A reduced form estimate of Swiss inflation

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Abstract:

The significance of various domestic and international variables as contributors to the inflationary pressures in Switzerland are tested by a reduced-form equation estimate. The evidence suggests that Swiss inflation has resulted primarily from monetary expansion that has been fueled by the acquisition of foreign reserves by the central bank during the period of fixed exchange rates though import prices and domestic fiscal policy also have had a contributing impact The Swiss experience confirms the ability of one country to significantly reduce its domestic inflation rate by minimizing its intervention in the foreign exchange market and following a low to moderate monetary growth policy.

Article:

Widespread concern exists over the imported nature of the inflation suffered by the smaller, more open countries. Discussions of imported inflation have considered numerous mechanisms by which inflation could be transmitted across national borders under fixed or floating exchange rates. Particular importance has been placed upon the liquidity effect through which balance-of-payments surpluses lead to domes-tic monetary expansion and upon the direct price effect through which the increase in price of internationally traded goods causes an immediate price increase in traded goods and eventually an increase in the price of non-traded goods. The inflationary role of floating exchange rates, militant labor unions, OPEC, and increased demand for a country's exports also has been discussed in the literature. While the recent inflationary experience of many countries is being analyzed in the literature, little research has been published concerning Swiss inflation. Even though it is considered among the most financially prudent and stable countries in the world, Switzerland has experienced inflation rates comparable to that of other European countries prior to 1976.

This paper uses a reduced-form equation to test the significance of various domestic and international variables that allegedly have contributed to inflation in Switzerland; it considers whether Swiss inflation was imported; and it evaluates the central bank's decision to abandon the fixed exchange rate system. The evidence suggests that the Swiss can avoid high inflation rates if they maintain a floating exchange rate and avoid excessive acquisition of foreign reserves.

The theory

Three main economic sources of inflation have been suggested [1]. The first cause is monetary and emphasizes the effect of monetary growth upon the level of prices. "An increase in money is a necessary condition for inflation, and any maintained increase in money relative to real output is sufficient condition for inflation" [1, p. 314]. A second cause of inflation is based upon the Keynesian emphasis on aggregate expenditures. According to this theory, increases in government expenditures and budgetary deficits increase aggregate demand and cause prices to be bid upward as the economy approaches full employment. Therefore, both a real government expenditure variable and a real tax receipt variable are included in the model. A third cause of inflation depends upon exogenous increases in demand by the private sector. In the case of a closed economy, economic factors which cause the expected rate of return on capital to be greater than the market rate of interest cause an increase in private investment. For the small, open economy, exports based upon foreign decisions to buy abroad are the

more important element of exogenous demand. Whether the influence of international trade on the domestic economy is a result of an increase in the expenditures of foreigners measured by changes in exports, or a result of domestic sources buying lower-priced domestic substitutes rather than higher-priced imports, private decisions can exert an influence upon the domestic economy. Brunner, et al. [1, pp. 315 and 328] suggest that any empirical study of small, open countries should include import prices and exports as variables. However, real export demand has been modeled as a function of the ratio of world to domestic consumer prices.[1] The effect of international cartel agreements among suppliers of raw materials can be captured by the import price term.

Table 1

Average Compounded Annual Rates of Change of CPI

	Switzerland	U.S.	Belgium	France	Germany	Italy	Netherlands	U.K.
1961–65	3.2	1.3	2.5	3.7	2.8	4.9	3.4	3.3
1966–70	3.5	4.3	3.5	4.4	2.4	3.0	4.7	4.6
1971–75	7.7	6.8	8.4	8.9	6.1	11.5	8.6	13.2

Source: [9].

These various causes do not exhaust the list which would be proposed by other economists. Wage-push inflation is not considered by this paper since labor unions are weak in Switzerland. These three sources of inflation provide the theoretical basis for testing the growth of the money supply, real government expenditures, real tax receipts, import prices, and world prices as possible explanations of Swiss inflation.

