

Explaining High Frequency Output Fluctuations During the Great Depression

by

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“Real monetary equilibrium in any single country requires the price level to be in harmony with the wage level, so that the margin of profit is sufficient, but not more than sufficient, to induce full activity and full employment.” (Hawtrey, 1947, p. 45.)

Economists like to explain business cycles with the simplest model possible. In contrast, historians are much more comfortable with complexity, with multiple causal factors. Which approach works best for the Great Depression? I believe both approaches are needed. The Great Depression is both surprisingly simple and extremely complex, depending on the level of abstraction.

In this paper I utilize an unorthodox approach to monetary economics; one that focuses not on changes in the money supply or interest rates, but rather on disturbances in the world gold market. Others have looked at how the gold standard constrained policy during the Great Depression, and/or how the undervaluation of gold after World War I put deflationary pressure on the world economy. These studies gave insights into the structural inadequacies of the interwar monetary system, but they didn't tell us why a major depression began in America in late 1929, and they certainly don't explain the 17 high frequency changes in U.S industrial production shown in Table 1.1.

Table 1 Seasonally Adjusted Changes in Industrial Production.

<u>Period</u>	<u>Change in IP</u>	<u>Period</u>	<u>Change in IP</u>
9/29 to 12/30	-29.3%	12/30 to 4/31	+2.5%
4/31 to 7/32	-34.8%	7/32 to 10/32	+13.3%
10/32 to 3/33	-9.2%	3/33 to 7/33	+57.4%
7/33 to 11/33	-18.8%	11/33 to 5/34	+15.9%
5/34 to 5/35	+3.1%	5/35 to 1/37	+38.8%
1/37 to 9/37	-0.9%		
9/37 to 5/38	-29.1%	5/38 to 11/38	+23.0%
11/38 to 5/39	+1.5%	5/39 to 11/39	+22.4%
11/39 to 5/40	-2.0%	5/40 to 12/41	+39.8%

Note: These are actual changes, not annualized rates of change. See appendix B for sources of data.

1. Aggregate Supply and Demand Models

What is generally called the “Great Depression” was actually a series of depressions, which occurred in such close proximity that they seemed to be a single event. The initial contraction was a demand-side problem; the hoarding of gold by the public and central banks caused worldwide deflation after late 1929. Another depression began just as the first was rapidly ending, as a high wage policy adopted in late July 1933 stopped a promising recovery in its tracks, and extended the depression for an additional 6 or 7 years. Another bout of gold hoarding began in late 1937, which led to renewed deflation and depression. As with the initial contraction of 1929-33, this relapse was triggered by a decline in aggregate demand.

The stylized facts of the Depression are easy to explain with a relatively simple aggregate supply and demand (AS/AD) model; there were large declines in aggregate demand during 1929-33 and 1937-38, and a sharp decrease in aggregate supply after July 1933. If we go one level deeper and ask what caused these supply and demand shocks then things get much more complicated, but mostly for the demand shocks.

Most scholars think the initial part of the Depression was triggered by a fall in aggregate demand, which is no surprise as the AS/AD model was developed primarily for the purpose of explaining the Great Contraction. According to this model, a large drop in aggregate demand should depress both prices and output in the short run. And this is exactly what happened during the early 1930s. Indeed the 1929-33 contraction is the example most often cited to refute new classical business cycle models that do not include demand shocks, such as some of the early “real business cycle” models.

What is misleadingly termed ‘classical economic theory’ suggests that an autonomous fall in nominal spending should result in an equal fall in wages and prices, leaving output unchanged. Of course the classical economists knew that things weren’t that simple. Even before the Great Depression they had noticed that rapid deflation was usually associated with falling output. The actual “classical theory” used by economists at least as far back as David Hume was surprisingly similar to modern business cycle theories; nominal shocks have real effects in the short run, but affect only prices in the long run.

Another common misconception is that the classical economists had an oversimplified view of what caused nominal shocks, focusing solely on changes in the money supply, and assuming the “velocity of circulation” was constant. But again, at least as far back as Hume economists knew that a decline in the velocity of circulation could depress prices and output just as easily as a decline in the money supply:

“If the coin be locked up in chests, it is the same thing with regard to prices, as if it were annihilated.” David Hume — *Of Money*

Classical economists did not just focus on demand shocks; they also understood that adverse supply shocks such as a higher minimum wage could depress output. Indeed by 1929 economists had all the intellectual tools necessary to understand the Great Depression, and even to prevent it. But if the classical economic theory can provide a satisfactory account of the Depression, then where are those explanations? And why didn't they prevent the Depression? And what explains the Keynesian revolution?

Some economists were able to account for the initial contraction of 1929-33 using classical concepts. But the very complexity of the Depression tended to obscure causal factors, and this opened the door to non-classical models, most notably the Keynesian models. Today there are many different versions of the AS/AD model, each using slightly different assumptions regarding wage and price stickiness, expectations, the monetary transmission mechanism, market efficiency, etc. Here are the assumptions that I will use:

1. Both wages and prices are sticky in the short run and flexible in the long run.
2. Expectations are “rational,” although the term ‘consistent expectations’ better describes the concept.
3. Financial and commodity markets are relatively efficient.
4. It is convenient to describe aggregate demand as a given level of nominal expenditure, or GDP.
5. Interest rates are an exceedingly poor indicator of the impact of monetary policy on aggregate demand. During the interwar years the gold/currency ratio and the price of gold were much better policy indicators.
6. Aggregate demand was also impacted by changes in the monetary gold stock, and by currency hoarding.
7. The most important factor influencing the current level of aggregate demand is the expected future path of aggregate demand.

2. Applying Occam's Razor to the Great Depression

The Great Depression is unavoidably complex, so let's at least see how much we can simplify without losing significant explanatory power. Start with the “monetarist” definition of aggregate demand, which is a given level of nominal

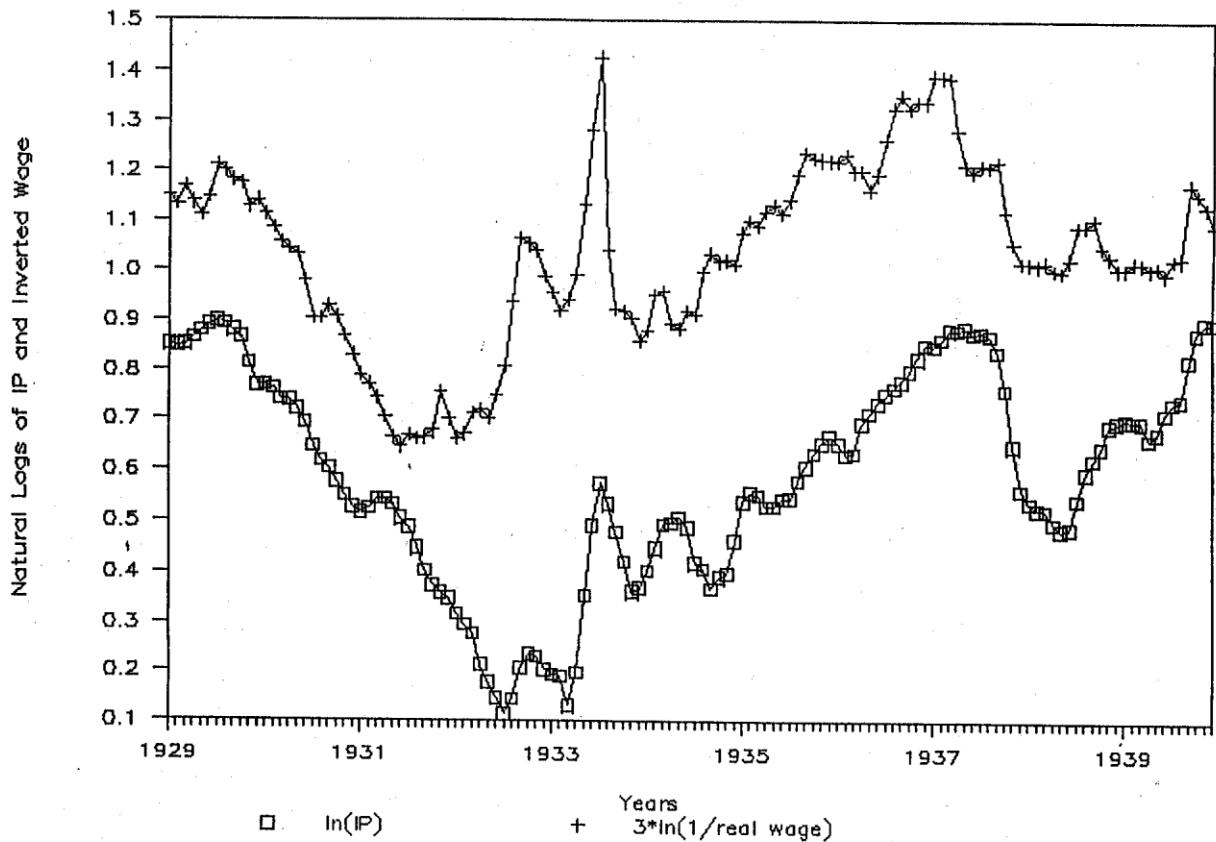
spending, or nominal GDP.¹ In that case a demand shock is simply an unanticipated change in nominal GDP. Of course the monetarists then go on to model nominal GDP using the famous $M*V$ concept, but we need not follow that choice. Indeed we will see that changes in nominal GDP during the interwar years can be much more easily explained using a model of the world gold market.

