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Fiscal Policy in the Reagan Years: A Burden on Future Generations?

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This paper tests alternative views of the burden that fiscal policy in the Reagan years placed on future generations. In the more conventional view, fiscal deficits substantially crowded out domestic capital formation and increased net indebtedness to foreigners, thereby placing a significant burden on future generations. In an alternative view, this burden was reduced, or possibly even eliminated, by higher personal saving, an improved investment climate for business, and a "safe-haven" effect that stimulated capital inflows and increased the value of the dollar. However, no significant support could be found for any of the various aspects of this alternative view. The total economic burden that fiscal policy in the Reagan years placed on future generations is estimated as equivalent to either a lump sum payment equal to 9 percent of the nation's current GNP or an annual payment equal to 0.4 percent.

The national debt nearly tripled during the Reagan Administration. This paper offers a quantitative assessment of the economic burden that may have been placed on future generations by fiscal policy in the Reagan years.

One widely held view is that the extra spending that was financed by the issuance of federal debt during the Reagan years was generally used for consumption, rather than investment, and as a result a burden was placed on future generations.[1] This burden takes the form of a lower capital stock, and therefore lower production and incomes in the future, to the extent that the expenditures that were financed by the debt issue "crowded out" private capital formation. Alternatively, it takes the form of increased indebtedness to foreigners (without an offsetting increase in the economy's capital stock) to the extent that capital inflows were attracted from abroad. In this case, the economy's capital stock, and hence production and incomes in the future, are not reduced, but the economy's absorption of future output must decline in order to service the debt to foreigners.

Both personal and corporate tax rates were cut in the Reagan years. The cut in corporate rates encouraged business investment by lowering its after-tax cost of capital. This would have tended to offset a crowding out of business investment stemming from the pressure of budget deficits on interest rates. As a result, it is likely that the greater proportion of the burden from additional debt took the form of a greater indebtedness to foreigners, rather than a lower domestic capital stock. Indeed, U.S. external debt grew very rapidly during this period.

An alternative view of the reason for rising indebtedness to foreigners during the Reagan years is that investment opportunities in the U.S. improved, not only because of the tax cuts for business but also as a result of deregulation and a reduced risk of government intervention.[2] Improved investment opportunities in the U.S., in turn, led to greater net capital inflows. To the extent that these inflows were matched by increases in the domestic capital stock, they would not have created a burden on future generations. The stimulus to larger net capital inflows also may have been reinforced by economic difficulties in many developing countries and the election of socialist governments abroad, which could have increased the relative safety of claims on American capital.

In the alternative view, the budget deficits of the 1980s had relatively benign effects.[3] Households are viewed as far-sighted enough to foresee the taxes needed to service the increased federal debt in the future. As a result, they would tend to increase their saving, offsetting the increased dissaving of government. With relatively little reduction in national saving, there would be no significant decline in domestic capital formation, and hence no significant burden on future generations. Finally, to the extent that lower marginal tax rates stimulated greater work effort, potential GNP would rise. This would provide a greater volume of national saving, tending to work against the adverse effects of budget deficits and minimize the burden they created for future generations.

This alternative view requires that major shifts occurred in business investment, the exchange rate, consumption, and potential output. Therefore Section I of this paper examines the stability of these variables in relation to their determinants in a mainline neo-Keynesian macroeconometric model of the U.S. economy.[4] It finds that these macroeconomic variables were not subject to statistically significant instabilities in the 1980s, and that prediction errors generally were not consistent with the patterns called for by the alternative view.

Section II goes on to make a quantitative assessment of the overall magnitude of the economic burden created for future generations by federal fiscal policy in the Reagan years. This is done by using the above macroeconometric model to simulate the effects of fiscal changes. This simulation provides a quantitative measure of the impact of Reagan fiscal policy on capital formation in the U.S. compared to what it would have been with an unchanged fiscal policy. It also gives an estimate of the contribution of fiscal policy to the increase in net inflows of foreign capital to the U.S.

The burden of fiscal policy created during the Reagan years can be expressed either in terms of (1) the lump sum amount that would be required to restore the capital stock and pay off the extra foreign debt, or (2) the annual loss of future income due to the reduced capital stock and the servicing of an increased amount of foreign debt. This is done in Section III, which also contains a summary and some policy conclusions.

I. Tests of the Alternative View

In the more conventional view, an expansive fiscal policy was the primary source of higher interest rates, a stronger dollar, greater net capital inflows, and larger trade deficits in the Reagan years. The alternative view stresses possible offsets to these fiscal effects through an increase in saving and work effort. In addition, it points to the possible importance of an improved investment climate in the U.S., stemming not only from lower taxes on business but also deregulation, a reduced risk of government intervention, and a safer haven for foreign investment in the U.S. This stronger investment climate could have been an independent source of the higher interest rates, stronger dollar, greater capital inflows, and larger trade deficits. The sections below examine the relevant equations in a structural macroeconometric model for evidence of these two types of effects.

Consumption and Saving

We begin with the behavior of consumption and saving. The consumption function in the macroeconometric model that is used to simulate the effects of Reagan fiscal policy follows in modified form the life-cycle theory of Modigliani and his colleagues.[5] In this approach, households are viewed as making a conscious attempt at achieving a preferred distribution of consumption over their lifetimes, subject to the size of the economic resources expected to accrue to them. Thus, total consumption of households is a function of expected labor and property incomes plus the current value of their wealth.

The formation of expectations of future income is crucial to the issue of fiscal effects. In the more conventional view, there is too much uncertainty about the future for household expectations to be very forward-looking. Instead, the best estimate that households can make of their future income tends to be based on actual current and past incomes. This adaptive approach to expectations formation is empirically implemented by making consumption a function of a distributed lag on actual current and past incomes. Thus, in the macroeconometric model consumption is, in part, a function of current and past disposable income and the current value of stock market and non-stock market wealth.

In a pure life-cycle model, a decline in the *real* market rate of interest increases the amount of income that is consumed if substitution effects outweigh income effects. The modification to the life-cycle model is that an important portion of households are liquidity constrained in the sense that they cannot borrow all that they might like to against future income.[6] The aggregate size of this liquidity constraint tends to be related to the unemployment rate and the level of *nominal* interest rates. Therefore, in addition to the variables mentioned above, the consumption function in the macroeconometric model includes a weighted average of the real and nominal short-term interest rates, as well as the unemployment rate.

The econometric model's consumption function, with estimated t statistics in parentheses, is:

$$\begin{aligned} CON82 = &\underset{(-6.41)}{-143.6} + \sum_{i=0}^{7} a_i\, AGYD82_{-i} + \underset{(6.04)}{.165}\, NSW \\ &+ \underset{(2.88)}{.0146}\, SW - \underset{(-2.22)}{.00217}\, U \cdot AGYD82 \\ &+ \sum_{i=0}^{3} b_i\, [(i_s - .5p_s^e)\, AGYD82]_{-i} \\ &+ \underset{(17.5)}{.899} e_{-1} \end{aligned}$$

$$\sum_{i=0}^{7} a_i = \underset{(8.12)}{.491} \qquad \sum_{i=0}^{3} b_i = \underset{(-3.07)}{-.00150}$$

where:

AGYD82 = personal disposable income in 1982 dollars, adjusted for the reduction in real value of government debt due to inflation.
NSW = real value of non-stock market wealth
SW = real value of stock market wealth
U = civilian unemployment rate.
i = short-term interest rate.
p_s^e = short-term expectation of inflation.

Expected inflation enters with a weight of 0.5, implying equal weights for real and nominal interest rates. The positive weight for nominal interest rates and the effect of the unemployment rate indicates the presence of liquidity constraints. In addition, current consumption is estimated to respond strongly and positively to disposable income over the past two years, and also to non-stock market and stock-market wealth.

A criticism of this type of consumption function is that households maybe more forward-looking in forming their expectations of income than assumed in the adaptive expectations approach. Formal modeling of fiscal effects under the assumption of forward-looking consumption behavior has been done in a life-cycle context with overlapping generations by Auerbach and Kotlikoff (1987) and Frenkel and Razin (1987), and on the assumption of an infinite planning horizon for households with altruistic bequest motives by Barro (1974).

Over an infinite horizon, the government eventually must pay off its debt—either explicitly with taxes or implicitly by inflating it away. As a result, a public with rational expectations and an infinite horizon could expect deficit financing now to be matched by explicit or implicit taxes of equal present value in the future. Therefore, the consumption spending of (altruistic) households maximizing utility over an infinite horizon would be the same whether current government expenditures are financed by debt or taxation. If a shift to deficit financing does not change household consumption, then household saving would increase by enough to finance the increase in the budget deficit; and there would be no potential for a crowding out of domestic investment. This idea has come to be known as the Ricardian equivalence of debt and taxes.[7]

In the less extreme case of planning only over a lifecycle, the saving response of households to fiscal deficits would not be large enough to fully prevent a reduction in capital formation, or increased indebtedness to foreigners, because some of the expected taxes would fall on future generations. However, Poterba and Summers (1986) have shown that, under a variety of plausible fiscal scenarios a substantial fraction of the deferred tax burden from deficit financing is likely to fall on present generations. So even with no altruistic bequest motive, a rational view of the government's intertemporal budget constraint could lead households to increase their saving by a substantial fraction of the increase in government's budget deficit.

Such a response could be considerably weakened, however, by liquidity constraints and by uncertainty about taxes facing individuals. Evidence of liquidity constraints that would make households relatively more responsive to current income was discussed above. Uncertainty about when and on whom taxes might be levied also is of particular importance. If because of uncertainty taxes are viewed by households as following a random walk, then the current level of taxes is the best estimate of any future level of taxes. So a reduction in current taxes would be interpreted by consumers as indicating a reduction in the permanent level of taxes. They would raise their consumption spending accordingly, so that current taxation would have a strong and immediate (Keynesian) effect on current consumption.[8]

Direct tests of Ricardian versus Keynesian views of household saving behavior using a wide range of historical data have not been fully conclusive.[9] A major difficulty has been that until the 1980s there was relatively little variation in government deficits independent of wars, cyclical fluctuations, and inflation, which might be expected to have a systematic impact on national saving independent of the effect of budget deficit. However, U.S. experience of a sustained high level of deficits in the 1980s provides the opportunity for a cleaner test.

We do this by examining the stability of the econometric model's consumption function with adaptive expectations. First, the Quandt (1958, 1960) maximum likelihood method is used to assess the most likely point (or points, if about equally likely) in the estimation sample at which a shift in the consumption function's coefficients may have occurred; and an F test then is used to assess the statistical significance of the possible shift.[10] Second, the pattern and direction of out-of-sample forecasting errors for the 1981 to 1988 period are examined.[11] This is the period over which the effects of Reagan fiscal policy are later simulated.

The maximum likelihood ratio indicates most likely break points in the consumption function at 1970:4 and 1981:1. But stability of the consumption function is accepted by the F test at a 5 percent level in both cases, as shown in Table 1.[12] The out-of-sample prediction errors for the period 1981 to 1988 are shown in Chart 1A. Up until 1984, there is some tendency towards negative errors, meaning that actual consumption was less than predicted. This would be consistent with a Ricardian type of response. But the size of these errors averages only around one-sixth of the large $45 billion tax reductions, in 1982 dollars, that occurred in both 1982 and 1983. Furthermore, rather than becoming more negative over time as the budget deficit grew, and as the Ricardian response would require, the prediction errors became less negative and eventually as positive as they were negative before. This pattern of errors appears to be related more to movements in consumer confidence over the business cycle than to a Ricardian response to changes in the budget deficit.

In summary, the errors in the consumption function during the Reagan years were not atypically large, and they appear to be more closely related to the business cycle than to a Ricardian response to budget deficits. These results are consistent with those of Summers and Carroll (1987), who tested Ricardian equivalence over the same period by examining the out-of-sample predictive power of a number of different models of national saving. If Ricardian equivalence holds and national saving has not been sharply reduced by budget deficits, it should be possible to find equations that do not consistently overpredict national saving. But Summers and Carroll could not find any, and in most cases the size of the errors was close to the size of the budget deficit, suggesting the lack of even a partial Ricardian response.

Potential Output

The macroeconometric model that is later used for simulating the effects of fiscal policy during the Reagan years assumes a constant rate of growth of full-employment, or potential, output. However, in the alternative view of little or no burden from the debt, reductions in marginal tax rates would have had a large impact on labor supply and thus potential output, as would increases in the rate of investment. These forces would have tended to offset the adverse effects of budget deficits on capital formation and indebtedness to foreigners. Therefore, we examine the need for adjusting the path of potential output for these effects.

In the macroeconometric model the rate of growth potential output follows an Okun's law relationship. As an identity, output (GNP82) equals output per person hours of labor services (q) times person hours of labor services. The latter, in turn, can be expressed as the product of hours per worker (h), the employment rate (e), the labor force participation rate (l), and the civilian adult population (N). Thus,

$$\text{GNP82} = q \cdot h \cdot e \cdot l \cdot N$$

or in terms of the civilian unemployment rate (U):

$$\text{GNP82} = q \cdot h \cdot (1-U) \cdot l \cdot N.$$

In rate of change form this becomes

$$\dot{\text{GNP82}} \cong \dot{q} + \dot{h} - \Delta\dot{U} + \dot{l} + \dot{N}.$$

Okun (1962) exploited systematic relationships between these variables to estimate a reduced-form relationship between changes in real GNP and changes in the unemployment rate. The macroeconometric model follows this approach, with the modification of explicitly allowing for the exogenous effect of population growth. Also, since quarterly data are used, changes in the unemployment rate depend upon a distributed lag on the rate of growth of real GNP.

Using annualized growth rates of real GNP and population, the estimated equation for the quarterly change in the civilian unemployment rate is:

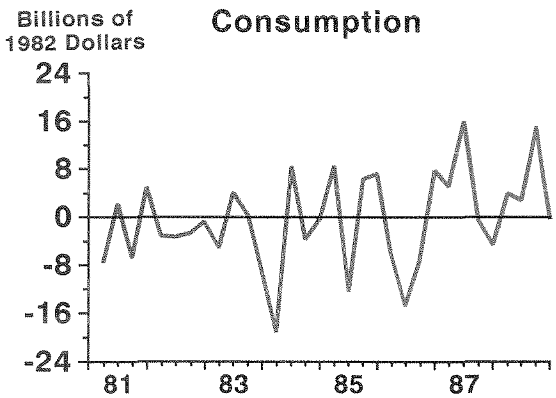
$$\Delta U = \underset{(2.59)}{.217} + \sum_{i=0}^{3} a_{-i}\,\text{GNP82}_{-i} + \underset{(1.70)}{.0761N}$$

$$\text{where } \sum_{i=0}^{3} a_{-i} = \underset{(-12.8)}{-\ .114}$$

The estimated growth rate of potential output is obtained by setting the change in the unemployment rate to zero and

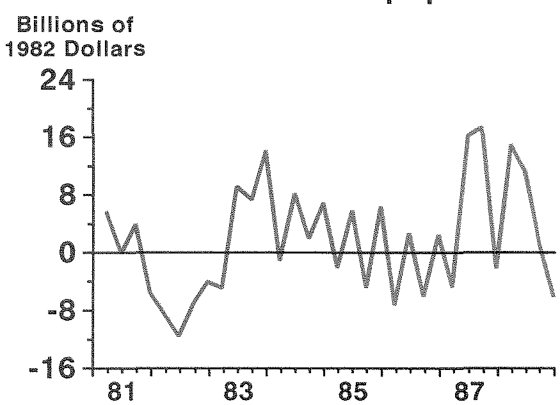
Chart 1
Out-of-Sample Forecasting Errors*

1A
Consumption

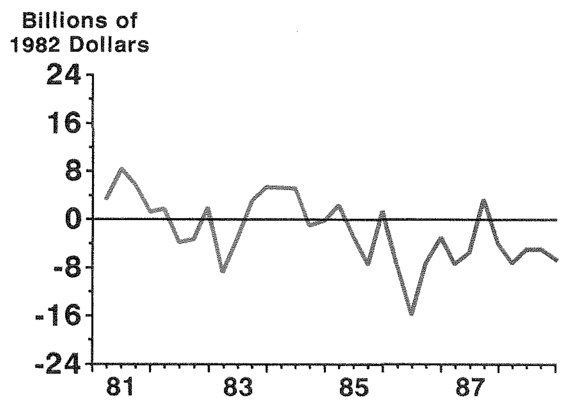


1B
Change in Unemployment Rate

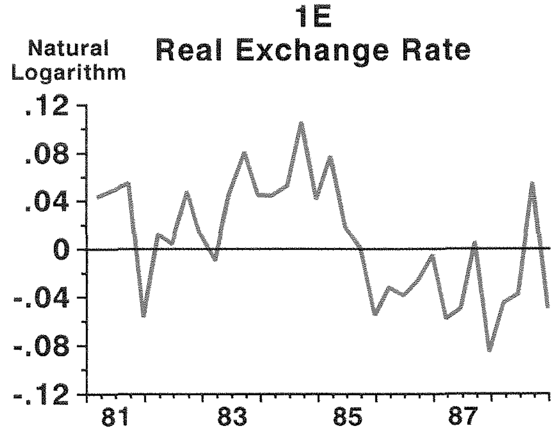
1C
Investment in Equipment



1D
Investment in Structures



1E
Real Exchange Rate



*Actual less predicted

solving for the corresponding growth rate of real GNP. With population growth averaging slightly more than 1.0 percent, the equation requires an annual growth rate of 2.7 percent to hold the unemployment rate constant. Therefore, in the macroeconometric model the growth of potential output is constant at this rate, except for the small variations due to population growth.

This equation has been quite stable. As shown in Table 1, the most likely breaks in structure occur at 1974:2 and 1984:1. But *F* tests reveal no significant shifts in the equation's coefficients at these points. In addition, the pattern of out-of-sample forecast errors over the 1981-88 period is not in the direction of unexpectedly high growth in potential GNP. As shown in Chart 1B, the actual change in unemployment tends to be lower than predicted. But the estimated growth rate in potential output equals the constant term (plus the contribution from population growth) divided by the sum of the coefficients on real GNP growth. So if these errors were due to downward shift in the constant term, potential growth would be reduced. Alternatively, if they were caused by more highly negative coefficients on real GNP growth, potential growth also would be less.

Thus, there is no evidence of any significant speed-up in the growth of potential output during the Reagan years. Still, there may have been a small effect from the fiscal changes that are known to have occurred. These include possible effects of lower personal tax rates on labor supply, of greater investment spending on labor productivity, and of a more efficient allocation of capital on productivity. Estimates of these specific effects are used to modify the estimate of the burden of Reagan debt obtained from the simulation of the macroeconometric model.

Hausman and Poterba (1987) have done a detailed study of the effects of the 1981-83 and 1986 tax changes on labor supply. They estimate that the 1981 Economic Recovery and Tax Act raised the labor supply of primary earners by 0.4 percent and that of secondary workers by 1.2 percent, giving a weighted increase of 0.6 percent in total labor supply. The 1986 Tax Reform Act is estimated to have increased primary earners' labor supply by 0.9 percent and secondary earners' supply by 2.6 percent, resulting in a total weighted increase of 1.4 percent. Thus, Hausman and Poterba estimate a total increase of 2 percent in labor supply due to tax reductions in the Reagan years. An alternative estimate can be derived from the work of Fullerton (1982). Fullerton calculates an overall weighted average elasticity of labor supply with respect to the real wage of 0.15 percent. As shown in Table 2, from 1980 to 1988 the average marginal tax rate for households fell from 30 percent to 23 percent, meaning that the average after-tax wage rose from 70 percent to 77 percent of the pre-tax wage, or by 10 percent. Thus, with an elasticity of 0.15, labor supply would rise by 1.5 percent—or close to the estimate by Hausman and Poterba.[13]

Table 1

F Tests for Stability

Equations	Periods	Critical Values 5%	Critical Values 1%	*F* Statistic
Consumption	1958:2-1970:4 1971:1-1989:4	1.91	2.47	1.21
	1958:2-1981:1 1981:2-1989:4	1.95	2.55	1.83
Change in Unemployment Rate	1966:3-1974:2 1974:3-1989:4	2.25	3.12	2.04
	1966:3-1984:1 1984:2-1989:4	2.21	3.04	0.80
Investment in Equipment	1959:1-1964:3 1964:4-1989:4	2.17	2.96	0.54
Investment in Structures	1963:1-1976:1 1976:2-1989:4	2.09	2.79	0.95
	1963:1-1984:1 1984:2-1989:4	2.09	2.79	2.04
Real Exchange Rate	1973:1-1982:2 1982:3-1989:4	2.08	2.80	1.71

Table 2

Marginal Tax Rates During Reagan Years

	Average Marginal Tax Rate for the Individual Federal Income Tax	Effective Federal Tax Rate on Equity Financed Business Investment		
		Equipment	Structures	Rental Housing
1960	.23	.29	.60	.35
1970	.24	.31	.69	.38
1980	.30	.13	.62	.44
1981	.31	.08	.54	.41
1982	.29	.06	.44	.40
1983	.28	.03	.40	.36
1984	.27	.02	.40	.39
1985	.27	.01	.39	.39
1986	.27	.07	.32	.31
1987	.25	.14	.29	.29
1988	.23	.14	.29	.29

As a generous estimate of labor supply effects, we assume in the simulation that labor supply was 2 percent higher than it otherwise would have been over all eight years of the Reagan administration, and that this increase was fully incorporated into actual employment and output. Assuming an elasticity of substitution of 1.0, potential real GNP would increase by labor's share in total output (.7) times the 2 percent increase in labor supply, or by 1.4 percent. The average level of real potential GNP over the period was approximately $3,500 billion. So the average increase in potential real GNP would be $3,500 × .014, or $49 billion. Net private saving (including household saving in the form of consumer durables) averages 7 percent of GNP. So the average addition to either the capital stock or net investment abroad would be $3.4 billion (49 × .07) per year. Over 8 years that comes to $27.2 billion in 1982 dollars. This amount will be added in to the simulated impact of fiscal policy in the Reagan years.

