Title

Macroeconomic Adjustment Under Bretton Woods and the Post-Bretton-Woods Float: An Impulse-Response Analysis

Authors

Bayoumi, Tamim
Eichengreen, Barry

Publication Date

1992-08-01

UNIVERSITY OF CALIFORNIA AT BERKELEY

Department of Economics

Berkeley, California 94720

Working Paper No. 92-201

Macroeconomic Adjustment Under Bretton Woods and the Post-Bretton-Woods Float: An Impulse-Response Analysis

Tamim Bayoumi
International Monetary Fund

Barry Eichengreen
University of California, Berkeley

August 1992

Key words: Bretton Woods, exchange rates, international adjustment

JEL Classification: F0, F4

This paper was prepared while the first author was visiting the Bank of England. We thank Luisa Lambertini for research assistance. The views expressed here are not those of the International Monetary Fund.

I. Introduction

More than two decades since the transition from fixed to flexible exchange rates, there is no consensus as to the consequences of the shift. In a sense this is not surprising, since there exists little agreement among economists about how exchange rate variations affect macroeconomic variables like output and inflation. The exchange rate being a nominal variable, the long-standing controversy over whether nominal disturbances have real effects inevitably comes into play, pitting market-clearing approaches against models with nominal rigidities and nominal inertia. In the theoretical world of open-economy macroeconomics, anything goes.

This inability to converge on a common model has been particularly debilitating for empirical economists. One response has been to fit historical time series to a specific theoretical model but without testing it against alternatives. Early work in this spirit simply wrote down and estimated structural equations designed to capture a particular view of how the exchange rate affected macroeconomic variables; a good example of the genre is Bomhoff and Kortewig (1983). Subsequent contributions have estimated the Euler equations derived from an explicit optimizing problem and a set of constraints. Either way, compromises are necessary when moving from theory to data. In the end, several competing theoretical models seem to end up fitting the facts equally well (or badly).

The alternative is to avoid positing a model and to focus atheoretically on correlations in the data. An example of this style of work is Baxter and Stockman (1989).[1] The variability of output and inflation over time or across countries is shown to differ under different exchange rate régimes.

The implication is that the exchange rate regime is responsible for the shift. One difficulty with this approach is that a given set of empirical observations may be compatible with a number of different economic interpretations. Another difficulty is that observed differences across exchange rate regimes in the behavior of macroeconomic variables like output and inflation may reflect other differences in the economic environment and not the effects of the exchange rate per se. For both reasons, evidence in the absence of theory is unlikely to be regarded as definitive.

In this paper we stake out a middle ground between these extremes. We show that the closest thing the economics profession possesses to a consensus model -- the aggregate-supply-aggregate-demand framework familiar from textbooks -- can be fit to historical time series in ways that shed light on the effects of the exchange rate regime. In particular, we inquire into the relative importance of supply and demand disturbances in periods of fixed and floating rates. We examine whether not just the impact effect of disturbances but also the economy's subsequent adjustment to shocks differ according to the exchange rate regime.

Our analysis focuses on the G7 countries under the Bretton Woods regime of fixed rates before 1971 and the regime of floating exchange rates that has prevailed subsequently.[2] The results point to consistent differences across these exchange rate regimes in the determination and behavior of output and inflation.

II. Methodology

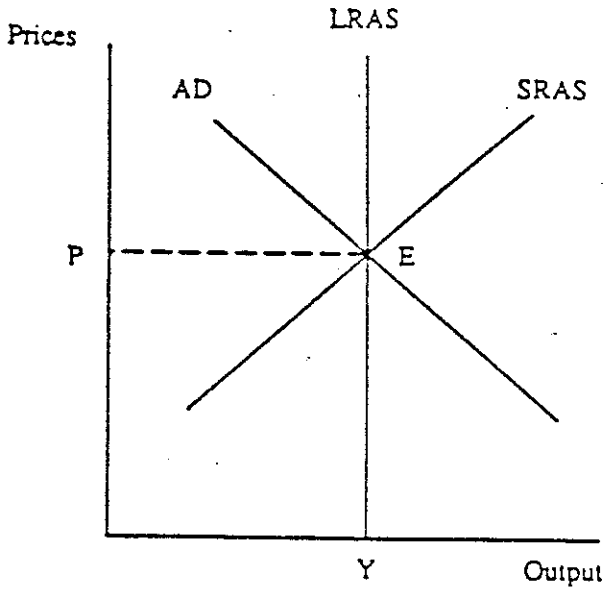
Our methodological point of departure is the familiar aggregate demand and aggregate supply diagram reproduced as the top panel in Figure 1. The aggregate demand curve (labelled AD) is downward sloping in price-output space, reflecting the fact that lower prices raise real money balances and therefore product demand. The short-run aggregate supply curve (SRAS) is upward sloping, reflecting the assumption that capacity utilization can be varied in the short run to capitalize on the profit opportunities afforded by changes in aggregate demand. The long-run aggregate supply curve (LRAS) is vertical, since capacity utilization eventually returns to its normal level, preventing demand shocks from permanently affecting the level of production.

The effect of a positive demand shock is shown in the left half of the lower panel. As the aggregate demand curve shifts from AD to AD', the short-run equilibrium moves from its initial point E to the intersection of SRAS with AD'. Both output and prices rise. As the aggregate supply curve becomes increasingly vertical over time, the economy moves gradually from the short-run equilibrium D' to the long-run equilibrium D". As the economy traverses the new aggregate demand curve, output falls back to its initial level, while the price level continues to rise. (Depending on the specifics of the adjustment, there could be some cycling around the new long-run equilibrium, a point to which we return in the empirical analysis.) Hence the response to a permanent positive demand shock is a short-term rise in production followed by a gradual return to the initial level of output, and a permanent rise in prices.

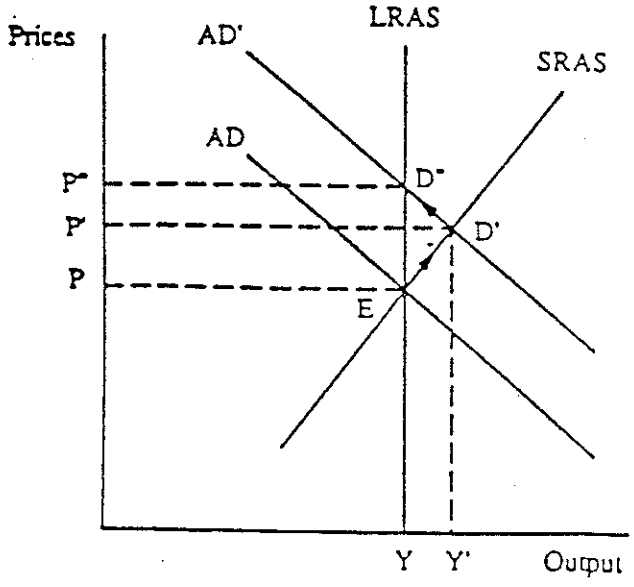
Figure 1

The Aggregate Demand and Supply Model

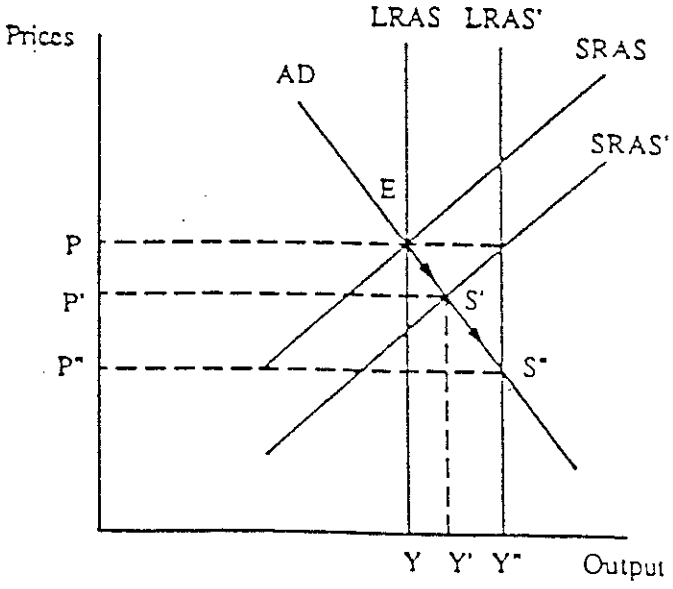
(a) The Model



(b) A Demand Shock



(c) A Supply Shock



The effects of a positive supply disturbance (a favorable technology shock that permanently raises potential output, for instance) is shown in the right-hand bottom panel. The short- and long-run aggregate supply curves shift to the right by the same amount, displacing the short-term equilibrium from E to S'. On impact, output rises but prices fall. As the supply curve becomes increasingly vertical over time, the economy moves from S' to S", leading to further increases in output and additional declines in prices. Whereas demand shocks affect output only temporarily, supply shocks affect it permanently. And whereas positive demand shocks raise prices, positive supply shocks reduce them.

We estimate this framework using a procedure proposed by Blanchard and Quah (1989) for distinguishing temporary from permanent shocks to a pair of time-series variables, as extended to the present case by Bayoumi (1992). Consider a system where the true model can be represented by an infinite moving average representation of a (vector) of variables, X_t, and an equal number of shocks, ϵ_t. Formally, using the lag operator L, this can be written as:

$$\begin{aligned} X_t &= A_0\epsilon_t + A_1\epsilon_{t-1} + A_2\epsilon_{t-2} + A_3\epsilon_{t-3} \ldots . \\ &= \sum_{i=0}^{\infty} L^i A_i \epsilon_t \end{aligned} \qquad (2.1)$$

where the matrices A_i represent the impulse response functions of the shocks to the elements of X.

Specifically, let X_t be made up of change in output and to the change in prices, and let ϵ_t be demand and supply shocks. Then the model becomes

$$\begin{bmatrix} \Delta y_t \\ \Delta p_t \end{bmatrix} = \sum_{i=0}^{\infty} L^i \begin{bmatrix} a_{11i} & a_{12i} \\ a_{21i} & a_{22i} \end{bmatrix} \begin{bmatrix} \epsilon_{dt} \\ \epsilon_{st} \end{bmatrix} \tag{2.2}$$

where y_t and p_t represent the logarithm of output and prices, ϵ_{dt} and ϵ_{st} are independent supply and demand shocks, and a_{11i} represents element a_{11} in matrix A_i.

The framework implies that while supply shocks have permanent effects on the level of output, demand shocks only have temporary effects. (Both have permanent effects upon the level of prices.) Since output is written in first difference form, this implies that the cumulative effect of demand shocks on the change in output (Δy_t) must be zero. This implies the restriction,

$$\sum_{i=0}^{\infty} a_{11i} = 0. \tag{2.3}$$

The model defined by equations (2.2) and (2.3) can be estimated using a vector autoregression. Each element of X_t can be regressed on lagged values of all the elements of X. Using B to represent these estimated coefficients, the estimating equation becomes,

$$
\begin{aligned}
X_t &= B_1 X_{t-1} + B_2 X_{t-2} + \ldots + B_n X_{t-n} + e_t \\
&= (I - B(L))^{-1} e_t \\
&= (I + B(L) + B(L)^2 + \ldots)\, e_t \\
&= e_t + D_1 e_{t-1} + D_2 e_{t-2} + D_3 e_{t-3} + \ldots
\end{aligned}
\tag{2.4}
$$

where e_t represents the residuals from the equations in the vector autoregression. In the case being considered, e_t is comprised of the residuals of a regression of lagged values of Δy_t and Δp_t on current values of each in turn; these residuals are labeled e_{yt} and e_{pt}, respectively.

To convert equation (2.4) into the model defined by equations (2.2) and (2.3), the residuals from the VAR, e_t, must be transformed into demand and supply shocks, ϵ_t. Writing $e_t = C\epsilon_t$, it is clear that, in the two-by-two case considered, four restrictions are required to define the four elements of the matrix C. Two of these restrictions are simple normalizations, which define the variance of the shocks ϵ_{dt} and ϵ_{st}. A third restriction comes from assuming that demand and supply shocks are orthogonal.[3]

The final restriction, which allows the matrix C to be uniquely defined, is that demand shocks have only temporary effects on output.[4] As noted above, this implies equation (2.3). In terms of the VAR it implies,

$$
\sum_{i=0}^{\infty} \begin{bmatrix} d_{11i} & d_{12i} \\ d_{21i} & d_{22i} \end{bmatrix} \begin{bmatrix} c_{11} & c_{12} \\ c_{21} & c_{22} \end{bmatrix} = \begin{bmatrix} 0 & . \\ . & . \end{bmatrix}
\tag{2.5}
$$

This restriction allows the matrix C to be uniquely defined and the demand and

supply shocks to identified.[5] Note that although the model is estimated in first differences, the restrictions are imposed on the level of output. Accordingly, we will generally report the estimation results in terms of the level of output and prices.