The model

The model of international inflation in this paper considers a direct price effect, domestic or internationally induced monetary expansion, and domestic fiscal policy as causes of inflation. The following macromodel of 16 equations is considered.

$$C = P \cdot f(y - t, r) \tag{1}$$

$$I = P \cdot I(r)_0 \tag{2}$$

$$G = P \cdot g_0 \tag{3}$$

$$t = t_0 \tag{4}$$

$$IM = P \cdot k((y - t), P/Pm) \tag{5}$$

$$Pm = Pm_0 \tag{6}$$

$$EX = P \cdot j(Pw/P) \tag{7}$$

$$Pw = Pw_0 \tag{8}$$

$$y = (C + I + G + EX - IM)/P \tag{9}$$

$$Md = P \cdot h(y, i) \tag{10}$$

$$i = i(r, \dot{P}_t) \tag{11}$$

$$Ms = s(D + R) \tag{12}$$

$$D = D_0 \tag{13}$$

$$BP = dR/dt = \Delta R_0 \tag{14}$$

$$Md = Ms \tag{15}$$

$$\dot{P}_t = \phi(y - q) \tag{16}$$

where

C = nominal consumption
I = nominal investment
G = nominal government expenditure
IM = nominal imports
EX = nominal exports
t = real tax receipts
g_0 = real government expenditures
y = real income
r = real interest rate
Pm = Swiss import prices denominated in Swiss francs
Pw = world price index
Md = demand for money
Ms = stock of money
D = domestic asset holdings of the Swiss National Bank (SNB)
R = foreign reserve holdings of SNB
s = the money multiplier
B = D + R, the monetary base
BP = balance of payments
P = the domestic price level
$\dot{P}_t$ = quarterly rate of inflation
q = full-employment real output

The direct price effect is assessed by the inclusion of an import price variable measured in the domestic currency in the import function and by the inclusion of a world price variable in the export function. Domestic fiscal policy is included by both real government expenditures and real tax receipts. The current level of aggregate demand in relationship to the potential full-employment level of output is also an important determinant of inflation. Since the system of. equations has been closed by the equation $\dot{P}_t = \phi$(y - q) [6, p. 312], the variable (y - q) serves as an Okun gap variable, an excess demand variable.

Monetary growth in a small, open country can be a result of the domestic asset component of the monetary base by the central bank or a result of acquiring foreign reserves under a fixed or managed exchange rate system. Phaup and Kusinitz [8] have provided empirical evidence which suggests that the Swiss National Bank (SNB) did not successfully sterilize the perpetual inflow of foreign reserves absorbed during the period of fixed exchange rates. This conclusion is not surprising, since the SNB has seldom attempted to sterilize foreign reserves. Switzerland is unique in that its monetary base is composed almost entirely of foreign reserves, and quarterly changes in the base parallel very closely quarterly changes in the SNB's foreign reserve holdings. This evidence suggests that the foreign reserve holdings or the base could be treated as exogenous variables that are determined outside the system.[2]

