finding in empirical work on inflation, as is the general nonrobustness of time-series relationships in recent macroeconomics. As noted by Fischer (1981), for example, much of the relationship between relative price variability and inflation comes from energy and food price changes in these years.[17] Bernanke (1990) finds that the forecasting power of interest rates for inflation has also deteriorated significantly since 1980.

Panel B reports contemporaneous correlations between inflation and short-

15. I thank David Romer for suggesting this subsample.

16. Using the monetary base instead of M2 produces similar results: the monetary base has predictive power in only half the sample. The difference is that the monetary base has power in the first half of the sample but not in the second.

17. Debelle and Lamont (1997), however, offer some evidence that, cross-sectionally in U.S. cities, the relationship between inflation and relative price variability is not dependent on these years.

Table 7.5 **Subsample Stability**

RHS Variable:	*WSJ* Shortages			M2 (Log-Differenced)[a]		
LHS Variable:	CPI	PPI	Wages	CPI	PPI	Wages
A. Monthly Granger-Causality Tests						
74:5–82:12	0.04	0.01	0.05	0.91	0.14	0.92
83:1–94:12	0.68	0.38	0.01	0.01	0.64	0.46
76:1–94:12	0.03	0.01	0.0004	0.30	0.91	0.30
B. Contemporaneous Correlation						
73:5–82:12	0.27	0.82	−0.05			
	(2.23)	(4.04)	(0.36)			
83:1–94:12	0.45	1.11	−0.34			
	(2.04)	(2.01)	(1.22)			
76:1–94:12	0.32	0.59	0.11			
	(3.01)	(2.85)	(0.80)			

Notes: See notes to tables 7.2 and 7.3. *t*-statistics are in parentheses.
[a]Subsample stability for log-differenced M2, for comparison only.

ages, and gives us some additional evidence on the stability of the shortages-inflation connection. Unlike lagged shortages, current shortages maintain their statistical significance over both halves of the sample, and the correlations are roughly the same over the two periods.

Since many of the shortages of the 1980s were labor shortages, table 7.5 also reports on analogous subsample stability statistics for a different type of inflation measure: the rate of change of manufacturing workers' hourly earnings. Panel A shows that, unlike CPI and PPI inflation, wage inflation is Granger-caused by shortages in both subperiods. Panel B shows that, unlike CPI and PPI inflation, there appears to be no contemporaneous correlation between monthly shortages and monthly wage inflation (for the whole sample, the coefficient is 0.01). In sum, the connection between wage inflation and shortages is highly stable over time.

Why does the predictive ability of shortages break down in panel A? As is visually obvious from figure 7.1, there is marked shortage of "shortages" in the 1990s. It is likely to be difficult to estimate the effect of "shortages" using a time period in which there was very little variation in the explanatory variable. Unlike M2, we have a good idea why the predictive ability of lagged shortages breaks down: because there very few shortages in the second half of the sample.

One way to summarize the relationship's subsample stability is to estimate a vector autoregression (VAR) over the two subsamples. Figure 7.2 shows impulse response functions from VARs estimated separately over the pre-1982 and post-1982 period.[18] The figure shows the dynamic response of the annu-

18. This VAR included on the right-hand side a constant term and twelve monthly lags of both *WSJ* shortages and the annualized monthly PPI inflation rate. The shortage measure was ordered

