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Deficits and Agriculture:
An Alternative Parable

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A little over a decade ago, a seminal paper by Schuh argued that U.S. exchange-rate policy during the postwar era depressed farm exports and farm incomes while causing low resource returns to the factors of production most specific to agriculture -- farm labor and farm land. By parallel reasoning Schuh then argued that the devaluation and subsequent floating of the dollar in the early 1970's provided a primary impetus to the farm export boom that followed.

The paper by Schuh was immediately controversial and widely disparaged. Eventually, however, the idea that the exchange rate could seriously affect agricultural trade patterns became widely accepted. And with acceptance came the realization that agriculture was not a closed and insulated sector but one closely integrated with a complex and dynamic macroeconomy. Consequently, many studies have attempted to develop models of the interrelationships between agriculture and the rest of the economy.

By and large, these models have focussed on the effects of monetary policy on agriculture (Shei; Shei and Thompson; Chambers, 1979; Chambers and Just, 1981; Barnett; Barnett, Bessler and Thompson; Chambers, 1981; Chambers, 1984; Bessler, 1984). One reason for the focus on monetary phenomena was that the exchange rate is essentially a monetary variable; consideration of its effects naturally leads to examining other monetary phenomena. Another reason was the abrupt change in policies attributed to the Federal Reserve in the late 1970's. Instead of targetting interest rates as in the past, the Federal Reserve targetted money growth rates that were quite restrictive. This slowed inflation and the sharp appreciation of the dollar in the early 1980's was at least partially attributed to these policies.
As agricultural exports, land values, and prices have slumped throughout the 1980's, it has become commonplace to blame at least the triggering of these problems on restrictive monetary policies pursued in the early 1980's. Of course, other reasons for agriculture's problem have been cited -- such as high loan rates and target prices and an upward spiral in real interest rates -- but these problems also have been attributed to restrictive monetary policy.

Beginning about the time of the G-5 accord in November, 1985, however, the United States began to pursue a more expansionary monetary policy. This raised hope for expansion of agricultural exports. However, quite the opposite has occurred. This paper argues that one reason these expectations have been unrealized is that an alternative interpretation of events associated with a rapidly expanding federal deficit applies to events in the 1980s.

Although many have recognized that fiscal deficits can have serious consequences for agriculture, little formal economic analysis of the manner in which fiscal deficits impinge on agricultural markets has been forthcoming. A primary purpose of this paper is to demonstrate that, under plausible circumstances, fiscal irresponsibility in a nonagricultural sector of the economy can lead to increased spending on farm programs when target prices are fixed in nominal terms. The chain of reasoning is simple. Overspending in a nonagricultural sector of the economy raises a deficit that must be financed and financing the deficit requires higher interest rates and exchange rates both of which depress prices for exportable agricultural commodities. Falling market prices thus cause higher deficiency payments and probably higher expenditures on farm programs because of fixed target prices. A natural corollary to this...
proposition is that the place to attack budget excesses in agriculture might be outside of agriculture rather than in instituting drastic supply control policies which may help the budget but ultimately damage long-run competitiveness in world markets.

A second purpose of this paper is to demonstrate that major developments in agricultural markets during the 1980's can be interpreted in terms of government overspending just as well as restrictive monetary policy. With a series of important fiscal policy changes at hand -- Gramm-Rudman budget reform and income-tax reform -- it is imperative that agricultural economists have a better grasp of the linkage between these policies and agriculture.

Finally, the paper takes a turn at counterfactual forecasting by analyzing three alternative ways out of the current deficit dilemma. Two of the solutions are real -- decreased government spending or increased taxes -- while the third -- inflation -- is only nominal. Somewhat surprisingly, spending reductions seem to best serve agriculture's short-term interests.

Alternative Interpretations of the 1980s

The role of U.S. agriculture in world markets has changed dramatically over the last 15 years. The value of U.S. agricultural exports rose from about $9 billion in 1972 to over $43 billion in 1981. Since 1981, however, U.S. agricultural export markets have collapsed. Having peaked at $43 billion in 1981, agricultural exports for 1985 were down to $28 billion. Volume has fallen as well. A central issue for U.S. agriculture is the cause of this slump.

No definitive answer has been forthcoming. However, conventional wisdom runs something like this. In the 1970's the United States twice devalued and ultimately floated the dollar. Consequently, the dollar was a
relatively weak currency during the 1970’s which naturally made U.S. exports more attractive. Almost simultaneously, the Soviet Union initiated large grain purchases in world markets, while rising affluence and increased borrowing by developing countries increased demand for food commodities (LDCs became our fastest growing export market). The world agricultural trade economy expanded at a rapid rate and the United States was ready to take advantage of this expansion both because of its relatively cheap currency and because it could rapidly expand production to meet the growing demand.

In the 1980s, however, agricultural exports plummeted. The fact that developments in the first half of this decade were the mirror image of what happened in the early 1970s was convincing evidence that exchange rates and macroeconomic policies were important for agriculture. Management of the money supply by the Federal Reserve during Paul Volcker’s early years as chairman came to be widely blamed for agriculture’s problem. The decision of the Federal Reserve to move away from targetting interest rates and toward targetting money growth rates was viewed as a devastating policy revision for American agricultural exports.

This conventional wisdom stems largely from the paper by Ed Schuh on “The Exchange Rate and U.S. Agriculture.” Without a doubt, this is the single most important paper to date on the effects of exchange rates and other macroeconomic phenomena on agriculture. The basic idea is that the monetary and exchange rate policy pursued by the United States in the postwar pre-1973 era had essentially taxed agricultural exports thus diminishing agricultural prices, agricultural incomes, returns to farm labor, and ultimately agricultural land values. Schuh also used the induced innovation hypothesis and an overvalued exchange rate to explain
the shift away from land-intensive to capital-intensive cultivation practices in the United States.