Clearly, interpreting shocks with a permanent impact on output as supply disturbances and shocks with only a temporary impact on output as demand disturbances is controversial. Doing so requires adopting the battery of restrictions incorporated into the aggregate-supply-aggregate-demand model of Figure 1. One can think of frameworks other than the standard aggregate-supply-aggregate-demand model in which that association might break down. Moreover, it is conceivable that temporary supply shocks (for example, an oil price increase that is reversed subsequently) or permanent demand shocks (for, example, a permanent increase in government spending which affects real interest rates and related variables) dominate our data. But here a critical feature of our methodology comes into play. While restriction (2.5) affects the response of output to the two shocks, it says nothing about their impact on prices. The aggregate-supply-aggregate-demand model implies that demand shocks should raise prices while supply shocks should lower them. Since these responses are not imposed, they can be thought of as "over-identifying restrictions" useful for testing our interpretation of permanent output disturbances in terms of supply and temporary ones in terms of demand. Only if this over-identifying restriction is satisfied can we be confident of our interpretation of disturbances with permanent and temporary effects on output as supply and demand disturbances, respectively.

III. A Preliminary Look at the Data

Annual data on real and nominal GDP for the G-7 countries spanning the period 1953-88 were collected from OECD *National Accounts* volumes and their machine-readable counterparts. Growth and inflation were calculated as the first difference of the logarithm of real GDP and the implicit GDP deflator, respectively.

We partitioned the series into the Bretton Woods period (1953-70) and the post-Bretton Woods float (1971-88). Allowing two observations for lags, this provided estimation periods of equal length: 1955-70 and 1973-88. In addition to analyzing the individual country data, we considered the behavior of aggregate G-7 output, computed using weights based on 1970 GDP converted into common currency using purchasing-power-parity exchange rates.

Table 1 displays these data for the Bretton Woods period, for the post-Bretton Woods float, and separately for the first and second halves of both periods. Consider the first two rows in the growth and inflation panels, which summarize the aggregate G-7 series. The row labelled SD reports the standard deviation of the G-7 series, while SD* shows the GDP-weighted standard deviation of the individual country series around the G-7 aggregate. The first row thus summarizes aggregate variation, the second one variation around the aggregate. (Since the data are in logarithms, a value of 0.01 represents a variation of approximately 1 percent).

Comparing SD and SD* over the two regimes, a change in the aggregate behavior of growth is apparent with the shift from fixed to floating rates. Between 1955 and 1970, the G-7 aggregate is stable compared to the amount of

Table 1
BASIC DATA

	1955-70	1955-62	1963-70	1973-88	1973-80	1981-88
GROWTH						
G7 SD	.014	.017	.010	.014	.022	.017
SD*	.024	.024	.025	.013	.013	.012
United States	.021	.024	.020	.026	.026	.027
Japan	.022	.022	.021	.019	.026	.011
Germany	.026	.026	.024	.019	.023	.014
France	.012	.015	.009	.014	.017	.009
United Kingdom	.013	.015	.013	.025	.030	.019
Italy	.013	.011	.015	.024	.030	.012
Canada	.022	.028	.016	.024	.019	.028
Average	.020	.022	.019	.023	.026	.021
Percent Explained By First Principal Component	33(1)	45(0)	42(2)	63(1)	74(0)	62(0)
INFLATION						
G7 SD	.011	.006	.011	.028	.016	.022
SD*	.014	.016	.012	.031	.036	.026
United States	.014	.008	.017	.025	.013	.023
Japan	.022	.030	.006	.050	.053	.010
Germany	.014	.010	.018	.015	.013	.010
France	.022	.028	.015	.029	.013	.033
United Kingdom	.016	.016	.016	.057	.050	.023
Italy	.022	.017	.023	.043	.022	.045
Canada	.014	.010	.009	.033	.025	.028
Average	.017	.017	.016	.035	.028	.024
Percent Explained By First Principal Component	41(1)	35(1)	44(1)	77(1)	50(0)	80(0)
CORRELATION OF GROWTH AND INFLATION						
G7	-.22	-.36	-.52	-.54	-.94	-.73
United States	-.29	-.11	-.63	-.55	-.94	-.50
Japan	.48	.64	-.20	-.37	-.57	-.39
Germany	-.07	-.68	.43	-.31	-.55	-.91
France	-.34	-.63	.57	-.15	-.79	-.50
United Kingdom	-.48	-.68	-.47	-.65	-.77	-.82
Italy	-.40	-.10	-.45	.01	-.07	-.90
Canada	.02	.14	-.31	-.20	-.19	-.54

Notes: G7 numbers derived from G7 data. G7' numbers derived from a weighted average of individual country data.
SD = standard deviation of series.
SD* = weighted standard deviation of variation around series.

dispersion around the aggregate that is evident. Between 1973 and 1988, aggregate variation is essentially unchanged, but dispersion falls noticeably relative to the Bretton Woods period.[6]

To confirm that the change in behavior is not an artefact of this particular statistic, we also computed the share of the variance across countries explained by the first principal component, along with the number of negative factor loadings in this component (reported in parentheses).[7] The share of the variance explained by the first principal component rises from 33 to 63 percent, confirming the increase in the cross-country coherence of output movements following the shift from fixed to floating rates. Nor is this finding of increasing synchronization of business cycles following the shift from fixed to floating rates a function of the inclusion of any one country in the sample. One might conjecture that output in different countries moved more independently in the 1950s and 1960s than after 1971 because in the former period levels of output per capita even within the G-7 were very different, and catch-up (convergence) effects dominated business-cycle effects.[8] After 1971, this argument implies, convergence was largely complete, and business-cycle factors played a larger role in output movements. Yet when the country to which this argument is most likely to apply, Japan, is excluded from the G-7 sample, the effect remains: SD* falls from 0.024 to 0.017 in the Bretton Woods decades and from 0.013 to 0.012 in the years of floating. Thus, the higher value of SD* before 1971 does not appear to reflect postwar catch-up and the convergence of growth rates alone.[9]

These summary statistics are at odds with conventional wisdom in which it is argued that the Bretton Woods period was one of output stability

compared to the turbulent era of oil shocks and fiscal disturbances that followed, and where it is suggested that the shift from fixed to flexible rates after 1970 weakened the international synchronization of business cycles. The first and fourth columns of Table 1 show that economic growth in the G-7 countries was no less volatile under Bretton Woods than under the post-Bretton Woods float, and that the international dispersion of growth rates was, if anything, greater under fixed than under floating rates.

The other columns of Table 1, which divide the data for each regime into halves, help to resolve the first of these paradoxes. They show that G-7 growth was more volatile in the first half of the Bretton Woods sample than in the second. Similarly, growth was more volatile in the period of oil shocks (1973-80) than in subsequent years. Hence authors like Baxter and Stockman (1989) who find that output growth was less variable under Bretton Woods than subsequently arrive at this conclusion because they limit their analysis of Bretton Woods to the years starting in 1960 and terminate their post-Bretton Woods sample in the mid-1980s. Bordo (1992) and Eichengreen (1992a) show that the ranking is reversed when the Bretton Woods sample is extended back to 1945 or 1950 and the post-Bretton Woods sample is extended forward to the late 1980s.

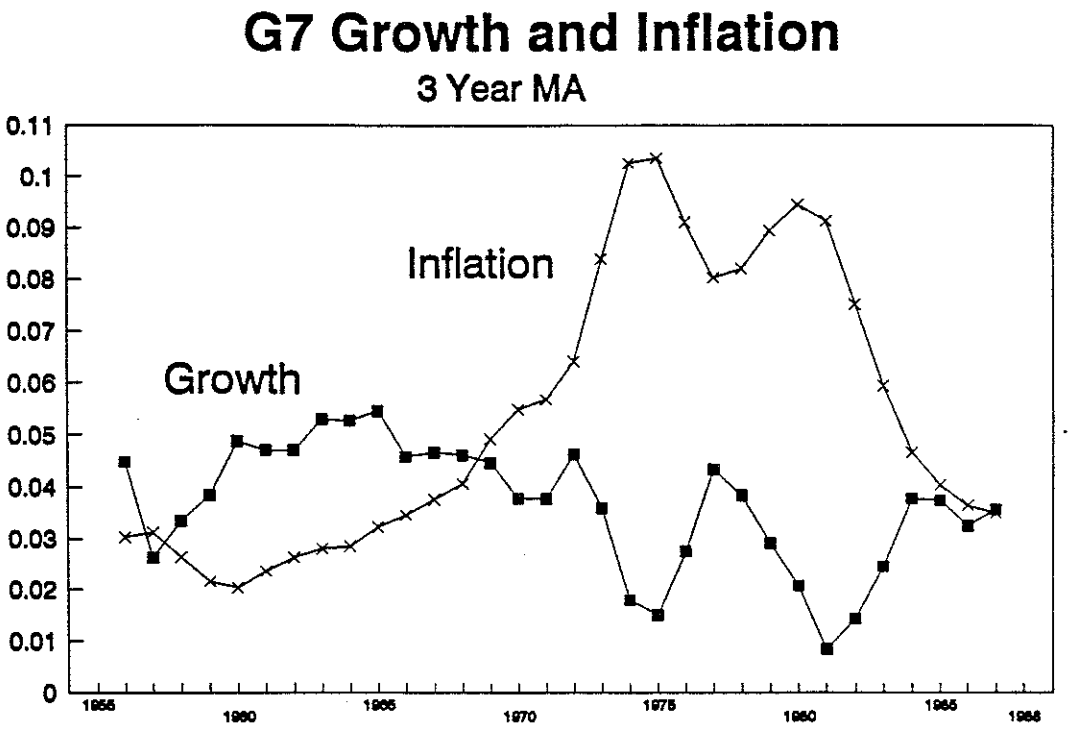
The rise in the cross-country correlation of output movements following the shift from fixed to flexible rates is more difficult to explain (although we offer a conjecture in Section III.c below). No one subperiod is responsible for the shift. The result is essentially the same for the two Bretton Woods subperiods on the one hand and for the two post-Bretton Woods subperiods on the other. This rise in the cross-country correlation of output

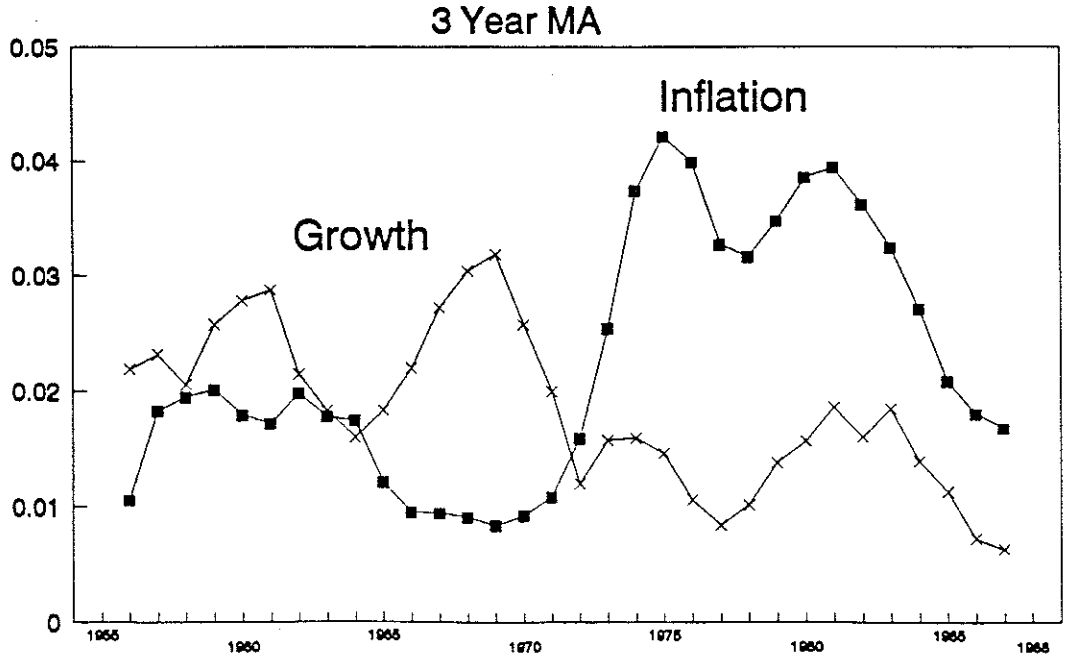
fluctuations was noted previously by Eichengreen (1992a). But Eichengreen also observed that the extent of the correlation depended on the way the data were rendered stationary.[10] When the series are detrended by first differencing, as here, there is relatively strong evidence of a post-1971 increase in the cross-country correlation of output movements. When they are filtered by fitting a linear trend to the logarithm of output and analyzing the residuals, however, evidence of a rise in the cross-country correlation is considerably weaker. Since the first-difference filter places a greater weight on high-frequency movements, this suggests that any decline in the cross-country dispersion of output movements after 1970 occurred mainly at high frequencies.[11] More persistent shifts in output growth such as those associated with the post-1971 productivity slowdown are evident primarily at lower frequencies; since they seem to have affected all countries simultaneously, there is little evidence of a change in dispersion at those lower frequencies.