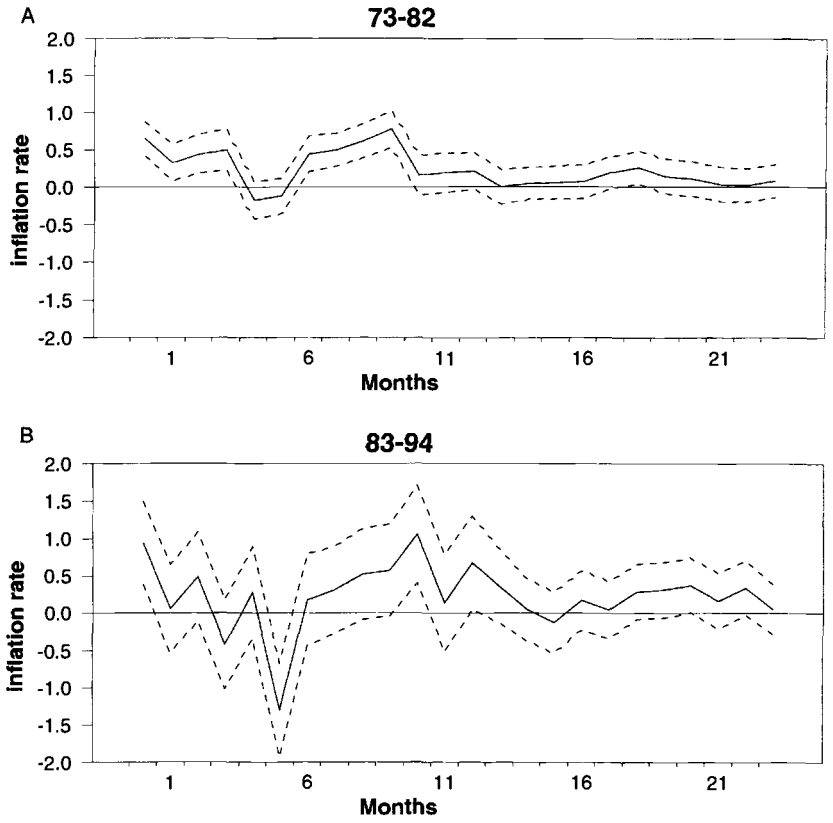

Fig. 7.2 Response of producer price index inflation to *WSJ* shortages, 1973–82 and 1982–94

alized PPI inflation rate in an innovation in the *WSJ* shortages measure of one additional article per month. The figure also shows one-standard-error bands, constructed using standard Monte Carlo simulation.

As one would expect from panel B, in both subperiods the publication of one additional article results in a contemporaneous increase in (annualized) PPI inflation of about 1 percentage point. This increase is somewhat lower than 1 before 1982, and somewhat higher than 1 after 1982. As one would expect from panel A, the response of inflation to shortages is positive and more than two standard errors from zero prior to 1982. After 1982, the response of inflation is larger but is less than two standard errors from zero.

Figure 7.2 certainly does not present a ringing endorsement of a positive correlation between shortages and future inflation in the post-1982 period. On

first in the VAR system. Annualized PPI inflation is defined as 1,200 times the difference in the log of the PPI index.

the other hand, the shape of the impulse response functions is broadly similar over the two periods, although the magnitude of the response is more erratic in the later period. Figure 7.2 also shows that standard error bands are much wider in the later period, so that one cannot reject the hypothesis that shortages and future inflation are positively correlated after 1982.[19]

The bottom line from table 7.5 and figure 7.2 is that the evidence is ambiguous. One cannot reject the hypothesis that there is no relationship between inflation and lagged shortages after 1982, but one also cannot reject the hypothesis that the relationship is stable over the two periods. Contemporaneously, CPI and PPI inflation and shortages are always positively and significantly correlated.

7.4.5 Is "Shortage" Just a Synonym for "Inflation"?

One possible problem with the shortage measure constructed here is that it depends on the precise use of language by journalists. Business reporters might simply use the word "shortage" when they really mean inflation (or perhaps shifts in the supply schedule). For example, the following was one of the data points: "buying could push some industries closer to capacity limits, lead to shortages, and force prices up further" (*WSJ*, February 17, 1977, 1). This sentence describes purely hypothetical shortages, and is consistent with a world where shortages never occur in actuality.

If "shortage" is just another word for "inflation," then the shortage measure constructed here might have predictive power because it captures the inflationary expectations of business reporters. To test this hypothesis, I measured the appearance of "inflation" in the same way that I measured "shortage." Table 7.6 reports the results.

Taken in isolation, the word "inflation" has little predictive power. What happens when the regression includes both lagged "inflation" and lagged "shortage"? Conditional on monthly "shortage," monthly "inflation" does not have predictive power for inflation at conventional significance levels. Conditional on monthly "inflation," monthly "shortage" does have significant predictive power for inflation.[20] I therefore conclude from table 7.6 that "shortage" is not merely a synonym for inflation. When a *WSJ* reporter uses the word "shortage," he or she does something that is statistically distinguishable from using the word "inflation."

19. The analogous impulse response functions for CPI inflation look less similar to each other. However, it is still true that both periods have impulse response functions with positive contemporaneous effects of a shock and fairly wide standard-error bands. One certainly can't reject that the correlation between shortages and future CPI inflation is positive in the post-1982 period.

