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STUDY S-356

A SHORTRUN MACROECONOMIC MODEL FOR THE ECONOMY OF SOUTH VIETNAM

William F. Beazer
Douglas C. Dacy

December 1969

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FOREWORD

Controlling inflation has been a major goal of economic policy in Vietnam since the United States became involved in the affairs of that Southeast Asian country. The principal analytical device economists have used in formulating anti-inflationary policy for Vietnam is called "gap analysis." "Gap analysis" is oriented toward monetary phenomena and cannot be used to investigate the effects which those phenomena have upon real output. Thus, it has limited applicability. The macroeconomic model presented in this Study was designed to be more general than "gap analysis." While we wanted a more flexible tool of analysis than that which existed, we felt constrained in our approach by two considerations: (1) The model should incorporate relatively simple structural equations in order that it might be used by persons with diverse backgrounds. (2) Even if one were not interested in quantitative answers, he ought to be able to learn something about the structure of the wartime economy of South Vietnam by reading our Study.

We recognize several ways in which our Study might be improved. We assume that the money stock can be increased only if the government runs a deficit. Yet, we realize that some money is created in the private sector even if the amount is small in comparison to that created by the government deficit. In an earlier presentation of the model we considered changes in the money stock due to private sector (banking) activities. We assumed that private sector money creation was autonomous, or not affected by other variables within the model. That may have been a proper assumption, but we confess that our knowledge of the internal workings of the private credit system in Vietnam is too limited for us to feel comfortable with such an assumption. Therefore, we do not deal with private sector money supply creation in this Study.

We have not tested our model for sensitivity. Small changes in some of the parameters might have relatively large impacts upon the predictive results. We do not really know how sensitive the model is to parameter changes, but have no a priori reason to believe it is highly sensitive.

The analytical quality of the model might be improved if the model were made dynamic. Static models treat change as instantaneous. If the process of change affects some of the variables then the equilibrium values indicated in a static model would usually be wrong. One example of relevance is our conclusion about the Piaster Expenditure Reduction Program. Certainly the program would have an inflationary effect rather than its intended deflationary effect if goods could be imported as fast as American troops and civilians spent piasters. Yet, in 1966 when the program was inaugurated, there were long import delays. In that situation, the immediate impact of the program probably was deflationary while the subsequent impact was inflationary.

The parameter estimates are very important for calculating the quantitative effect of any economic policy. Thus, a good model can be limited to qualitative analysis if the estimates of the parameters it uses are suspect. Good data are scarce in Vietnam. Even so, it might be possible to derive more reliable estimates of the parameters than we were able to do. Accordingly, we think further work on statistical estimation might be a fruitful area for research.

We received help from many members of the Joint Economic Division in Saigon. In particular we wish to thank Richmond Allen, Carl Cundiff, Randy Harris, and Bill Root. We also acknowledge the useful comments we received from Professor Lou's DeAlessi at The George Washington University, and Dr. William Niskanen and Dr. Henry Peskin of the Institute for Defense Analyses.

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SUMMARY

The macroeconomic model for wartime South Vietnam described in this Study is significantly oriented around the Quantity Theory approach and places considerable weight upon the foreign trade sector. Due to expenditures in piasters by the US military and civilian agencies, the government of South Vietnam acquires relatively large sums of foreign exchange (dollars) which are used to purchase imports from third countries. Through the Commercial Import and Food for Freedom programs the Vietnamese obtain additional dollars for the purpose of importing from the United States. In 1968 total imports amounted to approximately 660 million dollars or close to twenty percent of the national income of South Vietnam. Foreign trade not only supplies goods to the Vietnamese, but it also is a principal source of revenue to the government. Over one-third of government revenues (excluding foreign aid) was raised from import duties in 1968. This source of revenue is a major factor in reducing the government deficit and restraining the rise in the money supply. Thus, imports play a double role in economic policy to stabilize prices in South Vietnam.