Turning to inflation, there is an increase in both the variation of the G-7 aggregate and in individual-country variation around that average between the Bretton Woods and floating exchange rate periods. Industrial-country inflation became more variable both over time and across nations with the switch from fixed to flexible exchange rates. Figure 2 shows the behavior of aggregate growth and inflation (in the top panel) and of country-specific standard deviations around the aggregate (in the bottom panel). For ease of interpretation, three-year moving averages are displayed.

The bottom panel highlights this decline in the cross-country dispersion of growth rates after 1970, accompanied by a rise in the cross-country

Figure 2


G7 Growth and Inflation
3 Year MA
0.11
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
Inflation
Growth
1955
1960
1965
1970
1975
1980
1985
1988


G7 Standard Deviations
3 Year MA
0.05
0.04
0.03
0.02
0.01
0
Inflation
Growth
1955
1960
1965
1970
1975
1980
1985
1988

dispersion of inflation. An interpretation of these changes in the international dispersion of output and inflation movements with the shift from fixed to flexible exchange rates is that flexible rates allowed countries to stabilize relative growth rates vis-à-vis one another at the expense of their relative inflation rates. This would be the case, for example, if countries experienced different shocks but were constrained under fixed rates in the policies that might be used to offset them, whereas under flexible rates they were able to use policy to stabilize output relative to the G-7 average, but at the expense of different rates of inflation that depended on the nature of domestic disturbances. The final panel of Table 1 therefore reports the correlation of growth rates and inflation rates for the G-7 aggregate and for each country. The negative correlation that dominates is suggestive of a predominance of supply shocks. Still, direct evidence on both the incidence of shocks is required to substantiate this conjecture.

IV. The Magnitude and Dispersion of Shocks

To identify supply and demand disturbances we estimated bivariate VARs for each country and for the G-7 aggregate. In all cases, the number of lags was set to 2, since the Schwartz Bayesian information criterion indicated that all of the models should have a lag length of one or two. A uniform lag of 2 was chosen to preserve the symmetry of specification across countries.

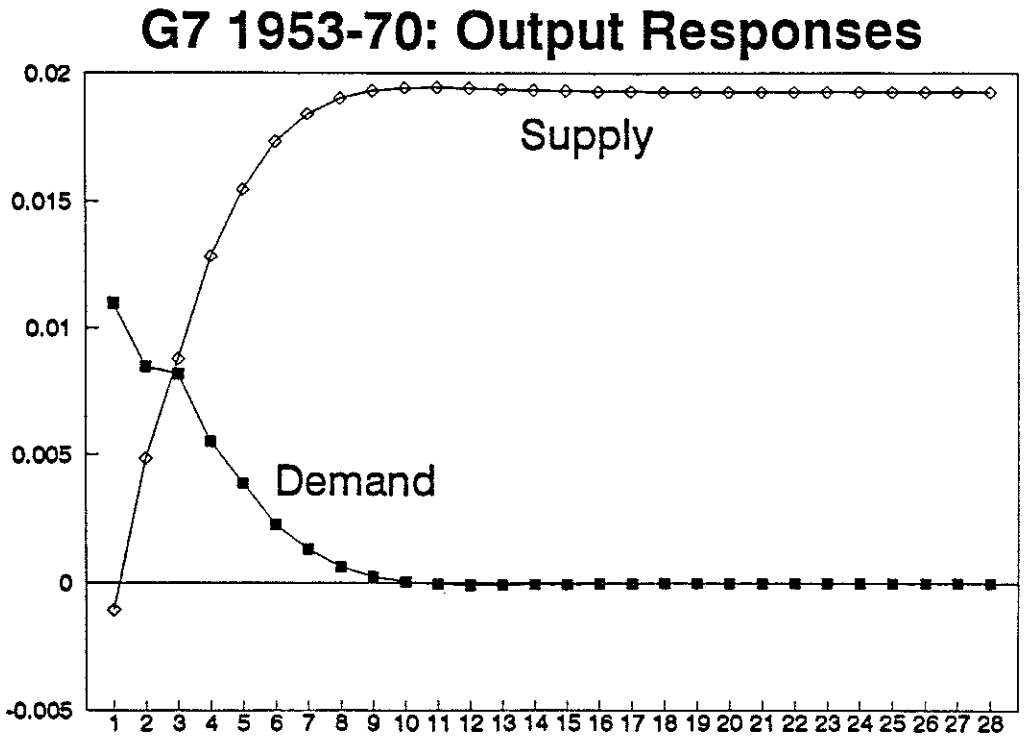
The estimation and simulation results accord with the aggregate-supply-aggregate demand framework discussed in Section II. Recall that the "over-identifying restriction" that positive aggregate demand shocks should be associated with increases in prices while positive aggregate supply shocks

should be associated with falls in prices was not imposed by the estimation procedure. In every case, it was an outcome of estimation and simulation using individual-country data, supporting our interpretation of the results in terms of aggregate demand and aggregate supply. Figures 3 and 4 display the impulse response functions for the G-7 aggregate. In Figure 3, supply disturbances raise output permanently, while demand disturbances have an output effect only in the short run. Both types of shocks alter prices permanently, but in different directions.

Table 2 summarizes the behavior of individual-country aggregate supply and aggregate demand disturbances in a format comparable to Table 1's analysis of output and inflation. Two different variants of the global aggregate are analyzed: "G-7" denotes supply and demand disturbances derived from the G-7 aggregate; while "G-7'" denotes disturbances calculated using a GDP-weighted average of the residuals from the individual country estimates. (Following Table 1, when constructing the weights, GDP was expressed in dollars using purchasing power parity exchange rates.) Again, SD denotes the standard deviation of the aggregate, SD* is the standard deviation of individual-country disturbances relative to that aggregate.

Consider first the supply shocks. There is at most a slight rise in their average magnitude following the shift from fixed to flexible rates. In contrast, there is a pronounced increase -- by a fraction on the order of one half -- in the dispersion of supply shocks around the aggregate with the shift from fixed to flexible rates. SD* rises from 0.010 to 0.015 when G-7 is used, and from 0.009 to 0.013 when G-7' is substituted. There is some evidence, then, that while supply shocks have become no larger following the shift from

Figure 3


G7 1953-70: Output Responses
0.02
0.015
0.01
0.005
0
-0.005
Supply
Demand
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28

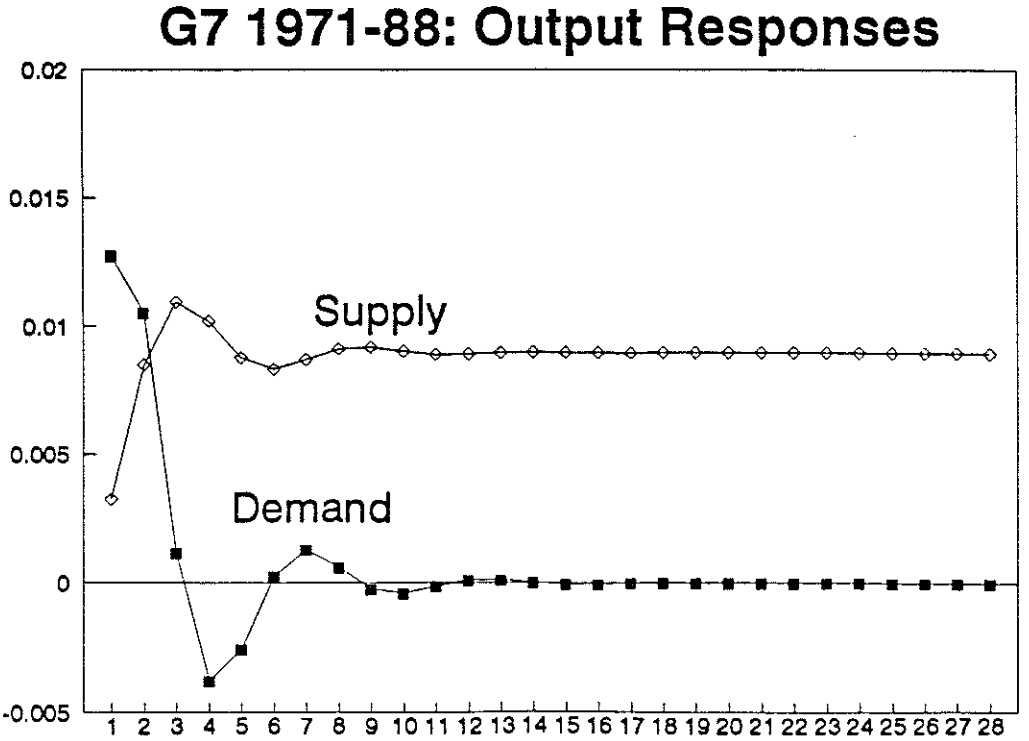
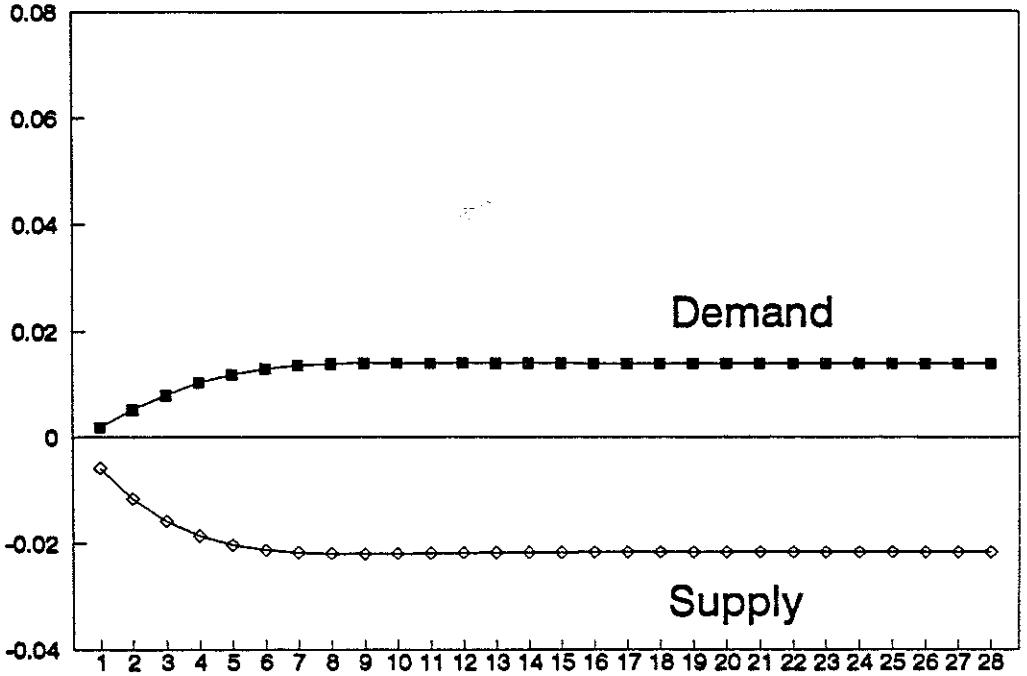

G7 1971-88: Output Responses
0.02
0.015
0.01
0.005
0
-0.005
Supply
Demand
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28