Other possible effects on potential output come from capital investment. First, to the extent that capital investment was increased, the productivity of labor would be increased and potential output raised. But this effect would not be captured by the Okun's law equation that assumes a constant growth rate of potential output. The extent of the required adjustment for this effect is examined below, after the results of the model's simulation on investment are obtained. However, the overall size of this adjustment is very much less than that for the effects on labor supply. Lower taxes on business tended to raise business investment, but the higher interest rates due to larger budget deficits tended to lower it, resulting in relatively little net effect on investment from fiscal policy.

A second effect could have come through a change in the efficiency of the allocation of capital. Capital is inefficiently allocated if the after-tax cost of capital differs between different types of capital investments as the result of differing tax treatment. Hendershott (1987a) has done the most detailed study on the effects of tax changes on the efficiency of capital's allocation during the Reagan years. He finds that the 1981-83 tax changes reduced the efficiency of capital's allocation within the corporate sector, but increased the efficiency of its allocation between owner-occupied housing and the corporate sector. Given the large bias toward owner-occupied housing prior to these tax changes, overall they probably allocated capital more efficiently. But then, although the 1986 Tax Reform Act narrowed the differences in the after-tax cost of capital across corporate assets, it greatly increased the bias in favor of owner-occupied housing. On balance, Hendershott estimates that the 1986 law returned the overall efficiency of the allocation of capital to about that of the pre-1981 law. Also, since the size of the efficiency loss under the current law is estimated at only 0.25 percent of GNP, any possible changes in it would be of a very small order of magnitude.[14] Consequently, no adjustment is made to the results of the simulation for any effect of fiscal changes on the efficiency of the allocation of capital.

Business Investment

In the alternative view of the economy, in the Reagan years investment opportunities improved not only because of tax cuts for business but also as a result of deregulation and a reduced risk of government intervention. An improved investment climate could have been an independent source of greater capital investment, higher interest rates, a stronger dollar, and larger capital inflows. Except for the tax effects, an improved climate for investment would not necessarily have been a part of the response to Reagan fiscal policy. Nonetheless, this investment would have increased the capital stock of future generations, and, therefore, provided an offset to any burden created for future generations by fiscal policy in the Reagan years. Therefore, we examine the stability of business investment in relation to its economic determinants.

The macroeconometric model used for the simulation employs a standard neoclassical model of business fixed investment, as refined by Hall and Jorgenson.[15] A firm's desired capital stock is determined by the expected scale of its output and relative factor prices. Given its expected output, the desired capital stock varies inversely with the real after-tax cost of capital. Because of an imperfect secondary market for business capital goods, market prices do not equate desired and actual capital stocks in the short run. Instead, firms are assumed to eliminate some fraction of the gap between desired and actual capital stocks in the current period. This makes planned investment a function of sales, the rental cost of capital, and the lagged capital stock.

Because the investment decision gives rise to a whole stream of investment expenditures, investment spending appears as a distributed lag on these variables, where the lags are those between appropriations and expenditures. In addition, expenditures may be modified after appropriations have been made. This effect is captured by adding a "surprise" variable, equal to the difference between sales lagged one quarter and a measure of expected sales.

The model's estimated equation for nonresidential fixed investment in equipment is:

$$\text{GIPD82} = \underset{(-4.11)}{-136.6} + \underset{(5.87)}{.178} \sum_{i=2}^{9} u_{-i}\,\text{GNS82}_{-i}$$

$$- \underset{(3.32)}{.0211} \sum_{i=2}^{9} u_{-i}\,\text{RE}_{-i}\,\text{GNS82}_{-i}$$

$$- \underset{(-0.11)}{.00529} \sum_{i=2}^{9} u_{-1}\,\text{KPD82}_{-i}$$

$$+ \underset{(5.35)}{.120} [\text{GNS82}_{-1} - \text{E(GNS82)}]$$

$$+ \underset{(13.2)}{.889} e_{-1}$$

where $\sum_{i=2}^{9} u_{-i} = 1.0$ and

GIPD82	=	nonresidential fixed investment in equipment in 1982 dollars
GNS82	=	final sales in 1982 dollars
RE	=	rental cost of capital for equipment
KPD82	=	capital stock of equipment, in 1982 dollars
E(GNS82)	=	expected final sales

The equation for nonresidential investment in structures is similar, except that a relatively short distributed lag on the real price of oil (POIL), scaled by the size of the capital stock in structures (KPS82), is included to account for investment in oil drilling:

$$\text{GIS82} = \underset{(5.17)}{77.1} + \underset{(3.70)}{.0674} \sum_{i=2}^{9} u_{-i}\text{GNS82}_{-i}$$

$$- \underset{(-1.63)}{.00482} \sum_{i=2}^{9} u_{-i}\,\text{RS}_{-i}\,\text{GNS82}_{-i}$$

$$- \underset{(-2.90)}{.106} \sum_{i=2}^{9} u_{-i}\,\text{KPS82}$$

$$+ \underset{(3.14)}{.0395} [\text{GNS82}_{-1} - \text{E(GNS82)}]$$

$$+ \underset{(4.25)}{.016}\,\text{POIL KPS82}$$

$$+ \underset{(2.92)}{.016}\,\text{POIL}_{-1}\,\text{KPS82}_{-1} + \underset{(17.9)}{.879}\, e_{-1}.$$

The real after-tax cost of capital has an important influence on both types of investment. A one percentage point increase in the real after-tax cost of capital is estimated to depress investment in equipment by 2.1 percent and investment in structures by 2.6 percent. The expectations of inflation in the real cost of capital are formed adaptively.

These investment equations exhibit a high degree of stability. The most likely break-points occur in 1964:3 for equipment and in 1976:1 and 1984:1 for structures. But stability is accepted with an F test at the 5 percent level in all cases (Table 1). Moreover, out-of-sample prediction errors for the period 1981-88 do not show any patterns that suggest a distinctly improved investment climate in the Reagan years (Charts 1C and 1D). Investment in equipment tends to be less than predicted in 1982 recession, but greater than predicted in 1983, and again in 1987 and 1988, when capacity utilization was relatively high. Thus, the errors appear more closely related to business cycle effects than to a permanent improvement in the investment climate. Also, while prediction errors for equipment are generally positive, those for structures tend to be negative. Thus, the view that the investment climate improved independently of tax factors that are already included in the model of business investment is not supported by the data.

Another recent study that examines the stability of a standard neoclassical model of business fixed investment in the 1980s is Corker, Evans, and Kenward (1989). It too finds that such a conventional model can explain investment behavior quite well over this period and that evidence of parameter instability is very limited.

The Exchange Rate

In the alternative view of the economy in the Reagan years, the emergence of a relatively safe haven for foreign investment was an important factor in increasing the net inflow of capital to the U.S. and driving up the value of the dollar, tending to offset any crowding out of domestic capital formation that would have been generated by budget deficits. Again, although a safe haven effect would not necessarily have been a response to Reagan fiscal policy, it could have provided an offset to the burden of fiscal policy created in the Reagan years by increasing the capital stock for future generations.

A safe haven effect would have produced instability in the macroeconometric model's equation for the exchange rate. This equation follows the asset theory of exchange rates in which an open interest parity condition approximately holds.[16] Except for a risk premium, the current real value of the exchange rate is assumed to be at the point where the expected capital gains or losses from its expected future return to long-run equilibrium just offset the difference between interest returns in the U.S. and abroad. This implies that the current real value of the dollar equals its expected future equilibrium value plus the difference in real interest returns between U.S. and foreign assets, plus the amount of any risk premium. A safe haven effect for the dollar would make this risk premium more positive.

Real long-term interest rates in the model are assumed to conform to the expectations theory of the term structure of interest rates, where expectations of future short-term rates and future inflation are formed adaptively.[17] Expectations may be formed differently for interest rates than for inflation. So the real value of the dollar becomes a function of separate distributed lags on the differences between U.S. and foreign interest rates, and between U.S. and foreign inflation. Also, the market's expectation of the equilibrium real value of the dollar depends upon expected high-employment budget balances at home and abroad. Although the sign of these latter effects is theoretically indeterminate, depending importantly on the market's effective time horizon, it is found that expectations of a larger budget surplus depress the expected real value of a country's currency because of the expected reduction in the government's demand for credit. Expectations of future budget positions are assumed to be formed adaptively, being based on the high-employment budgetary balance over the previous year.[18]

The econometric model's exchange rate equation is:

$$\begin{aligned}\ln EXCH = \ & \underset{(62.5)}{3.38} + \sum_{i=0}^{17} a_{-i}(i_s - i_s^*)_{-i} \\ & + \sum_{i=0}^{17} b_{-i}(\dot{p} - \dot{p}^*)_{-i} \\ & \underset{(-2.46)}{-.0374B} + \underset{(1.68)}{.0477B^*} + \underset{(7.79)}{.708e_{-1}} \\ & \sum_{i=0}^{17} a_{-i} = \underset{(6.90)}{.0908} \quad \sum_{i=0}^{17} b_{-i} = \underset{(-6.80)}{-.0908}\end{aligned}$$

where EXCH = real trade-weighted value of U.S. dollar

i_s, i_s^* = short-term interest rate in the U.S. and abroad, respectively.

$\dot{p}$, $\dot{p}^*$ = inflation rate in the U.S. and abroad, respectively.

B, B^* = high employment budget balance as percent of high employment GNP in previous four quarters for U.S. and foreign countries, respectively.

A sustained one percentage point increase in the differential between U.S. real short-term interest rates and the trade-weighted foreign real rate is estimated to raise the real trade-weighted value of the dollar by 9 percent. Also, a one percentage point increase in the U.S. budget surplus, as a percent of high employment GNP, lowers the real value of the dollar by approximately 4 percent through its effect on the expected equilibrium value of the dollar, while a like change in the trade-weighted foreign budget balance appreciates the dollar by about 5 percent.

Turning to the stability of the exchange rate equation, the most likely break point in its structure is found to be 1982:2. But an F test reveals no significant shift in its coefficients at this point, as shown in Table 1. Also, the out-of-sample prediction errors for the period 1981 to 1988, shown in Chart 1E, indicate only a temporary safe-haven effect at best. Up until 1985 the dollar's value is somewhat stronger than predicted. But the size of this error averages no more than 4 percent, and nearly equally large errors in the opposite direction subsequently develop. Thus, even if there was a small safe-haven effect acting to strengthen the dollar by increasing the risk premium up until 1985, a nearly equally large negative effect on the risk premium occurred after 1985. Therefore there is no evidence of a sustained safe-haven effect during the 1980s, which would have raised U.S. domestic investment significantly by attracting net capital inflows independently of the effect of U.S. fiscal policy[19]

II. Simulated Effects of Fiscal Policy

The previous section found no significant shifts in key macroeconomic relationships that might either bias the simulated effects of fiscal policy in the 1980s or create an independent offset to the estimated burden of fiscal policy on future generations. This section goes on to simulate the effects of fiscal policy on U.S. capital formation and indebtedness to foreigners, using the mainline neo-Keynesian macroeconometric model.

Most of the key relationships in this model have been described in the previous section. It is assumed that short-term interest rates are determined either as matter of Federal Reserve policy or, if money is being targeted, through an equilibrium between the supply and demand for money. Long-term interest rates basically follow the expectations theory of the term-structure of interest rates. Foreign central banks are assumed to partially respond to changes in U.S. interest rates so as to stabilize their economies.

Investment spending on consumer durables and housing is importantly determined by nominal after-tax interest rates because of the importance of liquidity constraints, while investment spending on business plant and equipment responds to real after-tax interest rates. Net exports are dependent upon the real exchange rate, which in turn is a function of differences between real interest rates at home and abroad, as well as expected budget deficits.

These elements of spending then combine with consumption spending and inventory investment to determine the aggregate demand for output and the rate of unemployment. The inflation rate is determined by an expectations-augmented Phillips curve, in which the inflation is a function of the current unemployment rate and expected inflation, with additional effects from the price of oil and the exchange rate. Expectations in the Phillips curve are formed adaptively, and there is no trade-off between inflation and unemployment in the long run.[20]

Simulation Methodology

The effects of fiscal policy during the Reagan years were estimated in two steps. First, the historical errors in each equation of the macroeconometric model were added back in to allow a simulation of the model to replicate history exactly, or in other words to produce the historical baseline. Second, with historical errors still in the equations, the effect on the economy of holding the relevant fiscal policy variables at their 1980 levels, instead of at their actual historical values, was simulated. Then the difference between the economy's performance in the historical baseline and in the counterfactual simulation with an unchanged fiscal policy after 1980 can be attributed to the changes in fiscal policy that occurred during the Reagan years.

Two aspects of this approach require further elaboration. The first is the measurement of an unchanged fiscal policy, and the second is the assumption made with respect to monetary policy. From a macroeconomic point of view, there are two dimensions to the measurement of an unchanged fiscal policy. First, there should be no change in federal marginal tax rates that would alter economic incentives. For example, in the macroeconometric model the average marginal tax rate for households affects their after-tax mortgage rate and, therefore, influences expenditures on housing. Similarly, business taxes influence the cost of capital for nonresidential investment and rental housing. An unchanged fiscal policy is defined, in part, as one that does not alter marginal tax rates that affect these expenditures.

As shown in Table 2, the Economic Recovery and Tax Act of 1981 and the Tax Reform Act of 1986 reduced the average marginal federal tax rate on individual income from 30 percent in 1980 to 23 percent in 1988. In the counterfactual simulation that keeps fiscal policy unchanged, the average federal marginal tax rate for households is therefore held constant at 30 percent from 1980 through 1988, instead of being allowed to fall. As a result, after-tax interest rates for households are reduced, and their expenditures on durable items are raised, relative to actual expenditures in this period.

The Tax Act of 1981 also reduced effective tax rates on business investment by shortening depreciable "tax lives" and increasing the investment tax credit for purchases of equipment. The Tax and Fiscal Responsibility Act of 1982 took back part, but by no means all, of these tax cuts for business as a part of a package to reduce the size of the federal budget deficit. Then, in 1986, the Tax Reform Act reduced the corporate income tax rate from 46 percent to 34 percent, but at the same time eliminated the investment tax credit for equipment and lengthened the tax lives for residential and nonresidential structures. The net effects of these changes are also shown in Table 2.[21] The effective tax rate on investment in equipment dropped from 13 percent in 1980 to only 1 percent in 1985, but then rose to 14 percent by 1988. The tax rates on investment in structures and rental housing were cut by one third to one half in this period. In the counterfactual simulation of an unchanged

Table 3

Federal Spending and Revenues During Reagan Years

(Percent of High Employment GNP)

	Cyclically Adjusted Federal Budget Balance[1]	Federal Purchases of Goods and Services	Cyclically Adjusted Federal Taxes[1]	Cyclically Adjusted Federal Transfer Payments	Grants-in-Aid to State and Local Governments
1960	1.7	10.5	17.6	5.9	1.2
1970	0.4	9.7	18.9	8.2	2.4
1980	−0.3	7.6	20.9	11.2	3.2
1981	0.0	7.9	21.8	11.7	2.9
1982	−1.4	8.6	20.6	12.0	2.5
1983	−2.2	8.3	20.0	12.4	2.4
1984	−2.8	8.2	19.5	12.3	2.5
1985	−3.8	8.8	19.7	12.8	2.5
1986	−4.0	8.6	19.5	13.0	2.6
1987	−2.8	8.4	20.2	13.1	2.4
1988	−2.4	7.8	20.3	13.3	2.4

[1]Counts erosion in real value of federal debt due to inflation as a federal receipt. (See Box 1.)

fiscal policy, these effective tax rates are held at their 1980 values, tending to reduce business investment spending relative to actual business investment in the 1980s.

The second dimension of an unchanged fiscal policy is that there should be no change in federal outlays and receipts measured on a high employment basis. Unchanged receipts would prevent disposable income, and hence consumption, from changing on account of fiscal policy. With unchanged government receipts and outlays, as well as unchanged marginal tax rates, there would be no change in aggregate demand due to a change in fiscal policy.

As shown in Table 3, the federal high employment budget deficit rose from 0.3 percent of high employment GNP in 1980 to 4.0 percent in 1986, and then dropped back to 2.4 percent of GNP by 1988. (In this calculation of the fixed deficit, the erosion in the real value of the federal debt due to inflation is counted as a receipt, as explained in Box 1). The most permanent contributor to the deficit's increase was an increasing ratio of federal transfer payments to GNP, which rose over 2 percentage points. In contrast, purchases of goods and services as a proportion of high employment GNP rose only a little more than one percentage point through 1985, but returned almost to their 1980

(Box 1)

Inflation Premiums and Budget Deficits

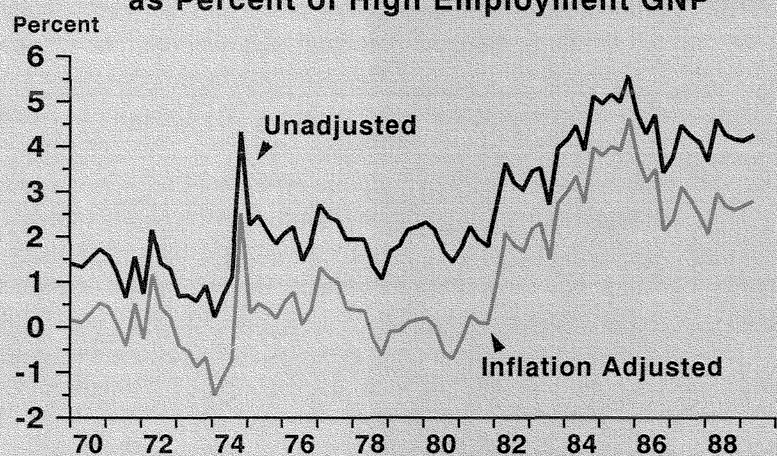
The federal government budget counts as an outlay the inflation premiums in interest rates that compensate bondholders for the loss in real purchasing power of the principal value of their holdings of government debt, but it does not count the corresponding loss in the real value of debt as a tax, which of course it is. As a result, the size of the federal deficit is overstated by the amount of the inflation premiums.

Correcting this overstatement gives a truer measure of the effect of a fiscal deficit on household income, and hence spending. Households should save the income that they receive in the form of inflation premiums in order to keep the real value of their wealth intact. As a result, any budget deficit that is created by such premiums will tend to be matched by an increase in household saving, producing no net increase in aggregate demand and no tendency for private investment to be crowded out. By counting the erosion in the real value of federal debt due to inflation as a tax, this overstatement of the degree of stimulus of the fiscal deficit to aggregate demand is corrected.[26]

The inflation tax on the federal government's debt has ranged approximately between 1 and 2 percent of GNP. It dropped from 1.9 percent of GNP in 1980 to 0.9 percent by 1986 as inflation and interest rates fell, but then rose back to 1.6 percent by 1988 as federal debt continued to rise faster than GNP.[27]

As shown in the accompanying chart, correcting for the inflation tax has a noticeable effect on the level of the federal government's fiscal deficit, but much less so on the extent of changes in the deficit over time. The figures on the deficit shown in Table 3 already make this correction. Thus, even after correcting for changes in the inflation tax, fiscal policy in the Reagan years created a substantial increase in the federal budget deficit.

Federal High Employment Budget Deficit as Percent of High Employment GNP



level by 1988. Although the ratio of income tax receipts to GNP dropped two percentage points, a rise in Social Security taxes approximately offset this decline.

In the counterfactual simulation of an unchanged fiscal policy, the ratio of federal purchases of goods and services to high-employment GNP is held at its 1980 value. In the macroeconometric model, the impact of policy induced changes in total federal receipts and transfer payments on household disposable income, and hence consumption, is captured by the ratio of cyclically adjusted federal taxes less transfer payments to high employment GNP. So in the counterfactual simulation of an unchanged fiscal policy, this ratio is also held at its 1980 value, except for an adjustment for state and local taxes.

As shown in Table 3, the Reagan fiscal package included a reduction in grants-in-aid to state and local governments. These governments were able to absorb the grant reductions and maintain approximately the same level of

(Box 2)

Capital Investment by the Federal Government

The national income accounts regard as investment the purchases of durable goods by businesses and households to create future output and, in turn, income. Government purchases of fixed facilities similar to business plant and equipment are not counted as investment, in part because they are not managed the way a private enterprise might manage them. Rather, they are classified as consumption. As a result, a rise in government spending or a decline in taxes reduces either domestic investment or net foreign investment in the national income accounts, given the level of private saving.[28]

But if the standard of durable goods that produce future output and income were applied to governments, some of their activities could well be considered as investment. Included for the federal government would be public investment in highways, office and other buildings, water resource development projects, military base facilities, and the physical assets of research and development agencies.