20. Similar results hold for the *NYT* series. An earlier version of this paper used the *NYT* data on "inflation" and "shortage" in the period January 1970–June 1980 and found that, conditional on monthly "shortage," monthly "inflation" does not have predictive power for inflation at conventional significance levels.

Table 7.6 **"Shortage" versus "Inflation" Granger-Causality Tests**

	WSJ	
LHS Variable:	CPI	PPI
	74:5–94:12	
"Inflation" only[a]	0.48	0.08
"Inflation" and "Shortage"	74:5–94:12	
"Inflation"[b]	0.57	0.47
"Shortage"[c]	0.01	0.05

Notes: The *p*-value tests the hypothesis that lagged shortages do not help predict inflation. All regressions include a constant term, trend, and twelve months of lagged dependent variables.

[a]Tests the hypothesis that twelve lags of the number of "inflation" articles do not help predict actual inflation.

[b]Tests the hypothesis that twelve lags of the number of "inflation" articles do not help predict actual inflation, given lagged "shortage" and lagged inflation.

[c]Tests the hypothesis that lagged "shortage" does not predict actual inflation given lagged "inflation" and lagged inflation.

7.4.6 Other Measures of Tightness/Shortages

Table 7.7 compares the shortage measure with other traditional measures of tightness in the U.S. economy. If the shortage measure used here really does measure economically important shortages, it should be positively correlated with other measures of tightness and negatively correlated with other measures of slack. If on the other hand, it is so correlated with these other measures that it contains no additional information, then we would conclude that the shortage measure is not a useful contribution to economic analysis.

Capacity utilization and industrial production are perhaps the most widely used measures of tightness, and are explicitly used by the Fed to predict inflation.[21] Unfilled orders and the National Association of Purchasing Managers' vendor performance index are also popular measures.[22] The *WSJ* article cited in section 7.1 discusses the merits of, and the Fed's fondness for, the vendor performance index as an indicator of inflationary pressures. Inventory-sales ratios are included to measure possible stockouts of goods. Overtime hours, the help-wanted advertising index, and the unemployment rate are standard measures of labor market tightness; the regression with the unemployment rate might be interpreted as a Phillips curve.[23] Finally, the Commerce Department's leading indicators index is included as a summary of economic conditions.

Table 7.7 tests both the predictive relationship between shortages and these

21. A long tradition uses capacity utilization to explain inflation; see Gordon (1989) for references. Shapiro (1989) finds, however, that capacity utilization is not helpful in explaining cross-sectional price changes.

22. Shapiro (1989) discusses both these measures.

23. I thank Olivier Blanchard for suggesting the help-wanted index.

Table 7.7 Other Measures of Tightness/Slack, Monthly PPI Inflation

		Granger Causality[b]		PPI Inflation[c]	
	Correlation[a]	S to C	C to S	S to π	C to π
Capacity utilization					
WSJ	0.38	0.0003	0.06	0.07	0.001
NYT	0.27	0.0000004	0.14	0.01	0.19
Industrial production (log differenced)					
WSJ	−0.19	0.00004	0.31	0.004	0.12
NYT	−0.16	0.00	0.79	0.001	0.04
Unfilled orders, durable manufactured goods (log differenced)					
WSJ	0.35	0.01	0.18	0.03	0.19
NYT	0.22	0.01	0.01	0.02	0.05
Vendor performance index (slower deliveries)					
WSJ	0.40	0.06	0.04	0.08	0.69
NYT	0.36	0.0004	0.0002	0.03	0.54
Inventory-sales ratios, manufacturing and trade					
WSJ	−0.33	0.02	0.29	0.03	0.02
NYT	−0.20	0.08	0.12	0.01	0.002
Manufacturing workers overtime					
WSJ	−0.05	0.02	0.02	0.07	0.04
NYT	0.004	0.00001	0.01	0.06	0.08
Unemployment rate					
WSJ	−0.31	0.04	0.25	0.09	0.49
NYT	−0.21	0.0002	0.30	0.004	0.47
Help-wanted index (log)					
WSJ	0.04	0.002	0.57	0.01	0.07
NYT	0.06	0.002	0.16	0.002	0.12
Leading indicators index (log differenced)					
WSJ	−0.24	0.0001	0.84	0.01	0.75
NYT	−0.23	0.000001	0.85	0.001	0.38

Notes: Estimation period is May 1974–December 1994 for *WSJ* and January 1970–December 1994 for *NYT*. *S* is shortage measure, *C* is candidate alternative measure for tightness. Every regression includes a time trend, and twelve months' lags of all variables.