There were a variety of supply shocks during the Great Depression, but I will focus on just one type, autonomous wage shocks caused by New Deal legislation. On five different occasions the aggregate nominal wage rate rose significantly, each time in response to policies enacted by the Roosevelt administration. And each of these five wage shocks aborted promising recoveries that were underway.

Now we have reduced the Great Depression to two major types of shocks; gold market shocks that influence aggregate demand, or nominal GDP, and autonomous wage shocks that impact aggregate supply, or the way NGDP gets split up between prices and real output. Can we simplify any further? Surprisingly, the answer is yes. The 17 high frequency output fluctuations shown in Table 1 can be explained with a single variable, real wages rates. More specifically, figure 1 shows that if you create a real wage series by deflating monthly average wages in manufacturing by the wholesale price index (WPI), and then invert that series, the resulting variable is very strongly correlated with industrial production.

¹ For the graphically inclined, this is a hyperbola in P-Y space.

Figure 1 The Relationship Between Detrended Industrial Production and Detrended (inverted) Real Wages, 1929-39, monthly.



If I was asked to give a talk on the Great Depression and allowed just one slide, it would undoubtedly be figure 1. There is much to be said about this graph, but let's start with the observation that modern macroeconomic theory would predict essentially no correlation between real wages and output. We would expect to see no pattern at all. If we apply regression analysis to the data we will see that the human eye is not deceived, there is an extremely strong correlation between real wages and industrial production during the 1930s. For instance, both series show sharp increases in the spring of 1933, both peak in July 1933, and then both fall sharply. And because we inverted the real wage series, the correlation is negative, or to use the more common terminology, real wages are *highly countercyclical* during the 1930s. Why did this happen, and why do economists often fail to find any correlation at all when using post-WWII data sets?

There are many possible explanations for the surprisingly strong correlation between real wages and output. Perhaps modern studies of real wage cyclicality are flawed. Or perhaps real wages were generally more countercyclical before

WWII than they are today. The unusual pattern might also reflect the specific nature of the shocks that hit the economy during the 1930s. And of course there may be flaws in the way I have estimated real wages. In fact, all four of these factors probably play a role in making real wages especially countercyclical during the 1930s.

In the next section I will show why this diagram holds the key to understanding the Great Depression, *even if real wage changes don't play a causal role in transmitting demand shocks*. To explain the path of industrial production between 1929 and 1939 we need to first explain the path of real wages. Because real wage cyclicality is a very complex topic, here I will focus on those factors that I think best explain figure 1.

3. Why was output so volatile during the 1930s?

The Great Depression wasn't just extremely long and deep, output was also unusually *volatile* during the 1930s. Unfortunately, many previous studies of the Depression have thrown away a lot of valuable evidence by confining their analysis to annual GDP data. In one sense this is understandable, GDP data is in some ways superior to industrial production, as it provides a more complete measure of output. But industrial production is the most cyclical part of GDP, so we can be reasonably confident that a series that added agriculture and services would show a similar cyclical pattern, albeit with smaller fluctuations.

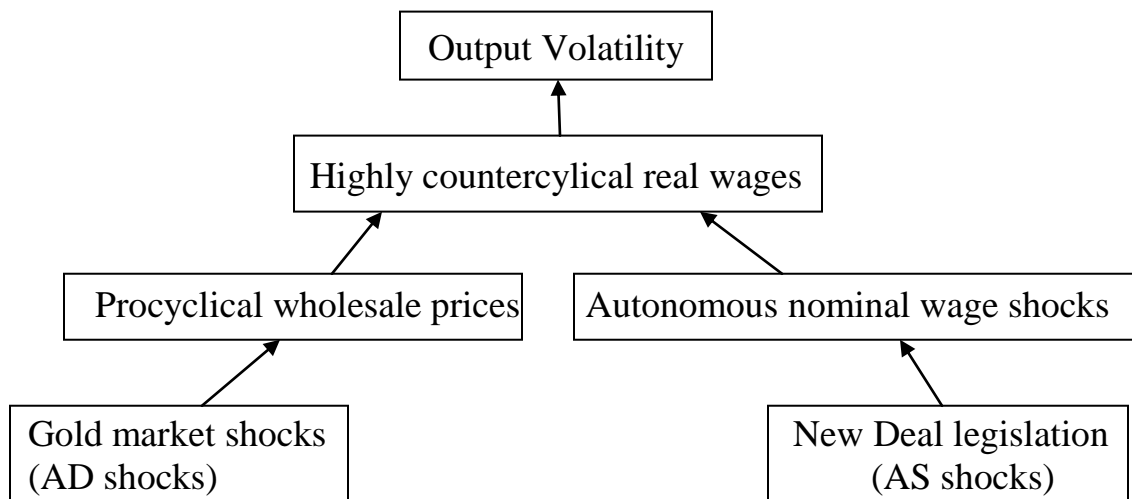
To see why the gains of using monthly IP data exceed the cost, look at the production boom in mid-1933 on figure 1, when industrial production rose 57% in just four months. After July 1933, output immediately began falling rapidly. Thus the boomlet of mid-1933 would be much less pronounced using quarterly data, and would be completely washed out in the annual data.

Now look at the corresponding real wage movements. Because the real wage series is inverted, the sharp upward spike corresponds to a roughly 15% fall in real wages between March and July 1933. And because nominal wages were almost constant during that four month period, the sharp fall in real wages was "caused" by a sharp rise in the WPI, resulting from Roosevelt's decision to devalue the dollar. Indeed we will see that *all* the high frequency fluctuations in output during the 1930s were caused by either gold or labor market shocks. And my argument is that the same factors that caused these high frequency fluctuations in output *also caused the Great Depression itself*.

If we want to find out why output was so volatile during the 1930s we first need to ask why real wages were so volatile. But we also need to explain why real wages were so strongly countercyclical. Figure 2 show how we can work

backward from our wage cyclicality findings to the deeper “root causes” of the Great Depression:

Figure 2 Causal Factors in the Great Depression



Demand shocks explain the earliest and most important phase of the Depression; the contraction of 1929-33, and the initial recovery from March to July 1933. This does not mean that aggregate supply shocks played no role in the initial contraction, indeed President Hoover’s high wage, high tariff, and high tax policies almost certainly aggravated the initial downturn. But the huge increase in the real demand for gold explains why national income fell in half between 1929 and early 1933. Even if Hoover had avoided his counterproductive “remedies” for the Depression, a fall in nominal income of that magnitude would have generated a major depression. Indeed, we don’t observe large declines in nominal GDP that are not associated with major contractions, and we don’t know of any “real” factors that were even close to being powerful enough to produce a depression after 1929.

So what caused nominal income and spending to fall in half? Some might argue that we already know what caused income to plummet. Wasn’t it a contractionary monetary policy? The problem with this explanation is that it doesn’t explain why the Depression began in late 1929. And if we can’t explain why a Great Depression began in late 1929, how can we possibly claim to have explained its cause?

The last half of this paper will sketch out a simple model of the world gold market that can explain why the Depression began in late 1929, and why it was so deep. But first we need to link together the language of aggregate supply and

demand, with the language of wages, prices, and industrial production. Unfortunately the terminology of macroeconomics is needlessly confusing, and what's worse there is no term for one of the most important concepts in macroeconomics; falling nominal GDP.

4. Wages, prices, and output

At least as far back as David Hume, economists have been aware of the effect of a sharp fall in nominal spending. But what should we call that type of shock? It could be called a contractionary monetary shock, except that it need not involve any decline in money—velocity would do just as well. Or it might be termed a ‘deflationary shock,’ except that deflation can also result from an increase in aggregate supply and need not be contractionary at all. It could be called a ‘demand shock,’ but in some new Keynesian models a supply shock can reduce both prices and output. We lack a simple term for changes in nominal GDP.

Because we also lack monthly data for nominal GDP, for the remainder of this study I will take a few linguistic short cuts. Whenever I use the term ‘deflationary shock,’ it should be understood as referring to deflation that is caused by falling nominal GDP, or falling aggregate demand. An ‘inflationary shock’ will refer to a price level increase caused by rising nominal GDP, or rising demand. To avoid confusion, I will only use these terms to describe periods where prices and output are moving in the same direction, which is *prima facie* evidence of a demand shock.

The easiest way to illustrate this convention is with the contraction of 1929-33. This can be called a “deflationary shock” because both prices and output fell sharply. If the price decline had been caused by increases in productivity (aggregate supply) then one would have expected output to rise. Fortunately, this short cut shouldn't cause much confusion. There were a few modest “price shocks” during the Dust Bowl, but in general prices were highly procyclical during the 1930s. When large “supply shocks” did occur they tended to show up as higher wages, not higher prices.

Three variables were used in constructing figure 1, nominal wages in manufacturing, wholesale prices and industrial production. Appendix A presents regression results confirming the highly countercyclical nature of interwar real wages. In both the 1920s and the 1930s, high frequency increases in real wages were associated with lower industrial production. But we are more interested in the independent contribution of price level shocks and nominal wage shocks, the two proximate causes of output volatility shown in figure 2. Higher prices (due to increased aggregate demand) should raise output in the short run, whereas higher nominal wages (an adverse supply shock), should reduce output. To test that

hypothesis, I regressed monthly industrial production on its lagged value, the WPI, and nominal wages:

Table 2 The Relationship Between Industrial Production and Its Lagged Value, Nominal Wages, Wholesale Prices, 1920-39, monthly.