Recent trends in such federal investment are shown in the accompanying table. Federal net investment in nondefense physical capital was quite small in the 1980s, and also not much larger than in the previous two decades.[29]

From 1980 to 1988 federal net investment in nondefense military capital increased by only $3.4 billion in 1982 dollars, or by less than one-tenth of 1 percent of the net national product. Adding in the available data on investment in military structures, total federal net investment in physical capital rose only from $4.1 billion in 1980 to $4.7 billion in constant dollars by 1986, leaving it an unchanged proportion of net national product.

A broader definition of federal government investment might include any expenditure that yields long-term benefits. Included in this broader concept would be military weapons systems, federally funded research and development, state and local investment through federal capital subsidies, and investment in human capital. The broader concept would require parallel changes in national estimates of investment in the private sector. The Congressional Budget Office (1987) has attempted to estimate what the inclusion of these broader types of net public investment would do to trends in national saving and investment during the 1980s. Using the more generous measure of net public investment in each category, broadening the concept of public investment adds about two percentage points to net domestically owned investment as a percent of net national product in the late 1970s, and also about two percentage points in the mid-1980s. Thus, it can be fairly concluded that there was no significant increase in the rate of federal capital formation during the Reagan years, however measured.

Federal Net Investment in Physical Capital

(Billions of 1982 Dollars)

	Nondefense[1]	Total[2]
1960	1.8	NA
1970	1.2	4.7
1980	2.6	4.1
1981	2.6	3.9
1982	1.6	1.1
1983	1.0	3.3
1984	2.6	1.6
1985	3.9	2.2
1986	3.2	4.7
1987	4.2	NA
1988	6.0	NA

[1]Source: *Special Analysis: Budget of the United States Government, Fiscal Year 1990*, p. D-11.

[2]Source: Congressional Budget Office, *Trends in Public Investment*, December 1987.

services by raising taxes toward the end of the 1981-82 recession (see Weicher (1987)). Since the change in the ratio of cyclically adjusted *federal* taxes less transfer payments to high-employment GNP overstates the *total* reduction in net taxes and transfers, in the counterfactual simulation this change was adjusted for the increase in state and local taxes.

Finally, the burden of fiscal policy during the Reagan years would have been reduced to the extent that the increase in federal debt financed greater capital formation by the federal government. But as discussed in Box 2, the federal government's capital formation as a percent of high employment GNP was neither significantly higher nor lower during the Reagan years than it was earlier. Therefore, in the counterfactual simulation of an unchanged fiscal policy no change is made in the amount of public investment.

The counterfactual simulation of an unchanged fiscal policy requires an assumption to be made with respect to the reaction of the Federal Reserve's monetary policy. The goal of the Reagan Administration and the Federal Reserve was to reduce the rate of inflation from near double digit to more moderate levels. Monetary policy was successful in achieving this objective. Inflation in the GNP price index dropped from 9.3 percent in 1980 to 4.0 percent in 1984 and stayed in the 4 percent range through the end of the decade. The demand for money became unstable in this period, however, and the Federal Reserve shifted emphasis in its short-run operating procedures from targeting money to looking through to its ultimate economic objective of controlling inflation. But because of the long lags between monetary policy and its impact on inflation, an intermediate target was still needed.

One widely used approach for forecasting the dynamics of inflation is the expectations-augmented Phillips curve with adaptive expectations, as used in the macroeconometric model in this paper. In this framework, the unemployment rate is a logical intermediate target for monetary policy. Unemployment has both a direct effect on the inflation rate through current labor market pressures and an indirect one operating through inflation expectations. So any desired path for inflation requires a corresponding path for the unemployment rate. In the basic counterfactual simulation of an unchanged fiscal policy, it is therefore assumed that the Federal Reserve used the unemployment rate as an intermediate target and achieved the same unemployment rate as occurred historically.[22]

As is common, the expectations-augmented Phillips curve in this macroeconometric model also contains an effect on inflation from current and lagged changes in the real value of the dollar. This effect operates through competitive pressures in the tradeable goods sector of the economy. These effects are assumed to be regarded as one-time changes by market participants and therefore do not feed through to inflation expectations. But an unchanged fiscal policy would have produced a lower value for the dollar than actually occurred, and consequently a higher price level. Therefore, to achieve any price level, the Federal Reserve would have had to conduct a tighter monetary policy than otherwise. For an alternative reaction of monetary policy, we therefore assume in the counterfactual simulation that the Federal Reserve achieved the same level of prices by the end of the Reagan years as actually occurred. This would imply higher interest rates and higher unemployment than in the case of the counterfactual simulation that uses the unemployment rate as a target.

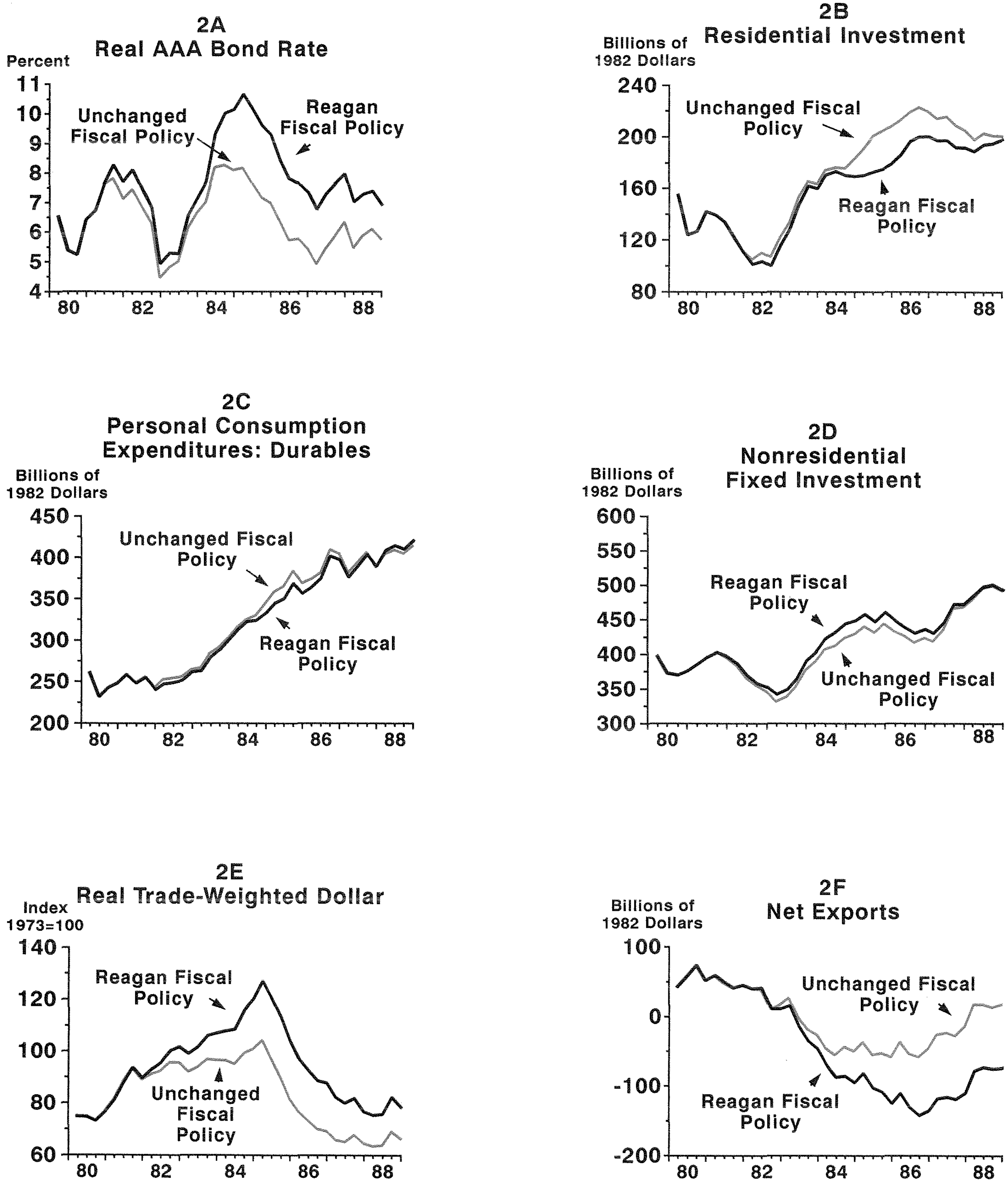
The simulated effects of fiscal policy during the Reagan years are most easily seen in chart form. These charts show the results of the simulation on the assumption that the Federal Reserve would have targeted the unemployment rate. The results of the simulation under the alternative target for monetary policy are discussed below. Although nominal yields on long-term bonds generally declined in the 1980s, real (or inflation adjusted) bond rates actually rose quite substantially. Furthermore, as shown in Chart 2A, the rise in real bond rates was primarily due to the effect of fiscal policy. It is estimated that with an unchanged fiscal policy the real bond rate still would have shown considerable cyclical fluctuation, but would have been 1 to 2 percentage points lower on average.

Next consider the investment sectors of the economy that would have been significantly affected by the higher interest rates, starting with residential investment. As mentioned earlier, in the case of owner occupied housing, the lower marginal income tax rates of the Reagan fiscal program worked to discourage housing investment by raising the after-tax cost of capital. But in rental housing the effective tax rate on new investment went down. Of course, both sectors were discouraged by higher interest rates. Chart 2B shows that the net effect of fiscal policy was to reduce total residential investment. Residential investment was clearly crowded out by the fiscal expansion in this period, consistent with the conventional view.

Chart 2C shows a similar story for household spending on consumer durables. Both the tax effects and the interest rate effects of fiscal policy in the Reagan years worked to discourage consumer spending on durables, and the simulation confirms that with an unchanged fiscal policy consumer spending on durables generally would have been higher.

There was a significant increase in tax incentives for

Chart 2
Simulated Effects of Fiscal Policy During Reagan Years



business investment, however. Indeed, Chart 2D shows that they were strong enough to outweigh the effects of higher real interest rates to some extent. Thus, the fiscal expansion in the Reagan years on balance acted to raise business investment by a modest amount, or to crowd it in rather than to crowd it out. But taking these three investment sectors together over the entire 1981 to 1988 period, the reduction in the stock of housing and consumer durables exceeded the stimulus to nonresidential fixed capital by $40.3 billion, as shown in Table 4. In addition, the simulation shows a $13.6 billion reduction in the stock of inventories, bringing the total simulated reduction in the capital stock to $53.9 billion.

Other studies have been unable to find any significant change in the rate of accumulation of fixed nonresidential capital in the 1980s. For example, Oliner (1989) concludes that the pace of accumulation of business capital in the 1980s continued to support a rate of capital deepening (relative to the labor force) not much different from the postwar average, suggesting that characterizations of capital formation in the 1980s as unusually weak or unusually strong are unwarranted. Another study by Englander and Steindel (1989) also reaches the same conclusion.

Table 4
Estimated Cumulative Impacts of Fiscal Policy During the Reagan Years
(In Billions of 1982 Dollars)

		Assumed Target for Monetary Policy	
	Sector	Unemployment Rate	Price Level
1.	Stock of Inventories	−15.5	−10.7
2.	Stock of Consumer Durables	−15.4	−8.5
3.	Stock of Residential Capital	−83.1	−72.7
4.	Stock of Nonresidential Fixed Capital	47.2	65.6
5.	Total Stock of Capital (1+2+3+4)	−66.8	−26.3
6.	Net Indebtedness to Foreigners	370.7	362.5
7.	Estimated Labor Supply Effects (Either Increasing the Capital Stock or Reducing Net Indebtedness to Foreigners	27.2	27.2
8.	Total Burden on Future Generations (6-5-7)	410.3	361.6

Our simulated increase in fixed nonresidential capital due to fiscal changes in the 1981 to 1988 period comes to $47.2 billion in 1982 dollars, or 1.3 percent of the average level of that stock in the 1980s; and under the alternative assumption for monetary policy it is $65.6 billion, or 1.8 percent. This is equivalent to an increase in the annual growth rate of the stock of fixed nonresidential capital of around 0.2 percent during this period. Given the small size of this number relative to the long-term growth trend of about 3 percent, it is not surprising that other studies have not been able to find a significant break in the rate of accumulation of business capital in the 1980s.

Neither are the estimated effects on the capital stock large enough to significantly alter potential GNP. Assume that all of the estimated $27.2 billion effect of a larger labor supply on private saving was channeled into domestic capital formation. Still, the total change in domestic capital stock (exclusive of consumer durables) comes to a decline of $24.2 billion in the simulation where the Federal Reserve targets the unemployment rate, and to an increase of $9.4 in the alternative simulation. As a result, the average level of the capital stock as a percent of GNP would have been 0.3 percent lower to 0.1 percent higher than otherwise. Assuming a 20 percent gross rate of return on investment, potential GNP therefore would have been .06 (.3 × .2) percent lower to .02 (.1 × .2) percent higher because of the effects of fiscal policy on capital formation. Since these estimates are small (equaling less than one-twentieth of the estimated effect of labor supply on potential output) and on average close to zero, no adjustment is made for the effect of investment on potential output.

The remaining burden of fiscal policy during the Reagan years stems from its effect on indebtedness to foreigners. As we have seen, fiscal policy put upward pressure on real interest rates in the United States. These, in turn, attracted capital from abroad which was used either directly or indirectly to finance the higher level of government borrowing. As foreign investors purchased dollars, they put upward pressure on the real foreign exchange value of the dollar.

Chart 2E shows the effect of fiscal policy on the real trade-weighted value of the dollar. The large volume of foreign capital that the Reagan fiscal expansion attracted put significant upward pressure on the dollar. It boosted the real value of the dollar by a maximum of nearly 25 percent in 1985; and even by 1988, when the federal budget deficit had been reduced somewhat, the real value of the dollar was still 15 percent higher than it otherwise would have been.

A by product of the stronger dollar was a large deterioration in our trade balance. For supply to equal demand in the foreign exchange market, a dollar of extra capital inflow must produce a dollar's worth of reduction in net exports. So the reduction in net exports is also a measure of the net increase in foreign capital inflows.[23] As shown in Chart 2F, U.S. net exports would have declined—and net capital inflows increased—even with an unchanged fiscal policy because of the strong growth of the U.S. economy as it pulled out of the 1982 recession. But by 1988 the change in fiscal policy had reduced the value of net exports in 1982 dollars by over $90 billion. Thus, the effect of fiscal policy in the Reagan years was to add about $90 billion dollars of indebtedness to foreigners in peak years, and lesser amounts in other years, without increasing the domestic capital stock to provide any more income to service this debt. As shown in Table 4, by 1988 foreign indebtedness is estimated to have been $370.7 billion greater, in 1982 dollars, than it otherwise would have been with an unchanged fiscal policy.

The assumption that the Federal Reserve would have targeted the price level, rather than the unemployment rate, makes relatively little difference to the simulated effects of fiscal policy, as shown in Table 4. On the assumption that monetary policy targeted the unemployment rate, fiscal policy in the Reagan years reduced the price level by 2 percent because of a stronger dollar. So targeting the price level would have allowed a somewhat easier monetary policy. However, this reduces the simulated increase in short-term interest rates that is attributed to the effects of fiscal changes in the Reagan years by only 15 basis points. The estimated impact of fiscal policy on the total stock of capital is reduced by $40.5 billion, and on indebtedness to foreigners by $8.2 billion. The total estimated burden of fiscal policy is reduced by only 12 percent.

Another intermediate target that the Federal Reserve might have followed in this period is nominal GNP. But targeting the unemployment rate is almost the same as targeting real GNP, given the small supply-side effects of fiscal policy on potential output. So a simulation assuming nominal GNP targeting (or some combination of real GNP and price level targeting) on the part of the Federal Reserve would lie between the other two alternatives.

III. Summary and Conclusions

This paper has tested alternative views of the burden that fiscal policy placed on future generations in the Reagan years. The more conventional view is that fiscal deficits led to a substantial crowding out of capital formation and net exports, and as a result reduced the capital stock and increased the indebtedness of future generations to foreigners. In the alternative view, there were important offsetting responses to fiscal policy that reduced these effects. One is a Ricardian response of private saving to the budget deficits, and another is a positive response of private saving, investment, and work effort to lower marginal tax rates. But no evidence of a Ricardian response in consumption is found, and the estimated response of saving to changes in the real interest rate is very small. Similarly, the estimated effects of lower marginal tax rates on labor supply, and hence potential output, provide only a small offset to the burden. Also, while lower tax rates stimulated domestic investment, higher real interest rates discouraged it. As a result, no significant influence of domestic investment on potential output is estimated.

Neither is it possible to find any evidence of an improvement in the investment climate of the U.S., which could have independently boosted the stock of capital for future generations. Although business investment responded positively to reductions in the effective rate of taxation, it did not exhibit any unusual strength relative to its usual economic determinants. Similarly, although there is some evidence of a small "safe-haven" effect acting to strengthen the dollar and net capital inflows up until 1985, an equal and opposite effect on the dollar developed afterward. Thus, there is no evidence of any sustained safe-haven effect during the 1980s, which would have lowered the cost of capital and raised U.S. domestic investment by attracting net capital inflows from abroad independently from the pull of U.S. fiscal policy.

The cumulative change in the U.S. high employment budget deficit from 1981 to 1988 comes to $619.4 billion, in 1982 dollars (Table 3). The longer-run tendency should be for budget deficits to fully crowd out interest sensitive private investment spending and net exports. But because of lags in the responses of investment to interest rates, and net exports to the exchange rate, the actual effect over any finite period should be smaller. A simulation using a mainline neo-Keynesian macroeconometric model estimates the reduction in the total domestic capital stock due to fiscal changes in the Reagan years at $66.8 billion, in 1982 dollars, when the unemployment rate is assumed to be the intermediate target of monetary policy. Alternatively, the reduction comes to $26.8 billion if it is assumed that the Federal Reserve targeted the price level. However, the largest estimated impact by far is on net exports, and therefore on an increased indebtedness to foreigners. It is estimated that fiscal policy in the Reagan years increased net indebtedness to foreigners by $410.3 billion, in 1982 dollars, if the unemployment rate is assumed as an intermediate target for monetary policy, and $361.6 billion if the price level is assumed as the target.

It is interesting to compare these estimates with those from other macroeconometric models. Helliwell (1990) has surveyed the consequences of an increase in debt-financed U.S. government spending for ten multicountry econometric models having alternative kinds of expectations. In almost all of them, there is complete or nearly complete crowding out of real private spending and net exports in the medium term; and the crowding out tends to be divided about evenly between investment expenditures and net exports.

There are two fundamental reasons why the simulation in this paper produces a larger proportionate effect on net exports, and smaller impact on investment, than in the models surveyed by Helliwell. In the first place, the simulations surveyed by Helliwell assume only a simple change in debt-financed government spending, and so do not capture the full details of the kinds of fiscal changes that occurred in the Reagan years. In particular, the large tax cuts for business tended to shift crowding out from domestic investment to net exports. Second, a unique feature of the present macroeconometric model is an expectational effect of budget deficits on the exchange rate. Thus, the expectation of continued U.S. budget deficits raised the value of the dollar independently from the budget's effect on interest rates. As a result, the dollar rose by more and interest rates rose by less than would otherwise have been the case. This shifted the crowding out even further on to net exports and away from domestic investment.[24]

The burden that fiscal policy placed on future generations in the Reagan years can be expressed either in terms of (1) the lump sum amount that would be required to restore the capital stock and pay off the extra foreign debt, or (2) the annual loss of future income due to the reduced capital stock and the servicing of an increased amount of foreign debt. Over the full eight years of the Reagan Administration, the total burden of fiscal policy on future generations comes to a lump sum amount of between $361.6 and $410.3 billion, in 1982 dollars, depending on the assumption made for monetary policy. This includes a $27.2 billion offset from favorable labor supply effects created by lower marginal tax rates. To put this total burden in perspective, it is equal to about 9 percent of the nation's current output, or $2,706 in current dollars for every member of the adult population. This is what it would cost to restore the lost capital stock and pay off the extra foreign debt incurred.

Alternatively, the burden would otherwise take the form of an annual loss in income due to a lower capital stock and the need to service the increased amount of foreign debt. At a current 4 percent real bond rate, this comes to an annual payment equal to 0.4 percent of current GNP, or $110 per year in today's dollars for every member of the adult population, forever.

Of course, current generations benefitted in the Reagan years by consuming more domestic and foreign goods than they would have otherwise. But since objective interpersonal welfare comparisons between different generations cannot be made, a scientific assessment of the overall effect of fiscal policy on the nation's economic welfare is not possible. Still, the estimated size of the burden on future generations is a good measure of the size of the intergenerational transfer that has occurred. If the burden were paid off now, future generations would be relieved of it, and the current generation would bear the full cost of its current consumption. This would be an appropriate policy if we truly do not want to better our own welfare at the expense of future generations.

To correct this intergenerational inequity, the Bush Administration has proposed running budget surpluses by the mid-1990s.[25] The broad outlines of this plan were incorporated into the budget summit agreement of last year, and a down payment of about $40 billion in deficit reduction has been made for fiscal 1991. Such reductions in the budget deficit, along with resulting reductions in interest rates and the value of the dollar, would stimulate private domestic investment and reduce net foreign capital inflows. As a consequence, the burden on future generations from fiscal changes in the Reagan years would tend to be eliminated.

NOTES

1. See, for example, B. Friedman (1988), Gramlich (1989), and Modigliani (1988) for statements of this view. For an earlier but still quite relevant collection of economists' writings on the burden of the public debt, see Ferguson (1964).