While the works of Schuh and others who followed represent important contributions to understanding how macroeconomic policies and phenomena affect agriculture, they focus primarily on monetary phenomena. This paper focuses on the role of fiscal policy in agricultural developments. To illustrate the point, consider the following interpretation of events in the early 1980s. In the early 1980s, the government budget deficit increased dramatically and the government was forced to go to international and domestic credit markets to raise the funds to finance the deficit. Increased borrowing by the federal government drove up interest rates as private borrowers were crowded out of the market. Rapidly rising U.S. interest rates made investment here more attractive to foreigners who had to buy dollars to make investments in the United States. The exchange rate (the price of the dollar) was bid up. Just as the restrictive monetary policy of the Fed has been argued to drive up interest and exchange rates, deficit-ridden fiscal policy thus pushes the economy in the same direction. Which effect dominates was and remains an empirical issue.

The relative emphasis on monetary policy, however, has seemingly led to unfulfilled expectations because the less restrictive monetary policies of the Federal Reserve recently have not led to an agricultural expansion. In spite of an expansionary U.S. monetary policy adopted in 1985 in keeping with the G-5 accord, problems persist in the export sectors of the U.S. economy. But even though monetary policy has been less restrictive a large fiscal deficit still persists. This suggests that a fiscal explanation of events may be more important at the current time.
Modeling the Effects of Fiscal Irresponsibility on Agriculture

While the effects of monetary policy on agriculture have been heavily researched since the work of Schuh, research on the effects of fiscal policy on agriculture have been relatively neglected. For the most part, exceptions are limited to complex econometric models, e.g., Rausser. This section develops a theoretical model with more transparent intuition that can demonstrate the effects of deficit government spending.

Consider an open, two-sector economy with a revenue function representing national income in terms of producer prices

\[ Y_t = Y(s_{1t}, s_{2t}, x_t) = \max \left\{ s_{1t} q_1 + s_{2t} q_2 : (x_t, q_1, q_2) \in T \right\} \]

where \( s_{it} \) is the producer price in sector \( i \) at time \( t \), \( x_t \) is a vector of fixed factor quantities, \( q_1 \) is the quantity produced in sector 1, and \( T \) is a technology set satisfying usual properties. Where consumer prices are represented by \( p_{it} \) and \( 1 - \gamma_t \) is the income tax rate, consumer demands follow \( D_{it} = D_i(p_{it}, p_{2t}, \gamma_t, Y_t) \) in sector \( i \). Suppose that sector 2, which will be called the agricultural sector, has guaranteed producer prices greater than market-equilibrium consumer prices, while the nonagricultural sector operates in equilibrium with \( s_{1t} = p_{1t} \).

Trade occurs only in the agricultural good, and foreign demand is \( D_{2t}^* = D_2(p_{2t}, e_t) \) where \( e_t \) is the exchange rate (\( p_{2t} e_t \) is the price in terms of foreign currency). Thus, equilibrium in the agricultural market is given by

\[ q_{2t} = D_{2t}^* + D_{2t}^* \]

where \( q_{1t}^* \) is the revenue maximizing supply for sector \( i \). Assume further that the government spends \( G_t \) in the nonagricultural sector which leads to
the market equilibrium equation

\[(2) \quad q_{1t} = D_{1t} + G_t / p_{1t}.\]

In financing the guaranteed price in agriculture, the government incurs a budgetary expense of \((s_{2t} - p_{2t}) q_{2t}\). If the government has a preexisting cumulative deficit of \(\bar{B}_t\) at time \(t\), the current flow deficit is

\[(3) \quad B_t = (s_{2t} - p_{2t}) q_{2t} + G_t - (1 - \gamma_t) Y_t + r_t \bar{B}_t\]

where \(r_t\) is the current interest rate. The interest rate and exchange rate are determined by monetary and fiscal policy following

\[(4) \quad r_t = r(\bar{B}_t, M_t),\]

\[(5) \quad e_t = e(\bar{B}_t, M_t),\]

where \(M_t\) is the money supply. Both the interest and exchange rate are increasing in the deficit \((r_b > 0, e_b > 0)\) and decreasing in the money supply \((r_m < 0, e_m < 0)\). Equations (4) and (5) represent a partially-reduced-form, financial-market equilibrium for a portfolio balance model of interest and exchange rate determination.

The analysis assumes that the budget is intertemporally constrained so that any current flow deficit must be made up in a later period. This is done using a three period model where the case of a flow deficit in the first period is compared to the case of a period-by-period balanced budget. Relatively more spending in the first period than in the balanced budget case is referred to as "overspending" or "fiscal irresponsibility." Conceptually, the first period corresponds to the 1970-1982 period during which taxes were cut but defense spending was expanded rapidly culminating
in record deficits. The second period represents the remainder of the Reagan Administration during which necessary adjustments to correct the deficit have been postponed with the deficit financed by expanded borrowing abroad. The third period depicts the period (still to come?) when actions to repay some of the cumulative budget deficit are necessary. Analytically these necessary future adjustments are integrated into the model by requiring an intertemporally balanced budget. In other words, the analysis constrains the ending cumulative deficit level. Specifically, the intertemporal budget constraint is

\[ B_1 + B_2 + B_3 = B^*. \]