The expenditure or demand sector of the model is composed of Vietnamese consumption and investment, US agency and personnel purchases in piasters, and purchases by the Vietnamese government (GVN). The latter two can be considered as policy variables. They are exogenous to the model. The consumption and investment functions are unconventional ones in that they both are explicitly related to imports. Consumption is also a function of national income. The supply side of the model consists of resources made available by domestic production and imports less export of goods.

The foreign trade sector includes equations for GVN and US financed imports. The former is tied to US official and personnel

piaster expenditures in Vietnam and the latter is related strictly to United States economic aid to Vietnam where aid is treated as an exogenous variable. The model is dependent upon an assumption that the GVN desires to maintain a constant level of foreign exchange reserves and, hence, will release the full dollar amount of its foreign exchange earnings for imports. Export of goods is treated as an exogenous factor.

A third group of equations can be called the financial sector. This is the part of the model in which the determination of changes in the stock of money is established. The government deficit is the only source for the creation of money. The deficit is fixed once the level of government expenditures is set and revenues determined. Revenues consist of domestic taxes which are related to domestic income, import duties, and "other revenues." "Other revenues" is a predetermined variable.

Supply and demand are brought into equilibrium by changes in the price level. The essential price equation is a form of the Quantity Theory of Money. Domestic prices are assumed to be determined by changes in the stock of money. Over the period of observed data prices rose at a slightly slower rate than the money stock and the model incorporates this past experience by predetermining the elasticity of price change with respect to money.

The model contains only two variables which are determined by simultaneous solution, real income and the price level. All other endogenous variables are determined in a recursive process. There are five predetermined variables, US aid, US piaster expenditures, GVN expenditures, "other revenues," and exports. In addition one can treat domestic taxes as exogenous if he feels it convenient to do so.

A schematic representation of the process through which the predetermined variables act upon the price level is given on page 15. In this summary, as an illustration, we shall trace one process which led to an unsuspected result. What is the effect upon the price level of the withdrawal of US troops? The withdrawal of troops

decreases the dollar earnings of the Vietnamese and thereby decreases the volume of imports. At this point in the analysis, the price effect is nil because the inflationary effect due to the reduced flow of imports would be cancelled exactly by the deflationary effect due to a reduction in American demand. However, the reduction in imports causes a reduction in GVN revenues due to a decline in import duties. The government deficit increases and so does the money supply. The inescapable conclusion under the assumptions of the model is that the price level rises as a result of US troop withdrawal. This conclusion appears reasonable when one realizes that a country can pay for (deflationary) imports only by borrowing or by exporting. The major Vietnamese export is services to the US establishment. If these exports are reduced, then imports, too, have to be reduced, revenues decline, and prices rise.

I

INTRODUCTION

This Study sets forth a method for analyzing the shortrun economic impact on the economy of South Vietnam of possible alternative changes in economic policy of either the government of South Vietnam (GVN) or the United States. Initially, we were concerned with the change in the general level of prices that could be expected from a reduction of US forces in Vietnam. However, to trace step by step the consequences of some given change, it is necessary to establish the causal sequence or, in economic language, to build a model making explicit all necessary behavioral relationships and assumptions. As a result our model is sufficiently general to answer a number of questions pertaining to a wide range of policy choices. For example, it can be used to predict the aggregate price effect of changes in (1) US force levels, (2) US-GVN commercial import (CIP) arrangements, (3) GVN financed import program, (4) GVN expenditures, and (5) Vietnamese consumption and investment patterns.

The model described in this Study is distinguished from the usual macroeconomic models in that it does not rely exclusively upon conventional national income accounting classifications. Conventional national income accounting serves well in a closed economy or one in which there exists a rough parity between imports and exports. Since neither of these conditions prevail in Vietnam, it was necessary to adopt a basic income equation more explicitly related to total resources than one tied strictly to national income. Thus, we consider price to be the economic variable that equilibrates the quantity of total resources demanded and those available, including net resources supplied through foreign trade. This change in orientation, dictated by the wartime situation in Vietnam, confronts one

with certain conceptual questions that do not arise in the familiar macroeconomic systems.¹

Section II of this Study describes the model equation by equation. All of our functions have been specified in linear form. This is more a matter of convenience than conviction. However, we do not believe that any other specification (given the signs we have employed) will affect the results greatly. Section III explains how to interpret the model. In Section V we use the model to determine the quantitative effects of hypothetical policy changes and in Section VI we point out some interesting and anomalous implications. Parameter estimates and the way they were derived are given in Appendix A.