2. See Darby (1988), M. Friedman (1989), and Judd (1989).

3. See Barro (1974, 1989).

4. This model is fully described in Throop (1989).

5. For elaboration of this theory, see Modigliani and Brumburg (1954), Ando and Modigliani (1963), Modigliani (1970), and Steindel (1981).

6. A detailed study showing the importance of liquidity constraints is Wilcox (1989).

7. Although David Ricardo was one of the first to discuss the issue, he did not believe in the equivalence between debt and taxes, but like Adam Smith before him, argued that taxes on households mainly reduce current consumption while internal borrowing tends to result in reduced capital formation. Thus, the "Ricardian Equivalence Theorem" should be relabeled the "Non-Ricardian Equivalence Theorem" and Ricardo's doctrine relabeled the "Ricardian Non-Equivalence Theorem." See Buiter and Tobin (1979) and O'Driscoll (1977). However, for ease of exposition we have followed conventional usage.

8. As Blinder (1986) puts it: "When an individual has very diffuse priorities over what long-run government policy will be, it strikes me as plausible that his point estimates of future policy variables may have weak effects on his current decisions—which is just the opposite of what Barro and Sargent and Wallace assume. If this is so, then expectational issues, although deep and weighty, may not be of great empirical importance."

9. For a thorough recent survey of the theory and evidence on Ricardian equivalence, see Bernheim (1987). Earlier surveys include Brunner (1986) and Tobin (1980, Ch. 3).

10. See Chow (1960). For this test all the variables were transformed according to the estimated serial correlation coefficient for the full sample. The *F* test was then performed on the residuals from the estimated equations using these transformed variables. This procedure avoids a rejection of stability simply because of instability in the error pattern, as opposed to a shift in the structural equation itself.

11. Similar to the procedure for the *F* tests, the forecasting equation was estimated for the period up until 1981 using the serial correlation coefficient from the full sample period through 1989.

12. Because the Quandt test was used to identify most likely break points, effective critical values would actually be somewhat higher than those reported for the *F* distribution alone in Table 1.

13. Other estimates in the same neighborhood have been made by Hausman (1983) and Kendrick (1983).

14. See Hendershott (1987a).

15. The basic theory and its application are described in Jorgenson (1963), Hall (1971) and Hall and Jorgenson (1967).

16. The asset view of exchange markets was pioneered by Dornbusch (1976) and Frankel (1979).

17. See Modigliani and Shiller (1973).

18. Earlier studies of this particular exchange rate equation are Hutchison and Throop (1985) and Throop (1989d, 1989e).

19. See also Throop (1989b, 1989c), in which it is argued that movements in U.S. and foreign monetary and fiscal policies, rather than other factors such as safe-haven effects, explain most of the fluctuation in the dollar's value during the floating rate period.

20. Throop (1988) tests adaptive measures of expected inflation against more "rational," or forward looking, measures, but finds that the adaptive expectations have provided a better representation of actual expectations of inflation, even when monetary policy was changing sharply as in the post-October 1979 period of disinflation. See also Kaufman and Woglom (1984).

Two relationships in the model which were not examined in the previous section but which are potentially subject to instabilities because of expectational effects are the term structure of interest rates and the inflation equation. Although the term structure equation does show some evidence of instability during a temporary shift in the "monetary regime" between 1979 and 1982, there is no evidence of significant instability due to changes in fiscal policy. In particular, expected budget deficits are not found to enter significantly into the term-structure equation. See Throop (1988, 1989a) and Blanchard (1984). The stability of the expectations-augmented Phillips curve that is used to explain inflation in the model has been confirmed in a number of studies. See, for example, Gordon (1985), Perry (1983), and Blanchard (1984).

21. The effective tax rate on equity financed business investment shown in Table 3 is calculated as:

$$\frac{1-uz-k}{1-u}$$

where u = corporate tax rate
z = present value of one dollar's worth of depreciation allowance
k = investment tax credit

The Reagan program initially reduced the tax rate on business investment by increasing the present value of depreciation (z) and increasing the investment tax credit (k). For the derivation of this formula, see Hall and Jorgenson (1967) or Throop (1989a).

22. Because of a problem known as instrument instability, this can only be done approximately. See Holbrook (1972) for a general discussion. Only a fraction of the total effect of a change in interest rates on the unemployment rate occurs contemporaneously. Thus, if the targeted unemployment rate is hit exactly in a current period, in subsequent periods the lagged effects of the initial change in interest rates have to be offset. This can result in ever-larger oscillations in interest rates. Therefore, a degree of smoothing of interest rates is required. Still, the unemployment rate in the counterfactual simulation of an unchanged fiscal policy does not differ from the historical unemployment rate by more than 0.1 percentage point in any quarter.

23. The reduction in net exports is only an approximate measure of the increase in net capital inflows. There are two types of errors that tend to work in opposite directions. Interest payments on foreign debt are not modeled explicitly in the macroeconometric model. Therefore, to the extent that interest payments on debt to foreigners are financed by further capital inflows, equating the change in net indebtedness to the simulated change in net exports understates the increase in indebtedness. On the other hand, this procedure overstates the increase in indebtedness if the assumption in the simulation of a constant risk premium in the foreign exchange market does not hold exactly. In this case, the accumulation of debt has the effect of reducing the risk premium, and therefore the value of the dollar. This would generate higher net exports and smaller net capital inflows than in the simulation.

24. See Throop (1989d, 1989e) for a fuller discussion.

25. See *Budget of the United States Government: Fiscal Year 1991.*

26. See Eisner (1986, 1989), Blades and Sturm (1982) and Throop (1980) for further discussion of this inflation tax. The structural macroeconometric model that is used to simulate the effects of Reagan fiscal policy subtracts the inflation tax on all government debt from the NIPA measure of disposable income. This inflation-adjusted measure of income is consistent with households behaving rationally and generally saving (and reinvesting) inflation premiums in the interest on government debt.

Because of this behavior, the private saving rate as conventionally measured should tend to rise and fall with the inflation rate. This response of the private saving rate to inflation is particularly evident in some European countries that have experienced sharp changes in inflation, but it is somewhat obscured in U.S. data by movements in the ratio of wealth to income, which influences the saving rate in a life-cycle model of consumption. See Throop (1989a).

27. Because of adjustment costs, households tend to respond to their perception of the *permanent* reduction in real wealth due to the inflation tax. The inflation tax on federal debt is therefore calculated as an eight-quarter moving average of the inflation rate in consumer prices times the stock of federal debt held by U.S. residents.

28. Algebraically, by definition GNP $= C + I + G + X - M$, where C is private consumption, I is domestic investment, G is government spending, and $X - M$ is exports less imports. But since GNP $- C = S$ (private saving) $+ T$ (taxes), then $S + T - G = I + X - M$. Thus, given private saving (S), a reduction in the government surplus ($T - G$) always decreases domestic investment (I) or net foreign investment (equal to $X - M$).

29. These figures do not include matching grants to state and local governments for state and local capital spending. In an accounting sense this capital does not belong to the federal government, and in a behavioral sense the prevailing empirical evidence is that grants do not build up the stock of state and local capital because of a fiscal substitution effect (see Gramlich (1978)). In any case, federal grants to finance state and local capital projects dropped by $7.5 billion in constant dollars between 1980 and 1988.

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Location, Branching, and Bank Portfolio Diversification: The Case of Agricultural Lending

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In this paper, we hypothesize that loan monitoring costs increase with distance from the borrower, and, thus, that bank loan portfolio choice depends on the bank's location. A corollary of our hypothesis is that branching increases bank loan portfolio diversification. To empirically test our hypothesis, we focus on banks' choice between agricultural and nonagricultural loans. We find that, even after controlling for a variety of other factors, rural banks devote a significantly larger proportion of their loan portfolio to agricultural loans than do urban banks. Moreover, we find that, when statewide branching is permitted, rural banks hold higher nonagricultural loan portfolio shares, and urban banks hold higher agricultural loan portfolio shares, than when branching is restricted. Thus, we conclude that branching enhances bank loan portfolio diversification.

Banking economists have given considerable attention to the special nature of commercial bank lending. Leland and Pyle (1977) and Diamond (1984), among others, argue that bank lending differs from other forms of lending, such as the purchase of debt that is directly issued by companies, because of the extensive information gathering and monitoring functions that banks perform. These authors argue that, to a greater extent than other lenders, banks gather their own detailed information on loan projects and monitor borrowers' conditions and adherence to loan covenants. Thus, although all lenders attempt to monitor their loans and enforce loan or debt covenants, banks may specialize in lending to borrowers who are particularly costly to monitor.

One implication of the importance of bank monitoring is that a bank's location may be a significant determinant of its choice of borrowers. It is reasonable to suppose that monitoring is more difficult and more costly from a distance, so banks would tend to favor local borrowers over distant borrowers, all other things equal.

Support for this view comes from the work of Black (1975), who suggests that deposit relationships with borrowers enhance a bank's ability to monitor.[1] Black argues that since bank borrowers often are depositors as well, the bank has a low-cost ongoing history of financial information. If deposit markets are local, as some evidence shows, then this effect would strengthen the tie between banks and local borrowers by reducing monitoring costs.[2]

The dependence of monitoring costs on distance implies that constraints on a bank's ability to expand beyond the local headquarters area through branching may directly affect its loan portfolio choice and perhaps its ability to diversify assets. This is because branching restrictions may impinge on the ability of banks to locate offices near different types of borrowers and thus efficiently monitor their loans. The effect on diversification is important because, in many situations, diversification across assets can reduce expected bankruptcy costs and the probability of bank failure.

In this article, we present evidence supporting the hypothesis that location affects the types of loans that banks choose, and, consequently, that branching enhances diversification. We focus on banks' choice between agricultural and nonagricultural loans. This choice is well-suited to our study because, by its nature, agriculture is location-specific and concentrated in rural areas.[3]

Unlike earlier related work, which was limited to a study of different types of rural banks, our analysis includes institutions headquartered in both urban and rural locations in restricted and unrestricted branching states. Our results indicate that rural banks have a significantly higher share of agricultural loans than urban banks, even after controlling for a variety of other factors. Moreover, we find that rural banks increase the share of nonagricultural loans in their portfolios when they are allowed to branch statewide, *and* that *urban* banks increase the share of *agricultural* loans in their portfolio when they are allowed to branch statewide. This offers support for the hypothesis that branching enhances diversification, and stronger support than can be obtained from a study of rural banks alone.

A theoretical model demonstrating the effects of location and branching laws on portfolio choice is presented in Section I. In Section II, we empirically test the implications of the theory, examining differences in agricultural loan shares across a wide selection of commercial banks over the period 1981-86. Results from the estimation are described in Section III, with concluding remarks in Section IV.

I. A Portfolio Model

In this paper, we hypothesize that monitoring costs increase with distance from the borrower, and, thus, that a bank's location affects its relative monitoring costs for different types of loans. Our hypothesis is based on reasoning that bank personnel are more familiar with local borrowers and local market conditions, and therefore can more easily monitor local borrowers than distant ones.[4] In addition, personnel should be better able to keep a close watch on a local loan project's progress.

We assume that monitoring costs are important for banks, so that differences in relative monitoring costs for different types of loans should influence a bank's loan portfolio choices. Thus, our hypothesis implies that location affects a bank's loan portfolio choices. To test our hypothesis, we focus on a bank's choice between agricultural and non-agricultural loans. Agricultural borrowers, by their nature, are assumed to be located in rural areas, while most nonagricultural loans are assumed to be for projects in urban areas. Thus, our hypothesis predicts that, at least when branching is restricted, banks located in rural areas will have lower monitoring costs for agricultural loans than will banks located in urban areas and will therefore devote a larger proportion of their portfolio to farm-related lending.

If branching is unrestricted, it may still be the case that agricultural shares will be higher for rural-headquartered banks, but we expect that the difference between rural and urban banks' agricultural shares will be smaller than when branching is restricted. This is because branching should decrease differences in monitoring costs between agricultural and nonagricultural loans. This would encourage banks to take advantage of the benefits of diversification, thereby lowering rural banks' agricultural loan portfolio shares and raising urban banks' agricultural portfolio shares.[5]

Previous researchers have already conducted some investigation of these topics. Gilbert and Belongia (1988) study how rural bank portfolios are affected by regulatory structure by examining whether affiliation with large multi-bank bank holding companies affects the proportion of loans devoted to agriculture in rural banks' portfolios. In some states, multi-bank bank holding companies are not permitted.

They find that rural banks which are subsidiaries of bank holding companies with assets greater than $1 billion have a lower agricultural loan ratio than other banks in the same counties. They attribute this to the greater ability that such banks have to diversify their loan portfolios away from agriculture. Thus, Gilbert and Belongia's results implicitly suggest that laws that restrict the geographic dispersion of bank affiliates or even bank offices also restrict the diversification of rural bank portfolios out of agriculture.

White (1984) suggests that geographic restrictions prevented loan diversification at small rural banks in the 1930s, increasing their failure rate, but he does not empirically test this hypothesis. In their empirical examination of the effect of bank credit on farm output, Calomiris, Hubbard, and Stock (1986) argue that branching restrictions, by impairing the ability of small rural banks to diversify assets, may contribute to bank failure, the depletion of bank credit, and a decline in farm output.[6] Again, though, they do not empirically test this hypothesis.

The Model

The effect of location and branching laws on portfolio choice can be seen using a portfolio model.[7] For simplicity, we assume that the *amount* of monitoring required per dollar lent is fixed.[8] However, following the above discussion, the *cost* per dollar of producing the required monitoring depends on the bank's location vis-a-vis the borrower, or distance from the borrower. Thus, the monitoring cost for an agricultural loan of a given size will be higher for an urban bank than a rural bank. We also assume the bank has a fixed stock of loanable funds to allocate among the two types of loans, agricultural and nonagricultural.

In the following discussion, we will introduce several variables that are not choice variables for the bank. Some of these variables, namely monitoring costs, interest rates, and risk-related variables, depend on bank-specific exogenous factors, such as location, that enter into our empirical analysis. We will explicitly introduce these exogenous factors in the next section, but, for the sake of notational simplicity, we will suppress these factors in the following formulas.

The explication of the theoretical model proceeds in two steps, first without uncertainty, and then with uncertainty added. In the absence of uncertainty, the bank would allocate all funds to the project yielding the highest return net of monitoring costs. Since the volume of total loans is fixed, we can normalize the volume to one. Mathematically, the decision is simple:

$$\textit{Maximize}\ \pi = \theta i_A + (1-\theta) i_N - \theta C_A - (1-\theta) C_N - r_d. \quad (1)$$

The bank chooses θ, the share of loans made to agricultural projects, so as to maximize profits, π, net of the cost of obtaining loanable funds, r_d. The interest rates on agricultural and nonagricultural loans, i_A and i_N, respectively, and the monitoring costs per dollar for agricultural and nonagricultural loans, C_A and C_N, respectively, determine the optimal allocation. In this simple case, the bank allocates all credit to the types of projects that pay the highest interest rate net of monitoring costs.

Now let returns to the two types of projects be randomly distributed. The random return variables for agricultural and nonagricultural projects are denoted by r_A and r_N, respectively. These are the returns to the project owners themselves. The expected return and variance may differ between agricultural and nonagricultural project pools, but we assume that individual project returns *within* a given loan pool are drawn from the same distribution.[9]

The bank is assumed to be risk-neutral, in the sense that its objective is simply to maximize expected profits. Portfolio variance enters the bank's objective function through bankruptcy costs; we assume that if the bank cannot pay off its own liabilities, it will face bankruptcy costs.[10] Because the probability of bankruptcy increases as the variance of the portfolio increases, holding interest rates constant, expected profits decrease with increased variance. In this way, uncertainty enters into the allocation decision of the bank.

The variances of individual project returns will affect expected profits through the portfolio variance and, independently, through a separate channel. The separate, independent influence is due to the effect of project return variance on the probability of borrower default. As the variance of a project's return increases, holding the loan rate and the expected value of the return constant, the probability of the borrower defaulting increases. Because the highest return that the bank can receive is the contracted loan rate, the bank is not compensated on the high end for the increase in the probability of default. Therefore, the increase in variance lowers the expected return to the bank from that particular loan.

The introduction of uncertainty into the model gives the bank an incentive to diversify its portfolio and hold some of both types of loans.[11] The principle of diversification says that by making loans to different types of borrowers, the risk to the lender's portfolio can be reduced in most cases. Realizations of future events that cause some projects to be successful can cause others to fail. Therefore, by combining different types of loans into the same portfolio, these offsetting risks cancel to some extent, thus reducing overall portfolio variance. Diversification is therefore defined, in this paper, as an adjustment of portfolio shares in such a way as to reduce portfolio variance.[12]

The decision problem for the bank now becomes the following:

$$\begin{aligned}\textit{Maximize}\ \pi = {} & \theta i_A + (1-\theta) i_N - \theta C_A - (1-\theta) C_N \\ & - \beta var(\theta r_A + (1-\theta) r_N) - \theta \alpha_A var(r_A) \\ & - (1-\theta)\alpha_N var(r_N) - r_d, \qquad (2)\end{aligned}$$

where π is now *expected* profits. The effect of portfolio variance on bankruptcy is captured in the fifth term of (2), while the independent effects of agricultural and nonagricultural loan defaults are captured in the sixth and seventh terms of (2), respectively. Here, $\beta var(\theta r_A + (1-\theta) r_N)$ is the expected cost of bankruptcy, which we assume rises linearly with the portfolio's variance, and $\theta \alpha_A var(r_A)$ and $(1-\theta)\alpha_N var(r_N)$ represent the expected costs associated with the default of agricultural and nonagricultural loan projects, respectively.

The optimal portfolio for the bank can be determined by maximizing (2) with respect to θ and solving for the equilibrium value of θ:

$$\theta^* = \frac{i_A - i_N - 2\beta cov(r_A, r_N) + 2\beta var(r_N) - \alpha_A var(r_A) + \alpha_N var(r_N) - C_A + C_N}{2\beta[var(r_A) + var(r_N) - 2cov(r_A, r_N)]} \quad (3)$$

Equation (3) shows that three types of factors affect the proportion of a bank's portfolio that is devoted to agriculture: interest rate spreads, relative monitoring costs and relative risk. Holding all other factors constant, an increase in the interest rate on agricultural loans (i_A) relative to the rate on nonagricultural loans (i_N) will increase agriculture's portfolio share. On the other hand, an increase in monitoring costs for agricultural loans (C_A) relative to monitoring costs on nonagricultural loans (C_N) will decrease agriculture's portfolio share. Finally, an increase in the relative variance of agricultural loan projects or in the relative cost of agricultural loan project defaults (which depends on relative variances and the relative sizes of the parameters α_A and α_N) will decrease agriculture's portfolio share.

We also can use equation (3) to see the effect of differences in relative monitoring costs on diversification. For simplicity, set the interest rates and project return variances equal on the two types of projects, and set the covariance between project returns equal to zero. Then, equation (3) tells us that, in the absence of differences in monitoring costs between the two types of loans, the optimal proportion of the portfolio devoted to agriculture is one-half. Since there are no differences in interest rates and no differences in monitoring costs to keep the bank from choosing a perfectly diversified portfolio, this must be the portfolio of minimum variance. An increase in monitoring costs for agricultural loans, for example, would decrease θ below one-half. This move away from the minimum variance portfolio, and into nonagricultural loans, would decrease portfolio diversification, as we have defined diversification.[13] Similarly, an increase in monitoring costs for nonagricultural loans would decrease diversification by decreasing the proportion of the portfolio devoted to nonagricultural loans.

As seen in equation (3), exogenous variables that affect relative monitoring costs, interest rate spreads, and relative risk, will, in turn, affect the share of a bank's portfolio that is devoted to agriculture. In the next section we will empirically examine how observable variables that should affect these three types of factors actually influence agricultural portfolio shares. Among the factors we will be examining are:

- Location and branching restrictions. These should affect relative monitoring costs. For example, banks that are located in urban areas and are prohibited from setting up branches in rural areas will have relatively higher monitoring costs for agricultural projects, and, therefore, lower agricultural loan portfolio shares. In addition, it may be the case that even urban headquartered banks that *can* branch have a comparative disadvantage in agricultural lending, relative to rural banks that can branch.[14] However, we expect that, for a given bank, branching reduces differences in monitoring costs between agricultural and nonagricultural loans, thereby encouraging diversificaion and narrowing the difference in agricultural loan portfolio shares between rural and urban banks.
- Competition in the agricultural loan market. If competition from other lenders in agriculture increases and forces agricultural interest rates downward, the bank will shift its portfolio away from agriculture.
- Government subsidies or guarantees for crops. An increase in government agricultural support, which stabilizes farm income, should decrease the relative risk of agricultural lending and increase bank willingness to lend to agriculture.

Graphical Solution

The bank's portfolio choice can be depicted graphically. This helps to illustrate the effect of location and branching restrictions on loan portfolio choice.