<u>Independent</u> <u>Variable</u>	<u>Period</u>		
	1920-39	1920-29	1930-39
DLY ₋₁	.509 (9.09)	.345 (3.73)	.543 (7.43)
DLW	-.459 (-3.31)	.124 (0.60)	-.697 (-3.84)
DLP	.624 (5.59)	.476 (3.91)	.898 (4.56)
Adj. R ²	.453	.374	.518
n	227	107	119

Note: The variables are defined as follows: DLY and DLY₋₁ are the first differences of the natural log of industrial production, and its first lag. DLRW and DLW are the first differences of the natural logs of real and nominal wages of production-workers, respectively, and DLP is the first difference of the natural log of the wholesale price index. All equations included a constant term. T-statistics are in parentheses. A regression of the residuals on the lagged residuals, and other independent variables, showed no evidence of serial correlation.

Wholesale prices are very strongly procyclical throughout the entire interwar period. This suggests that aggregate demand shocks may have played an important role in the interwar business cycle. For instance, prices fell sharply during the major contractions of 1920-21, 1929-33, and 1937-38. Note that the correlation goes back far earlier than the interwar period, and indeed explains the entire Humean tradition in macroeconomics. Because wages are sticky, falling prices push unemployment much higher in the short run. So there are no big surprises for the price variable. But it does confirm my conjecture that 1970s-style price shocks were not particularly important during the interwar years---we don't observe the sort of inflationary contractions seen during the oil shocks.

In contrast, nominal wages show a very unusual pattern. During the 1920s there is no significant correlation between nominal wage changes and industrial production. This presumably reflects the fact that there were changes in both the supply and demand for labor, leaving nominal wages almost uncorrelated with industrial production. In contrast, during the 1930s nominal wages became very countercyclical. Stephen Silver and I showed that the break point occurred not in 1930, but rather in 1933, which is exactly when New Deal policies began to artificially raise the nominal wage rate.² Indeed between July and September 1933 nominal wages soared by more than 22 percent in response to New Deal legislation. And that was merely the first of five wage shocks during the 1930s.

The unusual countercyclical nature of wages during the 1930s is probably due to a number of special factors. Here are a few that I believe are among the most important:

1. The interwar WPI was biased toward commodities, which tend to have relatively flexible prices. Because the real price of commodities tends to be somewhat cyclical, this made the WPI appear more procyclical than a more comprehensive index would have shown. Thus the WPI tended to fall more sharply than broader price indices during depressions, which exaggerated the countercyclical nature of real wages.
2. The strongly cyclical nature of the WPI also reflects the nature of the interwar economy. Although the index was biased towards commodities, it is also true that commodities comprised a far larger share of the interwar US economy than the 21st century economy. Thus the highly cyclical nature of the interwar price level is not just an artifact of measurement error, but also reflects the much more important role of farm products, coal, metals, and other commodities.
3. Because the WPI was very cyclical, and nominal wages tend to be sticky, real wages tended to be procyclical during the interwar period. Note that this was even true during the dramatic 1920-21 deflation, when wages fell sharply, but (wholesale) prices fell much more rapidly.
4. The fact that post-war studies of wage cyclical nature often show no pronounced pattern is partly a reflection of the time periods being examined. Real wages were highly *procyclical* during the 1970s, when oil shocks depressed both

² See Silver and Sumner (1995.)

output and real wages. Indeed most supply shocks generate procyclical real wages.³

5. The New Deal period was very unusual in that the dominant supply shock was legally mandated wage increases, and this made real wages especially countercyclical. The Orwellian-named *National Industrial Recovery Act* raised wages and reduced output.

So there are five special factors that explain why real wages were highly countercyclical during the interwar period, and yet are roughly acyclical in the post-war period. This gives us a simple way to organize the analysis of what went wrong in the 1930s; explain the countercyclicity of real wages in the 1930s and we've gone a long way to explaining the Great Depression. We don't even need to assume that real wages always played a causal role; aggregate demand shocks might have directly affected output, and the unusually countercyclical real wages might partly reflect the fact that wholesale prices were usually more volatile than nominal wages.

Every factor discussed in the study can be seen as affecting output through either autonomous wage changes or unanticipated price level changes. All that remains is to model the price level, and thus the level of aggregate demand. What we need is an *ad hoc* approach, in the best sense of the term. We need the monetary model that is best suited to uncovering the specific causal factors behind the Great Deflation of 1929-33. In the next section I begin developing a gold standard model of the price level. The goal is to explain why prices fell precipitously in the early 1930s, rose sharply between 1933 and 1937, and then began falling again in late 1937. The intuition behind the model is actually quite simple; under a gold standard changes in the price level are identical to changes in the (inverse of the) value of gold.

5. Modeling the Price Level When there are Two Media of Account

In the last three decades there has been an enormous amount of research on the role of the gold standard in the Great Depression. Many economic historians view the gold standard as simply a fixed exchange rate regime that constrained monetary policymakers. Others have focused on how gold flows impacted domestic money supplies, and thus transmitted the Depression from one country to another. Although these are important perspectives, this research has often overlooked some even more fundamental issues.

³ See Sumner and Silver (1989.)

The Great Depression was a worldwide phenomenon. By themselves, gold flows tell us nothing about the stance of *world* monetary policy. To develop an explanation for why the real value of gold (i.e. its purchasing power) rose so dramatically during the 1930s, we need to focus on the world gold market. A number of recent studies by have made progress toward this end by examining the problems created by the high inflation rates during and immediately after World War I, which left gold severely undervalued relative to its pre-war level.⁴ During the 1920s the demand for monetary gold increased as the European economies returned to the gold standard, and this put downward pressure on the world price level. But these studies don't explain why the value of gold suddenly began increasing rapidly in late 1929, after being relatively stable for the previous eight years. To explain high frequency price and output fluctuations during the Depression we need a model capable of pinpointing the precise timing of world gold market shocks.

Under a gold standard regime there are generally two media of account, cash and gold. A medium of account is an asset whose nominal price is fixed, not by artificial price controls, but rather by virtue of the fact that all other prices are quoted in terms of that asset. Between 1879 and 1933, the US dollar was both a dollar bill, and 1/20.67 ounces of gold. Thus during the Great Contraction there was a large increase in the value of both dollar bills and gold.

Which medium of account can best help us understand why prices fell so sharply in the early 1930s? Most economists focus on the "money supply," which could be defined narrowly as cash plus bank reserves (i.e. the monetary base), or more broadly as cash plus bank deposits (M1 or M2.) Their focus on the money supply isn't surprising, as this is the *only* way to model the medium of account in a modern fiat money regime. Under a gold standard, however, the price level can be modeled either in terms of changes in the supply and demand for money, or in terms of changes in the supply and demand for gold.

As we will see, there are great advantages to focusing on gold. The events that most powerfully impacted the price level during the 1930s are most easily explained in terms of gold market shocks, not monetary shocks. And this isn't just my view, the financial markets seemed to share this view, reacting strongly to gold market shocks, but often remaining impassive in the face of seemingly important changes in the traditional levers of monetary policy. At the same time we shouldn't lose sight of the fact that as long as gold and cash traded at a fixed price, for any gold market explanation for a change in the price level there is a parallel explanation involving changes in the supply and demand for currency.

⁴ See Glasner (1989), Temin (1989), Eichengreen (1992), Johnson, (1997) and Bernanke and Mihov (2000.)

It will be useful to begin with a simple commodity money model applicable to either a closed economy or an international gold standard regime. Bits and pieces of this model have been developed by others; Bernanke's "multiple monetary equilibria", Eichengreen's analysis of the asymmetrical response to gold flows, Temin and Wigmore's analysis of the impact of devaluation on expectations, Romer's analysis of the impact of European war scares on gold flows, and Mundell and Johnson's gold undervaluation hypothesis all play a role in this story.⁵ But no previous account of the Depression has combined all of these perspectives into a coherent model capable of showing how gold market disturbances generated high frequency fluctuations in aggregate demand during the 1930s.

The closest parallel to this analysis is to be found in studies of gold reserve ratios by Bernanke (1995) and Eichengreen (2004.) They did show how a higher gold reserve ratio could have a deflationary impact on the world economy, but failed to use this tool to its fullest extent. In a series of earlier papers⁶ I tried to show that gold market indicators could do more than provide a backdrop to the deflation of the early 1930s, they could help us understand month-to-month and quarter-to-quarter changes in the wholesale price level throughout the entire period from 1929-39 (and indeed the 1920-21 deflation as well.)

Some of the following analysis will seem strange to those more familiar with traditional monetary analysis. Thus, before deriving a detailed model of the world gold market it will be useful to first consider an even more basic question: Why is a gold market approach to be preferred to Keynesian or monetarist models of aggregate demand?

At the risk of oversimplification one might identify three basic approaches to monetary economics, an interest rate (or Keynesian) approach, a quantity theoretic (or monetarist) approach, and a commodity money (or gold market) approach. According to the Keynesian view, prices are 'sticky' in the short run and the single best indicator of the stance of monetary policy is the interest rate. Policy-induced changes in interest rates affect investment spending, aggregate demand, the output gap, and in the long run, prices.

The monetarist approach puts much less emphasis on the interest rate transmission mechanism. Instead, the quantity of money is the key policy indicator and the real demand for money is assumed to be relatively stable. In the long run the price level will rise in proportion to any exogenous change in the money supply. The short run transmission mechanism is more complex (or ambiguous) than under the Keynesian approach, with the relative prices of many different financial and real assets being impacted by monetary shocks. Because of

⁵ See Eichengreen (1992), Bernanke (1995), Johnson (1997), Romer (1992), Temin and Wigmore (1990), and Mundell (2000.)