Many different fiscal-monetary policies in periods 1 and 2 can satisfy equation (6) by making up deficits (surpluses) in time period 3. To define a unique comparative static experiment, consider a trajectory of government spending consistent with the hypothetical period by period balanced budget \( (B_t = 0, t = 1, 2, 3) \) given by

\[ G_t = \hat{G}(M_t, \gamma_t, s_t, B_t). \]

Government expenditures required to balance the current budget depends on the preexisting government deficit, the money supply which determines interest and exchange rates, government revenues raised by the income tax, and expenditures on agricultural subsidies. From this norm, consider an expansionary fiscal policy represented by a small increase in government spending, \( g_1 \), from \( G_1 \) in the first period. Then suppose that correction of the first-period deficit is postponed to the third period; the government finances its past overspending by increased borrowing in financial markets. (Government spending in the nonagricultural sector, \( G_2 \), is continued at a
level that would have balanced the budget had the government not overspent in the first period.) In the third period, the government takes actions to correct the first period overspending and the induced second-period overspending satisfying (6). Because the government possesses several instruments for controlling the deficit, the following three possibilities will be examined for third-period adjustment:

(a) A reduction in government spending to $G_3 + g_3$.
(b) An increase in the money supply to $M_3 + c$, and
(c) An increase in the tax rate to $\gamma_3 - \delta$.

Adjustment of agricultural subsidies will be considered separately in the context of returning agriculture to a free-market basis because they have a small effect on the overall budget relative to the these three instruments.

The comparative static effects of these three policy instruments are derived in the appendix by totally differentiating (1) and (2) and substituting total derivatives of $Y$, $e$, and $r$ which, upon dropping $t$ subscripts, are given by

\begin{align}
&\text{(8)} \quad dY = Y_1 dp_1 + Y_2 dp_2 \\
&\text{(9)} \quad de = e_b d\bar{B} + e_m dM \\
&\text{(10)} \quad dr = r_b d\bar{B} + r_m dM.
\end{align}

**Immediate Effects of Fiscal Irresponsibility**

The immediate effects of fiscal irresponsibility experienced in the first period from an increase in government spending represented by $g_1$ can be derived using the comparative static results from Appendix A. First, the effects on consumer prices are given by
\[ dp_{11} = p_{1g1} dg_1 > 0 \]

\[ dp_{21} = p_{2g1} dg_1 > 0 \]

where \( p_{izt} \) represents the total derivative of \( p_i \) with respect to policy instrument \( z \) at time \( t \) (see Appendix A). Both price effects are clearly positive. The increase in the nonagricultural price is a direct effect of the increase in government spending on nonagricultural goods. The increase in the agricultural consumer price occurs because the higher nonagricultural price causes substitution of agricultural goods for nonagricultural goods in consumption. Nonagricultural production increases in response to higher prices and thus nonagricultural income increases. Agricultural production declines because the higher nonagricultural price and returns to resources bid resources away from agriculture; thus, agricultural income declines. On balance, however, pre-tax income to the owners of productive resources rises (because \( Y \) is increasing in the nonagricultural price and the agricultural producer price is fixed). Agricultural exports decline because production declines and the consumer price increases; thus foreign consumers demand less of the agricultural product. \(^1\)

The flow budget deficit is given by

\[ dB_1 = X_{g1} dg_1 \]

where

\[(11) \quad X_{gt} = 1 + (s_{2t} - p_{2t})p_{1gt} - q_{2t} p_{2gt} - (1 - y)q_{1t} p_{1gt}.\]

The first right hand term in \( 11 \) represents the (unitary) direct effect of increased government spending on the deficit. The second and third right hand terms make up the entitlement effect which is the change in agricul-
tural program expenditures caused by price changes in both nonagricultural and agricultural markets induced by the change in expenditures. The entitlement effect is negative (i) because the higher nonagricultural price reduces the commitment of resources to agriculture thus reducing the amount of agricultural production on which subsidies are paid, and (ii) because the agricultural consumer price rises thus reducing the per unit subsidy. The fourth term is the change in income tax receipts induced by government overspending. It too is negative because the rise in income increases tax revenues. The overall effect $X_g$, however, is assumed positive because the alternative implies that an increase in government spending actually reduces the overall budget deficit due to indirect effects in other markets.

These results roughly parallel what actually occurred in 1979-1982. Inflation was raging, and resource prices were rising rapidly. Land prices were appreciating very rapidly and, in retrospect, probably overshooting longer run equilibrium levels. Higher nonfarm wage rates led to a sharp increase in nominal off-farm income. And agricultural export growth declined substantially.

**What Happens While Fiscal Responsibility Is Postponed**

The effects of fiscal irresponsibility in the first period are transmitted to the second period in the form of an increased cumulative deficit that needs to be financed by the government. The associated effects on prices follow from results in Appendix A and are given by

$$dp_{12} = p_{1b2} dB_1 < 0$$

$$dp_{22} = p_{2b2} dB_1 < 0$$
which are both clearly negative. The decrease in the agricultural price occurs because increased government borrowing drives up interest and exchange rates thereby reducing export demand. And falling agricultural price attracts consumption away from the nonagricultural good causing its price to fall.

Because the agricultural support price is held constant in nominal terms while pursuing deflationary macroeconomic policies, the falling nonagricultural price makes agricultural production relatively more profitable. Thus, resources that would otherwise have been devoted to nonagricultural production are now used in agricultural production. This occurs even though agricultural exports tend to fall because of the exchange rate effect.