Figure 1 breaks total profits into its two component parts. The vertical axis measures expected profits, while the horizontal axis measures agriculture's share of the

Figure 1

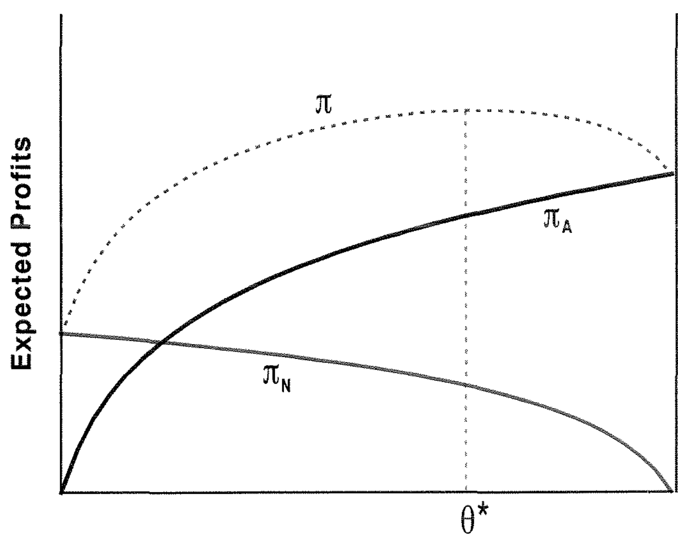


Figure 2

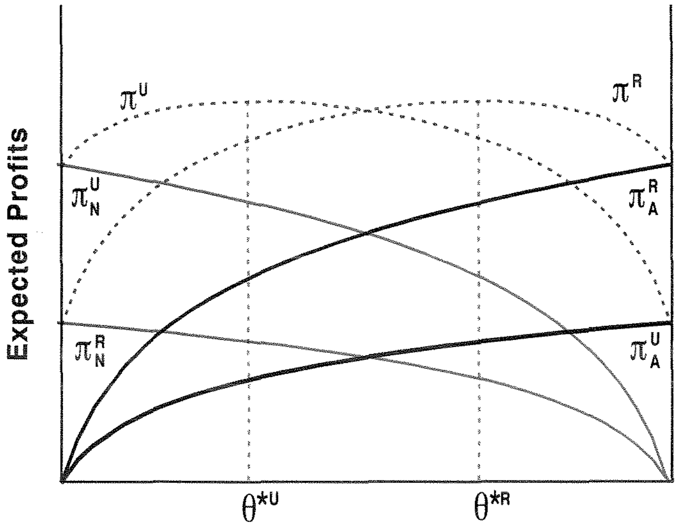
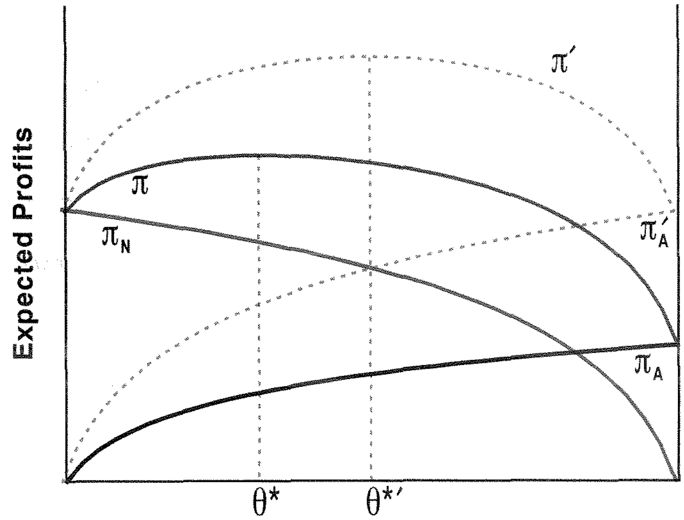


Figure 3



portfolio, ranging from 0 to 100 percent. The curve labeled π_A denotes total expected profits from agricultural lending. Expected profits from that source rise as more loans are made to agriculture, but the marginal profits begin to diminish as the benefits of diversification are lost. Similarly, the curve labeled π_N measures expected profits from nonagricultural lending, which fall as more of the portfolio is shifted into agriculture. The total profits for the bank are the vertical sum of the π_A and π_N curves. Expected total profits, π, are maximized at θ^*.[15]

Differences in bank locations can result in different optimal portfolios. Figure 2 compares two stylized banks, one urban (denoted with a U superscript) and the other rural (denoted with an R superscript). The rural bank is assumed to have lower monitoring costs for agricultural loans, while the urban bank has lower costs for nonagricultural loans. The effect of this assumption is to yield an expected agricultural profit function for the rural bank that lies above that of the urban bank ($\pi_A^R > \pi_A^U$), while the nonagricultural loan profit function of the urban bank exceeds that of the rural bank ($\pi_N^U > \pi_N^R$) at any given level of θ. As shown in Figure 2, these differences result in the urban bank lending less to agriculture.

Changes in monitoring costs (or other key variables) can change a bank's portfolio. Consider the case of changes in relative monitoring costs due to liberalization of branching restrictions. Figure 3 depicts the situation facing an urban bank that is suddenly permitted to open or acquire a rural branch. Monitoring costs fall for agricultural loans, because the bank now has a monitoring presence in an agricultural area.

The drop in monitoring costs pushes π_A up to π'_A and raises the total profit function to π' from π. The optimal allocation of credit, therefore, shifts in the direction of greater diversification, which, for the urban bank, corresponds to more agricultural lending ($\theta^{*\prime} > \theta^*$).

II. The Data and the Empirical Model

In Section I we suggest that differences in location and branching restrictions, among other factors, are likely to help explain differences in bank portfolios. In this section, we choose empirical counterparts for these factors and present an empirical model of differences in commercial banks' agricultural production loans as a proportion of total loans.[16] The model seeks to explain deviations in banks' agricultural portfolio shares from the average for the sample.

We model bank agricultural production loan portfolio shares as functions of exogenous factors which influence relative monitoring costs for the two types of loans, or interest rate spreads, or the relative amount and cost of risk for the two loan types.

Our empirical model is similar to Gilbert and Belongia's model in that, like these authors, we are modeling the relationship between the geographic dispersion of bank offices and bank loan portfolio choice. Three important factors distinguish our model from Gilbert and Belongia's model, however. First, we include urban banks in our study, while Gilbert and Belongia do not. If we find that urban banks respond to branching opportunities by holding more agricultural loans, we can better argue that it is the benefits of diversification that drive the results than if we only have evidence on the response of rural banks to branching opportunities.

The second difference between the two models is that Gilbert and Belongia do not place their model in the context of a bank portfolio choice model. Thus, we include some important explanatory variables that are not included in the Gilbert and Belongia model.[17] The third difference between the two models is that we look at the effects of branching laws per se, while Gilbert and Belongia look at the effects of affiliation with a multi-bank bank holding company.

The Variables

The explanatory variables of greatest interest to us involve the location of the bank and the branching laws in the state in which the bank operates. As discussed above, whether a bank is located in a metropolitan or rural area should influence its cost of monitoring agricultural loans and thus its agricultural production loan share.

Holding other factors constant, it is expected that a metropolitan bank will have a lower agricultural loan share than a rural bank, because it will find it relatively more difficult to monitor agricultural loans. However, if the metropolitan bank is located in a statewide branching state, we expect that it will have a higher agricultural loan share than if it is located in a limited branching or unit banking state. Likewise, we expect that a rural bank will have a lower agricultural loan share in a statewide branching state than in a restricted branching state.[18]

Thus, we include three interaction terms, one indicating whether the bank is a metropolitan bank in a restricted branching state, one indicating whether the bank is a rural bank in a restricted branching state, and one indicating whether the bank is a metropolitan bank in a statewide branching state. These are all thought to influence relative monitoring costs and thereby the proportion of the loan portfolio devoted to agriculture. (This leaves rural banks in statewide branching states as the control group.)

We also include the percent of gross state product accounted for by agriculture, bank size and average farm size in the regression. All three variables may influence relative monitoring costs. The first is an important additional location variable; banks that are located in "farm states" should have lower monitoring costs for agricultural loans and thus higher agricultural loan shares than banks located in nonfarm states.

Bank size and average farm size are included to allow for the possibility that there are economies of scale in monitoring.[19] Figures reported by "The Survey of Terms of Bank Lending" indicate that there may be consistently large differences in average loan sizes between commercial and agricultural loans, and that this difference is more pronounced for large banks than for small banks.[20] This means that if large loans have lower monitoring costs per dollar than small loans, then, all other things equal, large banks would have a comparative advantage in commercial loans and would devote a smaller proportion of their portfolio to agricultural loans than would small banks. In addition, if large farms require large loans, then an increase in average farm size may lower monitoring costs on agricultural loans relative to nonagricultural loans, thereby increasing agriculture's portfolio share.

On the other hand, it is possible that an increase in average farm size would decrease agriculture's portfolio share through its influence on the demand for bank loans. As stated in the introduction, banks may have a comparative advantage in lending to borrowers who are especially costly to monitor. To the extent that farm size is positively correlated with ease of monitoring, large farm borrowers may have less need for banks' special monitoring capabilities. They may have greater access to other types of lenders and may therefore have less of a demand for bank loans.

The remaining variables in our regression should influence either interest rate spreads or relative risk factors between the two types of loans. We include one variable that may influence interest rate spreads: competition from nonbank agricultural lenders, specifically, the Farm Credit System (FCS). In a survey of several California banks' agricultural lending, respondents noted that they face vigorous competition from the government-sponsored FCS.[21] (See Box for a brief description of the types of agricultural lenders, including the FCS.)

Such competition lowers the relative return that banks receive on agricultural loans. As pointed out by Gray, Woolridge, and Ferrara (1982), the FCS has some advantages over commercial banks in lending to agriculture. Its advantages help it to be an effective competitor with banks, thereby lowering equilibrium rates of return on agricultural loans. These include access to the national money markets through a government-sponsored entity, favorable tax treatment, and the absence of the loans-to-one-borrower limits that are imposed on nationally chartered commercial banks.[22]

The FCS's competitive disadvantages include strict eligibility restrictions for FCS loans to ensure that it remains only an agricultural lender, an obligation to serve *all* agricultural areas during *all* economic times and an inability to provide the full range of services provided by commercial banks.[23]

We measure the degree of competition from the FCS by the percent of total agricultural production loans outstanding in the state that were held by the FCS in the previous year. We expect this variable to have a negative coefficient. We use the *lagged* FCS market share rather than the contemporaneous market share because the contemporaneous share likely is a function of the dependent variable in the regression. Moreover, it is in the nature of lending relationships that the short-term price elasticity of demand would be relatively low, so the lagged FCS share should be strongly positively correlated with *current* competition facing banks.[24]

Our risk-related variables are the share of government payments in farm net income and the bank's deposit-to-loan ratio. An increase in the share of government guarantees (through price supports or export subsidies) should decrease the level of risk in agricultural lending and should increase agriculture's portfolio share.

The deposit-to-loan ratio is included to capture firm-specific differences in attitudes toward risk. Such differences may depend on management's goals concerning, for example, firm growth. Generally, the more "aggressive" the bank, the more it depends on borrowed funds, rather than just deposits, for loan funding. We consider such aggressiveness to be a sign that, given the variances of project returns, a relatively low cost is assigned to overall portfolio risk. (In other words, the parameter β in our theoretical model is relatively low.)

Agricultural Loans and Lenders

Agricultural loans can be divided into two main categories, real estate and non-real estate, or production, loans. Agricultural real estate loans tend to be relatively long-term, whereas production loans have a shorter maturity.

There are five major types of agricultural real estate lenders: the Farm Credit Banks, life insurance companies, commercial banks, the Farmers Home Administration and individuals, along with other noninstitutional lenders. In the production loan category, there are four major types of lenders: the Farm Credit Banks, commercial banks, the Farmers Home Administration and individuals and non-institutional lenders.

The Farm Credit Banks are part of the Farm Credit System (FCS).[a] The FCS was established by the government, in 1917, to help meet the specific credit needs of farmers. At that time, commercial banks apparently were reluctant to make the long-term loans, with maturities greater than 90 days, that farmers needed. Moreover, there were relatively few commercial banks located in agricultural areas.[b]

As explained by Todd (1985), the FCS sells securities in the money market and, through the Farm Credit Banks, lends the proceeds to farmers. Each Farm Credit Bank has the primary responsibility for meeting its share of the scheduled interest and principal payments on the system-wide securities, but these securities are ultimately the joint responsibility of all FCS banks.

At the time the loan is made, an FCS borrower is required to obtain stock in the lending office of the Farm Credit Bank that is issuing the loan. The amount of stock is equal to a certain percentage of the loan (usually 5 or 10 percent). Normally, stock is bought back by the FCS lender at its original price when the loan is paid off. However, should a Farm Credit Bank's financial reserves run out, borrowers' stock may be frozen.[c]

The other lenders fit into the agricultural loan market in various ways. The Farmers Home Administration is the government's farm lender of last resort. This agency provides credit to farmers who cannot obtain loans at reasonable rates from any other lender. Insurance companies have traditionally provided long-term or real estate credit to farmers. Commercial banks are the single most important source of short-term credit, although they also are involved in agricultural real estate lending. Finally, individual and noninstitutional lenders are active both in real estate and non-real estate agricultural lending. Included in this category are agricultural merchants and supply companies. These lenders often finance the equipment or materials that they sell, but also offer general purpose loans.[d]

a. Currently there are 12 FCS Districts, and 12 corresponding Farm Credit Banks. However, the Farm Credit Act of 1987 permitted the reorganization of the Farm Credit System into no fewer than six districts, and there are plans for several District mergers. (See Sullivan, 1990.) Also, it should be pointed out that the Farm Credit Banks are the result of mergers between Federal Land Banks and Federal Intermediate Credit Banks that were mandated by the 1987 Act. The Federal Land Banks provided real estate loans, while the Federal Intermediate Credit Banks provided short- and intermediate-term production credit.

b. See Sullivan (1990).

c. This happened on November 9, 1984, at two FCS lenders in Nebraska. See Todd (1985.)

d. See, for example, Blank (1990).

A decrease in the expected cost of bankruptcy, holding variances constant, would induce a bank to invest more in the projects with higher risk and higher contract interest rates.[25] Therefore, if agricultural loans tend to have higher interest rates, an increase in the deposit-to-loan ratio, corresponding to an increase in the cost assigned to bankruptcy, would decrease the agricultural loan portfolio share. If, on the other hand, commercial loans tend to have higher risk and higher interest rates, an increase in the deposit-to-loan ratio would increase the agricultural loan portfolio share.[26] We do not predict the sign of the coefficient for the deposit-to-loan ratio.

One variable not included explicitly in the model is the interest rate spread. This variable is excluded because of data limitations. The appropriate variable to include is bank-specific and not directly obtainable. The relevant spread depends on the bank's alternatives to agricultural loans—be they commercial, real estate or consumer loans. We do not have this information, nor do we have the relevant interest rates for each type of loan for each bank.

We would like to point out that the narrow categorization of several of the variables in the regression is mainly for the sake of exposition. Specifically, bank size, the deposit-to-loan ratio and average farm size may work through any or all of the monitoring costs, interest rate spread, or risk channels to influence the agricultural portfolio share. For example, examination of several years of data from the Survey of Terms of Bank Lending reveals that large farm loans tend to carry lower interest rates than small loans.[27] Therefore, if farm size is positively correlated with loan size, then farm size may be negatively correlated with interest rates on farm loans.

This caveat means that the coefficients on the bank size, deposit-to-loan ratio and average farm size variables should be interpreted with caution. These are reduced-form coefficients, not structural coefficients. Most important, their interpretation does not affect the interpretation of coefficients on the main variables of interest, the location and branching law interaction terms, and agriculture's share of gross state product.

The Data

We examine a subset of a sample of commercial banks that the Federal Reserve's Board of Governors has determined are representative of banks making farm production loans.[28] This sample consists of the banks that were surveyed on the quarterly FR 2028b, the Survey of Terms of Bank Lending to Agriculture, between 1981 and 1986.[29] The FR2028b surveys between 168 and 188 banks in each quarter. The set of banks can differ from survey to survey, with some banks reporting data throughout the sample period and other banks reporting only once or twice.

There are 1069 observations in our sample. A bank was included in our sample for a particular year if it reported having outstanding fixed or variable rate agricultural production loans on the FR2028b in at least one quarter of that year. In total, banks in 33 states are represented.[30] (The remaining states were not represented because they either had less than 2 percent of their gross state product in agriculture, or they had no banks surveyed in the sample.)

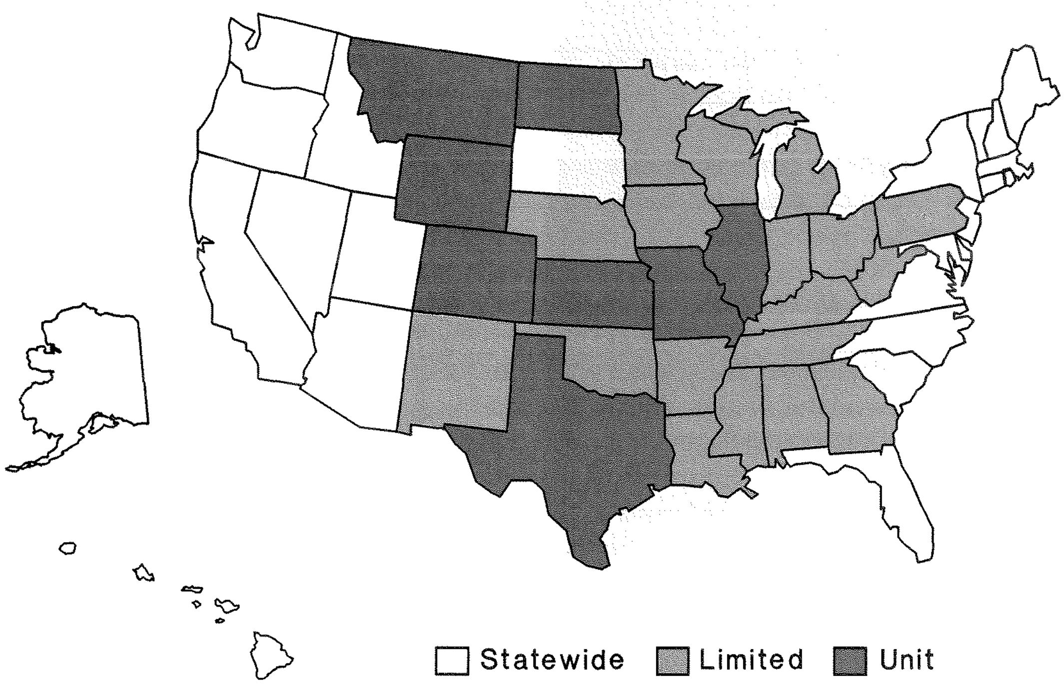
For purposes of our analysis it is important that the sample of banks be fairly evenly divided between banks with their head offices in metropolitan areas (565 observations) and those located in rural areas (504 observations). The breakdown between banks located in restricted branching states and statewide branching states is 811 and 258, respectively.

Our dependent variable, the share of agricultural production loans in total loans, bank assets, and the deposit-to-loan ratio were all obtained from data reported on

Table 1
Mean Values by Branching Status
(Standard Deviations in Parentheses)

Variable	Entire Sample	Statewide Branching States Urban	Statewide Branching States Rural	Restricted Branching States Urban	Restricted Branching States Rural
Number of Observations	1069	215	43	350	461
Agricultural Production Loan Share (% of Total Loans)	17.35 (20.82)	4.29 (6.20)	19.98 (18.78)	5.31 (10.23)	32.33 (21.48)
Bank Size ($ Assets, Millions)	2,579 (7,939)	8,846 (15,304)	115 (101)	2,364 (3,978)	50 (58)
Deposits to Loan Ratio (%)	154.40 (46.01)	135.14 (33.81)	160.16 (20.06)	138.30 (37.51)	175.08 (49.76)
Agriculture's Share of Gross State Product (%)	4.11 (3.70)	2.26 (1.76)	3.89 (2.65)	3.01 (2.39)	5.82 (4.46)
Average Farm Size (# of Acres)	615.59 (961.18)	900.48 (1,741.44)	501.91 (195.83)	482.74 (364.25)	594.20 (759.57)
Government Support as a Share of Farm Income (%)	4.67 (3.57)	2.22 (2.12)	4.92 (4.08)	4.90 (3.11)	5.61 (3.87)
Farm Credit System Share of Farm Loans, Lagged (%)	25.44 (9.47)	29.27 (9.16)	19.10 (11.51)	24.82 (8.31)	24.71 (9.66)

Figure 4
State Branching Laws in 1986



the quarterly "Report of Condition and Income (Call Report)." These items were averaged for the entire year to generate annual figures. The branching law variables were obtained from various editions of the *Annual Statistical Digest,* published by the Board of Governors of the Federal Reserve System.

The percent of gross state product in agriculture was obtained from the Bureau of Economic Analysis of the U.S. Department of Labor. Average farm size and the percent of state farm income from government payments were obtained from *Agricultural Statistics,* published by the U.S. Department of Agriculture. The Farm Credit System market share was obtained from editions of *Agricultural Finance Statistics.* Both of these publications are published annually by the U.S. Department of Agriculture.

Figure 4 shows the branching laws for all the states in 1986. (Unit and limited branching states are considered restricted branching states.) Table 1 presents the mean values for the agricultural production loan share and for the continuous independent variables. Means are given for the entire sample and for subsamples broken down by bank headquarters location and branching law status. Note the large differences in agricultural production loan shares between rural and urban banks. Also, urban banks in the sample are significantly larger than rural banks, especially in statewide branching states. We control for this difference in the regression.