Figure 4

G7 1953-70: Price Responses



G7 1971-88: Price Responses

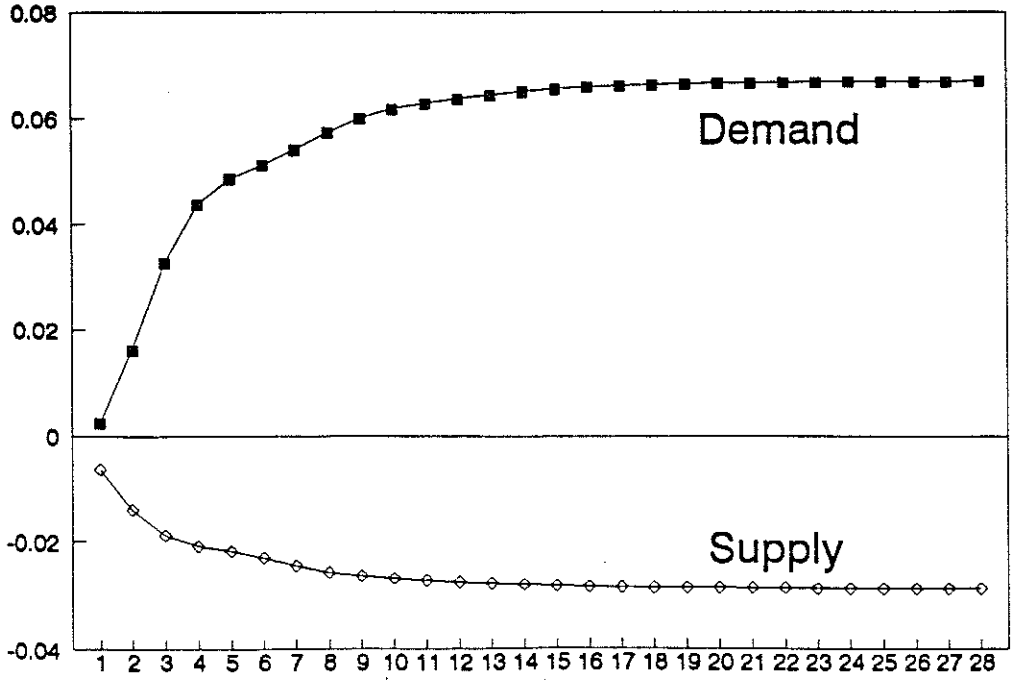


Table 2
UNDERLYING DISTURBANCES

	1955-70	1955-62	1963-70	1973-88	1973-80	1981-88
DEMAND						
G7 SD	.012	.013	.007	.014	.013	.013
SD*	.013	.014	.012	.015	.015	.014
G7' SD	.008	.008	.006	.011	.013	.007
SD*	.012	.013	.012	.013	.014	.013
United States	.016	.016	.011	.018	.020	.016
Japan	.016	.018	.013	.016	.018	.015
Germany	.018	.013	.023	.015	.013	.017
France	.019	.021	.016	.011	.008	.014
United Kingdom	.010	.010	.008	.021	.026	.015
Italy	.008	.007	.008	.028	.031	.012
Canada	.025	.026	.024	.021	.020	.020
Average	.016	.016	.014	.018	.020	.016
Percent Explained By First Principal Component	41(2)	44(1)	39(3)	31(3)	49(1)	53(3)
SUPPLY						
G7 SD	.006	.006	.007	.007	.008	.007
SD*	.010	.010	.011	.015	.015	.014
G7' SD	.006	.005	.006	.007	.009	.005
SD*	.009	.009	.010	.013	.013	.013
United States	.009	.009	.010	.013	.010	.015
Japan	.018	.016	.021	.016	.020	.008
Germany	.012	.013	.009	.010	.010	.010
France	.011	.013	.011	.011	.015	.005
United Kingdom	.011	.010	.011	.030	.027	.030
Italy	.013	.012	.016	.021	.023	.017
Canada	.005	.005	.006	.021	.022	.021
Average	.012	.011	.013	.016	.016	.015
Percent Explained By First Principal Component	24(2)	36(3)	30(2)	36(1)	44(2)	51(1)

Notes: G7 numbers derived from G7 data. G7' numbers derived from a weighted average of individual country data.
SD = standard deviation of series.
SD* = weighted standard deviation of variation around series.

fixed to floating rates, they have become more diverse.

The estimates for demand shocks suggest a modest increase in both average magnitude and dispersion whichever measure of the aggregate is used. In contrast to the results for supply shocks, where the evidence of increased dispersion is stronger than that of increased magnitude, for demand shocks the opposite is the case.

The two methods of constructing the G-7 aggregate make more of a difference when the magnitude of shocks in various subperiods is considered. For supply shocks the weighted average of individual shocks (G-7') shows a large rise in aggregate variance in 1973-80. Aggregate variance then falls back to Bretton Woods levels during the 1980s. In comparison, disturbances derived from the G-7 aggregate show a smaller rise in average magnitude. Neither measure of the aggregate indicates much of a change in the cross-country dispersion of supply disturbances between the first and second Bretton Woods subperiods or between the first and second halves of the floating-rate regime. Our other measure of dispersion, the share of the variance explained by the first principal component, indicates little cohesion in supply disturbances under Bretton Woods. The percentage of the variance explained by the first principal component is small and two or more of the factor loadings are negative. For the floating regime, the percentage of the variance explained rises and the number of negative loadings falls.

Turning to demand disturbances, both measures of the aggregate suggest a fall in the magnitude of demand disturbances between the first and second halves of Bretton Woods. In contrast, whereas the aggregate index suggests no change in the average magnitude of demand disturbances between the first and

second halves of the floating period, the weighted average (G-7') suggests that their average size fell by nearly a half between 1973-80 and 1981-88. Neither measure indicates a noticeable rise in cross-country dispersion in demand disturbances between the first and second Bretton Woods subperiods or between the first and second halves of floating. The first principal component basically confirms this result.

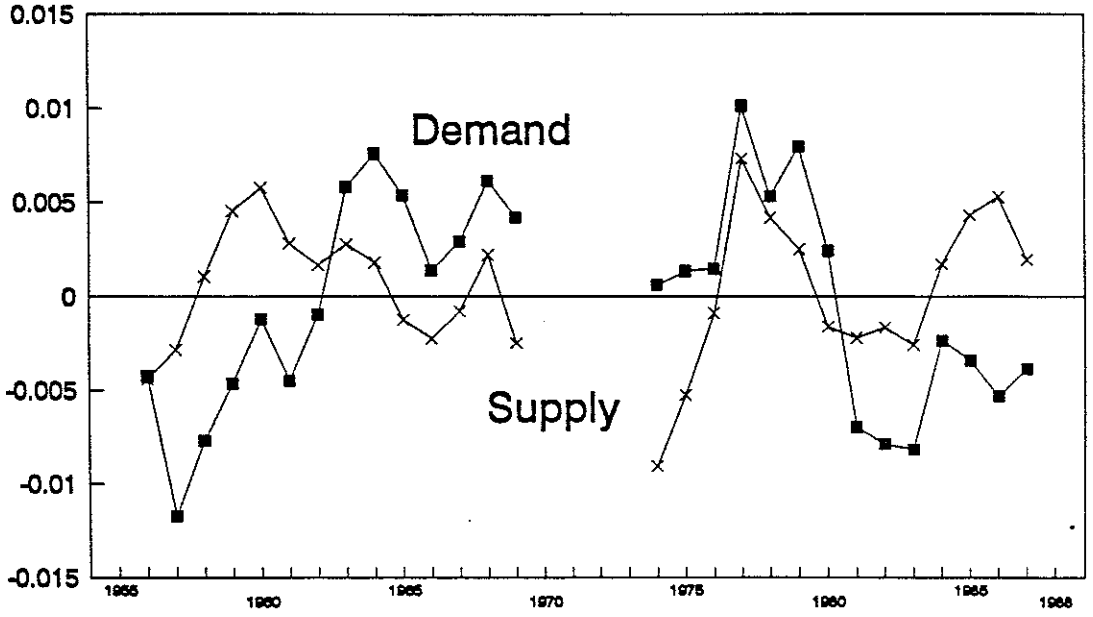
Individual time series observations are useful for interpreting these trends. Figure 5 plots three-year moving averages of the underlying supply and demand disturbances for the G-7 (top panel), along with the standard deviation of the individual-country supply and demand disturbances around these values (bottom panel), using the GDP-weighted average of the shocks to individual countries. The break after 1969 reflects the fact that the VARs estimated separately for the (non-overlapping) Bretton Woods and post-Bretton Woods periods utilized two lagged values of each variable. The figure paints a picture of increasing demand pressure as the Bretton Woods period progressed, matched by a decline in positive supply shocks. This shift from a predominance of positive supply shocks to a predominance of positive demand shocks may be relevant to the issue of why Bretton Woods collapsed, to which we return below.

The pattern traced out by supply and demand shocks since 1973 is readily interpreted in terms of historical events. Negative supply shocks are evident in 1974-5, coincident with the first OPEC oil price increase. This is followed by a sequence of positive supply shocks as oil prices decline back toward pre-OPEC levels, and then by another series of negative supply shocks following the second OPEC price hike in 1979. The time profile of demand

Figure 5

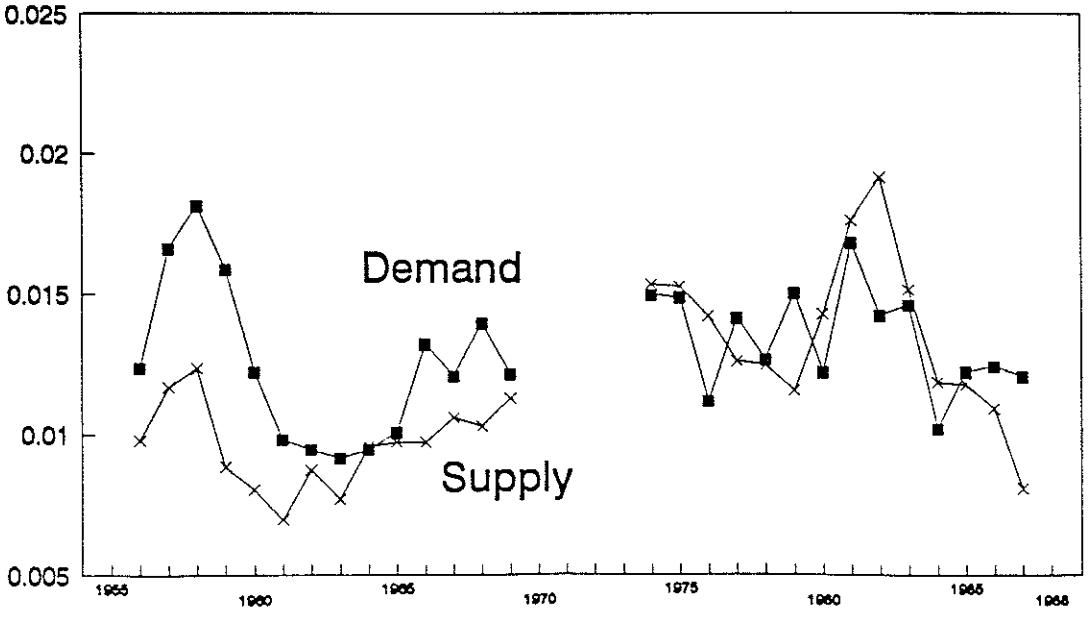
G7 Demand and Supply

3 Year MA



G7 Standard Deviations

3 Year MA



shocks in Figure 5 resembles the time profile of inflation in Figure 2. In other words, the positive demand shocks of the mid-1970s reflect the G-7 countries' attempt to finance rather than adjust to OPEC-I and to the commodity price boom. Demand disturbances then turn negative at the beginning of the 1980s, reflecting the shift to anti-inflationary policies in the U.S., the U.K., and other countries.

The dispersion of individual-country supply and demand disturbances around disturbances to the aggregate is shown in the bottom panel. The dispersion of both supply and demand disturbances falls to low levels during the first half of the 1960s, a period that might be called "the heyday of Bretton Woods." The dispersion of both series then rises in the second half of the 'sixties, though not to historically unprecedented heights. Again, these trends may be relevant to the question of what prompted the collapse of Bretton Woods, a subject to which we return. Under the post-1971 float, the only obvious movement in the dispersion of supply and demand disturbances is their temporary increase at the beginning of the 1980s. The increased dispersion of demand disturbances can be accounted for by differences across countries in the timing of anti-inflationary initiatives, with countries like France lagging behind the U.K. and the U.S. Also striking is the concurrent rise and fall in the cross-country dispersion of supply disturbances. This plausibly reflects differences across countries in the adoption of investment-promoting policies, such as the U.S. Congress' passage of accelerated depreciation provisions and the reduction of marginal tax rates on individual incomes.[12]

To recapitulate, then, while there is some indication of an increase in

the average magnitude of supply shocks between 1973 and 1980 when we construct the G-7 aggregate using GDP weights and purchasing power parity exchange rates, in other respects (and using alternative measures) the magnitude of supply shocks is essentially unchanged. The same measure of the aggregate also suggests an increase in the average magnitude of demand shocks in 1973-80, but otherwise the picture is one of intertemporal stability. Perhaps the most important difference across periods is the increase in the dispersion of individual-country aggregate supply disturbances following the shift from fixed to floating rates. In contrast, there is little difference in the dispersion of demand disturbances across subperiods. Overall, then, except for the possibility that increases in the dispersion of aggregate supply disturbances are responsible, it appears that the changes in the overall behavior of growth and inflation evident in Figure 2 are unlikely to flow exclusively from changes in the underlying aggregate supply and demand disturbances. The other principal factor that contributed, we will now suggest, was changes in the nature of the adjustment mechanism.

V. The Adjustment Mechanism

Figures 3 and 4 suggest that both aggregate supply and aggregate demand shocks produced larger price movements in comparison to output movements under flexible exchange rates. In the case of supply disturbances, the size of the output response falls, while for demand disturbances the price response rises. (To facilitate comparison, the figures for successive periods have been drawn to the same vertical scale.) Identically distributed supply shocks would produce this result--larger price responses and smaller output responses--if

the aggregate demand curve was steeper under flexible than under fixed rates. In this section we first present evidence to this effect and then explain why this shift in the slope of the AD curve occurred.