This income-increasing effect of overspending on agriculture may seem counterfactual. However, one must bear in mind that these are comparative static comparisons with what would have occurred during the second period without overspending. What this implies about the period 1982 to the present is that more resources have been allocated to agriculture and surpluses have been higher than if the government had not overspent in 1979 to 1982. It also implies that, because of fixed price supports, income in agriculture is supported at levels higher than they otherwise would have been thus postponing the necessary adjustment in the agricultural sector. This result demonstrates how fiscal irresponsibility in one sector leads to fiscal irresponsibility in a sector supported with inflexible policies (Just and Rausser). These results highlight the fact that the devastating effect of government overspending on farmers in the 1930s comes not through income effects but through interest-rate effects on the capitalized value of fixed assets like land and the corresponding debt service effects.
Future Reductions in Government Spending

Turning to the third period where the budget deficit must be reconciled, consider first the effects of correcting the first-period increase in government spending and the induced second-period deficit by a reduction in future government spending (while holding other policy instruments unchanged from their intratemporally balanced budget trajectory, $dS_2 = dγ = dM = 0$). Note that the corresponding cumulative budget deficit at the beginning of the third period caused by the increase in government spending in the first period is given by

$$d\bar{B}_3 = \left[X_{b2} + r_2 + \bar{B}_2 r_b\right]X_{g1} dg_1,$$

where $\bar{B}_3 = B_1 + B_2$ and

$$X_{bt} = 1 + (s_{2t} - p_{2t})Y_{2t} p_{ibt} - q_{2t} p_{2bt} - (1 - γ_t)q_{1t} p_{ibt}.$$

Note $X_{b2}$ is the effect of the first-period deficit on outstanding principal; the first right-hand term of (13) is the direct effect, the next two terms are an entitlement effect, and the last term is the income tax effect. As in the spending effect above, the entitlement and income tax effects mitigate the direct effect. The additional effects in brackets in (12) represent an increase in deficit associated with increased borrowing and an increased interest rate. Setting $B_3 = -d\bar{B}_3$ by (6), the necessary adjustment in government spending in the third period is

$$dg_3 = -\frac{X_{g1}}{X_{s3}} \left[X_{b2} + r_2 + \bar{B}_2 r_b\right]dg_1.$$

The effective interest rate on first-period overspending is reflected in the multiplier in (14). The effective interest rate need not be
positive for two reasons. First, the entitlement and income tax effects could dominate the total interest payment effect. This seems unlikely, however, since it implies that overspending begets government savings. Second, the real effects of spending could be sufficiently large in the third period so that \( \frac{X_1}{X_3} < 1 \); this could occur if entitlement and income tax effects in the third period are sufficiently smaller than in the first period. This case could be plausible if the initial balanced budget trajectory in (7) involved a trend toward free market agricultural policies and a lower income tax.

The intuition of the latter case is straightforward. Repayment of the accumulated deficit by decreasing spending in the nonagricultural sector depresses the consumer price of both goods. A lower consumer price for the agricultural good translates into higher production subsidies. At the same time, a lower price for the nonagricultural good decreases nonagricultural production and therefore income tax revenues. Both these effects exacerbate deficit repayment efforts since they increase government payments on the one hand while decreasing government revenues on the other. This can only be made up by increasing \( g_3 \). The smaller these exacerbating effects, the more effective a given spending reduction will be in reducing or eliminating the deficit. Thus, if there is an established trend toward less government intervention, the overall effects of overspending are less severe.

One should interpret this result with caution, however. For example, these results only imply that the effects of overspending in 1979-1982 would be relatively small if in 1979 there existed a clearly established policy to reduce government support prices and income taxes. But target prices and loan rates were rising in nominal terms according to the farm
bills of 1977 and 1981 while income taxes were only reduced in 1982. So even though this particular result is theoretically plausible, it is not applicable to the current problem. Alternatively, this result suggests that if the government had acted promptly in reducing intervention (both in and out of agriculture) in 1979, the ultimate budgetary adjustments could have been smaller.

To translate the budget deficit and necessary government spending adjustment into price effects in the third period, note that

\[ dP_{13} = p_{i3} dg_3 + p_{ib3} dB_3 < 0, \quad i = 1, 2. \]

The first right-hand term in (15) is the effect of reduced government spending in the current period which affects the nonagricultural sector directly with indirect effects in agriculture through substitution in consumption. The second right-hand term is the effect of a higher cumulative deficit which increases interest and exchange rates thereby reducing agricultural export demand and prices. Since both effects are negative, prices in both sectors are unambiguously lower than they would have been.

Substituting (12) and (14) into (15) obtains

\[ dp_{13} = \left[ x_{b2} + r_2 + \frac{\bar{b}}{2} r_b \right] \left[ p_{ib3} - \frac{p_{ig3}}{X_{g3}} \right] X_{g1} dg_1. \]

The magnitude of the comparative static adjustment depends on a number of competing factors. For example, high interest rates, a high cumulative deficit, and prices and interest rates responsive to government borrowing cause the price effects of the spending adjustment to be large. On the other hand, the magnitude of the adjustment of third-period prices over
what would have prevailed in the absence of the original overspending also depends upon the extent to which the original overspending initially bid up prices. So the more responsive prices are to direct government spending, the smaller will be the comparative static decline in third period prices associated with returning the budget to its original trajectory.

To understand the significance of these results for U.S. agriculture, one must recognize that agriculture is more closely related to financial and international agricultural markets than to the markets for nonagricultural commodities. Following this reasoning, suppose the cross elasticities of supply and demand between agriculture and nonagriculture are small relative to other effects in the model. Then the primary effect of government spending is to increase demand and prices in the nonagricultural sector while the primary effect of government borrowing is to drive up exchange rates and thereby reduce export demand for agriculture. In the latter case, the agricultural consumer price declines and the cost of agricultural programs increases while agricultural income remains artificially stable with a larger component of the tab borne by government.