⁶ See Sumner 1991, 1992 and 1997.

these alternative transmission mechanisms, and because the “Fisher effect” can make it difficult to distinguish between changes in real and nominal interest rates, monetarists tend to be skeptical of using short term interest rates as a policy indicator.

Under a gold standard we can employ a third approach to monetary economics; the price level (or aggregate demand) can be modeled in terms of shifts in the supply and demand for gold. Either a decrease in the supply of gold or an increase in the demand for gold will raise its real value, or purchasing power. If the nominal price of gold is fixed, as under a gold standard, then a higher purchasing power for gold means a lower price level.

Although these three frameworks are not mutually exclusive, there are important differences in emphasis. For instance, monetarists generally view gold market shocks as being important only to the extent to which they impact the quantity of money, and Keynesians generally view money supply shocks as being important only to the extent to which they impact the interest rate. And because of their focus on the interest rate transmission mechanism, Keynesians are much more likely than others to worry about monetary policy ineffectiveness due to a liquidity trap.⁷

Let’s begin with a simple barter economy where prices are denominated in terms of other goods. Now assume the community agrees that, henceforth, all prices will be quoted in terms of a specified quantity of a designated good. For instance, suppose 1/35 ounce of gold is defined as ‘one dollar.’ In that case the community has shifted from barter to a monetary economy, with (1/35 ounce of) gold serving as the ‘medium of account’ and the term ‘dollar’ becoming the ‘unit of account.’ A medium of account is a monetary asset whose nominal price is fixed by law or convention.

By definition, the price level is inversely proportional to the real value of the medium of account, where the term ‘value’ refers to purchasing power, not international exchange rate value. Basic economic principles⁸ suggest that we can use value theory to model the real value of gold (and hence the price level) in any economy where gold is the medium of account. More specifically, increases in the supply of gold should reduce its value and therefore increase the price level. Increases in the demand for gold have the opposite effect.

Thus far we have not assumed that gold plays any role as a *medium of exchange*. At its most basic level, monetary theory is a theory of the supply and demand for the medium of account, not the medium of exchange. Thus the gold market approach can explain fluctuations in the price level in an economy where

⁷ I use the term ‘monetary policy ineffectiveness’ in the original Keynesian sense where monetary policy cannot impact nominal GDP, not in the modern (new classical) sense where policy is incapable of impacting *real* GDP.

⁸ Barro (1979) provides a good example of a monetary model based on these principles.

gold coins no longer circulate. The replacement of gold coins with paper money does create one additional complication however, a dual medium of account.⁹

Consider the U.S. gold standard circa 1929. Gold coins had been mostly replaced by Federal Reserve Notes (along with several other types of currency.) And many central banks economized on gold by also holding foreign exchange reserves. Under this sort of “gold exchange standard” a 10 percent fall in the price level was equivalent to *both* a 10 percent increase in the value of gold and a 10 percent increase in the value of currency. Thus, in principle, we could model the price level in terms of the supply and demand for either currency or gold. At a purely theoretical level, it is not obvious which of the two approaches would be more useful. After sketching out a gold market model in the next 2 sections I will be able to offer a few preliminary observations as to why the gold market approach is the more useful way of analyzing aggregate demand shocks in the U.S. during the 1930s. I also have an unpublished narrative of the impact of gold market shocks on the financial markets, which provides much more evidence of the superiority of this approach.

6. Some Gold Market Identities

Monetary theory often begins with a simple identity. In equilibrium, the price level is equal to the ratio of the nominal supply of money (the policy variable) and the real demand for money (which is the focus of the modeling process.) Under the gold market approach a similar identity is used, but it is interpreted somewhat differently. The nominal supply of money is replaced with the (nominal) gold stock, and monetary policy now generally impacts the *demand* side of the market:

$$P = G_s/g \tag{1}$$

Where P is the price level, G_s is the nominal monetary gold stock, and g is the real demand for monetary gold.¹⁰

⁹ In the event of devaluation it was understood that it was the monetary link with gold that would be broken, not the link with currency. In one sense, then, currency could be viewed as the dominant medium of account.

¹⁰ On theoretical grounds, nominal GDP would represent a better proxy for aggregate demand than the price level. (Recall that for any given level of nominal spending, higher prices mean lower output.) Prices will only work as a proxy for aggregate demand during periods dominated by demand shocks, i.e. during periods where prices and output are moving in the same direction. But because we lack high frequency data for changes in nominal spending, and because the (wholesale) price level was highly procyclical during the Depression, the changes in the WPI and industrial production will often prove to be useful proxies for demand shocks.

From equation 2.1 we can see that price stability would occur if the gold stock increased at the same rate as the real demand for gold. These conditions were approximated (in the very long run) under the nineteenth century gold standard, as price levels showed relatively little long run variation. Even the classical gold standard, however, exhibited substantial short run price level volatility. During the 1920s prices were well above pre-WWI levels, and there was concern about a looming “shortage” of gold, i.e. that future increases in the world gold supply would not be sufficient to prevent deflation. Several experts claimed the world gold stock needed to rise by about 3 percent per year in order to maintain stable prices.

In a 1930 report commissioned by the League of Nations, Gustav Cassel pointed out that the ratio of (annual) gold output to the existing stock of gold had fallen from over 3 percent prior to World War I, to just over 2 percent by the late 1920s. (Because very little gold is lost, this is roughly the rate of increase in gold stocks.) Cassel expressed concern that future gold supplies might be inadequate. On the other hand he also acknowledged that there were many uncertainties on both the supply and demand side of the gold market, and he certainly did not predict the catastrophic deflation that we now know was already underway. As we will see, while the supply side was an aggravating factor, the demand side of the gold market holds the key to the Great Contraction.

Equation 1 is an identity whether we are referring to the supply and demand for all gold, or just the supply and demand for monetary gold.¹¹ If we focus on monetary gold stocks then flows in and out of private gold hoards show up as changes in the *supply* of monetary gold. This is a bit awkward since one normally thinks of the term ‘private gold hoarding’ as applying to the demand for gold. There are several reasons, however, why it makes more sense to model the supply of monetary gold, rather than the total gold stock. First, we have relatively good monthly data on monetary gold stocks, particularly during the late 1920s and early 1930s. Admittedly, it is also true that we have data on the flow of newly-mined gold. So if gold does depreciate at an extremely low rate then it would be possible to construct rough estimates of the growth rate of the total gold stock, including hoarded gold. But there is a more important advantage to focusing on the monetary gold stock. It simplifies the process of modeling the key determinants of the price level.

It will be useful to segment real monetary gold demand into two components, the gold reserve ratio (r) and the real demand for currency (m_d). The

¹¹ During the 1920s and 1930s most gold was used for monetary purposes. (Had most gold been used in filling teeth, then market conditions in the dental industry might have been the most important determinant of the price level.)

gold reserve ratio is then defined as the ratio of the monetary gold stock and the currency stock:¹²

$$P = G_s*(1/r)*(1/m_d) \quad (2)$$

Thus an increase in the price level can be generated by one of three factors: an increase in the monetary gold stock, a decrease in the gold reserve ratio, and/or a decrease in the real demand for currency. At this level of abstraction the term ‘gold standard’ simply refers to a monetary regime where the nominal price of gold is fixed. As long as the nominal price of gold is constant, and the real value of gold is set in free markets, then we can apply the gold standard model without making any further assumptions about policymakers following “the rules of the game,” that is, we do not need to assume a stable gold reserve ratio, or in fact any relationship between the monetary gold stock and the currency stock.

Any definition of money can be used in equation 2. In fact, equation 2 would remain a tautology if we defined ‘money’ as acres of land. However it was ostensibly for the purpose of insuring the convertibility of currency that central banks were required to hold gold reserves. In addition, defining money as currency¹³ allows us to use the gold reserve ratio as an indicator of central bank fidelity to one common definition of the “rules of the game.” Alternatively, it allows us to use variations in this ratio as an indicator of discretionary monetary policy.

When we apply the gold market approach to U.S. monetary policy during the Depression we are confronted with a nine-month period where the price of gold was not fixed. If we wish to generalize the model to allow for changes in the price of gold (i.e. currency depreciation) we can modify the previous identity by separating the nominal gold stock into the nominal price of gold (P_g) and the physical gold stock (g_s):

$$P = (P_g)*(g_s)*(1/r)*(1/m_d) \quad (3)$$

The right hand side of equation 3 features the four primary variables that will be used in the gold market model of aggregate demand and the price level. Interestingly, all four of these variables played a key role in the Great Contraction and initial recovery. Of course equation 3 is merely an identity, and as such plays

¹² This approach was first developed in Sumner (1991.) Bernanke and Mihov (2000) use slightly different ratios to model changes in M1.

¹³ It might have been better to use the monetary base, which also includes bank deposits at the central bank. However I found it easier to find currency data for many of the smaller countries, and my qualitative findings don’t seem to be particularly sensitive to whether currency or base money is used, at least for the larger countries where I did find monetary base data.

roughly¹⁴ the same role in gold market analysis as the equation of exchange plays in monetarist analysis. Critics of the equation of exchange often point out that merely because a change in M or V is correlated with a change in nominal spending, does not prove that the equation is a useful way of thinking about causal relationships. To construct a useful gold market *model* we need to identify the factors that cause variations in these four variables. Then we need to find independent evidence that those causal factors actually did affect aggregate demand. I have an unpublished manuscript that provides evidence of the importance of gold shocks.