Table 2

Granger Test
for the Exogeneity of the Monetary Variables

	R 1961-1973/IBase (*B*) 1961-1973/I*M*					
1957-1973/I						
Σ*FR*, *B* or *M*	−.31	(−0.23)††	−.53	(−1.15)††	.47	(0.49)†
Σ*P*	1.99	(0.42)	2.25	(0.63)	−.02	(−0.03)
Σ*Pm*	−2.43	(−1.12)	−2.97	(−1.41)	−.17	(−0.58)
Σ*Pw*	5.93	(1.32)†	6.06	(1.43)†	.51	(0.48)
g	.02	(0.38)	.04	(1.01)	.53	(2.79)*
t	−.14	(−1.20)	−.10	(0.87)	.01	(0.41)
y − *q*	−1.14	(−0.57)	−.20	(−0.10)	−.52	(−1.80)*
Constant	−.03	(−0.82)	−.25	(−0.74)	.00	(0.75)
R^2	.4403		.4404		.6209	
DW	1.96		1.93		2.00	
S.E.	.0717		.0682		.0157	
$F_{22,26}$	0.92	[2.01]	0.93	[2.01]		
$F_{22,42}$					3.13	[1.94]
	R 1961-1976Base (*B*) 1961-1976*M*					
1957-1976						
Σ*FR*, *B* or *M*	−.20	(0.63)††	−.35	(1.11)	.41	(2.22)†
Σ*P*	1.36	(0.91)	1.71	(0.51)	.28	(0.57)†
Σ*Pm*	−1.20	(−1.05)	−1.59	(1.41)	−.18	(0.76)††
Σ*Pw*	−.11	(0.06)†	−.10	(0.05)†††	−.14	(0.30)†
g	.01	(0.43)	.02	(0.82)	.03	(2.86)*
t	−.08	(−1.13)	−.03	(−0.38)	.00	(0.35)
y − *q*	−1.02	(−0.85)	.01	(0.01)	−.37	(−1.52)
Constant	.18	(0.81)	.02	(0.76)	.01	(1.40)
R^2	.2640		.2802		.6166	
DW	1.99		1.99		1.85	
S.E.	.0677		.0635		.0168	
$F_{22,41}$	0.67	[1.94]	0.73	[1.94]		
$F_{22,57}$					4.17	[1.89]

*Significant at the five percent level.
†One positive and significant coefficient.
††One negative and significant coefficient.
†††One negative and one positive significant coefficient.
S.E. is the standard error of the regression.
Critical values at the five percent level of significance for the *F*-statistic are shown in brackets to the right.

The exogeneity of the three monetary variables is tested by regressing each monetary variable against a four-quarter lag of itself, the current and four-quarter lag of the rate of growth of Swiss consumer prices, import prices and world consumer prices, the current rate of growth of real government expenditures and real tax receipts, and the Okun gap variable. The primary concern is whether higher foreign or domestic prices could cause an excess demand for money in Switzerland leading to balance-of-payments surpluses and inflows of

foreign reserves. This method of testing for the exogeneity of a variable stems from the work of Granger HI and was used by Gordon [3]. Gordon notes that the "dependent variable is considered exogenous and is influenced by its own past values if the coefficients on all of the independent variables are zero" [3, p. 430]. The empirical results are summarized in Table 1. The evidence suggests that the foreign reserves and the base can be assumed to be exogenous because nearly all of the coefficients on the right-hand side of the equation are insignificant. An F-test was conducted to test the null hypothesis that the right-hand-side coefficients are equal to zero. The hypothesis is accepted at the five percent level of significance for both the foreign reserve and base equations.

A reduced-form equation of the exogenous variable is used to estimate the quarterly Swiss rate of inflation. Economic theory and previous empirical work suggest that a distributed lag structure for the monetary and fiscal variables should be incorporated into the model because previous changes in these variables could affect the level of prices. The assumption of a log-linear relationship is also made so that the following price equation emerges.[3]

$$(17) \quad \dot{P}_t = \alpha + \sum_{i=0}^{n} \beta_i \dot{R}_{t-n} + \sum_{i=0}^{n} \lambda_i \dot{g}_{t-n} + \sum_{i=0}^{n} \xi_i \dot{t}_{t-n} + \delta(y - q) + \psi \dot{P}_m + \theta \dot{P}_w + u_t$$

The exogenous variables are the quarterly growth rates of the previously defined variables with a constant, α, and an error term, u, where $E(u_t) = 0$ and $E(u_t)^2 = \sigma^2$. The signs of the coefficients are expected to be positive for $\Sigma\beta_i$, $\Sigma\lambda_i$, δ, ψ, θ and negative for $\Sigma\xi_i$.[4]