Our impulse-response functions can be used to plot the aggregate demand and short-run aggregate supply curves in price-output space. For the AD curve, this simply the path traced out by prices and output in response to a supply shock. For the SRAS curve, it is the line segment marked off by the initial equilibrium on one end and by the level of output and prices that prevails in the first period following a demand shock on the other end. (This is the impact effect of a shift in aggregate demand, which induces a movement up or down the SRAS curve.) The rest of the adjustment to a demand shock can be thought of as a movement along the AD curve. In response to a positive shock, we should expect to see a subsequent movement up the AD curve, with prices rising and demand falling; this can be thought of as another illustration of our "over-identifying restriction."

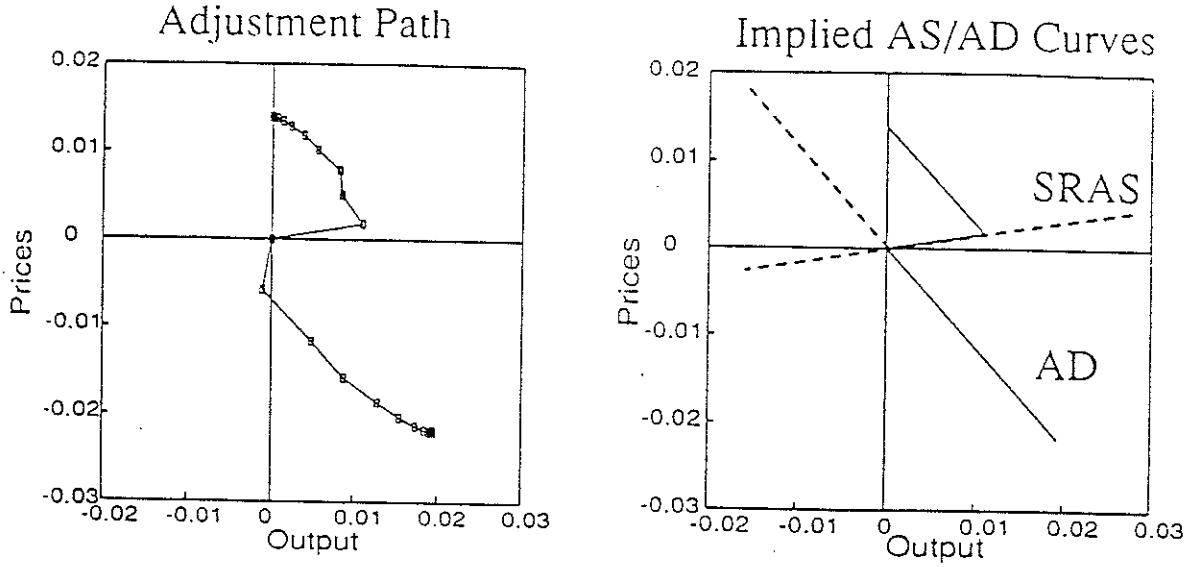
These plots are shown in Figure 6 for the OECD aggregate. Consider first the impulse response functions for the Bretton Woods period, displayed in the upper half of the figure. The response to a positive demand shock appears in the upper-right quadrant of the diagram on the left-hand side. In the first period, both output and prices rise, although the output response is large relative to the price response. This suggests a relatively flat SRAS curve. In all subsequent periods, output falls while prices continue to rise. Here the output responses are slightly smaller than the price responses. This suggests an AD curve slightly steeper in absolute value than a 45 degree line. The response to a positive supply shock (which should also trace out the AD

Figure 6

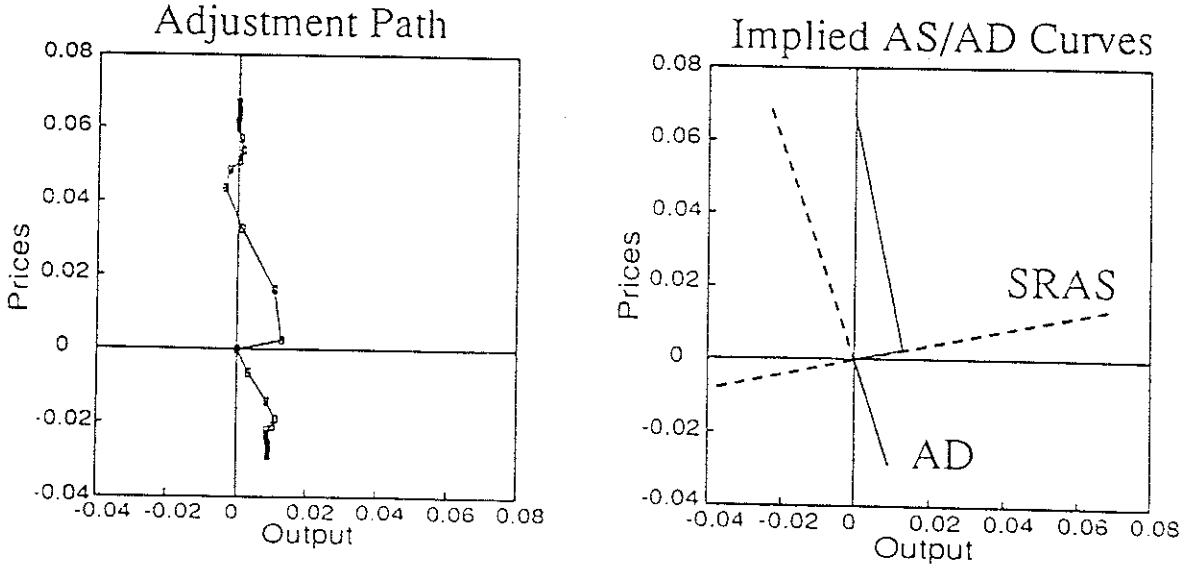
Chart. Adjustment Path and Curves

Post-World War 2

1955-1970



1971-1988



curve) appears in the lower-right-hand quadrant of the same diagram. Following a first period in which there is no output response, output rises and prices fall in response to the positive supply shock. The response of prices is slightly larger than the response of output, again suggesting an AD curve slightly steeper than a 45 degree line.

Stylized versions of these SRAS and AD curves are shown on the right-hand side of the upper row. The two parallel AD curves reflect the fact that we traced out the demand curve both by shifting the supply curve (in the lower-right hand quadrant of the first diagram) and without a supply shift (in the upper-right hand quadrant).

The bottom half of Figure 6 displays analogous results for the post-Bretton Woods float. Although the slope of the SRAS curve is essentially the same, the AD curve is *steeper* than during the Bretton Woods period of fixed rates. This result emerges whether one compares the movement up the demand curve following the impact effect of a supply shock (the negatively-sloped segment in the upper right-hand quadrant of the two diagrams) or the movement along the AD curve in response to a positive supply shock (the negatively-sloped segment in the lower right-hand quadrant of the two diagrams).

Figure 6 can also tell us something about the speed of adjustment to disturbances. Recall that the negatively-sloping part of the curve in the upper right-hand quadrant traces out the aggregate demand curve as the aggregate supply curve rotates from its relatively flat short-run slope to its vertical long-run position. Hence the speed of adjustment of the aggregate supply curve can be inferred from the rate at which the upper right segment of the curve returns to the initial level of output. Similarly, the speed of

movement along the AD curve defined in the lower right-hand quadrant of the diagram also represents the rotation of the AS curve. Neither period appears to have significantly faster adjustment than the other, although there is some evidence that output may have responded faster and prices slower during the floating exchange rate period.

Why should the Bretton Woods period be characterized by a flatter AD curve? The explanation, we suspect, lies in the monetary policy intervention rules used to stabilize exchange rates under Bretton Woods. Consider the following simple model of the economy, based on the AD/AS framework.

$$y = -a(i-\Delta p) + G \qquad (5.1) \quad \text{Product Demand (IS)}$$

$$m - p = y - bi \qquad (5.2) \quad \text{Money Demand (LM)}$$

$$y - Y = d(p-w) \qquad (5.3) \quad \text{Aggregate Supply (AS)}$$

These three equations represent the IS, LM and AS relationships. Demand depends upon the real interest rate $(i-\Delta p)$ and a shift parameter G. Money demand depends upon prices, output, and nominal interest rates in the standard manner; for simplicity we assume the output elasticity is unity. Finally, the level of output relative to potential (Y) depends negatively upon the real wage. (All variables except the interest rate are measured in logarithms).

The model is completed by three additional equations:

$$w = p_{-1} \qquad (5.4) \quad \text{Wage Adjustment}$$

$$e = p - p^* \qquad (5.5) \quad \text{Exchange Rate}$$

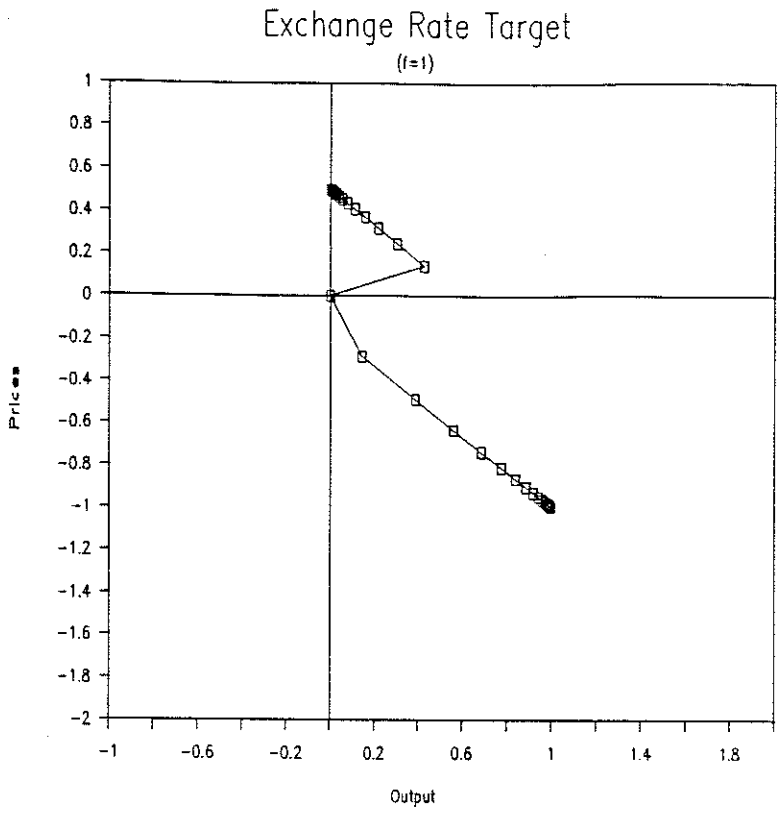
$$m = f(\hat{e} - e) \qquad (5.6) \quad \text{Monetary Intervention Rule}$$

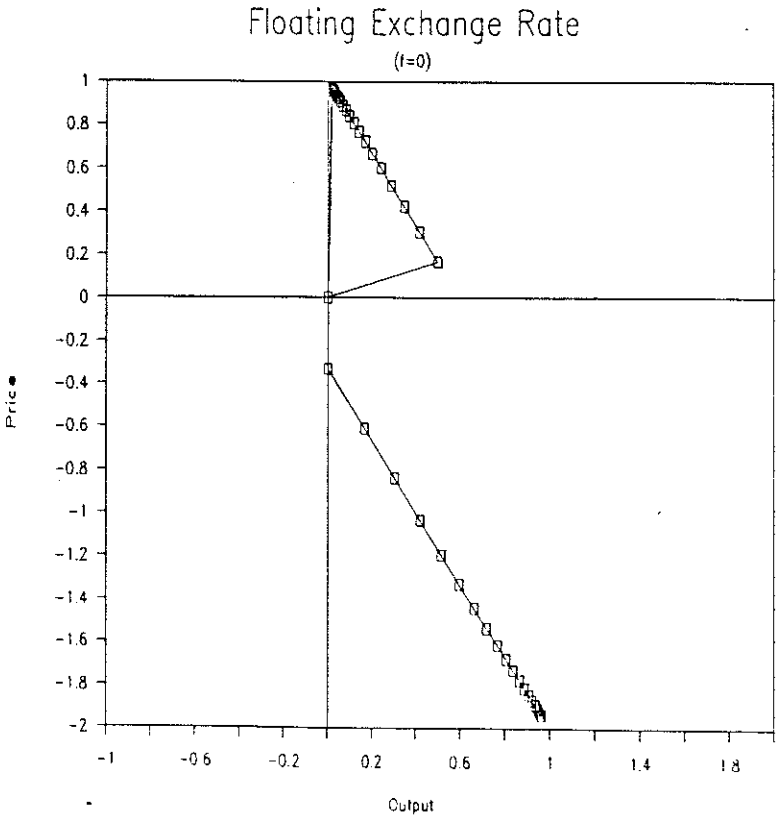
Equation (5.4) represents the assumption that wages are sticky. When combined with the aggregate supply relationship it defines the SRAS curve ($y-Y = dp$) and provides a Phillips curve relationship which defines the price dynamics of the model ($y-Y = g\dot{p}$). Equations (5.5) and (5.6) define the exchange rate and monetary policy. The exchange rate e depends on the ratio of domestic to foreign prices ($p-p^*$), while the intervention rule depends upon the deviation of $\hat{e}$, the target level of the exchange rate, from its actual level, defined as the domestic-currency price of a unit of foreign currency. Thus, if e rises (depreciates) relative to its target level, the authorities reduce the money supply. The vigor of the response (f) is an increasing function of the fixity of the exchange rate.