7. From a Gold Market Identity to a Gold Market Model

It is not difficult to come up with plausible explanatory variables for the right-hand-side terms in equation 3. Real currency demand is presumably a function of nominal interest rates, real income, risk of bank failures, and tax rates, among other variables.¹⁵ Changes in the (physical) monetary gold stock will depend on the flow of newly-mined gold, as well as industrial demand and private gold hoarding. Both the gold reserve ratio and the price of gold can be viewed as monetary policy indicators. To see which variables were important during the Depression it will be helpful to first look at some data showing changes in each of the key gold market variables. We will begin by focusing on the period when the dollar was still tied to gold, which allows us to abstract from changes in the price of gold. Table 3 shows how variations in each of the variables in equation 2 might have impacted the world price level under the interwar gold standard.¹⁶

¹⁴ The comparison would be even closer if P were replaced with nominal GDP, and $(1/M_d)$ were replaced with velocity.

¹⁵ See Cagan (1965.)

¹⁶ The world price level is a weighted average of prices in seven major gold standard economies. The weights are based on each country's share of world output. During the period from August 1931 to December 1932, Britain departed from the gold standard. Therefore the price level in Britain for that period is converted to a gold basis.

TABLE 3. The impact of changes in the world gold-reserve ratio, real demand for currency, real demand for gold, and monetary gold stock, on the world price level, 1926-1932.

	Time period					
	Dec 1926 to Jun 1928	Jun 1928 to Oct 1929	Oct 1929 to Oct 1930	Oct 1930 to Aug 1931	Aug 1931 to Dec 1932	Dec 1926 to Dec 1932
$\Delta(\ln 1/r)$	-3.98	-3.18	-9.62	+1.55	-5.80	-21.86
$\Delta(\ln 1/m_d)$	-4.05	-2.94	-4.97	-16.18	-13.56	-40.80
$\Delta(\ln 1/g)$	-8.03	-6.12	-14.59	-14.63	-19.36	-62.66
$\Delta(\ln G)$	+5.82	+5.42	+5.25	+3.93	+5.18	+25.61
$\Delta(\ln P)$	-2.21	-0.70	-9.34	-10.70	-14.18	-37.06

$\Delta(\ln 1/r)$ = change in the log of (the inverse of) the gold reserve ratio

$\Delta(\ln 1/m_d)$ = change in the log of (the inverse of) real money demand

$\Delta(\ln g)$ = change in the log of (the inverse of) the real demand for monetary gold

$\Delta(\ln G)$ = change in the log of the world monetary gold stock

$\Delta(\ln P)$ = change in the log of the world price level

(All of the percentage changes shown above represent first differences of logs.)

Notes: Outside the U.S., the currency stock was used as a proxy for the monetary base. The change in the real demand for monetary gold is equal to the sum of the changes in the gold reserve ratio and the real demand for currency. The change in P reflects changes in the monetary gold stock and the (inverse of the) real demand for monetary gold. The changes are not seasonally adjusted. The total change in each variable between 1926 and 1932 is the sum of the changes that occurred in each sub-period. See appendix 3a for data sources.

The most striking event in table 3 is the sharp break in the world price level after October 1929. In the 34 months preceding the stock market crash the world price level had declined by a mere 2.9 percent, whereas over the following 38 months prices it fell 34.2 percent.¹⁷ In contrast, there is no obvious change in the growth rate of world monetary gold stocks after October 1929; the annualized rate of

¹⁷ The decrease is 28.9% using ordinary percentages. In order to allow changes to be added over categories and across time, the changes in tables 3.1, 3.4, and 4.1 are reported as first differences of logs.

growth was actually slightly higher in the latter period. Thus in an accounting sense the Great Deflation of 1929-32 seems to have been triggered by a sharp increase in the demand for monetary gold.

Most gold standard models assume some relationship between the monetary gold stock and the money supply (usually currency or the monetary base.) For instance, a central bank might follow the ‘rules of the game,’ that is, choose to maintain a proportional relationship between the currency stock and the gold reserve that backs up that money. Thus when we look for reasons why central banks would have sharply increased their real demand for monetary gold, it is natural to first ask whether that increase represented a departure from the rules of the game. To answer this question we need to partition the increase in real gold demand into changes in the gold reserve ratio and changes in the real demand for currency. From table 3, we can see that both of these variables increased sharply during the period from 1926 to 1932. Unfortunately this data does not, by itself, tell us anything about the issue we care most about, which is causality.

Most of the increase in real currency demand occurred between October 1930 and December 1932. Because real income was falling throughout the industrial world during that period, the increase in real currency demand was presumably due to other factors, such as low nominal interest rates and banking instability. The gold standard approach has little to add to traditional monetarist analyses of currency hoarding by Friedman and Schwartz, and others. Instead I will focus my attention on the other three factors in equation 3, gold reserve ratios, the monetary gold stock, and (after 1933) the nominal price of gold.

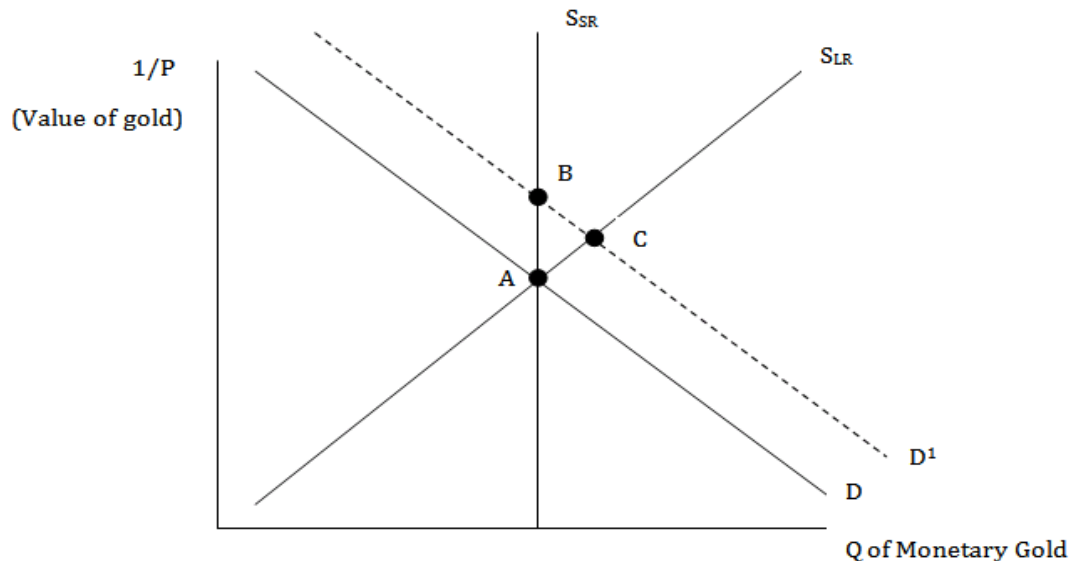
The world gold reserve ratio rose nearly 22 percent between 1926 and 1932, which is more than one half the size of the concurrent fall in the world price level. Is there a causal relationship between these two changes? This question is perhaps best posed as a counterfactual: What would have happened had the major central banks adhered to the ‘rules of the game,’ that is, what if they had maintained a stable gold reserve ratio during the late 1920s and early 1930s? To answer this question we would need to calculate the impact of changes in monetary policy (the gold reserve ratio) on the other primary variables; the world monetary gold stock and real currency demand. This turns out to be surprisingly difficult, if not impossible. In fact, we can’t even be certain as to whether these secondary effects would have tended to offset or reinforce the direct impact of changes in monetary policy.

At first glance it would seem that the easiest secondary effect to model would be the impact of monetary policy on the size of the world monetary gold stock. If central banks had maintained a stable gold reserve ratio during this period then there presumably would have been less deflation and hence a smaller increase in the real

value of gold.¹⁸ If we assume that the supply of newly-mined gold is positively related to the (real) value of gold, and that industrial demand is negatively related to the value of gold, then a more expansionary world monetary policy (which reduced the value of gold) would have led to a smaller increase in world monetary gold stocks. A reduction in output from gold mines, as well as increased industrial use of gold, should have partially offset the expansionary impact of the lower gold reserve ratio. Indeed this represents one of the allegedly stabilizing properties of a gold standard regime.¹⁹

Figure 3 shows the expected short and long run impact of a higher gold ratio on the value of gold, and hence the inverse of the price level ($1/P$). In the short run a higher gold ratio can sharply increase the value of gold, and sharply reduce the price level. If the supply of monetary gold is relatively elastic, then prices will gradually revert back toward the original level as gold output rises and industrial demand falls. Of course if commodity markets are forward-looking, then the anticipation of this long run effect can moderate any short run price level changes.

Figure 3. The Long Run Effect of a Higher Gold Reserve Ratio on the Value of Gold



A slight acceleration in the growth rate of the world monetary gold stock after October 1929 provides some evidence for the traditional gold standard model. Given the sharp fall in the price level after 1929, however, it is surprising that the supply response was not even greater. After all, the output of the world mining

¹⁸ Alternatively, one can think of deflation as reducing the nominal cost of production for a commodity whose nominal price is fixed.

¹⁹ See Barro (1979.)

industry roughly doubled during the 1930s. And industrial use of gold is believed to have fallen from 20% of the total output to roughly 5% in 1939, probably reflecting both the income and substitution effects.²⁰ One problem was private non-industrial demand. Beginning in mid-1931, fear of currency devaluation led to private gold hoarding, which slowed the growth of the world monetary gold stock and prevented changes in the supply of monetary gold from having their expected stabilizing impact. In figure 3 private gold hoarding would shift the supply of monetary gold to the left, further increasing its value and reducing the price level.