The Empirical Model

The dependent variable in our regression is the difference between the bank's agricultural production loan portfolio share and the mean value of this variable for all banks in the sample for that year. All explanatory variables except the location and the branching law interaction terms also are expressed as deviations from sample means. Expressing variables as deviations from means helps to control for macroeconomic effects such as agricultural business cycles and government policy cycles for which we have inadequate empirical measures.

The regression equation that we estimate is:

AGRICULTURAL PRODUCTION LOAN SHARE =
B1*ASSETS +
B2*DEPOSIT-TO-LOAN RATIO +
B3*AGRICULTURE'S SHARE OF GROSS STATE PRODUCT +
B4*AVERAGE FARM SIZE +
B5*GOVERNMENT SUPPORT +

B6*LAGGED FARM CREDIT SYSTEM SHARE OF FARM LOANS +
B7*RESTRICTED BRANCHING, RURAL +
B8*RESTRICTED BRANCHING, URBAN +
B9*STATEWIDE BRANCHING, URBAN +
ϵ,

where AGRICULTURAL PRODUCTION LOAN SHARE = percent of total loans outstanding in agricultural production loans;
ASSETS = bank assets, in billions of dollars;
DEPOSIT-TO-LOAN RATIO = the ratio of total deposits to total loans outstanding, in percent (positively correlated with the cost of risk);
AGRICULTURE'S SHARE OF GROSS STATE PRODUCT = for the state in which the bank is located, the percent of gross state product that is accounted for by agriculture;
AVERAGE FARM SIZE = average farm size in the state in 1978, in acres;
GOVERNMENT SUPPORT = the share of government payments in total state farm net income, in percent;
LAGGED FARM CREDIT SYSTEM SHARE OF FARM LOANS = the percent of total agricultural production loans outstanding in the state held by the FCS in the previous year;
RESTRICTED BRANCHING, RURAL = 1 if the bank's main office is not in a Metropolitan Statistical Area and if it is in a unit banking or limited branching state, 0 otherwise;[31]
RESTRICTED BRANCHING, URBAN = 1 if the bank's main office is in a Metropolitan Statistical Area and if it is in a unit banking or limited branching state, 0 otherwise;
STATEWIDE BRANCHING, URBAN = 1 if the bank's main office is in a Metropolitan Statistical Area and if it is in a statewide branching state, 0 otherwise;
and ϵ is an error term.

Our method of estimation was ordinary least squares. Because of the sample composition, we did not have a "panel" data set giving a consistent time series for each bank.[32] Therefore, we could not perform the usual corrections for heteroskedasticity and autocorrelation that are done for time-series, cross-section regressions.

Table 2

Estimated Relationships between Agricultural Production Loan Share, Regulatory Structure and Bank Location

Dependent Variable:

Agricultural Production Loan Share (% of Total Loans)

Independent Variable	Coefficient	*t*-statistic
Bank Size ($ Assets, billions)	−0.0700	−1.283
Deposit-to-loan-ratio (%)	0.0130	1.368
Agriculture's Share of Gross State Product (%)	2.4383***	19.545
Average Farm Size (Acres)	−0.0008*	−1.831
Government Support as a Percent of Farm Income (%)	0.3796**	2.088
Lagged Farm Credit System Share of Farm Loans (%)	−0.3552***	−7.360
Restricted Branching States, Rural Location	9.7481***	14.938
Restricted Branching States, Urban Location	−9.6175***	−13.492
Statewide Branching States, Urban Location	−5.3484***	−5.284
Number of Observations	1,069	
Adjusted R^2	0.6416	

Notes: *(**)(***) indicates coefficient significantly different from zero at the 10(5)(1) percent level.

III. Regression Results

The regression results are reported in Table 2. In general, the results provide strong evidence to support the importance of location in explaining differences in bank portfolios. As indicated by the adjusted R^2, the equation explains 64 percent of the variation in agricultural loan portfolio shares.

Coefficients on the three interactive dummies indicate the importance of location and restrictions on branching. All three are highly significant with the predicted signs. Results in Table 2 are consistent with the hypothesis that location, through its influence on relative monitoring costs, is an important determinant of bank portfolio choice, even when branching is permitted. Urban banks have significantly smaller portfolio shares in agricultural loans than rural banks, ranging from 5.3 percentage points smaller in statewide branching states to 19.3 percentage points smaller in restricted branching states.

Branching restrictions work in the expected direction. To the extent that branching allows urban banks to reduce the costs of monitoring agricultural loans and rural banks to lower monitoring costs for nonagricultural loans, unrestricted urban banks would be expected to have greater agricultural loan portfolio shares than restricted urban banks, and unrestricted rural banks would have smaller agricultural shares than restricted rural banks. As shown in Table 2, holding other factors constant, unrestricted urban banks would hold 4.3 percentage points more of their portfolio in agricultural loans than restricted urban banks.[33] Likewise, unrestricted rural banks would hold 9.7 percentage points less of their portfolio in agricultural loans than restricted rural banks. These effects are responsible for the considerably smaller difference in agricultural shares between urban and rural unrestricted banks than between urban and rural restricted banks.

As discussed above, monitoring costs for agricultural loans should be influenced not only by the location of the bank within the state, be it urban or rural, but also by the agricultural orientation of the state's economy as a whole. The regression results in Table 2 show that, as expected, AGRICULTURE'S SHARE OF GROSS STATE PRODUCT has a positive and highly significant coefficient.

Other factors besides bank location and branching laws may affect farm production loan portfolio shares. Although the coefficient on ASSETS is insignificant, indicating that bank size does not appear to affect relative monitoring costs in such a way as to significantly influence agricultural portfolio shares, AVERAGE FARM SIZE has a significant negative coefficient. This sign is consistent with the hypothesis that large farm borrowers may demand fewer bank loans.

One of the risk-related variables, GOVERNMENT SUPPORT, has a statistically significant coefficient. As expected, the sign is positive, indicating that such payments decrease the relative risk of agricultural loans, thereby making them more attractive investments. The other risk-related variable, the DEPOSIT-TO-LOAN RATIO, has an insignificant coefficient.

As discussed above, the interest rates on agricultural loans relative to nonagricultural loans for commercial banks should be negatively correlated with the lagged Farm Credit Share of the agricultural loan market. As expected, the regression results do show a negative and significant coefficient for LAGGED FARM CREDIT SYSTEM SHARE OF FARM LOANS.

V. Conclusion

In this paper, we present empirical evidence to support the hypothesis that location, through its effect on relative monitoring costs, affects bank loan portfolio choice. We also present evidence that branching restrictions, by confining the location of bank offices to a relatively small area, inhibits bank loan portfolio diversification.

Specifically, we find that rural banks devote a larger proportion of their loan portfolio to agricultural loans than do urban banks. Moreover, we find that, when branching is unrestricted, rural banks hold higher nonagricultural loan portfolio shares, *and* urban banks hold higher agricultural loan portfolio shares. As a result, the allocation of loan portfolios across agricultural and nonagricultural loans is more similar for urban and rural banks that are not constrained in their ability to branch than it is for constrained urban and rural banks.

Within the context of our theoretical model, our empirical results indicate that a move to statewide branching causes banks to *diversify* their loan portfolios. By permitting banks to locate branches near both agricultural and nonagricultural borrowers, statewide branching narrows the difference in monitoring costs between agricultural and nonagricultural loans for a given bank. As demonstrated in the theoretical model, differences in monitoring costs cause rural banks to concentrate more on agricultural loans and urban banks to concentrate more on nonagricultural loans than they would were their portfolio perfectly diversified. Therefore, the convergence of relative monitoring costs increases rural bank lending to nonagricultural projects and urban bank lending to agricultural projects, thereby increasing diversification. Given this interpretation, we can say that the benefits of intrastate branching liberalization would include the benefits that accompany asset diversification. Among these are a decrease in the risk of credit disruption as a result of bank failure and a decrease in the expected withdrawals from the deposit insurance fund.

Although our results are broadly consistent with those found by Gilbert and Belongia, our inclusion of urban banks in the study has enabled us to provide stronger confirmation of the hypothesis that branching restrictions constrain asset diversification. Previous authors made this conjecture, but did not provide any strong empirical evidence.

We also find evidence supporting the general conclusions of the theoretical model regarding the effect of relative rates of return and relative risks on bank loan portfolio choice. Specifically, we find that factors that presumably decrease the relative rate of return on agricultural loans, such as an increase in the Farm Credit System's competitiveness, have a statistically significant negative effect on agricultural loan portfolio shares. In addition, an increase in government agricultural supports, which likely is associated with a decrease in the relative riskiness of agricultural loans, has a statistically significant positive effect on a bank's agricultural lending. These results lend support to our theoretical model and, thus, our interpretation of the effects of location and branching laws on bank portfolio diversification.

NOTES

1. Black's work also suggests that banks would have a comparative advantage, all other things equal, over other financial intermediaries in the credit evaluation and monitoring process. For further discussion and evidence on banks' comparative advantage in monitoring, see Fama (1985) and James (1987).

2. See Keeley and Zimmerman (1985) and Neuberger and Zimmerman (1990) for evidence on the extent of geographic markets for different types of deposits.

3. Throughout this paper, in both the theoretical discussion and in the empirical work, we equate rural areas with agricultural areas. See endnote 18 for a discussion of how, ideally, one might deal with this issue.

4. As stated in the introduction, this may be especially true if borrowers tend to be depositors, and if deposit markets are local.

5. We have some evidence that metropolitan banks with branches in rural areas *are* quite active in agricultural lending in some states. California is an example. Zimmerman (1989) reports that although the proportion of large metropolitan California banks' loans in agriculture is quite small, these banks held almost 88 percent of the commercial bank total of $2.6 billion in outstanding agricultural production loans in the state in 1989.

6. Smith (1987) finds empirical evidence that banks in restricted branching states are generally at greater risk of closure than are banks in statewide-branching states. However, the link between branching laws and diversification is not strongly drawn.

7. The model presented in this section is very similar to the model of bank loan portfolio choice presented in Gruben, Neuberger and Schmidt (1990).

8. An alternative would be to have the level of monitoring be a decision variable for the bank, with increases in monitoring imposing costs, but also yielding benefits in the form of decreased project return variances. Such a treatment is beyond the scope of this paper.

9. It is important to note that the returns under discussion here are the returns to *project owners*, as opposed to returns to the bank. Projects may yield returns to their owners that exceed the contract loan rate, but the most the bank can receive, net of costs, is the contract loan rate.

10. For example, managers may face some sort of reputational penalty should their bank fail.

11. It may be argued that although diversification theory applies to investors, it does not apply to individual firms, such as banks. According to this view, bank equity holders are the decision-making agents in the bank, and their objective is to have the bank make loan allocations that yield the maximum risk-adjusted expected return on their entire portfolio. Because these investors can be expected to hold more than the stock of the one bank in their portfolios, the argument goes, their objectives will not necessarily be consistent with having the bank maximize the risk-adjusted return on the bank portfolio in isolation.

For this reason, those who model bank behavior sometimes assume that the bank should properly have a risk-neutral objective function, and thus should maximize expected return without any concern for risk. It is assumed that if investors are risk-averse, they can adequately hedge any risk in one bank's stock returns with investments in other firms.

However, several arguments have been made explaining why risk may indeed enter into the bank's asset choice decision. For example, if the bank would face bankruptcy costs should it turn out that its net worth is negative, then an increase in the variance of the bank's portfolio will actually lower its expected return. In this case, diversification within the bank's portfolio again becomes important. (See Santomero (1984), for a more detailed discussion of this issue.) In this paper, we will assume that this sort of mechanism is at work.

12. Even if loan returns are not negatively correlated, diversification can often reduce portfolio risk. As long as the returns on new and existing loans are not perfectly positively correlated, then, given the distribution of the returns on new loans, and their covariance with the return on the existing portfolio, there exists a set of non-zero weights to attach to new and existing loans such that the variance of a combined portfolio is less than the variance of the existing portfolio.

13. It must be emphasized, that, under different assumptions for relative interest rates, monitoring costs, and covariances, portfolio variance would not necessarily be minimized by devoting exactly one-half of the portfolio to agriculture.

14. A bank may have centralized credit policies or credit approval processes that make the location of the bank headquarters important.

15. The solution depends on the relative curvature of the two individual profit functions. A major factor causing the functions to be concave is the importance of bankruptcy costs, β. As β increases, the functions become more concave, making it more likely that diversification will take place.

16. The other type of agricultural loan is an agricultural loan secured by real estate, which typically has a much longer maturity than an agricultural production loan (about 15 years versus about one year). We focus on agricultural production loans because they are more comparable, in maturity, with the commercial loans that we envision as the alternative asset. In addition, commercial banks are more involved in agricultural production lending than in agricultural real estate lending, as measured by market share. Over the years 1981-1986 (the years which we study), an average of 9.35 percent of total agricultural real estate loans were held by commercial banks. The corresponding figure for agricultural production loans was 41.7 percent. (Source: Sullivan, 1990.)

17. Gilbert and Belongia's explanatory variables are limited to variables related to bank holding company size and the length of time that a bank has been affiliated with a bank holding company.

18. Implicitly, we are equating rural areas with agricultural areas. Ideally, we would use county-level information on, for example, agriculture's share of total personal income, to refine our definition of an agricultural area. However, we do not have such information for every county in our study. On the surface, an alternative may be to use the entire state's share of agriculture in gross state product to measure the degree to which rural areas in the state are in fact engaged in agriculture. However, this is not likely to be a good indicator of agricultural activity in rural areas. This is because a state is likely to have a low agricultural gross state product share not because its rural areas are not engaged in agriculture, but because the contribution of industry to the state's economy is more important than the contribution of agriculture. California, with approximately a 2 percent share of agriculture in gross state product, is an example of such a state.

19. This notion was not incorporated into the theoretical model. There, a change in the proportion of funds devoted to agricultural loans, holding loan size constant, did not affect monitoring costs per dollar for agricultural loans. Likewise, a change in average agricultural loan size, holding the total proportion of the portfolio devoted to agriculture constant, did not affect monitoring costs per dollar for agricultural loans. Allowing for such effects in the theoretical model would have unnecessarily complicated the model, given that the main focus is on the relationship between monitoring costs and location.

20. For example, figures for loans made during one week in August in each of the years 1981 to 1986 reveal the following: Averaged over all six years, for the 48 large banks surveyed, the average size of short-term commercial and industrial loans was $1.433 million, the average size of long-term commercial and industrial loans was $1.093 million, and the average size of farm loans was $73,000. For small and medium sized banks, the corresponding numbers were $68,000, $62,000 and $12,000. Moreover, the pattern was consistent over all six years. (Source: Survey of Terms of Bank Lending.)

21. Source: Informal survey conducted by Federal Reserve Bank of San Francisco of six major commercial bank agricultural lenders in the Twelfth Federal Reserve District, March 1990.

22. Nationally chartered banks may lend no more than the value of 10 percent of their capital to any one borrower.

23. In addition, the FCS has a requirement that borrowers purchase stock in the organization. (See Box.) Under certain circumstances this too can be detrimental to its competitiveness. If farmers fear substantial losses on any FCS bank stock, they may "run" on the bank, rushing to pay off loans and redeem their stock at full price. This effort is most feasible for the financially strongest borrowers, so any exodus would leave behind the most troubled borrowers, exacerbating bank losses. Commercial banks do not face the possibility of runs by their borrowers, and deposit insurance protects them from runs by their depositors. Also, until recently the FCS has followed the practice of setting its loan rate based on its historical average cost of funds. This meant that, in periods of falling interest rates, the FCS was less competitive with commercial banks, who are more apt to price on a marginal cost basis.

24. According to the theory of financial intermediation outlined in the introduction to this paper, banks provide credit to borrowers who are unable to obtain funds by issuing their own debt. A bank is willing to lend to such a borrower because it has special credit evaluation and monitoring capabilities that are specific to that borrower. A relatively low short-term interest rate elasticity of demand is consistent with this theory; a borrower could expect that although another lender may offer a lower interest rate, other terms of the contract may be less favorable due to the new lender being less familiar with the borrower. For example, a borrower may rationally have loyalty to his lender born of experience that shows that the lender "stands by" the borrower in difficult times. A lender that has not had a long-term relationship with the borrower would not be expected to be as accommodating. Agricultural lending relationships seem to be particularly stable; an official of one commercial bank involved in agricultural lending stated that in order to win over a customer from another lender you often have to call on the customer for three or four years.

25. We assume that investing in the higher interest rate projects also adds to portfolio risk and/or raises the probability of project defaults. If it did not, then the bank would already have invested its entire portfolio in the projects with the highest interest rates, and changing the cost assigned to bankruptcy would not affect its portfolio.

26. Another variable that may affect the cost of risk to the bank is the capital-to-asset ratio. We included this variable in some versions of our regression, but this did not signifi-

cantly affect the results we report here. Therefore, we report only the version of the regression that excludes the capital-to-asset ratio.

27. For example, for farm loans made by large banks during the week of August 4, 1986, weighted average interest rates for six size classes decreased monotonically from 10.57 percent for $1,000 to $3,000 loans to 8.94 percent for loans of at least $250,000. (Source: Survey of Terms of Bank Lending, August 4-8, 1986.)

28. By restricting our sample to defined "agricultural lenders," we may be introducing selectivity bias into our regression estimation. However, we believe that our model is more applicable to banks that do *some* agricultural lending than it is to banks that do none at all, and that the determination of *whether* a bank does agricultural lending can be separated from the determination of *how much* agricultural lending it does.

29. These banks account for about one-third of total commercial bank agricultural lending nationwide.

30. It may be noted that agricultural loan market conditions experienced a severe downturn during our sample period due to a significant decrease in the trend of expected earnings and a consequent plunge in the value of farmland. (See Melichar (1986) and Melichar (1987) for discussions of this period of financial stress in agriculture.) However, we do not believe that this biases our results.

31. Metropolitan Statistical Area is a designation assigned to counties or areas of contiguous counties by the Census Bureau.

32. Because some banks appear more than once in our data set, we do not have completely independent observations. However, because bank size and the deposit-to-loan ratio should be fairly constant over time for each bank, the inclusion of these variables in the regression should help to control for firm-specific effects.

33. The difference between the coeffients on the restricted branching, urban location variable and the statewide branching, urban location variable is statistically significant.

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Explaining the U.S. Export Boom

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This paper assesses the performance of U.S. exports in the later part of the 1980s and finds that it cannot be fully explained by key variables that are generally believed to determine the demand for U.S. exports: the nominal trade-weighted dollar, relative inflation, and foreign GNP growth.

The unexpectedly robust performance of U.S. exports partly reflects improvements in the competitiveness of U.S. exporters that are not captured by the trends in inflation in the U.S. and abroad. In particular, U.S. export price increases in the 1980s fell below the rate of inflation in the U.S., apparently as a result of a change in the pricing behavior of U.S. exporters.

For much of the 1980s, there was widespread pessimism about the outlook for U.S. exports. U.S. exports declined over the period 1980–85. Given the widespread perception of lagging productivity growth and a lack of competitiveness in U.S. manufacturing,[1] dramatic improvements in U.S. export performance were not expected.

As a result, the robust performance of U.S. exports at the end of the last decade surprised a number of observers. Real U.S. exports of goods and services grew at a compound annual rate of 12.5 percent between 1985–89, well above the 8.1 percent average growth of the 1970s. Furthermore, the growth in exports was not confined to the period of dollar depreciation between 1985 and 1987. Exports grew nearly 14 percent in 1988, and 10 percent in 1989, even as the dollar appreciated between early 1988 and the third quarter of 1989.

This paper assesses the performance of U.S. exports up to 1989 and finds that it cannot be fully explained by key variables that are generally believed to determine the demand for U.S. exports: the nominal trade-weighted dollar, relative inflation, and foreign GNP growth. Three possible explanations for the tendency to underpredict exports are examined. First, exports of services may have grown unusually fast in relation to exports of goods. Second, recent efforts by Japan, Taiwan and South Korea to increase access to their markets have contributed to an increase in U.S. exports to these economies that is not captured by the standard determinants of export demand. Third, there has been a tendency to understate the competitiveness of U.S. exporters, because of changes in their pricing behavior.

The paper is organized as follows. Section I reviews the determinants of U.S. export demand and assesses their ability to predict exports in recent years. Section II evaluates the role of services exports in explaining the behavior of total exports. Section III examines whether recent efforts by rapidly growing Asian economies to liberalize imports may have contributed to the inability to explain the growth in U.S. exports. Section IV discusses the possibility that pricing behavior in the U.S. export sector may have changed, and Section V examines the implications of the pattern of export pricing for U.S. competitiveness and the ability to predict exports. Section VI offers some conclusions.

I. The Determinants of U.S. Exports

Two main factors are generally believed to determine the change in the demand for U.S. exports: the competitiveness of U.S. exporters, which is influenced by the U.S. dollar and relative inflation rates, and the overall demand for goods abroad, which is influenced by the GNP growth of major U.S. trading partners. Table 1 shows the behavior of these determinants of export demand in the 1970s and 1980s.

Table 1 suggests that in the first half of the 1980s, U.S. export growth was limited by the sharp appreciation of the dollar and a slowdown in foreign GNP growth in comparison to the 1970s. These trends were largely reversed in the second half of the 1980s. In particular, the growth of U.S. exports in recent years appears to be partly the result of the lagged effects of the depreciation of the dollar between 1985 and 1987 and of an acceleration in the growth of U.S. trading partners since 1985. It may also be noted that in the first half of the 1980s, U.S. inflation remained on average below foreign inflation, contributing to U.S. export competitiveness. In contrast, an acceleration in U.S. inflation above inflation abroad adversely affected the competitiveness of U.S. exporters in the second half of the 1980s.