Paths for output and prices for one set of "reasonable" parameter values are shown in Figure 7.[13] The top panel shows the results when f=1, which represents an exchange rate targeting regime, while the bottom panel shows the results for a f=0, a floating exchange rate regime. The results generally accord with those shown in Figure 6. The floating exchange rate period has a steeper AD curve (it is easy to show that the slope of the AD curve is given by $-(a+b)/a(1+f)$ and hence that as f rises the AD curve becomes flatter for all parameter values). In addition, there is no clear difference in the speed of adjustment between the two exchange rate regimes. Finally, the path for the AD curve in the bottom right hand quadrant is slightly curved due to the fact that the IS curve depends upon real interest rates, a phenomenon which can be seen in the Bretton Woods period, although it does not show up under floating rates.

Thus, as f grows large, the AD curve becomes increasingly flat. There

Figure 7


Exchange Rate Target
(f=1)
Price
Output
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1.2
-1.4
-1.6
-1.8
-2
-1
-0.6
-0.2
0.2
0.6
1
1.4
1.8


Floating Exchange Rate
(f=0)
Price
Output
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1.2
-1.4
-1.6
-1.8
-2
-1
-0.6
-0.2
0.2
0.6
1
1.4
1.8

is little price response to an aggregate demand shock because the authorities intervene to stabilize the exchange rate and hence the price level. They increase the money supply in response to a positive supply shock which would lead otherwise to a fall in prices and an exchange rate appreciation; they reduce the money supply in response to a positive demand shock which would otherwise lead to price increases and exchange rate depreciation.

We can think of two independent checks on this interpretation. First, since monetary-policy reactions affect output in the opposite direction from autonomous demand shocks (as can be seen in Figure 7), the output response to demand shocks should be smaller under fixed than flexible rates. Although difficult to discern due to the differences in scales between the panels of Table 6, this is indeed the case.[14]

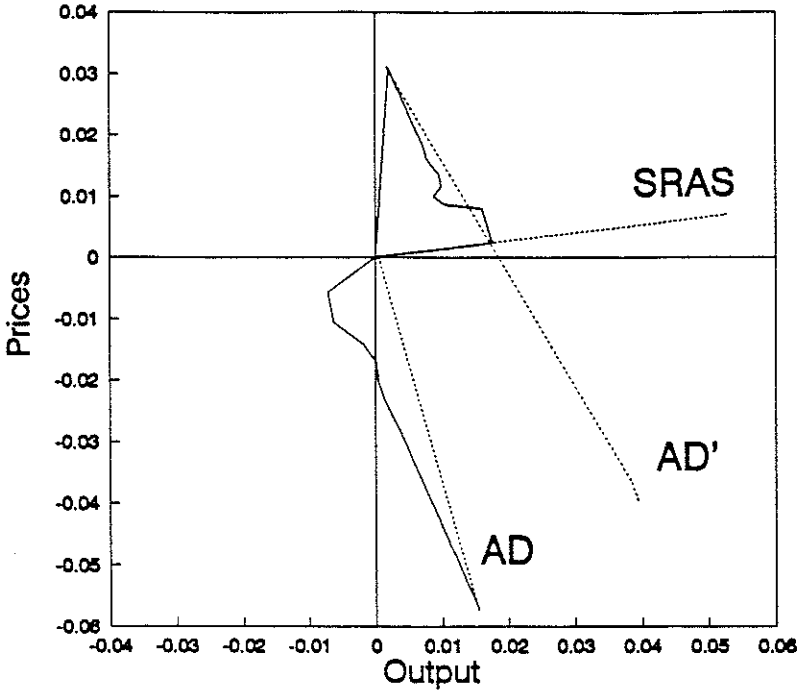
Second, one country in our sample, Canada, maintained a floating exchange rate for a good part of the first period as well as the second.[15] Since Canadian officials were not compelled to intervene to peg the nominal rate for much of the floating period, there should be little evidence of a shift in the slope of the Canadian aggregate demand curve. The Canadian responses, plotted in price-output space in Figure 8, show little evidence of a steeping of the AD curve in the second period. Nor does it appear that the output response to demand shocks was smaller in the first than the second period. For comparison, we also show the impulse responses for the U.S. and the U.K. (Figures 9 and 10), where in contrast to Canada both a steepening of the AD curve and a reduction in the magnitude of the output response to demand shocks are evident in the second period.[16]

To recapitulate, our results suggest that the increased cross-country

Figure 8

Canada Aggregate Demand and Supply

1955-70



1973-88

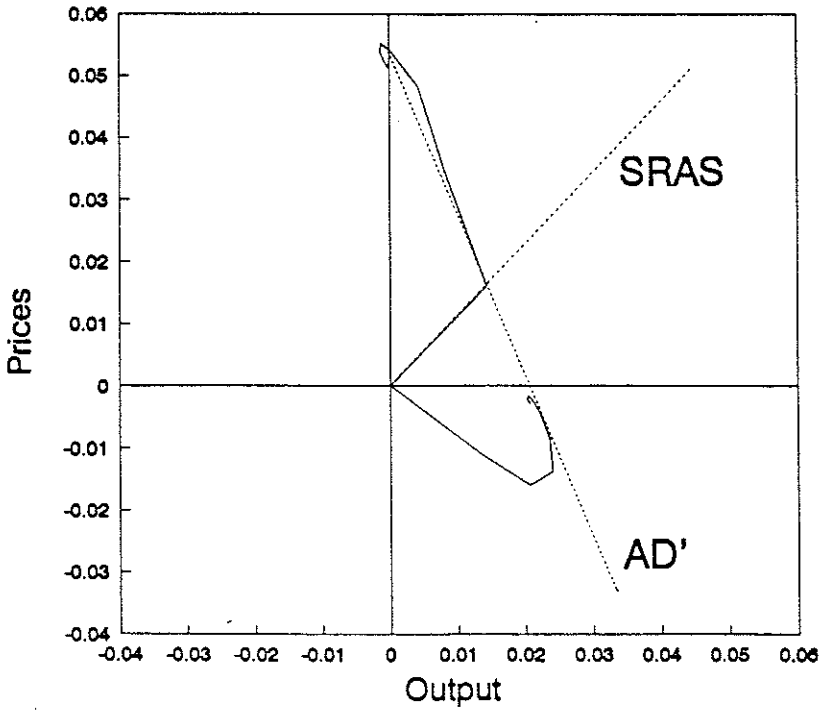
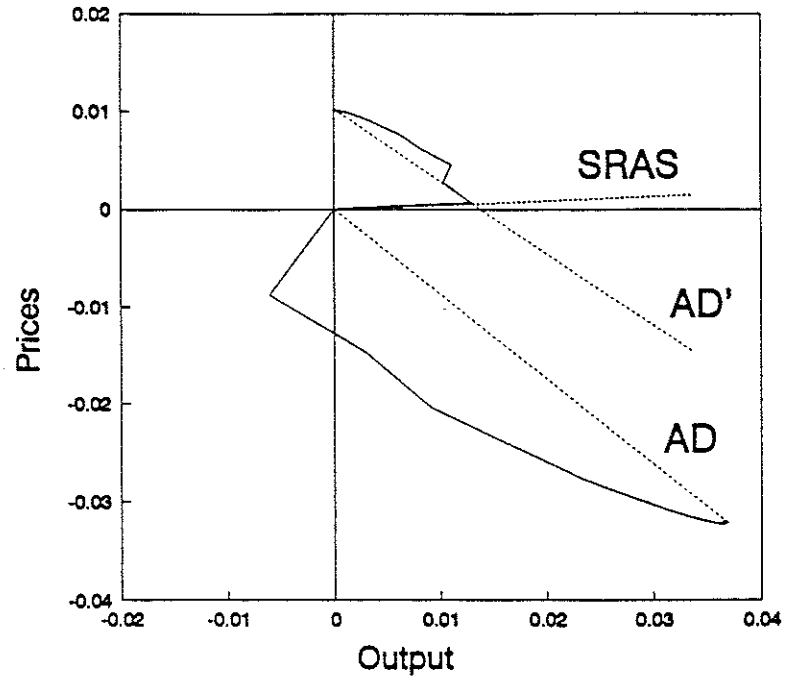


Figure 9
US Aggregate Demand and Supply

1955-70



1973-88

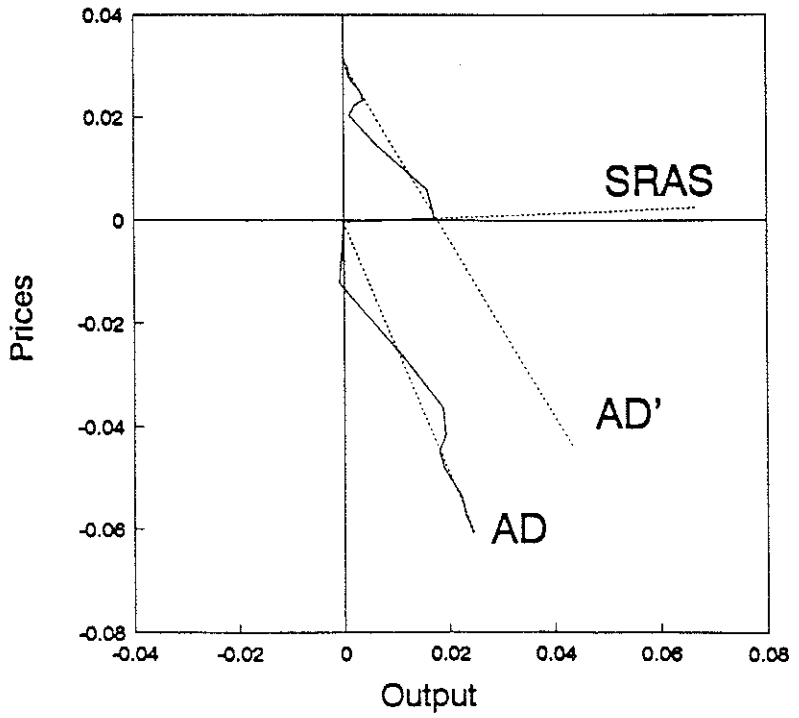
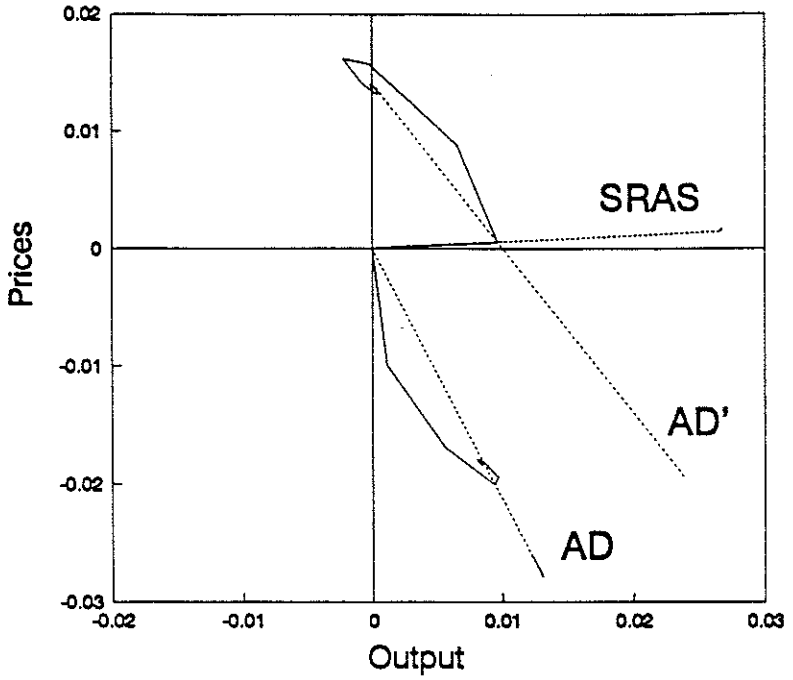