The empirical results

Equation (17) is estimated separately for each of the three monetary variables for the purpose of comparison. Since the money supply is an endogenous variable by the Granger test, the model uses only lagged values of M_1 which enter the equation as predetermined variables.[5] The appropriate distributed lag is determined by minimizing the standard error of the regression and checking the *t*-statistic of the final lagged coefficient. If the coefficient is not significant and of the correct sign, it is eliminated in an effort to preserve sufficient degrees of freedom. An F-test is conducted to test the null hypothesis that the group of the eliminated coefficients is equal to zero. If the null hypothesis is not rejected, then the length of the lag is assumed to be determined. If the null hypothesis is rejected, then the last omitted coefficient is placed back into the equation, and another F-test is conducted. This procedure is repeated until the F-test cannot be rejected.[6]

Estimates of equation (17) for the three different monetary variables for the period of fixed exchange rates are presented in Table 3. The adjusted R^2 and Durbin-Watson statistics are encouraging when foreign reserves and the monetary base are used as the exogenous monetary variable. Time-series estimates often have a serious autocorrelation problem which may indicate that important variables have been omitted. The inclusion of a distributed lag for three of the variables eliminates the severity of the autocorrelation problem. The adjusted R^2 for the foreign reserve and base estimates are excellent given the large number of exogenous variables.

The size and significance of the coefficients suggest that Swiss inflation was primarily a result of a liquidity effect and a direct price effect. The sum of the monetary coefficients for the foreign reserve and the base equations is between .3 and .4 and is highly significant. The large *t*-statistic on these coefficients suggests that domestic control over the foreign reserve component of the base or the base itself would have been the most effective policy instruments to combat inflation. There is evidence of a direct price effect, although the evidence is not consistent. The import price coefficient is positive and significant for the foreign reserve equation, while the world price coefficient is positive and significant for the base equation. This evidence suggests that Switzerland was importing inflation through balance-of-payments surpluses which were causing an over-expansion of the money supply and through a direct price effect. There is minor evidence of home-grown inflation because real government expenditures and tax receipts had significant or nearly significant coefficients.

Table 3

Swiss Inflation Estimates Under Fixed Exchange Rates

	Foreign Reserves 1961-73/I			Monetary Base 1961-73/I			Money Supply 1957-73/I		
	R	*g*	*t*	*B*	*g*	*t*	*M*	*g*	*t*
0	−.016	−.060	−.015	−.030	−.035	−.030		.014	−.031
	(−2.23)	(−3.51)	(−0.85)	(−3.08)	(−1.87)	(−1.86)		(1.00)	(−1.82)
1	.071	−.013	−.063	.070	.062	−.043	−.091	.041	−.028
	(4.93)	(−0.85)	(−3.52)	(4.00)	(0.31)	(−2.58)	(−1.45)	(2.30)	(−1.44)
2	.081	−.060	−.002	.052	−.039	.028	−.012	.030	−.034
	(5.44)	(−3.67)	(−0.11)	(2.92)	(−2.08)	(1.39)	(−.022)	(1.74)	(−1.82)
3	.061	−.046	−.018	.035	−.058	.041	.135	.007	
	(4.01)	(−3.31)	(−0.95)	(1.89)	(−3.32)	(2.18)	(1.94)	(0.39)	
4	.057	−.010	−.058	.049	−.047		.037	.017	
	(4.48)	(−0.86)	(−2.63)	(2.88)	(−2.65)		(0.49)	(0.96)	
5	.048	.010	−.039	.088	.003		−.034	.036	
	(3.88)	(0.76)	(−2.14)	(4.89)	(0.17)		(−0.47)	(1.86)	
6	.082	.064	−.001	.077	.052		−.001	.055	
	(4.47)	(2.92)	(−0.08)	(3.89)	(2.36)		(−0.15)	(2.36)	
7		.010	−.054		.058		−.093	.070	
		(0.47)	(−3.05)		(2.51)		(−1.39)	(3.30)	
8		.079	−.059		.071		−.168	.039	
		(4.33)	(−3.29)		(4.52)		(−2.51)	(2.03)	
9		.071			.044		−.103		
		(4.06)			(2.66)		(−1.42)		
10		.035			−.008		.086		
		(2.00)			(−0.45)		(1.29)		
11		.013			.026		.194		
		(0.71)			(1.40)		(3.27)		
12					.024		.129		
					(1.36)		(2.22)		
13					.004				
					(0.26)				
14					.068				
					(4.00)				
Σ*	.384	.094	−.310	.341	.169	−.004	.079	.309	−.093
	(7.62)	(1.43)	(−4.19)	(6.34)	(1.87)	(−2.38)	(0.41)	(2.74)	(−0.96)
C	.033			−.013			−.021		
	(0.45)			(−1.89)			(−3.40)		
$y - q$	−.082			.028			.211		
	(−1.18)			(−0.38)			(2.34)		
Pm	.124			−.033			−.013		
	(2.58)			(−0.66)			(−0.20)		
Pw	.138			.495			.860		
	(0.99)			(3.23)			(4.61)		
$\bar{R}^2$/*SE*/*DW*	.818	.00251	1.86	.758	.00293	1.75	.592	.00380	1.30