[a]The correlation coefficient of the shortage measure, *S*, with the candidate measure, *C*.

[b]Tests whether *S* Granger-causes *C* and whether *C* Granger-causes *S*.

[c]Tests whether *S* or *C* Granger-cause PPI inflation, in a regression with both lagged *S* and lagged *C*.

measures, and whether shortages have predictive power for inflation that is not contained in these measures. The first column displays the correlation coefficient of shortages with the candidate measure of tightness.[24] As expected, shortages are positively correlated with other measures of tightness, such as capacity utilization, unfilled orders, and the slowness of vendors' deliveries. Shortages are negatively correlated with indicators of slack such as the unemployment rate and the inventory-sales ratio.

24. This is the standard correlation coefficient, as opposed to the regression coefficient reported in table 7.2.

The next two columns test whether shortages Granger-cause these candidate measures, and whether these candidate measures Granger-cause shortages. In five out of eighteen cases the candidate measures of tightness Granger-cause the shortage measure. In contrast, shortages have predictive power for the candidate measure in sixteen out of eighteen cases at the 5% level and in every case at the 10% level. Interestingly, shortages appear to be an excellent predictor of output-related series such as employment and industrial production. I leave for future research a full examination of the relationship between shortages and output.

The last two columns report on the predictive power of shortages and the candidate variables, in the presence of each other, for PPI inflation. Conditional on the lagged candidate variable, lagged shortages have predictive power at the 5% level in thirteen out of eighteen cases and at the 10% level in all cases. In contrast, the candidate variables have a spotty record (six are significant at the 5% level and eight are significant at the 10% level).

In terms of consistent Granger causality, inventory-sales ratios have the best record, since they Granger-cause inflation in the presence of either the *WSJ* or the *NYT* shortages. In this case, shortages are also significant at the 5% level. Shortages fare worse in the presence of overtime hours; here the p-values are 0.07 for the *WSJ* and 0.06 for the *NYT*.

I conclude from table 7.7 that the shortage measure contains information about inflation not present in other measures of tightness in the economy. It appears to fairly robust to the inclusion of these other measures, and is always significant at the 10% level.

7.5 Conclusion

The methodology used here shares some of the features of the "narrative" approach of Romer and Romer (1989), since both involve examining textual evidence. Compared with the "narrative" approach, however, the approach used here is more quantitative and requires less judgment from the empiricist. It might be called the "quantitative textual" approach. Although this approach is new to macroeconomics, it is often used in other disciplines that analyze texts.

This methodology has produced a variable that appears to be strongly related to high-frequency movements in inflation. At the very least, then, this paper introduces a potentially useful new variable for forecasting inflation at the monthly level. On the other hand, this variable appears to be less useful in forecasting long-term inflation. Of course, I have considered only twenty-one years of *WSJ* data here, so making long-term evaluations is difficult. One possible avenue for future research would be collecting more data, since in principle the time series could go back as far as the *WSJ* itself.

Since there is little evidence that shortages can predict long-term inflation, and since there have so far been very few "shortages" in the 1990s, the use-

fulness of the shortage measure for monetary policymaking appears limited (although the quotation at the beginning of this paper suggests that the Fed seriously worries about shortages). On the other hand, should the appearance of the word "shortage" on the front page of the *WSJ* suddenly increase in coming months, it would appear prudent for forecasters and policymakers to take this into account.

We all know from personal experience that markets do not literally clear perfectly and instantaneously. Prices do not always equilibrate supply and demand; this fact explains the existence of such economic phenomena as restaurant reservations, waiting lists, queues, and stockouts. Whether disequilibrium is empirically important to macroeconomics is another question. The evidence presented here suggests that disequilibrium is an observable part of the dynamic adjustment of prices to macroeconomic shocks, since the shortage measure contains information that is not present in other variables.