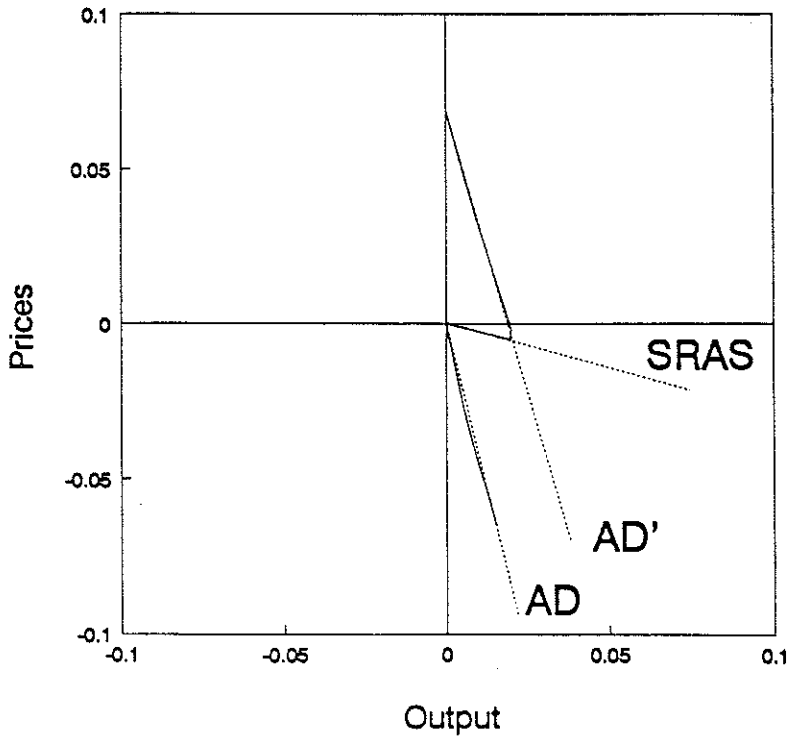
Figure 10

UK Aggregate Demand and Supply

1955-70



1973-88



dispersion of price variability relative to output variability following the shift from fixed to flexible rates (noted in the discussion of Table 1) reflects not merely changes in the cross-country dispersion of supply shocks but the different opportunities for demand-side intervention to stabilize output (at the expense of destabilizing prices) afforded by the shift from fixed to floating rates. Under fixed rates, countries experienced different shocks but were constrained in the policies that might be pursued to offset them. Under flexible rates, in contrast, they had the freedom to use policy to stabilize domestic output relative to that of other countries, but at the expense of different rates of inflation that reflected the nature of local disturbances.[17] To the extent that supply shocks also grew more diverse in 1973-80, we would expect to see even greater dispersion across countries of price performance following the shift from fixed to floating rates, and some attenuation of the reduction in output dispersion.

VI. Explaining the Shift from Fixed to Floating Rates

With these results in hand, it is logical to ask whether they can help one understand the collapse of the Bretton Woods System. The shift from fixed to flexible exchange rates occurred under duress. Governments may have found the maintenance of fixed rates increasingly difficult due to an increase in the 1960s in the magnitude of country-specific supply shocks which destabilized output and increased the cost of stabilizing prices and exchange rates. Alternatively, the collapse of the Bretton Woods parities may have been due to an increase in the magnitude of country-specific aggregate demand shocks that created inflation and pressure for exchange rate depreciation.

Some of our conclusions were foreshadowed above. Figure 5 indicates a slight rise in the average magnitude of positive aggregate demand disturbances in the second half of the Bretton Woods period, matched by a modest decline in the average magnitude of positive aggregate supply disturbances. However, there is no dramatic increase in the average size of supply and demand shocks or of a widening gap between concurrent supply and demand shocks at the end of the 1960s.[18] Insofar as all that happened in the 1960s was that G-7 countries as a whole experienced accelerating inflation (see Figure 1), it is not clear why this should have increased the difficulty of maintaining fixed exchange rates between them.[19] One possibility is that inflation increased the rate of growth of global monetary claims relative to international reserves of gold and dollars, thereby exacerbating the difficulty for countries like the U.S. of maintaining the convertibility of domestic currency into gold and heightening the fragility of the system.[20]

The bottom panel of Figure 5 indicates a modest rise in the dispersion of aggregate supply disturbances across countries, and a more noticeable increase the international dispersion of aggregate demand disturbances after 1965. It could be that differences in supply shocks across countries and the different demand responses they elicited destabilized the fixed-rate system. At the same time, the increase in the cross-country dispersion of shocks is relatively modest, and that dispersion -- especially for demand shocks -- remains low compared to that of the 1950s. This may indicate the importance of capital controls in the period of Bretton Woods current-account inconvertibility that ended in 1958.[21] In other words, current account inconvertibility could have helped to reconcile different demand management

policies across countries with the maintenance of stable exchange rates between them before 1958 but not after.

If demand-management policies became increasingly constrained in the second half of the Bretton Woods period, we would expect to see an increase in the correlation of demand and supply shocks over the estimation period.[22] Governments would be forced to respond to a negative supply shock which raised prices and weakened the exchange rate, for example, by reducing demand (lowering prices and strengthening the exchange rate). In fact, as Table 3 shows, there is precisely such an increase in the correlation of demand and supply disturbances in the second Bretton Woods subperiod. Evidence of the increase is more striking when we aggregate the individual country disturbances (in the line labelled G-7') than when we analyze the behavior of the G-7 aggregate (in the line labelled G-7), but it is apparent in both measures. An increase in the correlation is evident for all countries but Germany, the U.K., and Italy. For Italy the correlation is essentially unchanged. Germany moves from a position of current account weakness in the early 1950s to one of strength in the 1960s; it is not surprising, therefore, that the German government was less constrained in its demand-management policies in the second subperiod. For the U.K. the 1960s was far from a period of external strength, but it could be that the decline in the correlation of demand and supply disturbances (perhaps reflecting stop-go policies) was itself responsible for Britain's recurrent balance-of-payments problems.[23]

Finally, a series of negative aggregate supply and/or positive demand disturbances in the United States could have undermined confidence in the

Table 3
CORRELATION OF AGGREGATE SUPPLY AND AGGREGATE DEMAND DISTURBANCES

	1955-62	1963-70	1973-80	1981-88
G7	-.22	.17	-.13	.28
United States	-.23	.43	.78	-.43
Japan	-.31	.11	.09	-.38
Germany	.29	-.33	.67	-.56
France	-.30	.54	.28	-.63
United Kingdom	.38	-.32	.40	-.34
Italy	.05	.03	-.10	-.77
Canada	-.30	.42	-.53	.49
G7'	.12	.74	.80	.11

Source: see text.

dollar, and doubts about America's commitment to the dollar's Bretton Woods parity could brought down the system. This interpretation finds relatively little support in the data, however. Figure 11 shows the aggregate demand and 'aggregate supply disturbances for the United States. (In contrast to previous figures, these are the annual estimates rather than three-year moving averages.) Except for the positive demand disturbance in 1969, plausibly associated with the Vietnam War, there is little evidence supportive of this hypothesis.

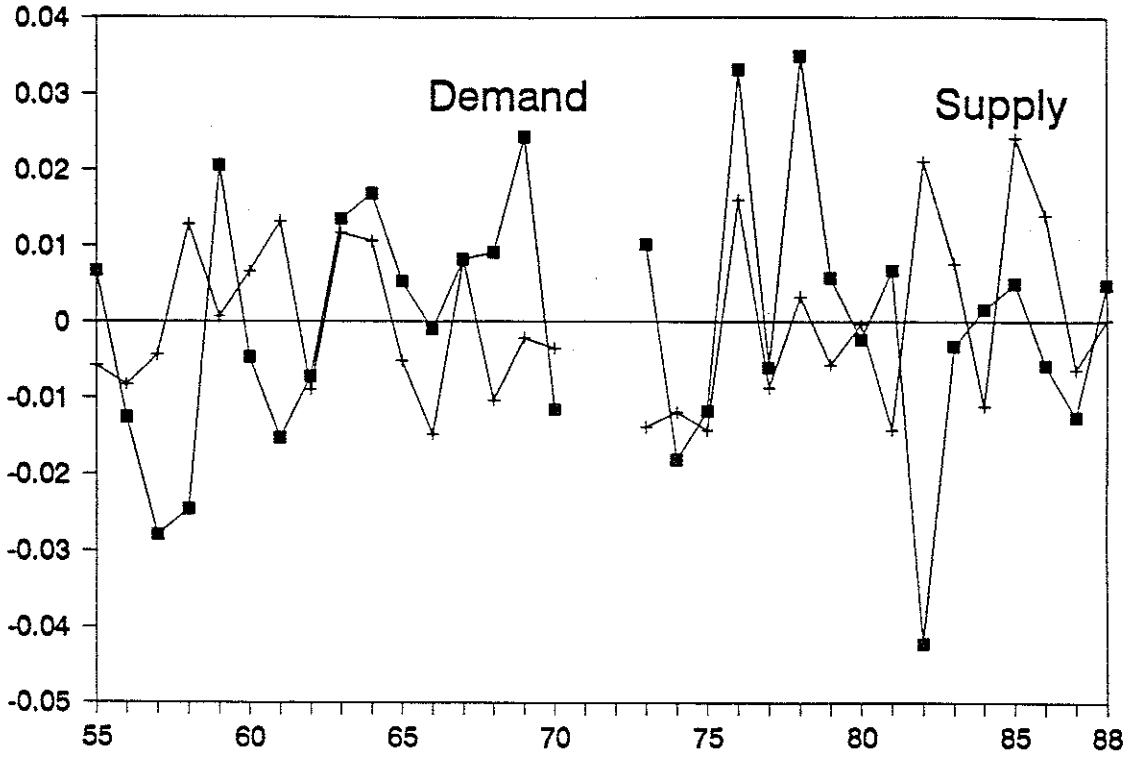
Our analysis suggests, then, that the collapse of the Bretton Woods System reflected a combination of factors.[24] Accelerating inflation increased the value of monetary liabilities relative to global gold reserves. This reflected an increase in (positive) aggregate demand disturbances relative to (positive) aggregate supply disturbances between the 1950s and 1960s. Supply and demand shocks also grew more diverse across countries, and more correlated with one another as if the impact of supply shocks on the exchange rate grew due to the removal of capital controls. Even if none of these effects is sufficient by itself to account for the collapse of the Bretton Woods System, together they would appear to provide a coherent explanation for the downfall of the pegged exchange rate regime.

VII. Conclusion

This paper has demonstrated how the use of time-series methods to estimate and analyze a simple aggregate-supply-aggregate-demand model can shed light on the comparative performance of fixed- and flexible exchange rate systems and winnow hypotheses offered to explain shifts between exchange-rate

Figure 11

US Supply and Demand DIsturbances



regimes. The empirical analysis here has compared the Bretton Woods System of pegged exchange rates with the post-Bretton Woods float.[25] It provides, we have argued, a coherent explanation of the causes and consequences of the post-1971 shift from fixed to floating rates. The shift from fixed to floating, we found, was associated with a modest increase in the cross-country dispersion of supply shocks but not with an increase in their average magnitude. In contrast, there was little change in either the cross-country dispersion or the average magnitude of demand shocks. More important in explaining the collapse of Bretton Woods were factors (including the removal of controls on current-account convertibility in 1958 and perhaps the declining effectiveness of controls on capital account transactions) that heightened the impact of shocks on the external accounts, forcing governments to respond to supply shocks with changes in demand that stabilized prices and the exchange rate at the expense of increased output volatility.

The noticeably greater volatility of prices and arguably lesser volatility of output during the subsequent period of floating (evident in the top panel of Figure 1) seem unlikely to reflect, therefore, mainly differences in the underlying disturbances. Rather, it is a reflection of the incentives and constraints imposed by fixed and flexible rates. Under fixed rates, monetary policy had to be adjusted to stabilize the exchange rate, flattening the aggregate demand curve and thereby increasing the output response and reducing the price response to supply shocks. When a combination of factors, including but not limited to an increase in the dispersion of supply shocks, occasioned the shift from fixed to floating rates, monetary policy was freed, steepening the aggregate demand curve, and -- other things equal -- increasing

the volatility of prices relative to output.

Endnotes

1. See Mussa (1986), Bordo (1992) and Eichengreen (1992a) for additional examples of this approach.

2. In a series of companion papers, we have examined similar evidence for a wider sample of countries. See Bayoumi and Eichengreen (1992a, b, c).

3. The conventional normalization is that the two variances are set equal to unity, which together with the assumption of orthogonality implies $C'C = \Sigma$, where Σ is the variance covariance matrix of e_y and e_p. However, when we wish to calculate the variance of the shocks themselves, we report results using the normalization $C'C = \Gamma$, where Γ is the correlation matrix of e_y and e_p. These two normalizations gave almost identical paths for the shocks, except for a scaling factor, and hence are used interchangeably.

4. This is where our analysis, based on the work of Blanchard and Quah (1989), differs from other VAR models. The usual decomposition assumes that the variables in the VAR can be ordered such that all the effects which could be attributed to (say) either a_t or b_t are attributed to whichever comes first in the ordering. This is achieved by a Choleski decomposition.

5. Note from equation (2.4) that the long run impact of the shocks on output and prices is equal to $(I-B(1))^{-1}$. The restriction that the long run effect of demand shocks on output is zero implies a simple linear restriction on the coefficients of this matrix.