*Summation of the coefficients of the distributed lags.

Estimates of equation (17) for the period including both fixed and floating exchange rates are presented in Table 4. The sharp reduction in the adjusted R^2 (the goodness-of-fit) for the foreign reserve equation reflects the endogeneity of this variable under a regime of floating or managed exchange rates. Under the flexible exchange rate system, the SNB has purchased foreign reserves to lessen the appreciation of the Swiss franc while partially offsetting the effect of the base through a sale of domestic assets. Therefore, the monetary base is an exogenous variable under a managed exchange rate system and also the only monetary variable which can claim to be exogenous under either exchange rate system.[7]

A comparison of the results from Tables 3 and 4, given the monetary base as the appropriate monetary variable, reveals significant changes occurring with the addition of almost four years of floating exchange rates. The size of the world price coefficient drops by 50 percent, though it is still significant. Therefore, the impact of the direct price effect has lessened during the period of managed exchange rates. The decision by the SNB to allow the Swiss franc to appreciate relative to other currencies appears to have dampened the impact of world inflation on the domestic economy. The coefficients of real government expenditures and real tax receipts are small and no longer statistically significant. While the magnitude of the base coefficient essentially is unchanged, its *t*-statistic has increased by 16 percent. The size of the *t*-statistic indicates that the decision by the SNB to abandon a fixed exchange rate policy in 1973 has made the monetary base the most effective policy instrument to combat inflation. The implication is that the causality runs from the growth of the base to growth in the level of prices. A Granger test for causality was implemented by including a six-quarter lag of the dependent variable, the Swiss inflation rate for the period 1961-76. The results are shown in Table 5. Since the coefficients on the current and lagged values of the exogenous variables remain significant even with the inclusion of the lagged dependent variable on the right-hand side of the equation, the dependent variable is

considered to be endogenous. The results confirm the endogenous nature of the Swiss inflation rate and the positive and statistical significance of the base and world price coefficients.