Appendix

Table 7A.1 **Monthly Data Shortage Measure**

	NYT Monthly Shortage												*WSJ* Monthly Shortage											
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
1969	1	3	2	0	1	3	2	6	6	3	1	7												
1970	4	3	1	4	1	2	7	6	5	2	3	2												
1971	3	3	4	1	2	1	5	2	1	0	5	3												
1972	4	3	1	1	1	2	1	2	0	1	4	4												
1973	1	0	4	1	1	3	7	7	0	2	23	48					0	3	3	7	3	8	12	14
1974	30	47	20	5	4	4	1	1	7	7	5	10	19	12	10	6	7	3	3	7	3	9	7	5
1975	4	3	0	1	0	3	2	1	2	1	0	1	1	1	5	1	3	5	1	1	2	4	4	2
1976	0	3	1	0	1	0	0	0	3	1	0	2	1	1	5	2	2	1	2	2	2	1	0	4
1977	24	20	5	2	3	0	3	0	1	2	4	2	4	6	5	1	3	1	1	3	3	3	2	4
1978	5	7	3	1	0	1	0	1	0	0	2	0	2	3	6	4	3	2	2	2	3	3	0	4
1979	1	6	7	6	25	32	34	9	4	0	0	0	3	6	3	2	5	10	14	5	3	3	6	3
1980	2	2	2	1	2	0	0	0	0	1	2	0	1	5	0	3	4	2	3	2	3	0	1	1
1981	4	4	0	1	2	0	2	3	0	0	0	0	0	0	3	0	0	1	0	2	1	0	1	0
1982	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
1983	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0
1984	0	1	2	2	0	2	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0
1985	0	0	0	4	0	3	4	5	3	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0
1986	2	2	1	1	0	1	2	0	0	0	1	0	1	1	0	3	0	1	0	1	1	1	0	1
1987	0	1	0	0	1	1	2	1	1	0	0	1	4	1	1	1	0	1	2	2	1	0	0	0
1988	0	2	0	1	1	0	3	0	0	1	1	3	0	0	0	1	0	1	0	1	0	0	0	0
1989	1	0	2	0	1	0	1	0	2	1	0	0	0	1	4	2	1	1	1	0	2	2	0	0
1990	0	1	1	2	1	0	0	2	2	0	0	2	2	1	0	0	0	1	0	0	2	0	1	0
1991	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	1	0	0	0	0
1992	0	0	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	1	0	0	1	1
1993	1	0	0	0	0	0	1	0	0	1	0	0	1	1	2	2	1	0	0	0	0	0	0	2
1994	2	2	1	1	3	0	0	0	0	0	1	1	1	2	1	0	0	0	0	0	0	0	0	2

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Comment

Matthew D. Shapiro

Owen Lamont has assembled a new data set in the best spirit of social science. He has identified a question: Do shortages or disequilibrium conditions cause inflation? He observes: data on prices and quantities do not provide a direct measure of disequilibrium. He therefore seeks new data. Specifically, he systematically collects a new data set designed to provide a direct measure of the phenomena in question. His data on shortages—as well as his paper calling attention to their role in an important period of economics history—are likely to stimulate further analysis. The paper is valuable in calling attention to the topic of shortages. And its original data set should stimulate further research.

We should applaud the effort to create and analyze new and unconventional data. Too often, economists limit themselves to conventional measures that are readily available in databases. Lamont's effort, and that of Robert Shiller in this volume, to use textual searches as a source of data is an interesting approach that is worthy of further study. There is presumably research on how to do such searches optimally. Economists using these techniques should avail themselves of such research.

My discussion concerns Lamont's analysis of this time series of shortages. First, I discuss the historical setting and economic institutions in which these shortages arose. I then turn to the statistical analysis of the effect of Lamont's index of shortages on the price level.

Let me begin the historical discussion with some personal history. The time: June 1979. I am driving to Washington, DC, after graduating from college to start working as a junior staffer at President Carter's Council of Economic Advisers. I am driving my first car (yes, it was my father's Oldsmobile) and am considering the class-day address of John Kenneth Galbraith. It was as if his speech were made directly to me. Galbraith had exhorted the class to government service. I thought the principles he had articulated in the address would be useful as I strolled the corridors of government.

But I was about to get a much more visceral lesson in economic policy. I was greeted in Washington by two-hour waits for gasoline at the Georgetown Amoco station. I had to cancel a Fourth of July rafting trip because it was clear I would not be able to get gasoline for the return trip. Perhaps I should have been reading Galbraith's *Theory of Price Control.* Although President Nixon's price controls had largely been phased out several years earlier, price controls for petroleum products remained in place. When the second Organization of Petroleum Exporting Countries (OPEC) price shock occurred, these controls led to a large gap between the domestic and world price of oil. The shortages that I so woefully experienced were caused by the price controls.