6. This result differs from one reported by Bordo (1992). By his calculations, the cross-country dispersion of output growth rates rose rather than falling between the Bretton Woods and post-Bretton Woods periods. The explanation for the contrast appears to lie not in the different data sources or country samples used in the two calculations but in the summary statistic used to measure dispersion. Where we calculate dispersion of individual country observations around a G-7 aggregate in each year and then take a simple average of annual standard deviations, Bordo computes the absolute differences between each country's summary statistic and the grand means of he group of countries.

7. Negative factor loadings indicate the degree to which the underlying series are moving in different directions.

8. On postwar catch-up and convergence and their implications for output movements, see Abramovitz (1991) and Barro and Sala-i-Martin (1991).

9. Eichengreen (1992a) further confirms that this result is not altered when other countries like Australia are added to the sample.

10. Removing trends is necessary for sample statistics like standard deviations to be meaningfully compared.

11. For further discussion, see Baxter and Stockman (1989).

12. For details on these policy initiatives and an attempt to measure empirically their impact on aggregate supply and aggregate demand, see Eichengreen and Goulder (1989).

13. The values were a=.25, b=.25, and d=3.

14. It is also noteworthy that the long-run output effect of a supply shock is actually smaller in the floating rate period than under Bretton Woods. This is further evidence that on average supply disturbances were no larger in the floating rate period than in the Bretton Woods years.

15. For details, see Johnson (1962).

16. The impulse responses for the other countries are more difficult to characterize. The model works relatively well in the first period for all countries. (For Germany and Italy, the economy appears to spiral in to the new long-run equilibrium, while for the other countries convergence is direct. Bill Branson has suggested to us that this spiraling may reflect the importance of inventories. Rather than being on the short-run supply curve at every point in time, demand may exceed supply following a positive AD shock due to price inertia, leading to inventory deaccumulation until price adjustment takes place and inventories are rebuilt.) For Japan there is evidence of instability in the aggregate demand curve in the Bretton Woods period. In all cases, however, the AD curve is flat in the first period and steepens in the second. In these three cases, however, the impulse responses are more difficult to interpret in the second period. In particular, the response to a supply shock traces out an aggregate demand curve which is downward sloping in the short run but upward sloping in the long run. This kind of response would be evident if governments responded to negative supply shocks after 1973 by also reducing aggregate demand.

17. This result is consistent with the evidence presented in Eichengreen (1992a) that policy was responsible for the decline in the cross-country dispersion of output movements following the transition from fixed to floating rates.

18. Readers predisposed to see an increase in the average magnitude of estimated demand disturbances may however find some modest support for their position. Recall that the time-series plots for the Bretton Woods subperiod end in 1969 because the figure depicts three-year moving averages and the data end in 1970.

19. While the top panel of Figure 5 indicates a rise in the average inflation rate in the second Bretton Woods subperiod, the bottom panel shows that the cross-country dispersion of inflation rates (as measured by the standard deviation) falls at the same time.

20. This relates to the debate over the possible inadequacy of international reserves in the 1960s and the Triffin Dilemma (the fact that the only way of significantly augmenting reserves was by acquiring U.S. dollars, to the point where U.S. monetary liabilities to foreigners came to exceed U.S. gold reserves). For further discussion, see Garber (1992) and Genberg and Swoboda (1992).

21. For details on the importance of capital controls under Bretton Woods and the distinction between the periods of current account inconvertibility and convertibility, see Bordo (1992).

22. Since one of our identifying restrictions was that demand and supply responses are orthogonal over the entire estimation period, we are only able to compare behavior within estimation periods, not between them.

23. On stop-go in general and the 1967 devaluation of sterling in particular, see Cairncross and Eichengreen (1983).

24. This is the interpretation offered previously by one of the present authors (Eichengreen, 1992b).

25. A companion paper extends the analysis to the classical gold standard and the interwar period.

References

Abramovitz, Moses (1991), Thinking About Growth, Cambridge: Cambridge University Press.

Baxter, Marianne and Alan Stockman (1989), "Business Cycles and the Exchange Rate Regime: Some International Evidence," Journal of Monetary Economics 23, pp.377-400.

Barro, Robert and Xavier Sala-i-Martin (1991), "Convergence Across States and Regions," Brookings Papers on Economic Activity, pp.107-158.

Bayoumi, Tamim and Barry Eichengreen (1992a), "Shocking Aspects of European Monetary Unification," in Francisco Torres and Francesco Giavazzi (eds), The Transition to Economic and Monetary Union in Europe, Cambridge: Cambridge University Press (forthcoming).

Bayoumi, Tamim and Barry Eichengreen (1992b), "Is There a Conflict Between EC Enlargement and European Monetary Unification?" Greek Economic Review (forthcoming).

Bayoumi, Tamim and Barry Eichengreen (1992c), "Exchange Rate and Monetary Arrangements for NAFTA" paper presented to the Interamerican Seminar on Macroeconomics (May).

Blanchard, Olivier and Danny Quah (1989), "The Dynamic Effects of Aggregate Demand and Supply Disturbances," American Economic Review 79, pp.655-673.

Bomhoff, Edward J. and Pieter Korteweg (1983), "Exchange Rate Variability and Monetary Policy Under Rational Expectations: Some Euro-American Evidence 1973-1979," Journal of Monetary Economics 11, pp.169-206.

Bordo, Michael (1992), "The Bretton Woods International Monetary System: An Historical Overview," in Michael Bordo and Barry Eichengreen (eds), A Retrospective on the Bretton Woods System, Chicago: University of Chicago Press (forthcoming).

Cairncross, Alec and Barry Eichengreen (1983), Sterling in Decline, Oxford: Blackwell.

Eichengreen, Barry (1992a), "History of the International Monetary System: Implications for Research in International Macroeconomics and Finance," in Frederick van der Ploeg (ed.), Handbook of International Macroeconomics, Chicago: University of Chicago Press (forthcoming).

Eichengreen, Barry (1992b), "Three Perspectives on the Bretton Woods System," in Michael Bordo and Barry Eichengreen (eds), A Retrospective on the Bretton Woods System, Chicago: University of Chicago Press (forthcoming).

Eichengreen, Barry and Lawrence H. Goulder (1989), "The U.S. Basic Industries in the 1980s: Can Fiscal Policies Explain Their Changing Competitive Position?" in Stanley Black (ed.), Productivity Growth and the Competitiveness of the American Economy, Norwell, Mass.: Kluwer Academic Publishers.

Garber, Peter (1992), "The Collapse of the Bretton Woods Fixed Exchange Rate System," in Michael Bordo and Barry Eichengreen (eds), A Retrospective on the Bretton Woods System, Chicago: University of Chicago Press (forthcoming).

Genberg, Hans and Alexander Swoboda (1992), "The Provision of Liquidity in the Bretton Woods System," in Michael Bordo and Barry Eichengreen (eds), A Retrospective on the Bretton Woods System, Chicago: University of Chicago Press (forthcoming).

Johnson, Harry G. (1962), Canada in a Changing World Economy, Toronto: University of Toronto Press.

Lippi, M. and L. Reichlin (1990), "A Note on Measuring the Dynamic Effects of Aggregate Demand and Supply Disturbances," unpublished manuscript.

Mussa, Michael (1985), "Nominal Exchange Rates and the Behavior of Real Exchange Rates: Evidence and Implications," Carnegie Rochester Conference Series on Public Policy 25, pp.117-124.

Organization for European Economic Cooperation (1957), Statistics of National Product and Expenditure, Paris: OEEC.

Quah, Danny (1991), "Identifying Vector Autoregressions: A Discussion of P. Englund, A. Credin and A. Warne: Macroeconomic Shocks in Sweden, 1925-86," unpublished manuscript, London School of Economics.

September 17, 1992

Working Paper Series
Department of Economics
University of California, Berkeley

Individual copies are available for $3.50 within the USA and Canada; $6.00 for Europe and South America; and $7.00 for all other areas. Papers may be obtained from the Institute of Business and Economic Research: send requests to IBER, 156 Barrows Hall, University of California, Berkeley CA 94720. Prepayment is required. Make checks or money orders payable to "The Regents of the University of California."

91-164 "A Model of Pre-game Communication." Matthew Rabin. April 1991.

91-165 "Contracting Between Sophisticated Parties: A More Complete View of Incomplete Contracts and Their Breach." Benjamin E. Hermalin and Michael L. Katz. May 1991.

91-166 "The Stabilizing Properties of a Nominal GNP Rule in an Open Economy." Jeffrey A. Frankel and Menzie Chinn. May 1991.

91-167 "A Note on Internationally Coordinated Policy Packages Intended to Be Robust Under Model Uncertainty or Policy Cooperation Under Uncertainty: The Case for Some Disappointment." Jeffrey A. Frankel. May 1991.

91-168 "Managerial Preferences Concerning Risky Projects." Benjamin Hermalin. June 1991.

91-169 "Information and the Control of Productive Assets." Matthew Rabin. July 1991.

91-170 "Rational Bubbles: A Test." Roger Craine. July 1991.

91-171 "The Eternal Fiscal Question: Free Trade and Protection in Britain, 1860-1929." Barry Eichengreen. July 1991.

91-172 "Game-Playing Agents: Unobservable Contracts as Precommitments." Michael L. Katz. July 1991.

91-173 "Taxation, Regulation, and Addiction: A Demand Function for Cigarettes Based on Time-Series Evidence." Theodore E. Keeler, Teh-wei Hu, and Paul G. Barnett. July 1991

91-174 "The Impact of a Large Tax Increase on Cigarette Consumption: The Case of California." Teh-wei Hu, Jushan Bai, Theodore E. Keeler and Paul G. Barnett. July 1991.

91-175 "Market Socialism: A Case for Rejuvenation." Pranab Bardhan and John E. Roemer. July 1991.

91-176 "Designing A Central Bank For Europe: A Cautionary Tale from the Early Years of the Federal Reserve." Barry Eichengreen. July 1991.

91-177 "Restructuring Centrally-Planned Economies: The Case of China in the Long Term." John M. Letiche. September 1991.

91-178 "Willingness to Pay for the Quality and Intensity of Medical Care: Evidence from Low Income Households in Ghana." Victor Lavy and John M. Quigley. September 1991.

91-179 "Focal Points in Pre-Game Communication." Matthew Rabin. September 1991.

91-180 "Cognitive Dissonance and Social Change." Matthew Rabin. September 1991.

91-181 "European Monetary Unification and the Regional Unemployment Problem." Barry Eichengreen. October 1991.

91-182 "The Effects of Competition on Executive Behavior." Benjamin E. Hermalin. October 1991.

91-183 "The Use of an Agent in a Signalling Model." Bernard Caillaud and Benjamin Hermalin. October 1991.

91-184 "The Marshall Plan: History's Most Successful Structural Adjustment Program." J. Bradford De Long and Barry Eichengreen. November 1991.

91-185 "Incorporating Fairness into Game Theory." Matthew Rabin. December 1991.

91-186 "How Pervasive Is the Product Cycle? The Empirical Dynamics of American and Japanese Trade Flows." Joseph E. Gagnon and Andrew K. Rose. December 1991.

92-187 "Shocking Aspects of European Monetary Unification." Tamim Bayoumi and Barry Eichengreen. January 1992.

92-188 "Is There a Conflict Between EC Enlargement and European Monetary Unification?" Tamim Bayoumi and Barry Eichengreen. January 1992.

92-189 "The Marshall Plan: Economic Effects and Implications for Eastern Europe and the Soviet Union." Barry Eichengreen and Marc Uzan. January 1992.

92-190 "Exploring the Relationship between R&D and Productivity at the Firm Level in French Manufacturing." Bronwyn H. Hall and Jacques Mairesse. February 1992.

92-191 "Three Perspectives on the Bretton Woods System." Barry Eichengreen. February 1992.

92-192 "Are Futures Margins Adequate?" Roger Craine. April 1992.

92-193 "Heterogeneity in Organizational Form: Why Otherwise Identical Firms Choose Different Incentives for Their Managers." Benjamin E. Hermalin. May 1992.

92-194 "Investment and Research and Development at the Firm Level: Does the Source of Financing Matter?" Bronwyn H. Hall. May 1992.

92-195 "The Determinants of Efficiency and Solvency in Savings and Loans." Benjamin E. Hermalin and Nancy E. Wallace. May 1992.

92-196 "Economics of Development and the Development of Economics." Pranab Bardhan. June 1992.

92-197 "The Core and the Hedonic Core: Equivalence and Comparative Statics." Suzanne Scotchmer and Greg Engl. July 1992.

92-198 "Incorporating Behavioral Assumptions into Game Theory." Matthew Rabin. July 1992.

92-199 "Incorporating Fairness into Game Theory and Economics." Matthew Rabin. July 1992.

92-200 "A Consumer's Guide to EMU." Barry Eichengreen. July 1992.

92-201 "Macroeconomic Adjustment Under Bretton Woods and the Post-Bretton-Woods Float: An Impulse-Response Analysis." Tamim Bayoumi and Barry Eichengreen. August 1992.