To place these primary effects in proper dynamic perspective, note that the stimulating effects on the nonagricultural sector occur in the first period while the devastating effects on agricultural exports occur in the second and third periods. Hence, the model suggests that reducing the budget deficit by cutting spending outside of agriculture will further depress agriculture exports and make farmers more dependent on government programs.

**Future Monetizing of the Deficit**

An alternative to repaying the deficit by reducing government spending is to pursue a more expansionary monetary policy which effectively reduces
the amount the government must repay. By (12) and results in Appendix A, the monetary expansion necessary to return to the original budget trajectory is

\[ (17) \quad dM_3 = -X^{g_1}_{m3} \left[ X_{b2} + r_2 + \bar{B}_2 \bar{r}_b \right] dg_1 \]

where \( X_{mt} \) is the money-supply multiplier effect on the deficit which follows from (3),

\[ (18) \quad X_{mt} = \bar{B}_t r_m + (s_{2t} - p_{2t}) \gamma_{2t} p_{1mt} - q_{2t} p_{2mt} - (1 - \gamma_t)q_{1t} p_{1mt} < 0. \]

The first right-hand term in (18) is the decrease in interest payments on the cumulative deficit associated with lower interest rates due to monetary expansion. The next two terms are the entitlement effect and the last term is the income-tax effect. The last three terms are all negative because of the inflationary effects of monetary expansion on prices. Therefore, expanding the money supply unambiguously decreases the current deficit.

Note that the numerator of (17) is identical to the numerator of (14) and reflects the effect of first period spending on the cumulative deficit following (12). Dividing this expression by \( X_{m3} \) converts this effect into the monetary adjustment necessary to return the budget to its original trajectory.

The associated adjustment in commodity prices obeys

\[ (19) \quad dp_{i3} = p_{i3} dM_3 + p_{ib3} \bar{d} \gamma_{ij}, \quad i = 1, 2. \]

The first right-hand effect is the inflationary effect of monetary policy which is positive and the second term is the deflationary effect of the cumulative deficit on commodity prices which is negative. Because these
effects tend to offset one another the net effect is unclear. To determine
the net effect of monetary expansion on prices in the third period,
substitute (12) and (17) into (19) to get

\( \frac{d}{d} \text{p} = X + P + B \) 

(20) \( \text{p} = \left( \frac{P_{m3}}{X_{m3}} \right) g, \text{ i = 1, 2.} \)

By results in Appendix A,

\( \text{p} \geq \frac{P_{m3}}{X_{m3}} \text{ as } e \geq \frac{e_{m}}{X_{m3}}, \text{ i = 1, 2.} \)

The term e measures the responsiveness of the exchange rate to increases
in the money supply absent any other intervention. The term X measures
the reduction in the flow deficit associated with inflating the money
supply. This latter reduction enhances the relative effectiveness of any
given increase in the money supply in eradicating a cumulative budget
deficit. When X is larger, a given increase in the money supply will
finance a larger cumulative deficit. The ratio e /X , therefore, is an
index of the direct versus indirect effectiveness of monetary policy in
changing exchange rates. If this index is greater than the direct effect
of the cumulative budget deficit on exchange rates (e), then prices will
rise.

The direction of the inequalities in (21) and the sign of (20) thus
depends on five major considerations: (i) the relative effects of
government borrowing and monetary expansion on exchange rates, (ii) the
outstanding cumulative deficit, (iii) the magnitude of government
intervention in agriculture, (iv) the importance of income taxes, and (v)
the exchange-rate elasticities of prices. A larger cumulative deficit,
greater intervention in agriculture, and higher income taxes cause a more negative money supply multiplier effect on the deficit which tends toward positive price effects of monetary expansion. In addition, higher exchange-rate elasticities of prices cause the money supply multiplier to be larger for a given exchange-rate effect of monetary policy increasing the tendency toward higher prices.

Suppose again that the agricultural sector is more closely related to financial and international agricultural markets than domestic nonagricultural commodity markets. Furthermore, following the current U.S. experience, suppose that the cumulative deficit is large, intervention in agricultural markets is high, and exchange rates are more responsive to direct intervention in currency markets than to indirect intervention by increased government borrowing. Then correcting the budget deficit by monetary expansion will tend to increase agricultural exports, decrease government spending on farm programs, and increase nonagricultural income. However, some of these gains are only apparent. For example, real agricultural income declines because of inflation in the context of fixed nominal agricultural support prices. So even though farm exports rise, farmers are worse off because real spending on farm programs declines more rapidly than nominal spending on farm programs.

**Future Increased Income Taxation**

Another way of correcting the budget deficit is to increase income taxes. By (12) and results in Appendix A, the necessary increase in the income tax rate in the third period to return the budget to its original trajectory is
(22) \[ d\gamma_3 = - \frac{X_{g1}}{X_{\gamma3}} [X_{b2} + r_2 + B_1 r_b] d\tilde{g}_1 \]

where \( X_{\gamma3} \) is the income tax rate multiplier effect on the deficit.

(23) \[ X_{\gamma t} = \pi_t + (s_{2t} - p_{2t}) Y_{21t} p_{1t} - q_{2t} p_{22t} - (1 - \gamma_t) q_{1t} p_{12t} \]

The first right-hand term of (23) is the direct revenue effect of increasing the tax rate (decreasing \( \gamma_t \)) and the fourth term is the indirect revenue effect. The second and third terms again represent an entitlement effect which is an indirect effect of changing disposable income.