There was a complicated system of "entitlements" allocating the cheaper,

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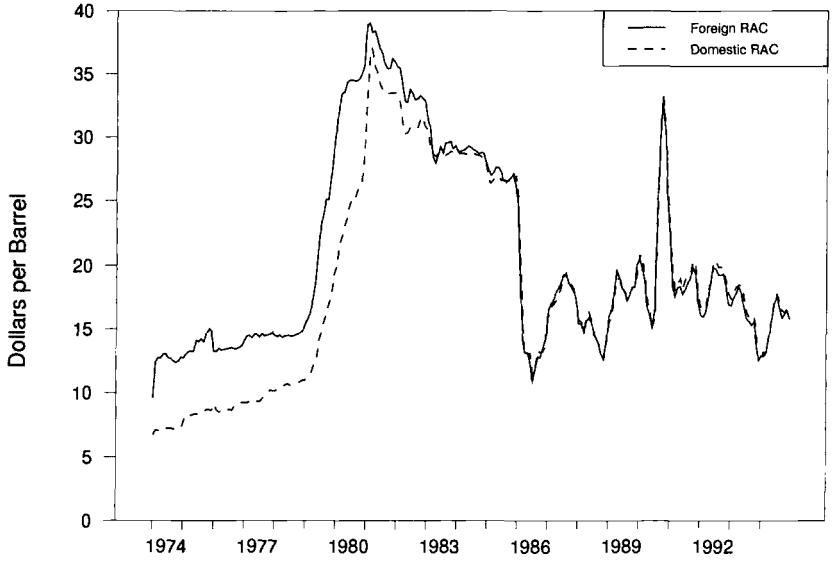

Fig. 7C.1 Refiners' acquisition cost

domestically produced oil to U.S. refineries. Owing to this regulation of supply, there are data on the price refiners paid for oil. Figure 7C.1 shows refiners' acquisition cost (RAC) for a barrel of foreign and domestically produced crude oil. Figure 7C.2 shows the difference between the prices. The difference widened sharply after the first OPEC shock, narrowed, and then widened dramatically after the second OPEC shock. The prices converged following President Carter's phased deregulation of oil prices in 1980.

The key result of Lamont's paper—that newspaper mentions of "shortage" are correlated with inflation—can be explained by the interaction of the oil price shocks and the price controls. The oil price shocks created upward pressure on the price level. The partial price controls caused rationing and queues: it was hard to buy gasoline, but when it was purchased, the price was higher.

Figure 7C.3 shows the *Wall Street Journal* index of shortages versus the difference of the foreign and domestic RAC from figure 7C.2. The two spikes in the shortages come at the beginning of the two OPEC episodes. Newspapers cover events when they first occur. Coverage diminishes for ongoing events. Hence, the shortage index has spikes and is a leading indicator. Yet it is clear that most of the leverage of the shortages series is associated with the widening of the wedge between foreign and domestic RAC.

Lamont is aware of the possibility that "shortage" is a proxy for "oil shock." He presents two types of statistical evidence to support the hypothesis of the incremental explanatory power of shortages. First, he checks directly for incremental explanatory power by estimating equations for predicting inflation with both the shortages and other variables. Second, he looks for the effect of short-