1. For another study that utilizes the concept of total resources rather than national income see Don Patinkin, The Israel Economy: The First Decade, The Maurice Falk Institute for Economic Research in Israel, Jerusalem (August 1967).

II

THE MODEL

This model is an explicit statement of the relationships that exist among key macroeconomic variables that define the economy of South Vietnam. If one is to estimate the effect upon the general price level, income, and consumption of the withdrawal of US troops and evaluate the economic impact of other policy changes he can use a model of this type to advantage as an organizing device for his inquiry. Since we have determined empirically the values of the parameters that link the important variables, the user of this model can have a feel for the magnitude of change as well as its direction.

The basic assumptions underlying the model presented below are that the demand for goods and services and their supply, both stated in real terms, can be specified and that the economy works in such a way that the two are equated at the equilibrium value.¹ The equilibrating variable is the price level, and it is essential to our model that prices are perfectly flexible.²

1. Real value here is synonymous with constant dollar value measured in the prices of some base year. Our parameter estimates use 1960 as the base year.

2. In fact, all prices were not perfectly flexible in wartime Vietnam. The major area of control was in government wages. However, for most goods and services, prices did respond fairly rapidly to changing supply and demand conditions. For example, at the time of the Tet offensive early in 1968, prices of some foodstuffs more than doubled in Saigon in consequence of the disruption of commercial traffic from the Delta to Saigon and along Route 20. Several months later, when normal traffic patterns were resumed, prices approached their pre-Tet levels. The prices of vegetables fluctuated widely from week to week as a result of blown bridges and Viet Cong interdiction of traffic. Rice prices have risen significantly when rumors of rice shortages were circulating, but they dropped back to normal levels when the rumors were countered by government announcements. Thus, the assumption of price flexibility is a fairly easy one to accept in the case of wartime South Vietnam.

The demands against available resources are consumption (C), investment (I), US government purchases (U), and GVN purchases (G). Starred variables represent real (or constant dollar) values and unstarred variables are nominal values. The equation for total resources demanded (R_d) is:

$$R_d^* = C^* + I^* + U^* + G^* \quad (1)$$

The availability of resources, i.e., goods and services, depends upon domestic production and imports less exports. These will be designated Y^* , M^* , and X^* respectively. Total supply is:

$$R_s^* = Y^* + M^* - X^* \quad (2)$$

Imports and exports in Eq. 2 refer only to the values of physical goods. This restricted definition is used for wartime Vietnam because the single largest component of U^* in Eq. 1 is wages paid to Vietnamese employed by the United States. However, this local employment is also the major Vietnamese export if exports are defined in the broad sense. To count these wages as an export and, hence, a negative contribution to supply and also as part of US demand against resources would be improper.

The requirement that real demand be equal to availability (supply) is expressed as:

$$R_d^* = R_s^* \quad (3)$$

If the model is to provide some useful information for policy guidance, the policy variables underlying these aggregate measures must be specified more fully and prices must be brought into the model explicitly. In order to do the latter, we shall rewrite Eqs. 1 and 2 in terms of monetary variables and their price deflators (P).