It is even more difficult to estimate the impact of monetary policy on the real demand for currency. If central banks had maintained a stable gold reserve ratio between 1926 and 1932, i.e. if they had adopted a much more expansionary monetary policy than what was actually implemented, then real income growth would have been greater, and real currency demand might have increased by even more than 41 percent.

Yet one could make an even stronger argument for the opposite effect, for stronger real growth leading to *less* currency hoarding. Currency hoarding tends to occur during depressions, as nominal interest rates are low and depositors anticipate bank failures. If more central bank gold hoarding (i.e. a higher gold ratio) had depressed the economy and increased currency hoarding, then this would have reinforced the impact of the contractionary monetary policy. This is an important point, as it means that the change in the world gold ratio probably *understates* the impact of central bank gold hoarding. It is well known that tight money can set in motion macroeconomic conditions that reduce velocity. The same is true for central bank gold policies. Central bank gold hoarding can lead to a macroeconomic environment that encourages private gold hoarding, as well as currency hoarding.

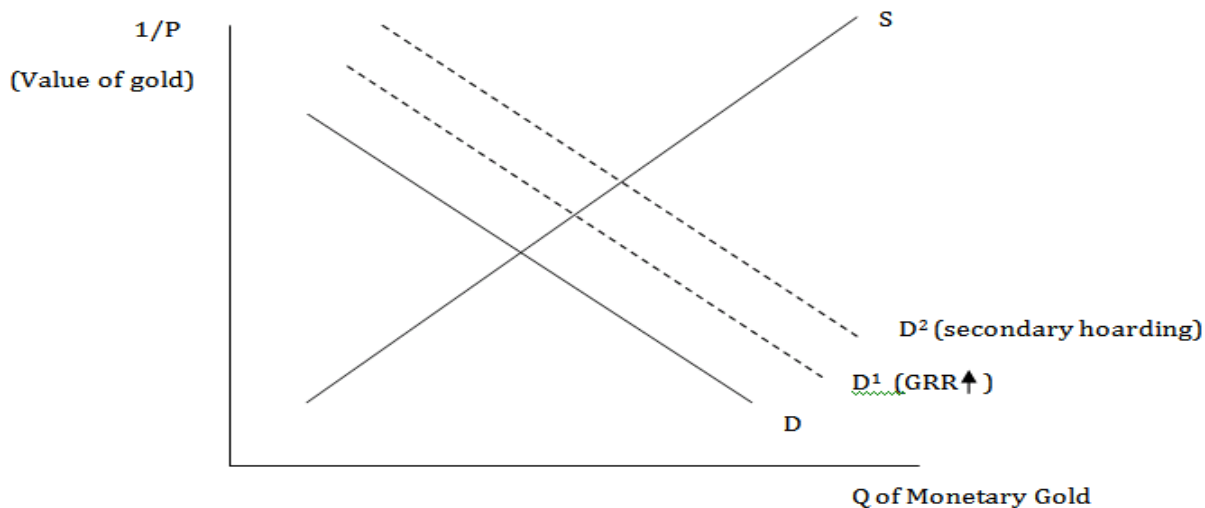
If monetary policy had been far more expansionary, and the Depression had been significantly milder, it's quite possible that the dramatic increases in real currency demand during the early 1930s would never have occurred. Indeed without the large increase in central banks gold ratios during 1929-30, it is difficult to see any plausible mechanism by which aggregate demand would have plummeted during the 1930s.

Figure 4 shows the case where a higher gold reserve ratio depresses the economy so much that the public begins hoarding and currency. A higher gold reserve ratio, *ceteris paribus*, represents a rightward shift in the demand for monetary

²⁰ These figures are from Shirras (1940.) Barro (1984) cites a study by Mark Rush that estimated the short-run flow elasticity of supply from mines to be .31. Subtracting out the private demand for gold implies a higher flow elasticity for the supply of *monetary* gold. However the short-run stock elasticity of supply during the late 1920s and early 1930s was probably much smaller than the flow elasticity since the annual increase in the monetary gold stock was only about 4 percent per year during that period.

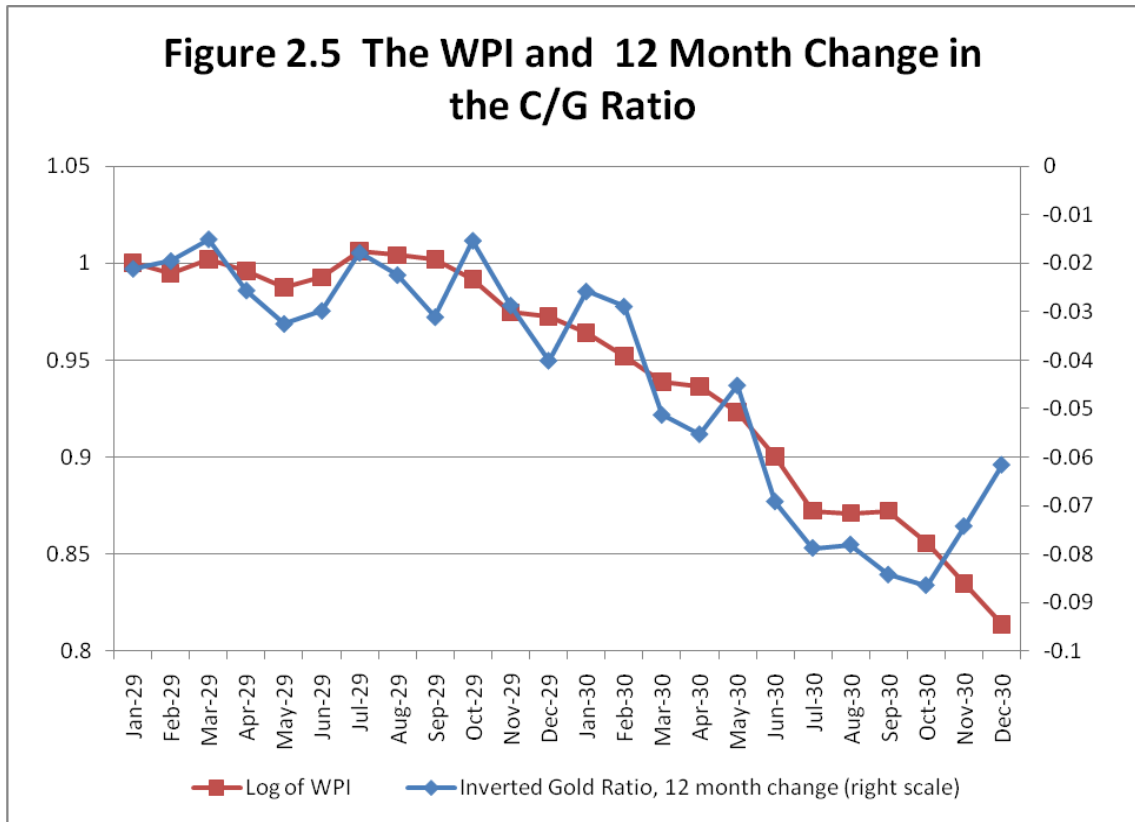
gold, and currency hoarding (i.e. higher real currency demand) pushes the demand for monetary gold even further to the right.

Figure 4. The Effect of a Higher Gold Reserve Ratio on the Value of Gold



The preceding discussion is reminiscent of the old Keynesian/monetarist debate over the effectiveness of monetary policy. Keynes (1936) argued that an increase in the money supply would reduce interest rates, and that the subsequent increase in the demand for liquidity might produce an offsetting decline in velocity. In contrast, Friedman (1969) argued that increases in the money supply growth rate typically lead to increases in real income and higher inflation expectations. These secondary effects tend to increase the velocity of circulation, thus reinforcing the impact of the original monetary shock. The various indirect effects are so complex that it is almost impossible to develop reliable estimates of how changes in the world gold ratio affected the world price level. The actual effects would be highly sensitive to expectations, and thus the deeper institutional setting that shapes those expectations. What we do know is that the world gold reserve ratio rose sharply after October 1929, and that *ceteris paribus* this action would be expected to sharply depress world prices and output.²¹ And as shown in figure 2.5, the rise in the gold reserve ratio was associated with sharply falling prices in the US. (The gold reserve ratio is inverted to make it easier to see the correlation):

²¹ One should not infer from this discussion that there was ever a golden age when countries adhered to the rules of the game. Nurske (1944) showed that interwar central banks failed to adhere to the rules of the game, and Bloomfield (1959) showed that the rules were not even followed during the classical gold standard era (1879-1914.) Rather, the rules of the game provide a useful benchmark to evaluate discretionary monetary policy.



8. Private Gold Hoarding and the Supply of Monetary Gold

The dramatic increase in the world gold reserve ratio between 1926 and 1932 represented gold hoarding by central banks. But private gold hoarding also played a role in the international gold market during the 1930s. Because we lack direct data on private gold holdings we are forced to infer changes in private gold demand by looking at variations in the world monetary gold stock and the output of gold mines.