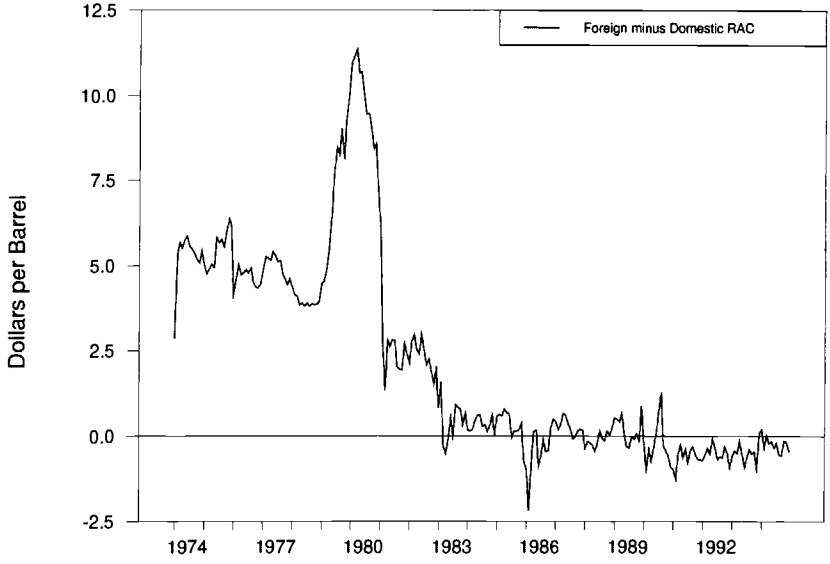

Fig. 7C.2 Difference between foreign and domestic refiners' acquisition cost

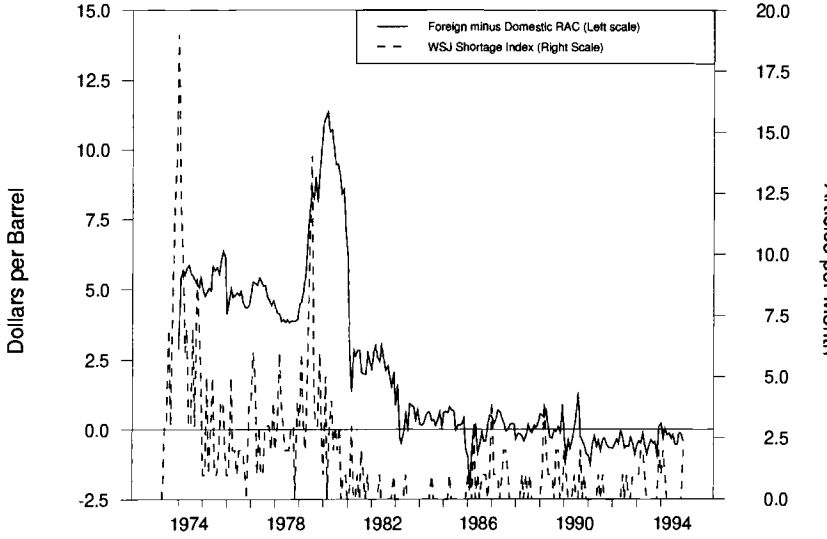

Fig. 7C.3 "Shortages" versus difference between foreign and domestic refiners' acquisition cost

ages in the sample period excluding the OPEC shocks. My reading of the statistical evidence is that the correlation of shortage and inflation is strictly a phenomenon of the oil shocks.

In table 7.4 Lamont examines whether the predictive power for inflation of shortages remains statistically significant when other variables are also included in the regression. The statistical significance of shortages drops when RAC or the wedge between the foreign and domestic RAC is included in the regression. In particular, if inflation is measured by the PPI, shortages are no longer statistically significant when the RAC is included (panel A). Moreover, the nonpetroleum shortages have only marginally significant predictive power for inflation (panel D).

Lamont checks for subsample stability in table 7.5 and figure 7.2. The aim is to establish whether inflation is predicted by shortages when the economy is not afflicted by the oil shocks. The first panel of table 7.5 gives the statistical significance of the forecastability of inflation by the index of shortages. There is essentially no predictive power of shortages for inflation in the 1983–94 sample. This finding is consistent with the hypothesis that the shortage index is merely a proxy of the oil price shocks. It predicts inflation only in the 1970s. There is, however, a significant contemporaneous correlation between price increase and shortages (table 7.5, panel B). This correlation could lead to dynamic response of inflation to a shortage through the lags in the inflation process. Lamont's figure 7.2 reports such dynamic responses. There is a significant response of inflation to shortages in the first subsample—the period of the oil shocks. But in the second subsample, the impact is small and insignificant. Indeed, after about half a year, the impact on the price level of shortages is zero (the positive impulse responses of inflation are followed by negative ones).

Interestingly, the Granger test of shortages for wages rejects no causality in the second subsample. But the contemporaneous correlation has the wrong sign. This wrong sign is likely also a feature of the dynamic response of wages to shortage. Given that most mentions of shortage in the 1980s refer to the labor market, this wrong sign is particularly problematic for the claim that shortages have a generic role in explaining U.S. inflation.

In summary, though Lamont's paper makes a substantial contribution by calling attention to the role of oil shortages in the 1970s, it fails to show that shortages have any generic role in the U.S. inflation process. What the paper does suggest, however, is another channel for the stagflationary supply shocks of the 1970s. Partial price controls allowed some of the world oil price increase to affect the overall price level, but they also had the effect of reducing output by the rationing and queues they created.

III The Contribution of Monetary Institutions

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