Table 4

Swiss Inflation Estimates Under Fixed and Managed Exchange Rates

	Foreign Reserves 1961-76			Monetary Base 1961-76			Money Supply 1957-76		
	R	*g*	*t*	*B*	*g*	*t*	*M*	*g*	*t*
0	−.012	−.040	−.010	−.025	−.036	−.030		−.000	−.027
	(−1.14)	(−2.36)	(−0.76)	(−2.73)	(−3.67)	(−2.97)		(−0.05)	(−1.99)
1	.046	−.036	−.044	.060	−.031	−.007	.028	.016	−.023
	(2.65)	(−2.86)	(−2.90)	(5.02)	(−3.08)	(−0.74)	(0.47)	(1.44)	(−2.06)
2	.082	−.015	−.054	.069	−.048	−.016	−.018	.020	−.031
	(4.54)	(−1.12)	(−3.65)	(5.11)	(−3.76)	(−1.96)	(−0.30)	(1.74)	(−2.62)
3	.051	−.022	−.010	.055	−.044	.003	.070	.007	
	(3.55)	(−1.65)	(−0.74)	(4.24)	(−3.41)	(0.29)	(1.02)	(0.52)	
4	.020	−.003	−.040	.055	−.029		.070	.013	
	(1.32)	(−0.24)	(−2.44)	(4.00)	(−2.26)		(0.97)	(0.73)	
5	.056	.021	−.014	−.074	.020		−.000	.029	
	(3.54)	(1.38)	(−0.85)	(5.33)	(1.60)		(−0.01)	(1.45)	
6	.071	.020	−.063	.074	.006		−.018	.029	
	(4.03)	(1.67)	(−4.09)	(4.91)	(0.70)		(−0.28)	(1.60)	
7		.032	−.026		.019		−.053	.031	
		(2.75)	(−1.94)		(2.04)		(−0.79)	(1.78)	
8		.076	−.052		.073		−.011	.026	
		(6.03	(−3.52)		(7.29)		(−0.18)	(1.85)	
9		.037			.042		−.125		
		(3.21)			(4.72)		(−2.15)		
10		.029			.008		−.010		
		(2.39)			(0.98)		(−0.20)		
11		.031			.035		.244		
		(2.30)			(4.15)		(4.88)		
12					.012		.138		
					(1.52)		(2.46)		
13					−.011				
					(−1.26)				
14					.047				
					(6.00)				
Σ*	.314	.130	−.314	.362	.063	−.050	.306	.171	−.081
	(5.53)	(1.93)	(−3.23)	(7.38)	(0.94)	(−0.74)	(1.56)	(1.74)	(−3.06)
Constant	.000			−.002			−.012		
	(0.05)			(−0.43)			(−1.96)		
$y - q$	−.172			−.044			.081		
	(−2.03)			(−0.69)			(0.96)		
Pm	−.079			−.047			.000		
	(−2.02)			(−1.33)			(0.01)		
Pw	.340			.249			.453		
	(3.73)			(3.31)			(3.84)		
$\bar{R}^2$/*SE*/*DW*	.608	.00420	1.79	.757	.00342	2.21	.617	.00502	1.66

*The summation of the coefficients of the distributed lags.

Conclusion

The empirical results provide evidence that Swiss inflation has been linked to domestic fiscal policy, international cost variables, and monetary expansion fueled by the acquisition of foreign reserves by the central bank for the period of fixed exchange rates. A comparison of the size of the coefficients suggests that domestic factors contributed marginally to Swiss inflation prior to the breakdown of the Bretton Woods system in March 1973 and not at all in the past four years. Switzerland seems to have suffered from inflation imported by both a direct price effect from abroad and by a liquidity effect from balance-of-payments surpluses.

Table 5

Granger test for Endogeneity of the Dependent Variable
Equation (17) with Lagged Dependent Variable
Monetary Base Version

	Coefficient	*t*-Statistic	Summary Statistics
Constant	.000	(0.02)	R^2 = .9273
$\Sigma_1^6 P_i$	−.021	(0.09)	$\bar{R}^2$ = .8264
$\Sigma_0^6 B_i$	.361	(4.77)	*DW* = 1.95
$\Sigma_0^{14} g_i$	−.062	(−0.70)	*SE* = .00328
$\Sigma_0^3 t_i$	−.054	(0.72)	
$y - q$	.009	(0.12)	
Pm	−.032	(−0.84)	
Pw	.270	(2.08)	