The world stock of monetary gold grew at a relatively steady rate during the late 1920s and early 1930s. We also have monthly data showing that the flow supply of newly-mined gold was quite stable on a month to month basis. Between January 1929 and June 1931 monthly world gold output fluctuated in a narrow range between \$31 million and \$39 million. And it is widely believed that very little gold is lost each month. Therefore by comparing the data for newly-mined gold with changes in world monetary gold stocks, I was able to derive a fairly accurate estimate of changes in the private stock of gold. Private gold stocks increase whenever the supply of newly mined gold exceeds the net increase in the world monetary gold stock.

In the 30 months between December 1928 and June 1931, the world private stock of gold rose 15 times and declined 15 times. There was only one month during this period when the private stock of gold increased by an amount greater

than ½ percent of the world monetary gold stock. Then over the next 12 months there were 5 occasions where the stock of privately held gold rose by an amount greater than ½ percent of world monetary gold stocks. Note that July 1931 is precisely when the international gold standard began to fall apart. In mid-1931 the public began to hoard gold as a precaution against currency devaluation, just as they had earlier hoarded currency in fear of bank defaults.

Table 4 shows the (annualized) growth rate of the world monetary gold stock over selected periods during the 1930s:

Table 4. Annualized Changes in World (Physical) Monetary Gold Stock and Related Crises, 1929 - 1939.

<u>Time Period</u>	<u>DLG</u>	<u>Event</u>
Dec. 1929 - June 1931	6.0 percent	
June 1931 - Oct. 1931	-3.4 percent	German/U.K. crises
Oct. 1931 - Apr. 1932	6.7 percent	
Apr. 1932 - June 1932	-8.7 percent	Deficit Fears, Fed OMPs
June 1932 - Jan. 1933	8.4 percent	
Jan. 1933 - Feb. 1933	-18.8 percent	Third run on the dollar
Feb. 1933 - Apr. 1933	11.8 percent	
Apr. 1933 - Jan. 1934	-0.1 percent	Dollar depreciation
Jan. 1934 - Mar. 1935	7.6 percent	
Mar. 1935 - May 1935	-15.8 percent	Belgian crisis
May 1935 - Mar. 1936	5.3 percent	
Mar. 1936 - Sep. 1936	0.4 percent	French crisis
Sep. 1936 - June 1937	11.3 percent	Gold Panic (revaluation fears)
June 1937 - Mar. 1938	0.0 percent	Dollar Panic (devaluation fears)
Mar. 1938 - Dec. 1939	9.8 percent	

DLG is the (annualized) first difference of the log of the world monetary gold stock.

This table clearly shows that growth in the world monetary gold stock slowed sharply during periods when currencies were perceived to be at risk. Gold stocks grew especially fast when fears of devaluation receded, or when there were fears of currency revaluation, as in early 1937. And because monetary gold stock data excludes U.S gold coins, table 4 modestly understates the amount of private gold hoarding that occurred during currency crises.²²

²² For the same reason, table 3 slightly overstates the role of currency hoarding in the Depression. Brown (1940) indicates that Europeans hoarded large quantities of U.S gold coins during the currency crises of the early 1930s. At

Periods of gold hoarding were often correlated with (and perhaps caused) economic contractions in the U.S. Because this issue is so important, and because some economic historians have expressed doubts about this evidence, it is important to first establish that variations in the growth rate of the world monetary gold stock do, in fact, reflect variations in private gold hoarding.

We have already seen that the output of newly mined gold shows little month to month variation. Thus the fact that growth in world gold reserves became highly erratic after June 1931 provides powerful *prima facie* evidence that private gold hoarding was having a significant impact on world gold stocks. But this is not the only evidence we have. Periods of slow growth in the world monetary gold stock were associated with currency crises and that major banks reported widespread private gold purchases during those episodes. If this is what caused variations in private gold hoarding then one might expect an association between changes in the growth rate of the world monetary gold stock and the expected rate of depreciation of major currencies.

Table 5 shows the relationship between the world monetary gold stock and the forward discount for three important currencies during the period from 1931 through 1936. PDISC is the three-month forward discount on the British pound against the U.S. dollar. DDISC and FDISC are the three-month forward discounts on the U.S. dollar and the French franc against the British pound. These forward discounts (which are set at zero when the forward currency is at a premium) represent proxies for currency devaluation fears. GGAP is the difference between the actual world monetary gold stock and a four-year moving average of the monetary gold stock.

that time, the U.S was one of the few countries to still mint gold coins, and the stock of those coins was roughly 1/30th the size of the world monetary gold stock.

Table 5. The Relationship Between Variations in the World Monetary Gold Stock and Forward Discounts on the Pound, Dollar and Franc, Jan. 1931 - Dec. 1936, monthly.

Independent Variable - GGAP

<u>Dependent Variables</u>	<u>Coefficient</u>	<u>T-statistic</u>
PDISC	-.378	(-1.06)
DDISC	-.886	(-3.90)
FDISC	-.213	(-4.11)
GGAP ₋₁	.681	(10.29)

Adj. R² = .772, n = 72

Note: GGAP was constructed by subtracting a four-year moving average of the world monetary gold stock from the actual world monetary gold stock. GGAP₋₁ is the first lag of GGAP. Diagnostic tests show no evidence of serial correlation.

A regression of GGAP on the three forward discounts, and lagged GGAP, suggests that gold hoarding had an important impact on fluctuations in the world monetary gold stock. The negative coefficients on DDISC and FDISC indicate that increases in the (absolute value of the) discount on the dollar and franc led to reductions in the monetary gold stock, and, by implication, increases in the (unobservable) non-monetary gold stock. If these discounts are good proxies for expectations of devaluation, then these findings suggest that fears of devaluation led to private gold hoarding, which reduced the world monetary gold stock. With the pound not tied to gold for most of this period, it is not surprising that PDISC did not have a significant impact on GGAP.

To summarize, there are four pieces of circumstantial evidence to connect private gold hoarding and variations in the world monetary gold stock:

1. Growth in the world monetary gold stock was relatively stable until the onset of currency crises beginning in mid-1931.
2. Between 1931 and 1938, periods of slow growth in the monetary gold stocks were associated with currency crises.
3. Forward exchange rate data for the U.S dollar and French franc suggests

that increased expectations of currency depreciation led to slower growth in the world monetary gold stock.

4. Contemporaneous news reports suggest that private gold hoarders were particularly active during these currency crises.

To these four arguments I would add an (admittedly subjective) fifth argument. There are *no plausible alternative explanations*.

There are a number of obvious parallels between the causes and consequences of currency hoarding and private gold hoarding during the Depression. Both were triggered by fears of what can be loosely termed ‘default’, both led to increases in the demand for a medium of account, and both exerted deflationary pressure on the world economy. And yet while previous accounts of the Great Depression focused much attention on currency hoarding, gold hoarding has generally been overlooked.

Although private gold hoarding played an important role in the period after mid-1931, the data in table 3 suggest that any explanation for the large decline in prices between October 1929 and December 1932 must focus primarily on the extraordinary increase in the demand for *monetary* gold. But if private hoarding of gold did not cause the Great Depression, it did play an important role in depressing aggregate demand and prices during certain key episodes, particularly during 1931-32 and 1937-38. And the ‘gold panics’ (i.e. the periods of gold dishoarding) also had a significant impact during the mid-1930s. If fluctuations in the monetary gold stock were important, then private gold hoarding might also have been expected to influence the financial markets. Indeed there is abundant evidence that gold hoarding did affect stock and commodity prices.

To summarize, there are four gold market variables that can be used to model aggregate demand during the 1930s. It’s worth considering just how far the preceding analysis seems to carry us without addressing any of the issues linked to the *international* nature of the gold standard that have so interested economic historians. These issues include Hume’s famous price-specie-flow mechanism, McCloskey and Zecher’s assertion that domestic money supplies were endogenous under the international gold standard, Eichengreen and Temin’s view that the international gold standard constrained the Federal Reserve during the early 1930s, and Romer’s argument that gold flows to the U.S. contributed to economic recovery during the late 1930s. These issues are important. But it is striking just how much we can do with a model that abstracts from nation states and essentially ignores the “fixed exchange rate” aspect of the gold standard.

9. A Brief Narrative of High Frequency Output Changes During the 1930s

I began this paper with a table showing the erratic path of output during the 1930s. The high frequency changes in industrial production were much larger than one sees during “normal times,” especially during periods where there is no official business cycle turning point. I believe the gold/wage model outlined above can explain all of those high frequency changes, whereas other models of the Great Depression are not able to do so. Here is a brief narrative that I develop much more fully in an unpublished manuscript on the Depression:

1. October 1929 to December 1930: Industrial production fell by 29.3%

The world gold reserve ratio, which had been rising gradually during the 1920s, suddenly increased sharply between October 1929 and October 1930. French policy had been tight throughout the 1926-32 period, what changed is that US and British policy became dramatically tighter after October 1929. These three countries explain most of the rise in the world gold ratio, and most of the collapse in world aggregate demand in the year after the stock crash. In November and December 1930, US banking distress further depressed aggregate demand.

2. December 1930 to April 1931: Industrial production rose 2.5%

There were no major shocks to the world economy.

3. April 1931 to July 1932: Industrial production fell by 34.8%.

Banking distress in central Europe led to a German financial crisis in mid-1931, followed by the British devaluation in September 1931. The dollar came under stress during the spring of 1932. These events dramatically increased the demand for gold in two different ways. First, private gold hoarding became a significant problem for the first time during the Depression, and this sharply slowed growth in the world monetary gold stock. (Growth that otherwise would have sped up during the Depression.) Second, fear of dollar devaluation led the so-called “gold bloc” (dominated by France) to replace dollar reserves with gold reserves. And banking distress continued to boost the demand for currency and bank reserves.