$$R_d^* = \frac{C}{zP_Y + (1-z)P_M} + \frac{U}{P_Y} + \frac{G}{P_G} + \frac{I}{P_I} \quad (1a)$$

$$R_s^* = \frac{Y}{P_Y} + \frac{M}{P_M} - \frac{X}{P_X} \quad (2a)$$

Each of the price deflators refers to the price index associated with a specific set of goods. P will always designate an index: Thus

$$P_t = \frac{P'(t)}{P'(0)}$$

where P' is an absolute price level. P_Y is the price index for domestic production. It is applicable to consumption expenditures on domestic goods and also to US purchases in local currency. P_M is the price index for imports.³ z is the weight for domestic prices in the overall price index; hence the denominator in the first expression on the right hand side of Eq. 1a is made up of the two components P_Y and P_M with an appropriate weight for each.⁴ P_X is the price index for exports determined by conditions in world markets. P_G is the price index of goods and services purchased by the GVN.⁵ We can express the general relationship between P_G and P_Y as:

$$P_G = 1 + k(P_Y - 1) \quad (4)$$

where k is a constant less than one and greater than zero. Starting with the same base year, Eq. 4 assures that P_G will always be less than P_Y . Finally P_I is the index for investment goods and can be expressed as a weighted average of domestic and import prices.

3. P_M has risen more slowly than the index for domestic goods because the supply elasticity for imports in general probably is greater than that for local production. For example, the consumer price index for working class families rose 244 percent between 1965 and 1969 while the import price index rose only 58 percent.

4. The derivation of the value of z and conceptual problems related to it are presented in Appendix A4.2 and A4.3.

5. P_G rose at a slower rate than the index for domestic production due to the monopsony power of the government over wages paid--especially those paid to military and paramilitary forces.

$$P_I = wP_Y + (1 - w)P_M \quad (5)$$

Before the interconnections between the price level and real variables of the economy can be determined, it is necessary to further specify the behavioral functions relating the aggregate variables to the policy variables.

Consumption is related to income through the following equation:

$$C^* = a^* + b(Y^* - T_d^*) + cCIP^* + dFFF^* \quad (6)$$

The variables are all measured in real terms. T_d^* is domestic tax receipts.⁶ Thus, consumption is determined only partly by real personal income. CIP and FFF are US aid financed through the Commercial Import and Food for Freedom programs. These imports affect the marginal propensity to consume out of domestically produced goods because consumption of CIP and FFF products are substitutes for domestic products.⁷

Investment demand is usually related to the profitability of investment. In an economy such as Vietnam's, however, virtually all investment goods are imported and import licensing serves to constrain the level of investment. As a result the demand for investment is taken to be a function of imports.⁸

$$I^* = e^* + fM_G^* + hCIP^* \quad (7)$$

where M_G are imports financed by the GVN and CIP are commercial-type imports financed by the United States.⁹

6. $T_d^* = sY^*$ where s is the domestic tax rate (see Eq. 13 and Appendix A3). Thus, $C^* = a^* + b(1 - s)Y^* + cCIP^* + dFFF^*$.

7. The procedure for estimating this function and its rationale are described in Appendix A2.

8. This kind of investment demand function is probably applicable to other underdeveloped countries in which foreign exchange is rationed.

9. For a discussion of the function and the procedure for estimating it see Appendix A1.

US agency and personnel piaster expenditures, U, are expressed as a function of the numbers of US troops and civilians in Vietnam since an important policy question about their disposition relates to numbers rather than money expended. The linear specification of this function may not be entirely satisfactory but it seems to be the best choice on the basis of the scanty information available.¹⁰ The function has a positive intercept which ought to be interpreted as basic expenditures due to the existence of US civilian and military forces in Vietnam. The coefficients attached to the troop and civilian variables are the expenditures per time period per thousand individuals.¹¹ In fact, the coefficient of civilian expenditures is much higher than that for troops. We assume the following linear function:

$$U = q + tTR + vCV \quad (8)$$

TR is the number of troops and CV the number of civilians in Vietnam at a point in time. A policy decision to reduce the force size gives an immediate estimate of the reduction in US expenditure in piasters that will result. The United States through MACV purchases piasters from the National Bank of Vietnam at a fixed exchange rate. Many of these piasters are used to pay for services rendered by Vietnamese to the American establishment. The remainder are sold to servicemen and civilians who use piasters for local purchases. Note that Eq. 8 is expressed in monetary (piaster) terms. This implies that piaster purchases by the United States are independent of price effects. Given a fixed exchange rate, the United States does not automatically step up its purchase of piasters when local prices rise. Rather it tends to set annual ceilings on piaster expenditures, and to stay under the ceilings, it cuts back on its real purchases of services.