While Table 1 highlights some of the factors that may have contributed to recent U.S. export performance, it cannot tell us whether these factors fully account for recent export growth. To shed some light on this question, the demand for U.S. exports of goods and services was modeled as a function of the exchange rate-adjusted ratio of U.S. to foreign prices, or the real exchange rate (as a proxy for U.S. competitiveness) and to foreign GNP (as a proxy for foreign demand). This model of export volume was expressed in log first-difference form, with the (one quarter) lagged levels of the explanatory variables and the respective dependent variables on the right-hand side of each equation. This representation, also known as an "error-correction" specification, is shown in equation (1):

$$\Delta XGS = \alpha + \sum_{i=0}^{m} \beta_i \Delta RXR_{1\,t-i} + \sum_{i=0}^{m} \gamma_i \Delta FGNP_{t-i} + \sum_{i=1}^{m} \delta_i \Delta XGS_{t-i} + \eta_1 RXR_{t-1} + \eta_2 FGNP_{t-1} + \eta_3 XGS_{t-1} \quad (1)$$

where

XGS = real exports of goods and services, NIPA basis

RXR_1 = real exchange rate = $\frac{NXR \times P_{US}}{TWFCPI}$

NXR = Nominal trade-weighted dollar

P_{US} = U.S. fixed-weight GNP price index

$TWFCPI$ = trade-weighted CPI of 10-major industrial countries

$FGNP$ = trade-weighted GNP of 10 major industrial countries

The error-correction specification used in equation (1) has three desirable features: (1) it avoids the possibility of spurious correlation among strongly trended variables; (2) long-run relationships which may be lost by expressing the data in differences are captured by including the lagged levels of the variables on the right hand side; and (3) the specification can distinguish between short-run (first differences) and long-run (lagged levels) effects.

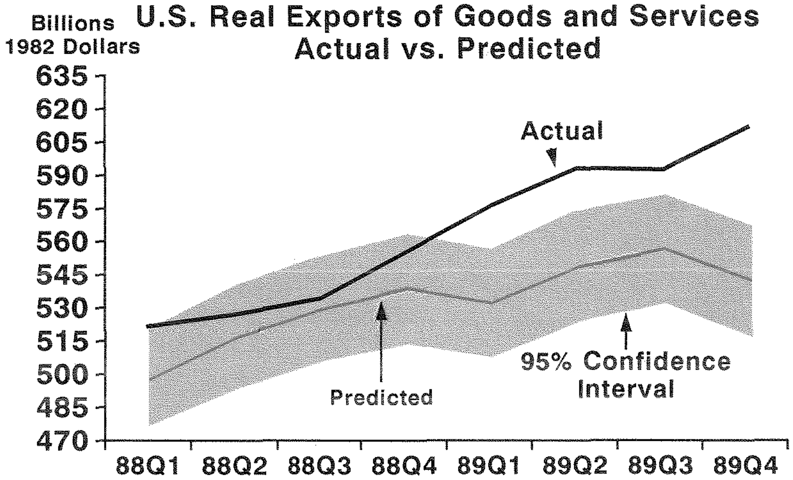
To test the ability of competitiveness and demand factors to explain recent export behavior, equation (1) was estimated from 1972:4 through 1987:4 and an out-of-sample simulation was performed for the period 1988:1 to 1989:4. The sample was broken in 1987:4 because the dollar reached its most recent trough in that quarter.[2] The coefficients and summary statistics from the estimation of equation (1) are reported in a later section. We focus on the

Table 1
Growth Rates of Factors Affecting the Demand for U.S. Exports
(compound annual rates)

	Change in the Dollar[1]	Relative Inflation (U.S.–Foreign)[2]	Foreign GNP Growth[3]
1970–75	−4.0	−3.2	3.0
1975–80	−2.4	−1.5	3.2
1980–85	10.4	−1.2	1.9
1985–89	−8.9	1.2	3.2
1985–87	−17.7	1.1	2.6
1987–89	0.8	1.3	3.8

[1]Nominal trade-weighted average value of the U.S. dollar against the currencies of 10 major industrial countries (Japan, Germany, France, U.K., Canada, Italy, Netherlands, Belgium, Sweden and Switzerland).
[2]Inflation in U.S. fixed-weight GNP deflator versus inflation in trade-weighted CPIs of 10 major industrial countries.
[3]Trade-weighted average of growth of 10 major industrial countries.

Chart 1
U.S. Real Exports of Goods and Services
Actual vs. Predicted



results of the simulation here. Chart 1, which compares the path of actual and predicted exports, shows that the export equation did not fully anticipate the robust performance of the U.S. export sector in 1988 and 1989. Over that period, there was a systematic and growing underprediction of the level of real exports of goods and services, so that by 1989, the out-of-sample forecast was outside the 95 percent confidence range. Thus, factors other than changes in the dollar, relative inflation, and growth abroad appear to have contributed to export growth in the latter part of the 1980s.[3]

Three explanations may be offered for the tendency of equation (1) to underpredict exports of goods and services over that period. First, exports of services, which are included in the left-hand-side of equation (1), may have grown faster than expected in response to variables (such as rising interest rates abroad) other than the real exchange rate and foreign GNP.

Second, recent efforts by Japan, Taiwan and South Korea to increase access to their markets have contributed to an increase in U.S. exports to these economies. As a result, the coefficients on foreign GNP in equation (1) may be unstable.

Third, the improved competitiveness of U.S. exporters may not have been fully reflected in movements in the dollar or in U.S. inflation, which are the basis for the competitiveness measure used in equation (1).

II. Exports of Services, Not Goods?

A possible explanation for the underprediction of exports towards the end of the 1980s is that in Section I, a single export equation is used to forecast exports of both goods and services. Since factor incomes or services may respond to variables other than the real exchange rate and foreign GNP (notably foreign interest rates), their behavior may account for the underprediction of total exports. The plausibility of this hypothesis may be examined in two ways. First, if exports of services explain the underprediction observed in Chart 1 they must have grown unusually fast in comparison to merchandise exports. Second, if exports of services contributed to the underprediction of total exports, the out-of-sample forecast of exports should improve when services are excluded.

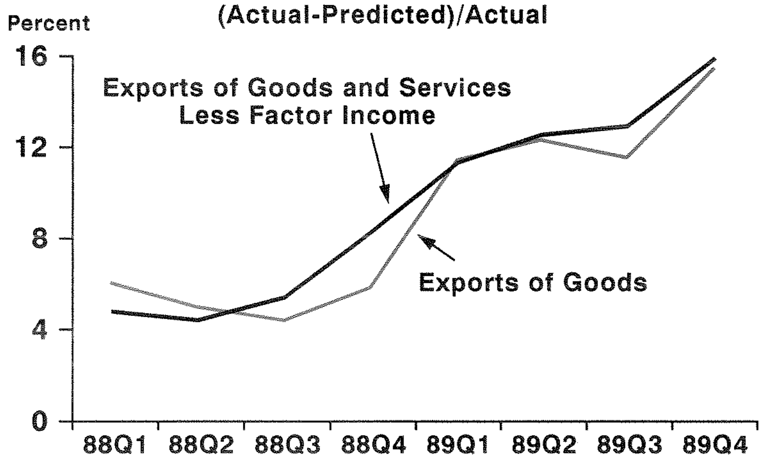
To check the first possibility, Table 2 compares the growth in the components of real exports of goods and services. Table 2 shows that U.S. merchandise exports grew faster than U.S. exports of services in the 1980s, reversing the pattern of the 1970s, when exports of services grew faster. (As a result, the real share of U.S. merchandise exports in total exports, which had fallen from nearly 68 percent in 1970 to 62 percent in 1980, rose to nearly 66

Table 2

Growth Rates of Real U.S. Exports of Goods and Services
(compound annual rates)

	Total	Merchandise	Services	Factor Income
1970–75	7.8	7.3	8.9	9.0
1975–80	8.4	7.1	10.8	14.9
1980–85	−1.1	−0.9	−1.6	−2.7
1985–89	12.7	14.0	10.6	7.1

Chart 2
Errors in Predicting US Exports
(Actual-Predicted)/Actual



percent in 1989.) Thus, Table 2 does not support the hypothesis that unusually rapid growth in services accounts for the remarkable growth in exports at the end of the 1980s.[4]

To check the second possibility, equation (1) was re-estimated respectively using (i) exports of goods and services net of factor income and (ii) exports of goods as the dependent variable. Inspection of the errors, illustrated in Chart 2, indicates that the systematic and rising tendency to underpredict exports *still occurs* when factor incomes or services are excluded. Thus, the underprediction of exports does not appear to be the result of any unusual pattern in exports of services. In the discussion that follows, we will therefore continue to focus on total exports of goods and services.

III. Growing Access to Foreign Markets

In the 1980s, a number of highly successful Asian economies sought to liberalize their commercial policies and improve access to their domestic markets. The cases of Japan, Taiwan and South Korea have drawn particular attention, as all three economies experienced large trade surpluses over extended periods in the 1980s. In the case of Japan, where tariffs are low, and formal nontariff barriers are quite limited, efforts have focused on eliminating impediments to agricultural imports (for example, by eliminating prohibitions on beef and citrus imports), and lifting so-called "intangible" barriers to trade that have tended to discourage imports. In the cases of Taiwan and South Korea, steps have been taken to eliminate nontariff barriers or to replace them by tariff barriers (thus enhancing the transparency of protection, which facilitates trade), and also to lower tariff barriers.

For example, South Korea increased the percentage of goods approved for import licenses from 64 percent in 1978 to 95 percent by the late 1980s. It also adopted a plan to reduce average tariff rates progressively. Tariffs have fallen from an average of nearly 24 percent in 1983 to 19 percent in 1987 and to under 13 percent in 1989. Assuming no reversals, they are projected to fall to 7 percent by 1993. Taiwan's trade liberalization efforts have been even more extensive. In early 1989, 98 percent of the products could be freely imported. Average tariff rates, which had remained at around 31 percent from 1980 to 1984 fell to around 20 percent in 1987 and to 6.3 percent in 1989. Tariff rates are to fall to 3.5 percent by 1993.

Table 3
Growth Rates of Nominal U.S. Exports of Goods

	1970–89[1]	1987–89[2]
Japan	11.2 (0.7)	25.6
Taiwan	15.4 (0.9)	53.3
South Korea	15.7 (0.8)	29.0

[1]Based on time trend regression. Standard errors in parentheses.
[2]Compound annual rate.

These efforts by major Asian economies to improve access to their markets appear to have benefited U.S. exporters. U.S. nominal exports to Japan, South Korea and Taiwan grew at an unprecedented rate in the later part of the 1980s. As shown in Table 3, annual U.S. export growth between 1987 and 1989 respectively averaged 26 percent to Japan, 53 percent to Taiwan and 29 percent to Korea. This is well above historical averages. While real bilateral export data are not available, it is likely that real export growth follows a similar pattern. The rapid growth of U.S. exports to these economies implies that they accounted for a significant proportion of total U.S. export growth in the later part of the 1980s.

If the acceleration of U.S. exports to Japan, Taiwan and South Korea is due to their efforts to improve access to their economies, the explanatory power of equation (1) may be adversely affected. In particular, it may be argued that greater openness in these markets will tend to increase the responsiveness of the demand for U.S. exports to foreign GNP. To investigate this possibility, equation (1) was estimated over the period 1972–1989, with slope dummies for the foreign GNP variable beginning in 1988:1. The results are summarized in Table 4. It is apparent that there has been no statistically significant change in the response of exports to foreign GNP. Thus, a larger marginal propensity to import abroad does not explain the underprediction of U.S. exports over the past two years.

Table 4

Testing for Stability in the Responsiveness of Exports to Foreign GNP

	No. of lags	Sum of slope-dummy coefficients on Foreign GNP[1]
Short-run	0–2	0.451 (0.17)
Long-run	1	.0007 (0.15)

[1]t-statistics in parentheses

IV. A Change in Exporter Pricing Behavior?

Another possible explanation for the tendency to underpredict exports at the end of the 1980s is that the improvements in the competitiveness of U.S. exporters may not be fully reflected in the measure of competitiveness used in equation (1). The competitiveness of U.S. exporters may be measured in two different ways. One approach is to take the exchange rate-adjusted ratio of a domestic U.S. price (such as the U.S. fixed-weight GNP price) and trade-weighted foreign prices (such as foreign CPIs).[5] In this case we obtain the measure of U.S. competitiveness, or the real exchange rate, used in estimating equation (1):

$$RXR1 = \frac{NXR \times P_{US}}{TWFCPI} \qquad (2)$$

where an *increase* in RXR_1 corresponds to a real appreciation, or a *decline* in external competitiveness. An alternative approach is to construct an exchange rate-adjusted index of the price of U.S. exports relative to trade-weighted foreign prices, that is:

$$RXR_2 = \frac{NXR \times PX}{TWFCPI} \qquad (3)$$

where PX is the (fixed-weight) export deflator.

Although RXR_2 is a more direct measure of the competitiveness of U.S. exporters, RXR_1, which is based on a domestic U.S. price, is often used as a proxy for U.S. competitiveness for a number of reasons. First, RXR_1 reflects the overall competitiveness of all goods produced in the U.S. rather than of the goods that are currently produced in the export sector. A broad measure of U.S. competitiveness, such as RXR_1, accounts for the possibility that if domestic prices are sufficiently competitive, certain U.S. producers may begin producing for the U.S. export sector even if they do not do so currently. RXR_2, which is based on the export price of current exporters, does not explicitly take this possibility into account. Second, RXR_1 reflects the plausible view that in the long run, the competitiveness of U.S. exporters will largely be determined by domestic costs of production, as represented by a domestic U.S. price. Third, the use of RXR_1 is consistent with the traditional conventional wisdom regarding the market conditions that face U.S. exporters.[6] According to this view, substitutes for U.S. products in world markets historically were not readily available and exports had a limited impact on total profitability. As a result, U.S. exporters were relatively less concerned about their external competitiveness, and export prices were set primarily on the basis of domestic costs of production, rather than on conditions prevailing in export markets. In this environment, there would be a stable relationship between the U.S. export price (used in RXR_2) and the fixed-weight GNP price (used in RXR_1), and the two measures RXR_1 and RXR_2 would give the same overall picture of competitiveness. The GNP price in RXR_1 can then be interpreted as a proxy for the export price that is used directly in RXR_2.

However, RXR_1 will give a misleading picture of the competitiveness of U.S. exporters if the relationship between the export price and the fixed-weight GNP price is not stable because of a change in the pricing behavior of exporters.

To assess whether the relationship appears to be stable, Chart 3 shows the ratio of these two prices between 1970 and 1989. I call this ratio the relative export price. As can be seen from equations (2) and (3) the relative export price is equivalent to dividing RXR_2 by RXR_1, and thus indicates whether the two measures of competitiveness behave in a similar way. If the trend in the ratio is flat, RXR_1 and RXR_2 give the same measure of competitiveness. If the ratio declines, exporters are more competitive than suggested by RXR_1; the reverse is true if the ratio rises. As a reference, the chart also shows the path of the nominal trade-weighted dollar.

The interpretation of Chart 3 is facilitated if we think of the relative export price as an indicator of the aggregate profit margin of the export sector.[7] The chart suggests that there was no trend in export profit margins in the 1970s, as there was little *net* change in the relative export price between the early and late 1970s. In contrast, a pronounced decline in the relative export price occurred between 1980 and 1985, and was not reversed subsequently.[8]

The decline in the relative export price in the early 1980s may have been partly the result of a contraction in world economic activity that reduced demand for U.S. exports and thus prompted a (cyclical) reduction in U.S. export prices. An alternative explanation, which we focus on here, is that U.S. producers may have been attempting to price more competitively in U.S. export markets. This explanation is suggested by the fact that a lower relative export price persisted after world economic activity recovered in 1983 and particularly after the dollar depreciation between 1985 and 1987 sharply reduced the foreign currency price of U.S. exports.

Such a change in pricing behavior would be consistent with growing competitive pressures caused by the entry of producers from Japan, and later the newly industrializing Asian economies in world markets previously dominated by U.S. producers, such as capital goods and electronics, beginning in the 1970s. These pressures probably intensified in the 1980s because the sharp appreciation of the dollar (see Chart 3) in the first half of the 1980s increased the price of U.S. products in foreign currencies, paving the way for further entry by Asian producers in U.S. and world markets. Furthermore, the debt crisis that began in 1982 led to stagnation in traditional U.S. exports of manufactures to Latin America, which required U.S. producers to seek out new markets.

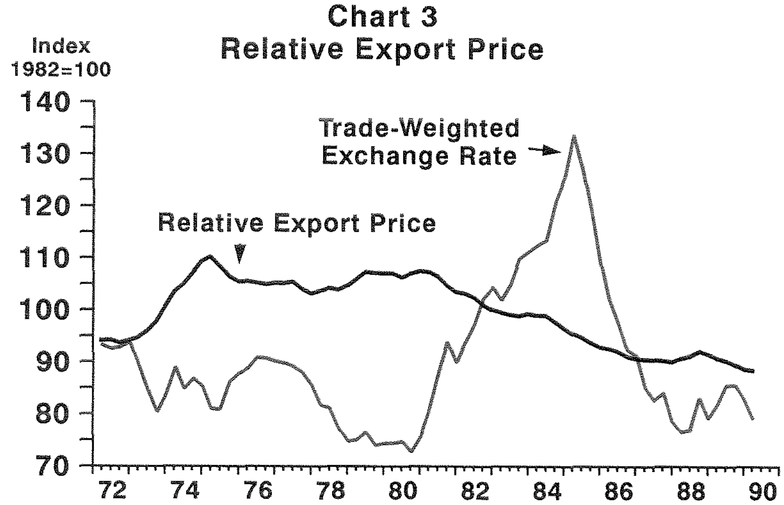
Testing for Stability in Export Pricing

The discussion in the preceding section raises the question of whether the decline in the U.S. relative export price can be detected as a change in exporter pricing behavior.

We may attempt to test more formally for such a change and attempt to identify the sources of any such change at the aggregate level, by using a model of export pricing.

Following the literature on this subject, assume that in setting the prices of traded goods, suppliers add a markup over their costs of production. The markup is in turn a function of competing goods prices, which are influenced by the exchange rate and foreign prices. The export price

Chart 3
Relative Export Price



can then be expressed as a function of the domestic GNP price (to represent domestic costs of production), and the exchange rate-adjusted foreign price (to represent foreign competition). In error-correction form, this relationship may be expressed as follows:

$$\Delta PX_t = \kappa_0 + \sum_{i=0}^{m} \mu_i \Delta P_{USt-i} + \sum_{i=0}^{m} \nu_i \Delta [\frac{TWFCPI}{NXR}]_{t-i} + \sum_{j=1}^{m} \xi_j \Delta PX_{t-j} + \tau_1 P_{USt-1} + \tau_2 [\frac{TWFCPI}{NXR}]_{t-1} + \tau_3 PX_{t-1} \quad (4)$$

In the long run the export price will tend to rise in response to an increase in the domestic GNP price, which raises the costs of production. The export price will also tend to rise in response to an increase in the foreign price or a dollar depreciation, to the extent that U.S. producers respond to export market conditions in setting the export price.[9] The long-run coefficients in equation (4) (based on τ_1, τ_2) are thus expected to be positive. The signs on the short-run coefficients (μ_i, υ_i, ξ_j) depend on the precise pattern of adjustment.

To verify whether the response of export prices to its determinants has changed, equation (4) was estimated between 1972:1 and 1985:1, and the equation was simulated out-of-sample from 1985:2 to 1989:4. The sample was broken in 1985:1, when the U.S. dollar peaked, because in the period that followed, cyclical and exchange rate factors would tend to put upward pressure on U.S. export prices. A moderate export price response to these upward pressures, as indicated by a systematic tendency to overpredict export prices after 1985:1, would thus suggest more competitive pricing behavior on the part of U.S. exporters.

The results of the regression are reported in column I of Table 5. As can be seen, equation (4) produces a satisfactory fit and the hypothesis that there is no serial correlation cannot be rejected. In line with conventional wisdom, the regression results suggest that U.S. exporters priced mainly on the basis of domestic costs of production, and ignored the exchange rate-adjusted foreign price up to the first half of the 1980s.

Chart 4 illustrates the results of the simulation from 1985:2 to 1989:4. As can be seen, there was a tendency to *overpredict* the export price in the second half of the 1980s, which supports the view that exporters were pricing more competitively.