The first term is clearly positive while the sign of the latter three terms is ambiguous. However, under plausible conditions of gross substitutability and normal goods, these terms are negative (\( p_{1\gamma t} > 0, \ i=1,2 \)). Supply side economists argue that the last term can outweigh the first term. That is, the incentive effects of increasing taxation can outweigh the direct revenue effects. If so, then \( X_{\gamma t} < 0 \). The results here, however, also demonstrate that other factors can cause a cut in the tax rate to be associated with increased net government revenues. This happens because cutting taxes increases demand for the nonagricultural commodity which by substitution increases the agricultural price thus reducing farm program outlays. Historically, however, the first term appears to dominate.

The increase in taxation in (22) translates into the following price effects in the third period:

(24) \[ dp_{i3} = p_{i\gamma3} d\gamma_3 + p_{i\beta3} \tilde{d}3 < 0, \ i = 1,2. \]

Substituting (12) and (22) into (24) obtains
The first right-hand term in (24) is negative because increasing the income tax rate (decreasing $\gamma_3$) reduces disposable income and therefore demand for both goods declines. The second term is negative as in equations (15) and (19). Thus, prices are unambiguously lower in the third period than they would have been without overspending.

These results imply the following third period effects of correcting the deficit by increased taxation. Agricultural production increases because the fixed nominal support price attracts resources to agriculture as the nonagricultural price falls. Nonagricultural nominal disposable income falls. The movement of resources to agriculture increases pretax agricultural income but the increase in the tax rate tends also to reduce disposable income in agriculture leaving the net effect ambiguous. Falling agricultural prices tend to encourage exports but borrowing to finance the carryin cumulative deficit tends to bid up the exchange rate and discourage exports. Farm program expenditures rise because of fixed nominal support levels, increased agricultural production, and falling agricultural consumer prices.

**Comparison of Policies to Correct the Deficit**

At this point, a comparison of the major effects of the three corrective policy actions is instructive. Reducing government spending and increasing income taxes have the same qualitative effects on prices and exchange rates, and thus also have the same qualitative effects on other variables such as income and exports. Although the qualitative effect of monetary policy on prices is technically ambiguous, the positive price
effects are presumably of overriding importance. In any case the exchange rate effect of encouraging exports is clearly the opposite of the other two policies where exports are implicitly taxed. As a result, the qualitative effects on income and exports are the opposite of the other two policies. Therefore, the important remaining comparison is between the magnitude of effects of reducing spending and increasing taxation.

To make this comparison, observe that the price effects in (16) and (25) differ only in the ratios \( \frac{p_{ijt}}{X_{jt}} \) where \( j = g, \gamma \). The larger this ratio the smaller the price effect. Suppose initially that \( D_{2\gamma} \) is negligible. Then from Appendix A

\[(26) \quad p_{igt} p_{i\gamma} D_{i\gamma} Y \approx p_{\gamma yt} \]

and

\[(27) \quad \left(\frac{X_{\gamma t} - 1}{X_{\gamma t}}\right) p_{i\gamma} D_{i\gamma} Y + \pi \approx X_{\gamma t}.\]

Because the marginal propensity to consume good \( i, p_{i\gamma} D_{i\gamma} \), is less than 1 if both goods are normal goods,

\[(28) \quad p_{i\gamma} D_{i\gamma} Y < Y.\]

Substitution of (28) into (27) and use of (26) obtains

\[\frac{p_{igt}}{X_{\gamma t}} < \frac{p_{\gamma yt}}{X_{\gamma t}}.\]

Further considering any nonnegligible effect of \( D_{2\gamma} \) in this result only increases \( p_{\gamma yt} \) and decreases \( X_{\gamma t} \) if the agricultural good is normal. Thus, the price depressing effects of correcting the budget through increasing the income tax are larger than correcting the budget through reducing government spending.
The economic intuition of this result is that an income tax simultaneously has a direct effect of discouraging consumption on both commodities. Reducing spending, on the other hand, only has a direct effect in reducing consumption of the nonagricultural commodity. Because the price reductions are less, reducing spending thus dominates increased taxation as an approach to correcting the deficit from the standpoint of both sectors. In addition, reducing government spending is apparently preferred to monetary expansion by agricultural interests -- even though monetary expansion raises prices and expands exports -- because reducing spending raises real agricultural income while inflation reduces real agricultural income. This result points out that the singular emphasis on increasing agricultural exports as a solution to the farm problem may be misdirected. Nevertheless, another important difference with monetary expansion is that the role of government in agriculture is reduced with inflation (because of the fixed nominal supports) whereas it is increased with reduced spending or increased taxation. This raises the issue of whether the monetary approach is relatively more preferred by farmers in the event that government intervention in agriculture is eliminated.

Returning Agriculture to a Free Market

A major policy topic since 1985 has been returning agriculture to a free market. Several alternative questions are of interest in this context. One interesting question has to do with the case where agriculture is returned to a free market as the primary component of an attempt to correct the deficit caused by overspending. Such a question, however, requires the use of discrete as opposed to continuous comparative static methods. This requires a substantial leap in the mathematical sophistication of the paper. Another question involves cutting back
agricultural program payments in some relationship to government spending reductions or other macroeconomic corrections. However, the mathematical computations for this case are extremely cumbersome and yield few insights.