The decision by the SNB to allow the Swiss franc to float in February 1973 appears to be the key to Switzerland's low inflation rate in recent years. Swiss inflation, which peaked at 10.6 percent for the 12 months

ending 1974/111, has been reduced to a less than two percent annual rate since 1976/11, three years after the SNB regained control of the monetary base. The empirical results for the 1961-76 period indicate that the base is the key instrument available to the Swiss authorities to combat inflation. The SNB actually reduced the monetary base by three-and-one-half percent between 1973/1 and 1975/1, although the stock of money declined by less than one percent. Beginning in 1975 the SNB has pursued a growth in the money stock of six percent annually. Because the SNB has intervened more actively in the foreign exchange market in 1978, it will not meet its target rate of monetary growth.

The Swiss experience confirms the ability of one country to significantly reduce its domestic inflation abandoning a fixed exchanged rate policy, minimizing its intervention in the foreign exchange market, and following a low to moderate monetary growth policy.

Notes:

1. The world price data are a weighted average of consumer prices of ten major industrial countries constructed by Duck, et. al [2] and updated by the author for this study. Attempts to use real export demand as an independent variable instead of modeling it as a function of the ratio of world to domestic consumer prices yielded poorer results.
2. There is nearly a one-to-one relationship between changes in the base and foreign reserves. For the 1962/IV--1973 /I period, the average quarterly changes were .392 billion SF for foreign reserves and .384 billion SF for the base. The Spearman coefficient of rank correlation was computed to be .88 for the quarterly change of foreign reserves and the monetary base. Domestic asset holdings of the SNI3 increased from .54 billion to 1.18 billion during this period.
3. The reduced-form price equation should be estimated by a two-stage least squares (2SLS) procedure because the Okun gap variable is not exogenous. The lack of quarterly data for gross domestic product thwarted any reasonable attempt to use 2SLS. Semi-annual output gap data was obtained from OECD Occasional Studies [7] and interpolated to yield quarterly data.
4. All data except for the Okun gap variable are taken from the IMF's International Financial Statistics [5]. Since data on government expenditures and tax receipts are available only on an annual basis until 1971, the annual growth rates of government expenditures and tax receipts are divided equally into quarterly growth rates prior to 1971. The quarterly rate of growth of consumer prices is found by taking the growth rate of the average price level for each three-month period.
5. A modification is made in the treatment of the monetary variables. End-of-the-quarter and end-of-the-year window dressing by Swiss banks resulted in significant accounting changes in the monetary base and money supply during March, June, September, and December during the 60s and 70s. Therefore, February, May, August, and November observations are used.
6. In the case of the monetary variable, a distributed lag of six quarters for *R*, eight quarters for *B*, and 16 quarters for M_1 minimizes the standard error. Regressions were run to estimate distributed lags of up to 15 quarters for foreign reserves, the base, real government expenditures, and real Lax receipts and up to 19 quarters for the money supply since M_1 data was available prior to 1957/I. The coefficients of the last two quarters of the monetary base are eliminated on the basis of their t-statistics and by the fact that the null hypothesis that $\beta_7 = \beta_8 = 0$ is not rejected by an *F*-test. By the same process, the last four quarters of the money supply are eliminated. In the case of real government expenditures, the minimum standard error was obtained for a distributed lag of real government expenditure of 14 quarters for *R*, 15 quarters for *B*, and 15 quarters for M_1. Coefficients which were not significant and of the right sign were eliminated, thereby shortening the distributed lag to 11, 14, and eight quarters, respectively. An *F*-test failed to reject the null hypothesis that the omitted coefficients were equal to zero. In the case of real tax receipts, the minimum standard error of the regression was then obtained for a distributed lag of eight quarters for *R*, ten quarters for *B*, and a thirteen-quarter lag for M_1. On the basis of a similar procedure, the length of the lag was reduced to eight quarters for *R*, three quarters for *B*, and two quarters for M_1.
7. The exogeneity of the three monetary variables was tested for the 1961-76 period. The results which are summarized in Table 2 are similar to those previously reported.

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