4. July to October 1932: Industrial production rose by 13.3%

Private gold hoarding fell sharply after July 1932, as it became clear that expansionary monetary and fiscal policy would not result in dollar devaluation

under Hoover. By July 1932 the gold bloc had mostly completed its conversion of foreign exchange into gold. With a reduction in gold demand, aggregate demand began rising in the US, pushing up wholesale prices and industrial output.

5. October 1932 to March 1933: Industrial production fell by 9.2%.

A bungled campaign speech by Herbert Hoover led to renewed fears of dollar devaluation. Then during the interregnum there was increasing uncertainty about whether President-elect Roosevelt would devalue the dollar. That led to a run on the dollar, which triggered a severe banking crisis in February 1933. Private gold hoarding increased sharply.

6. March to July 1933: Industrial production soars 57.4%.

In March FDR restricted private ownership of gold, and in April he began depreciating the dollar. Daily movements in the dollar were strongly correlated with specific actions by the FDR administration (indicating the policy was exogenous) and also with all sorts of indicators of rising AD (such as bond risk spreads, equity prices, and commodity prices.)

7. July to November 1933: Industrial production fell by 18.8%.

As part of the NIRA, in late July FDR raised average hourly wages by roughly 20%. The stock market crashed. This wage shock (the first of 5) offset the rise in prices caused by dollar devaluation, and aborted the recovery. Industrial production would not regain July 1933 levels until mid-1935, by which time the Supreme Court had ruled the NIRA unconstitutional.

8. November 1933 to May 1934: Industrial production rose by 15.9%.

With the recovery flagging, in late 1933 FDR renewed his push for dollar depreciation with the greatly underrated gold buying program. Output bottomed out in November and both prices and output began rising again as the dollar depreciated sharply. The drag from the NIRA wage shock made the second round of devaluation seem less effective. It became highly unpopular, and led FDR to re-peg gold prices in early 1934.

9. May 1934 to May 1935: Output leveled off, rising by only 3.1%.

The NIRA wage codes were tightened again in the spring of 1934. As nominal wages rose, the recovery faltered, although there was a modest recovery in early 1935.

10. May 1935 to January 1937: Industrial production soared by 38.8%.

After the NIRA was declared unconstitutional in May 1935, wages moderated and output began rising briskly. Then when the gold standard collapsed in 1936 the private demand for gold dropped sharply. Monetary gold stocks rose sharply, and wholesale prices began rising rapidly after mid-1936.

11. January 1937 to September 1937: Output relatively flat, down 0.9%.

After FDR won a huge victory in 1936, his union supporters became much more aggressive. Organizing drives enabled by the Wagner Act led to rapid growth in unionization and nominal wages. During the first half of 1937 these wage gains were accompanied by sharp price gains, as a “gold panic” developed. Investors feared the huge wave of gold being dishoarded after the collapse of the gold standard would lead to dollar revaluation. (A crisis that economic historians have mostly ignored.) The net effect of the wage and price shocks was roughly neutral for output, but the economy was actually being buffeted by very two strong forces.

12. September 1937 to May 1938: Industrial production plunged 29.1%.

By the summer of 1937 the gold panic was over, and prices stopped rising. Now the rising wages began to noticeably slow the economy. Fear of dollar revaluation ended, and expectations of future monetary policy began a dramatic turnaround. By the early fall a “dollar panic” began to develop, as there were increasing fears that FDR would devalue as he did in 1933, to give the economy a “shot in the arm.” Roosevelt did not devalue, but the private gold hoarding brought a dramatic halt to the rapid growth in the world monetary gold stock, triggering sharply lower expectations of future prices. Aggregate demand and output fell rapidly, and real wages increased.

13. May 1938 to November 1938: Industrial production rose by 23.0%.

In mid-1938 workers began to accept wage cuts, under the pressure of high unemployment. FDR made some expansionary moves short of dollar devaluation (such as gold desterilization), which ended the dollar panic. Gold stocks began

rising rapidly again, as gold poured in from Europe (war fears.) As prices leveled off and wages fell, real wages declined and the economy began growing rapidly.

14. November 1938 to May 1939: Output leveled off, rising 1.5%.

In late 1938 FDR enacted the nation's first national minimum wage law. Average nominal wages rose modestly and the recovery slowed sharply.

15. May 1939 to November 1939: Output rose by 22.4%.

Gold from Europe continued to pour into the US, and wages were flat.

16. November 1939 to May 1940: Output leveled off, falling 2.0%

In late 1939 FDR raised the minimum wage rate from 25 to 30 cents an hour. This was the fifth and last nominal wage shock of the 1930s. Once again, there was a temporary pause in the recovery. All five New Deal wage shocks temporarily stalled the recovery

17. May 1940 to December 1941. Industrial production soared 39.8%.

In the spring of 1940 it became clear that the war was intensifying dramatically. This sharply increased inflation expectations, as gold continued to flow into the US. Prices began rising and by the time Pearl Harbor was attacked the Great Depression was essentially over.

10. Summary

There is no monocausal explanation for the Great Depression. The most promising models emphasize the role of demand shocks in the Great Contraction, the initial recovery, and the relapse of 1937-38. The most important demand shock occurred between 1929 and 1933, when nominal GDP fell by more than half. President Roosevelt's policy of dollar depreciation boosted output sharply after March 1933, but his high wage policy appears to have reduced aggregate supply and stalled the recovery at five distinct points between 1933 and 1940.

There are many ways of modeling the deflationary monetary policies of the early 1930s. Friedman and Schwartz focused on how Fed decisions, or errors of omission, led to a sharp decline in the broader monetary aggregates. But this approach doesn't explain why the entire world suffered a severe slump after 1929. More recent studies have emphasized the importance of the international gold

standard, but even these studies have failed to explain why a severe slump began in late 1929, and why a relapse occurred in late 1937. The problem was not that these gold standard studies focused too much on the role of gold, but rather too little.

Under an international gold standard the world price level is determined by three fundamental factors: the size of the monetary gold stock, the gold reserve ratio, and the real demand for currency. An increase in the monetary gold stock is inflationary, whereas an increase in the gold reserve ratio and/or an increase in the demand for currency are deflationary. A fourth variable became important when the gold standard was temporarily suspended in 1933 and changes in the price of gold also began impacting the US price level.

In previous studies of the Depression the international gold standard has been a sort of handmaiden to the analysis of stabilization policy, something that constrained monetary and fiscal policymakers, but didn't really have much direct impact on the price level. In this paper I've suggested that gold market shocks aren't just important when they affect the money supply, rather they *directly affect aggregate demand and the world price level*. This goes against the common-sense intuition of most macroeconomists, who have generally spent their entire careers focused on fiat money regimes with only a single medium of account; money. But the gold market approach is very much consistent with the most recent trends in both new classical and new Keynesian economic theory, which suggest that the most important influence on aggregate demand is changes in the *expected future path of monetary policy*. Gold market shocks often impacted expected future monetary policy far more strongly than changes in the sort of traditional monetary policy tools studied by Friedman and Schwartz.

Appendix A. Real Wages During the 1930s

The following table shows the results of regressing the first difference of the log of industrial production on its lagged value, and also the first difference of the log of real wages. Real wages were already strongly countercyclical during the 1920s, and became much more so in the 1930s.

Table 6. The Relationship Between Industrial Production and Its Lagged Value and Real Wages, 1920-39, monthly.

<u>Independent Variable</u>	<u>Period</u>		
	1920-39	1920-29	1930-39
DLY ₋₁	.533 (10.51)	.449 (5.18)	.570 (8.79)
DLRW	-.560 (-6.00)	-.348 (-3.00)	-.787 (-5.52)
Adj. R ²	.453	.335	.520
n	227	107	119

Note: The variables are defined as follows: DLY and DLY₋₁ are the first differences of the natural log of industrial production, and its first lag. DLRW and is the first difference of the natural logs of real wage rates of production-workers. Nominal wages are deflated by the Wholesale Price Index. All equations shown in this chapter included a constant term. T-statistics are in parentheses. A regression of the residuals on the lagged residuals, and other independent variables, shows no evidence of serial correlation.

In earlier research, Stephen Silver and I (1989) found that real wages tend to move countercyclically in periods dominated by aggregate demand shocks and procyclically in periods dominated by aggregate supply shocks. We suggested that these findings were consistent with ‘sticky-wage’ versions of the AS/AD model. Thus an adverse aggregate demand shock would reduce prices and output in the short run. If nominal wages were slow to adjust, this shock would then produce a (countercyclical) increase in real wage rates. Similarly, supply shocks would generate countercyclical price level movements and procyclical movements in real wage rates.

Appendix B. Data Sources

The monthly wage data came from two different sources. The 1930s data were taken from the Bureau of Labor Statistics (BLS) production-worker average hourly earnings series. This data is found in *Employment, Hours, and Earnings, United States, 1909-84*, Vol. 1, U.S. Dept. of Labor, Bureau of Labor Statistics, March 1985, p. 57. The 1920s data were taken from the National Industrial Conference Board (NICB) average hourly earnings in manufacturing series reported in Beney (1936, pp. 44-47), and *Survey of Current Business*, 1936-40, various issues. (There is a six month gap in the NICB series from January to June 1922.)

The Wholesale Price Index series are BLS data taken from various issues of the *Federal Reserve Bulletin*. The industrial production series is from *Industrial Production: 1976 Revision*, a 1977 publication by the Board of Governors of the Federal Reserve System.

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