An important question that can be addressed with the model is how adjustments in the third period will differ if agriculture is returned to a free market whether or not government overspending occurs. If agriculture operates as a free market in the third period, then the model must be restructured to ascertain third-period effects of correcting the budget deficit. That is, suppose that agriculture does not have price supports in the third period. Then in the third period let \( s_{2t} = p_{2t} \) in which case the first right-hand side term of equation (3) vanishes. The resulting price effects of various policy instruments are derived in Appendix B. The major difference between this version of the model and the original version is that in the third period agricultural supply is responsive to the agricultural consumer price. Hence, most of the results apply with minor modification. The only change in the results in equations (12) through (25) is that \( p_{ij3} \) is replaced by \( p_{ij3}^0 \) and \( X_{jt} \) is replaced by \( X_{jt}^0 \) where

\[
X_{jt}^0 = X_{jt} + \gamma_t q_{2t} p_{2tj}.
\]

The multipliers in (29) differ from earlier policy multipliers because the entitlement effect is eliminated and the income tax effect now includes an agricultural component. When evaluated at the same point, the agricultural income tax effect is dominated by the entitlement effect associated with the agricultural programs. Only a fraction of the income change associated with the change in \( p_{2t} \) is taxed whereas the entitlement effect captures all of this income adjustment. Hence, the multipliers in (29) are larger than the earlier policy multipliers.
Consider first how results change when this altered version of the model is used to evaluate the effects of reducing the cumulative deficit by reducing government spending in the third period. The necessary adjustment in government spending is

$$dg_3^0 = - \frac{dB_3^0}{X^0_{g3}}$$

where $dB_3^0$ is the same as before. Because $X^0_{g3}$ tends to be larger than $X_{g3}$, the adjustment in government spending necessary to return to the original budget trajectory tends to be smaller. By analogy, the necessary adjustment using the other policy approaches also tend to be smaller. When agricultural supply responds to market prices, some of the agricultural sector’s adjustment to the policy change can be absorbed by agricultural supply whereas with fixed price supports all adjustment comes in terms of consumer price and government payments. The agricultural price, therefore, no longer "overshoots".

The price effects are

$$dp_{i3}^0 = p_{i3}^0 d_{g3}^0 + p_{ib3}^0 dB_3 < 0, \quad i = 1, 2.$$ 

Comparing the results of Appendix B with those in Appendix A suggests that the nonagricultural price here adjusts downward relatively more and the agricultural price relatively less than in the previous case.²

These arguments are illustrated by Figure 1 where $D_2$ represents demand for the agricultural commodity and $q_2$ represents supply of the agricultural commodity. Suppose agricultural demand is relatively price and income inelastic so that for analytical purposes it is legitimate to ignore price developments in the nonagricultural market. Correcting the budget deficit
by reducing government spending in the nonagricultural sector decreases $p_1$, which makes agricultural production relatively more profitable and increase agricultural supply to $q'$. If a support price is effective at $s_2$ when the supply shift occurs, agricultural production increases and the consumer price declines from $p_2$ to $p_2'$. Without a support program, however, the equilibrium price decline is from $p^0_2$ to $p^0_2'$. Because of the price scissors effect, the latter change is smaller than the former and tends to be more so with more inelastic demand and more inelastic supply. Moreover, when the agricultural support program does not exist, the reduction in government spending required to return the budget to its original trajectory tends to be smaller because there is no entitlement effect and the income tax effect is enhanced. Hence, the supply shift in Figure 1 when a program does not exist is smaller than when it does. If one modifies this analysis to consider the secondary effects that occur as a result of cross relationships with the nonagricultural market, the results change relatively little unless supply and demand curves are sufficiently nonlinear and/or shifts are sufficiently far from vertically parallel.

The implications of these results for agriculture is as follows. First, the adjustment in production associated with the budget correction is smaller if no agricultural program is in place in the third period. Agricultural income may rise or fall depending upon the elasticities of demand and supply but any rise is clearly less than the unambiguous rise experienced with support programs. Because exchange rate effects are smaller, agricultural exports tend to fall less than with support programs. So if agricultural support programs are terminated, correcting a budget deficit by cutting spending does not tend to drive agriculture further into disequilibrium.
Without going into details, the analysis of the other policy corrections to the original overspending is similar to the above. Agricultural prices, and therefore, incomes and exports must adjust less as a result of corrective macroeconomic policies when no agricultural programs are in effect than when they are. In particular, because prices to agricultural producers are now flexible, an inflationary policy to correct the deficit no longer clearly lowers real agricultural income. So if government intervention in agriculture is eliminated the monetary approach is relatively more preferred than it would be if agricultural programs were not eliminated.

Moral of the Parable

Fiscal policy has direct and important effects on agriculture. Overspending in nonagricultural sectors encourages increased government intervention in agriculture and diminishes U.S. agricultural competitiveness in world markets while encouraging excessive agricultural production and inflation of agricultural asset values. These effects are only magnified by postponing inevitable budgetary corrections. Therefore, the ultimate adjustments that must be made in agriculture grow as fiscal responsibility is postponed.

Easy money is not the way out of the dilemma for agriculture if support programs are maintained. As long as agricultural programs remain intact, monetary expansion encourages agricultural exports at the expense of real farm income. Increasing government revenues by raising taxes depresses both sectors more than reducing government spending. Thus, from an agricultural perspective, a reduction of government spending in other sectors is the most favorable approach to returning to fiscal responsibility.
Footnotes

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1. In this model, the further depressing effects of deficit spending on agricultural exports through exchange-rate and interest-rate effects do not occur instantaneously, but are reflected in later periods.