To identify the sources of this apparent change in pricing behavior, equation (4) was re-estimated over the period 1974:4–1989:4. Several regressions were then performed,

Table 5
Export Pricing Behavior

	No. of lags	1972:4–1985:1 I	1972:4–1989:1 II	1972:4–1989:1 III
Constant		.04	.05**	.03
		(1.1)	(2.4)	(1.5)
First differences				
ΔP_{US}	0–2	1.2**	1.3***	1.2***
		(2.5)	(3.6)	(3.4)
$\Delta(\frac{FCPI}{NXR})$	0–2	.02	−0.0004	0.03
		(0.3)	(−0.01)	(0.9)
ΔPX	1–2	0.45***	0.40***	0.43***
		(3.4)	(3.8)	(4.1)
Lagged levels				
P_{US}	1	0.10***	0.07***	0.10***
		(2.8)	(2.8)	(3.4)
$\frac{FCPI}{NXR}$	1	.01	−0.002	0.004
		(0.4)	(−0.3)	(0.5)
PX	1 or 2	−0.12***	−0.08***	−0.11***
		(−2.8)	(−3.3)	(−3.8)
Slope dummies				
PX	1			−0.002*
				(−1.8)
S.E.E.		6.4×10^{-3}	5.9×10^{-3}	5.8×10^{-3}
$\bar{R}^2$		0.79	0.82	0.82
Durbin's test for serial correlation[1]		−0.47	−0.56	−0.17
		(−0.5)	(−1.2)	(−0.3)
Long-run elasticities				
$-(\frac{P_{US}}{PX})$		0.85	0.88	0.91

Notes: t-statistics in parentheses

*** Significant at 1 percent
** Significant at 5 percent
* Significant at 10 percent

[1]Coefficient on lagged residual and associated t-test. Based on regression of current residual on lagged residual and on right-hand-side variables in export price equation.

with slope dummy variables for the period 1985:2–1989:4 on the following variables:

1) the first differences of the domestic U.S. price, the exchange-rate adjusted foreign price, and the lagged dependent variable;
2) the lagged levels of the domestic U.S. price and the exchange-rate adjusted foreign price, with and without a slope dummy on the lagged dependent variable; and
3) the lagged level of the dependent variable only.

A negative slope dummy coefficient on the domestic U.S. price variable would suggest that exporters were adjusting their export prices by less in response to changes in their costs of production, which would be consistent with growing competitive pressures.[10]

A positive slope dummy coefficient on the foreign price variable would suggest that U.S. exporters were responding to external competitive pressures after 1985, whereas they had not done so in the past.[11]

A change in the response to the lagged dependent variable is more difficult to interpret. However, a negative coefficient on the slope dummy indicates that the increase in the U.S. export price associated with its past value has fallen, which is consistent with more moderation in the pricing behavior of U.S. exporters or a change in the desired level of U.S. export prices.

Column II in Table 5 reports the results of the regression over the period 1972:4–1989:4 without any slope dummy variables. A comparison of columns I and II suggests that the long-run response to U.S. prices and to the lagged level of the dependent variable may have changed. However, it was difficult to isolate the precise nature of the change.

The slope dummy coefficients on the levels and changes of the U.S. GNP price and the exchange rate-adjusted foreign price were not significant (regressions 1 and 2 above). The results of the corresponding regressions are not reported because they are very similar to the results shown in column II.

However, there is some weak evidence that the rate at which exporters adjust their export prices in response to deviations from equilibrium, or possibly the desired level of export prices, may have changed. As shown in column III of Table 5 the coefficient on the slope dummy variable for the lagged level of the dependent variable (regression 3 above) is significant at the 10 percent level.

To sum up, the U.S. export price fell in comparison to the GNP price as the dollar appreciated in the early 1980s. This relative decline persisted even after the dollar appreciation was fully reversed over the period 1985–1987. The decline in the relative export price appears to reflect a change in the pricing behavior of exporters, but the precise nature of the change was not easy to identify or interpret. Further research is required to clarify the process governing the pricing behavior of U.S. exporters. In particular, studies of export pricing at the industry level may be necessary, as recent research of the U.S. import market suggests that aggregation problems may limit the ability to model aggregate pricing behavior.[12]

Chart 4
Export Price Index (Actual vs. Predicted)

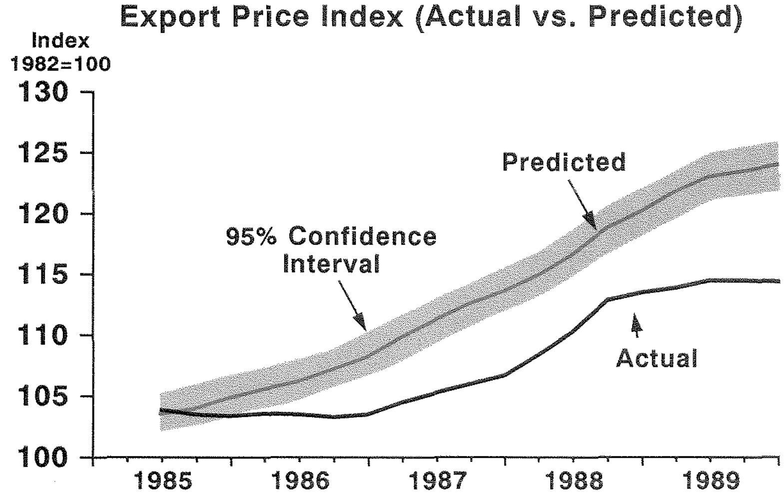
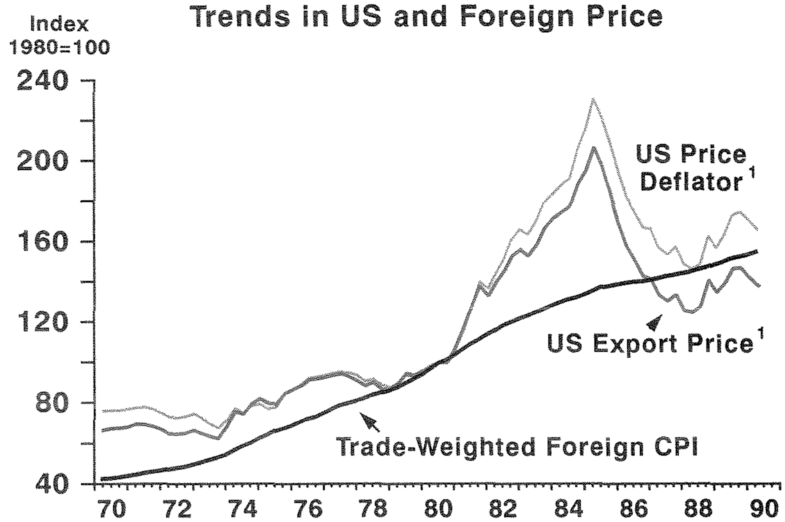


Chart 5
Trends in US and Foreign Price



[1]Expressed in foreign currency by multiplying with the Federal Reserve Board's nominal trade-weighted index of the dollar.

V. U.S. Competitiveness and Export Performance

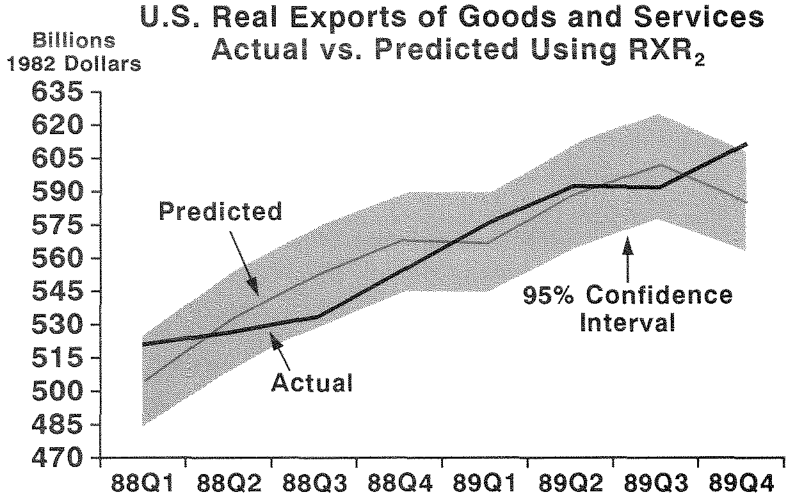
The preceding discussion suggests that a measure of U.S. competitiveness based on the export price may give a markedly different picture of U.S. competitiveness than does a measure based on the U.S. GNP price. This can be seen in Chart 5, which compares the respective paths of the U.S. GNP price and the U.S. export price, both in foreign currency, to the trade-weighted foreign CPI over the period 1970–1989. Note that fluctuations in the U.S. GNP price and U.S. export price now reflect changes in the dollar exchange rate.

The U.S. GNP price measure suggests that after adjusting for exchange rates, U.S. inflation on average exceeded foreign inflation, so that U.S. exporters were still relatively uncompetitive at the end of the 1980s. In contrast, the export price measure suggests that U.S. exporters at the end of the 1980s were better positioned to face foreign competition than they had been at any other time during the preceding twenty years.

After rising in the first half of the 1980s, the U.S. export price in foreign currency fell sharply in 1985. Even though the drop in the U.S. export price was reversed starting in 1988, the *level* of the export price was still below the level of the trade-weighted foreign CPI in 1989. Of course, comparisons of indices can be sensitive to the choice of base period (Chart 5 uses 1980 as the base year), but the conclusion that U.S. exporters are still competitive relative to their trading partners is fairly robust; any base year between 1970 and 1985 yields the same conclusion.[13]

Chart 5 suggests that the post-1985 increase in U.S. inflation relative to inflation abroad (recall Table 1) was not

Chart 6
U.S. Real Exports of Goods and Services
Actual vs. Predicted Using RXR_2



fully reflected in export prices. As a result, the measure of competitiveness based on the U.S. GNP price (RXR_1) used in equation (1) tends to understate U.S. competitiveness, while RXR_2 may give a more realistic picture of U.S. competitiveness in the 1980s. Changes in U.S. competitiveness not captured by RXR_1 may thus explain the tendency for equation (1) to underpredict U.S. exports.

To verify this last hypothesis, equation (1) was estimated over the period 1972:4–1987:4, replacing RXR_1 by RXR_2. An out-of-sample dynamic simulation was then performed for the period 1988:1–1989:4.

Table 6 compares the results of the regressions using RXR_1 and RXR_2 while Table 7 compares the out-of-sample forecasting performance over the period 1988:1–1989:4. Taken together the tables show that the in-sample performance of either measure of competitiveness over the period 1972:4–1987:4 is roughly comparable. However, when RXR_2 is used, the mean square error of the out-of-sample forecast in the last two years of the 1980s falls by 60 percent in comparison to the forecast using RXR_1. Furthermore, Chart 6 shows that using RXR_2 eliminates the systematic underprediction of U.S. exports after 1988, and that the path of actual exports now tends to remain within the 95 percent confidence band of the forecast.[14]

The ability of RXR_2 to improve the forecast of exports, in comparison to the forecast based on RXR_1, suggests that the rapid growth in exports towards the end of the 1980s was partly the result of changes in the competitiveness of U.S. exporters. This change in competitiveness was in turn apparently attributable to changes in their pricing behavior.[15]

Table 6

Regression of Export Demand

1972:4–1987:4

	Lags	RXR_1	RXR_2
Constant	0	−.57*	−.97
		(−1.8)	(−3.0)
First differences			
ΔRXR	0–4	0.38	0.68**
		(1.2)	(2.5)
$\Delta FGNP$	0–4	−0.44	0.25
		(−0.2)	(0.2)
ΔXGS	1–4	0.84**	0.49*
		(2.1)	(1.8)
Lagged levels			
RXR	1	−0.16***	−0.23***
		(−2.8)	(−4.1)
FGNP	1	0.72**	0.69***
		(2.5)	(3.5)
XGS	1	−0.41**	−0.42***
		(−2.5)	(−3.7)
Durbin's test for serial correlation[1]		0.19	0.15
		(0.4)	(0.3)
$\bar{R}^2$		.568	.609
S.E.E.		.021	.020
Long-run elasticities			
$-(RXR/XGS)$		−0.41	−0.55
$-(FGNP/XGS)$		1.78	1.64

Notes: t-statistics in parentheses

*** Significant at 1 percent
** Significant at 5 percent
* Significant at 10 percent

[1]Coefficient and t-statistic based on regression of residual on lagged residual and right-hand-side variables.

Table 7

Out-of-Sample Forecasting Performance for Exports

1988:1–1989:4

	RXR_1	RXR_2
Mean square error[1]	36.4	14.7

[1]The mean square error was calculated by taking the average sum of squares of actual less predicted export volume in billions of 1982 dollars.

VI. Conclusion

The rapid growth of U.S. exports of goods and services in 1988 and 1989 is not fully explained by a standard model of export demand that accounts for trends in the dollar, relative inflation rates in the U.S. and abroad and robust growth among U.S. trading partners. U.S. exports grew rapidly in 1988 and 1989 in spite of an appreciating dollar and an increase in U.S. inflation in comparison to inflation abroad.

The unexpectedly robust performance of U.S. exports partly reflects improvements in the competitiveness of U.S. exporters that are not captured by the trends in inflation in the U.S. and abroad. In the 1980s, U.S. export prices increased by less than inflation in the U.S. or (after adjusting for exchange rates) in major foreign industrial countries. Thus, the relative rate of U.S. inflation has tended to understate the competitiveness of the U.S. export sector. The empirical tests reported in this paper suggest that the deviation between export price increases and U.S. inflation in the 1980s may in turn have been caused by a change in pricing behavior on the part of U.S. exporters. However, further research at the industry level is required to confirm this hypothesis.

The findings of this paper underscore the fragility of the boom in U.S. exports that began in the late 1980s. While the relative slowdown in the rise of the U.S. export price offset the adverse impact of rising U.S. inflation on U.S. competitiveness, this offset cannot persist indefinitely. Export price increases can remain below the U.S. rate of inflation in the long run only if the productivity of the export sector consistently exceeds productivity growth in the U.S. domestic sector. There appears to be no evidence that this is occurring, and in the absence of further U.S. dollar depreciation, continued gains in U.S. competitiveness will require a reduction in U.S. inflation below the rate of inflation of its trading partners.

NOTES

1. For a recent discussion of the poor productivity performance of the U.S. manufacturing sector and the possible contribution of lagging innovation, see Baily and Chakrabarti (1988). A more optimistic interpretation of trends in U.S. productivity is offered by Baumol, Blackman and Wolff (1989).

2. Furthermore, the discussion of Chart 5 later in the text suggests that in contrast to previous episodes of dollar appreciation, U.S. exporters remained competitive in comparison to foreign producers during the dollar appreciation of 1988–89. Out-of-sample simulations of equation (1) for the period 1985:1–1989:4 also suggest that there was no systematic tendency to underpredict until 1988. These out-of-sample simulations were performed after the break-point was selected.

3. A similar conclusion is reached when the simulations are based on the export equation of the structural model of the Federal Reserve Bank of San Francisco, which uses a quadratic PDL specification. See Throop (1989). A PDL specification is also used in the export equations of the MPS model of the U.S. economy maintained by the Board of Governors of the Federal Reserve System.

4. The nominal data convey a different impression. While the growth of merchandise and services exports were roughly the same in the 1970s, in the 1980s, the value of services exports grew more rapidly than did the value of merchandise exports. As a result, the nominal share of services in U.S. exports grew from 35 percent in 1970 to 36 percent in 1980 and to 41 percent in 1989. This rising share reflects the more rapid rate of inflation in the services sector.

5. This approach is followed in the FRBSF structural model as well as the Federal Reserve Board's MPS model. The latter model uses the nonfarm business fixed-weight deflator net of indirect business taxes, in lieu of the export price, in measuring the competitiveness of the U.S. export sector. See Brayton and Mauskopf (1985), Section VII. In contrast, the Board's MCM model uses the export price in measuring U.S. export competitiveness, as in equation (3). See Helkie and Hooper (1988), Table 2-3.

6. These market conditions are discussed in Hooper and Mann (1987). Another reason the use of RXR_1 is appealing is that it eliminates the need to estimate an export price separately (the same is true on the import side). This can be useful in forecasting, particularly since specifying a stable price equation can be difficult.

7. For related measures see Hooper and Mann (1987) and Moreno (1989b).

8. Note that there also seems to be a decline in the relative export price if other price indices are used. See Moreno (1989b), which compares the nonagricultural export price to the PPI. A comparison of export unit values and the PPI yields a similar conclusion, although it may be argued that this may reflect a shift in the composition of exports towards high-productivity and low-price sectors, such as computers.

9. For an analogous equation, see the export equation of the Federal Reserve Board's Multicountry Model (MCM), described in Helkie and Hooper (1988). However, Helkie and Hooper use the non-agricultural export price on the left-hand-side and a specially constructed price index to represent domestic costs of production on the right-hand-side. Note that as in Helkie and Hooper, equation (4) assumes that exporters respond in exactly the same way to changes in the exchange rate that they do to changes in the foreign price, on the assumption that the response to changes in the exchange rate is motivated purely by the effect it may have on competitiveness in foreign markets.

10. One possible interpretation of such a result is that increases in productivity in the export sector have recently exceeded increases in overall U.S. productivity, and that exporters are passing on these gains to their customers. An informal examination of some of the industry data provides no clear indication of whether productivity gains among exporters in the 1980s have in fact exceeded productivity gains for U.S. producers as a whole. For example, in the capital goods industry-one of the most dynamic U.S. export sectors—labor productivity growth in the 1980s in semiconductors, computers and non-electrical machinery—exceeded the growth of labor productivity in manufacturing as a whole. On the other hand, labor productivity growth was below average in a number of historically important U.S. export sectors, such as construction machinery, ball bearings, machine tools and pump and compressors. For a more detailed discussion, see Orr (1989).

11. Using data at the four-digit SIC level, Hooper and Mann (1987) found some indications that U.S. producers tend to price more competitively relative to foreign producers in industries where exposure to export markets is rising or where there is strong competition for market share because close substitutes for U.S. products are available abroad (for example, in semiconductors).

12. See Melick (1990). Melick has performed a battery of econometric tests to characterize U.S. import pricing behavior. His results highlight the difficulties that arise when using aggregate data to model pricing behavior. Econometric tests rejected the restrictions suggested by three widely used models of import pricing behavior: (i) perfect competition; (ii) Nash imperfect competition; (iii) the mark-up model (as in Hooper and Mann (1989)). Melick attributes this rejection to aggregation problems. In particular, all three types of market structure may be present at the aggregate level. Other tests suggested that the widely used PDL specification with correction for serial correlation may produce spurious instability, but appropriate alternative specifications are not obvious. Additional tests using similar recursive econometric techniques may verify whether the apparent instability in export pricing behavior suggested by Chart 4 is robust to changes in specification and clarify its sources.

13. For a related discussion, see Moreno (1989b). The reader should recall that the trade-weighted foreign CPI measure covers only major industrial countries. A measure that includes the CPIs of a number of developing countries—notably the Asian newly industrializing economies—might indicate a less robust improvement in the competitiveness of U.S. exporters. However, it would still be true that U.S. exporters are more competitive in relation to their industrial country trading partners.

14. Similar results are obtained when using a PDL specification for the export equation, as in the FRBSF structural model. One issue that has not been directly addressed in the paper is whether the single equation estimation techniques used here—which are commonly used in the literature—may account for the tendency to underpredict export volume observed in Chart 1. Since single equation estimates are correct if the elasticity of supply is infinite (or the demand function is stable while the supply function shifts around), one way of justifying the use of single equation techniques is to note that the U.S. domestic production sector is very large in comparison to the export sector, and that supply can therefore shift to the export sector quite easily.

Furthermore, it does not appear that simultaneous equation bias would produce the underprediction of exports obtained in this paper. As pointed out by Goldstein and Khan (1985), single equation estimates can produce weighted averages of demand and supply elasticities and may therefore be biased downward. Consider now the demand function estimated in Table 6. Assuming this function was stable over the period 1988–1989, the U.S. dollar appreciation over much of this period would tend to reduce the demand for U.S. exports. However, if the estimates were subject to simultaneous equation bias, there would be a tendency to *understate* the impact of dollar appreciation in out-of-sample simulations, that is, a tendency to *overpredict* exports. Thus, the underprediction in Chart 1 does not appear to be the result of simultaneous equation bias.

15. The preceding results permit us to rule out another explanation for the tendency to underpredict exports, the phenomenon of "hysteresis." Hysteresis is a situation where a phenomenon (for example, large export volume) persists even when the disturbance that produced it (for example, dollar depreciation) is removed. As applied to the present case, hysteresis would imply that sharp gains in U.S. competitiveness after 1985 produced persistent effects on U.S. exports that are not readily captured in equation (1).

To understand how hysteresis in export markets may arise, suppose that entry and exit from world export markets is characterized by relatively high fixed costs. One implication is that large swings in prices may encourage entry or force exit, while small swings may not. Small swings in U.S. competitiveness (such as those observed up to the early 1980s) would be characterized by changes in export demand that are well-captured by equation (1). However, large swings in U.S. competitiveness (such as the dollar appreciation between 1980–85 and the depreciation that immediately followed) would be accompanied by entry or exit decisions that are not easily explained by equation (1).

Consider the trends revealed in Chart 5. The Chart suggests that the depreciation of the dollar after 1985, in combination with the tendency to restrain increases in the export price, resulted in a net *competitive gain* for U.S. exporters over the decade, in comparison to their industrial country trading partners. In particular, the sharp gains in U.S. competitiveness after 1985 were probably sufficiently large to prompt the exit or deter the entry of foreign competitors (specifically, competitors in industrial countries). Foreign producers may have been dissuaded from entering export markets to compete with U.S. producers even when the dollar appreciated between 1988 and 1989, because the gains in competitiveness U.S. exporters achieved earlier were not entirely eliminated. Such a situation, where U.S. export volume remains high even if the competitiveness of U.S. exporters is being eroded, fits the definition of hysteresis.

However, the effects of hysteresis in explaining robust export growth, if any, are not very strong. Otherwise, the forecast using RXR_2 should also show a persistent tendency to underpredict exports in recent years.

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