2. Comparing results in Appendices A and B suggests that $H^0 > H$, $c_{22} > -D_{22}$, and $c_{12} < -D_{12}$ in which case $p_{1j}^0 > p_{1j}$, and $p_{2j}^0 < p_{2j}$. 
Appendix A

Totally differentiating (1) and (2) obtains:

\[(A.1)\]
\[Y_{11} \, dp_1 + Y_{12} \, ds_2 = D_{11} \, dp_1 + D_{12} \, dp_2 + D_{1y} \, ydy\]
\[+ D_{1y} \, Ydy + \frac{1}{p_1} \, dG - \frac{G}{p_1^2} \, dp_1\]

\[(A.2)\]
\[Y_{21} \, dp_1 + Y_{22} \, ds_2 = D_{21} \, dp_1 + D_{22} \, dp_2 + D_{2y} \, ydy\]
\[+ D_{2y} \, Ydy + D^*_{22} \, edp_2 + D^*_{22} \, p_2 \, de\]

Collecting terms and using (8) - (10) gives

\[(A.3)\]
\[(c_{11} + G/p_1^2)dp_1 - D_{12} \, dp_2 = (D_{1y} \, yq_2 - Y_{12})ds_2 + \frac{g_1}{p_1} \, dG + D_{1y} \, Ydy, \text{ and}\]

\[(A.4)\]
\[c_{21} \, dp_1 - (D_{22} + D^*_{22} \, e)dp_2 = (D_{2y} \, yq_2 - Y_{22})ds_2 + D^*_{22} \, p_2 \, e \, dB\]
\[+ D^*_{22} \, p_2 \, e \, dM + D_{2y} \, Ydy,\]

where

\[c_{ji} = Y_{ji} - D_{ji} \, yD_{ij} \, q_1.\]

29
Solving these expressions simultaneously yields

\[
\frac{dp_1}{dG} = - \frac{1}{H} \frac{D_{22} + D_{22}^*}{p_1} > 0 ;
\]

(A.5)

\[
\frac{dp_2}{dG} = - \frac{1}{H} \frac{c_{21}}{p_1} > 0 ;
\]

(A.6)

\[
\frac{dp_1}{dB} = - \frac{1}{H} D_{12} D_{22}^* p_2 e_b < 0 ;
\]

(A.7)

\[
\frac{dp_2}{dB} = - \frac{1}{H} (c_{11} + G/p_1^2) D_{22}^* p_2 e_b < 0 ;
\]

(A.8)

\[
\frac{dp_1}{dM} = \frac{1}{H} D_{12} D_{22}^* p_2 e_m > 0 ;
\]

(A.9)

\[
\frac{dp_2}{dM} = \frac{1}{H} (c_{11} + G/p_1^2) D_{22}^* p_2 e_m > 0 ;
\]

(A.10)

\[
\frac{dp_1}{dy} = \frac{1}{H} \left[ D_{12} D_{2y} Y - (D_{22} + D_{22}^*) D_{1y} Y \right] ; \text{ and}
\]

(A.11)

\[
\frac{dp_2}{dy} = \frac{1}{H} \left[ (c_{11} + G/p_1^2) D_{2y} Y - c_{21} D_{1y} Y \right].
\]

(A.12)

Here it is assumed that \( H = (D_{22} + D_{22}^*) (c_{11} + G/p_1^2) + D_{12} c_{21} > 0 \)
and \( D_{12} > 0 \) which means that own price effects dominate cross-price
effects in both demand and supply response. The last two expressions \( (p_1y \)
and \( p_2y \)) are both positive if both goods are normal and gross substitutes
in consumption and gross substitutes in supply.
Appendix B

To return agriculture to the free market let $s_{2t} = p_{2t}$. Making this substitution in equations (A.1) and (A.2) gives in place of (A.3) and (A.4)

(A.13) \[ (c_{11} + G/p_1^2)dp_1 + c_{12} dp_2 = \frac{1}{p} dG + D_{1y} Ydy \]

(A.14) \[ c_{21} dp_1 + (c_{22} - D_{22} e) = D_{22} p_2 e_b d\bar{B} + D_{22} p_2 e_m dM + D_{2y} Ydy . \]

Solving (A.13) and (A.14) then yields in place (A.5) - (A.12)

\[ p_1^{0g} = \frac{dp_1}{dG} = \frac{1}{H^0} \frac{c_{22} - D_{22} e}{p_1} \]

\[ p_1^{0b} = \frac{dp_1}{d\bar{B}} = - \frac{1}{H^0} \frac{c_{12} D_{22} p_2 e_b}{p} \]

\[ p_2^{0b} = \frac{dp_2}{d\bar{B}} = \frac{1}{H^0} \left( c_{11} + G/p_1^2 \right) \frac{c_{22} - D_{22} e}{D_{22} p_2 e_b} \]

\[ p_1^{0m} = \frac{dp_1}{dM} = - \frac{1}{H^0} \frac{c_{12} D_{22} p_2 e_m}{p_1} \]

\[ p_2^{0m} = \frac{dp_2}{dM} = \frac{1}{H^0} \left( c_{11} + G/p_1^2 \right) \frac{c_{22} - D_{22} e}{D_{22} p_2 e_m} \]
\[
\begin{align*}
\rho_{1y}^0 &= \frac{dp_1}{dy} = \frac{1}{H^0} \left[ \left( c_{22} - D_{22}^* \right) D_{1y} Y - c_{12} D_{2y} Y \right] \\
\rho_{2y}^0 &= \frac{dp_2}{dy} = \frac{1}{H^0} \left[ \left( c_{11} + G/P_1^2 \right) D_{2y} Y - c_{21} D_{1y} Y \right]
\end{align*}
\]

where

\[
H^0 = \left( c_{11} + G/P_1^2 \right) \left( c_{22} - D_{22}^* \right) - c_{21} c_{12}
\]

and the superscript "0" is used to denote the effect on price when

\[ S_{2t} = P_{2t} \]
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