10. The function probably is complex and depends on what kind of troops and which civilians are to be withdrawn. Cases can be made for both increasing and decreasing rates of change although the relationship between U and withdrawal undoubtedly is positive.

11. See Appendix A6.

Troops and civilians are discouraged from spending on the local economy by attractive programs encouraging them to accumulate dollars.

GVN expenditures are determined primarily by the requirements of the war effort and for that reason are not assumed to be determined within the model. However, actual (monetary) expenditures are influenced by price level changes.

$$G^* = \bar{G}^* \quad (9)$$

The GVN expenditures are financed from four sources: tax collections, other revenue, foreign aid, and budget deficits supported by increasing the money supply. Since the deficit is the important residual variable in determining the price level, we need a revenue balancing equation:

$$D = G - T - O - A \quad (10)$$

where D is the deficit, G is the GVN expenditures in current piasters, T is total taxes collected in current piasters, O is other revenue and A is the piaster value of CIP and FFF foreign aid calculated at the official exchange rate. The total tax can be further broken down into domestic taxes and import taxes:

$$T = T_d + T_{MG} + T_{MU} \quad (11)$$

where T_d is domestic taxes, T_{MG} is taxes on GVN financed imports, and T_{MU} is taxes collected on US financed imports. The latter two, in turn, can be expressed as functions of import values and tax rates, and the former as a function of domestic income.

$$T_{MG} = gM_G \quad (12a)$$

$$T_{MU} = uM_U \quad (12b)$$

$$T_d^* = sY^* \quad (13)$$

with the symbols M_G and M_U representing GVN and US financed imports respectively. g is the average customs rate on GVN financed imports and u the average customs rate on those financed by the United States.¹²

US financed imports are determined by the amount of foreign aid granted by the United States.¹³ Thus, M_U is an important policy variable for the United States but is exogenously set for GVN policy makers.

$$M_U = A \quad (14)$$

It is helpful to write the equation for the deficit in terms of a combination of some real values and their price indices and other nominal values.

$$D = P_G G^* - P_Y T_d^* - gM_G - uM_U - A - 0 \quad (10a)$$

Later we shall use Eq. 10a in determining the price level effects of various policies.

We require four more equations in order to state how all the endogenous variables affect the general level of domestic prices. These are given in Eqs. 15 through 18.

GVN imports play a major role in the analysis. Thus, it is necessary to be explicit about the determinants of the level of those imports. GVN imports depend upon the amount of foreign exchange the GVN receives from export of goods and US piaster expenditures adjusted by any change in its foreign reserve balance.¹⁴

12. In "customs rate" we include the perequation tax and austerity tax as well as the customs rate proper. g and u could have the alternative interpretation of the number of piasters collected per dollar of imports. In that case M_G and M_U would have to be stated in real (dollar) terms.

13. Only the foreign aid destined for GVN budgetary support is relevant. Under the present conditions in South Vietnam, foreign aid which accrues to the Trust Fund account and AIK must be subtracted from total aid.

14. Of course, there could be other sources of financing for imports such as repayment of loans and other capital flows. These are relatively unimportant in the case of South Vietnam.

$$M_G = U + X - \Delta B \quad (15)$$

We shall assume, partly for convenience and partly because it appears to be true from the available evidence, that the GVN attempts to maintain a constant level of foreign exchange reserves, or that $\Delta B = 0$, and therefore the last term in Eq. 15 can be ignored. This assumption can be removed at any time one wishes to state explicitly how B changes.

Total imports are the sum of GVN financed imports and those financed by the United States. The latter are the sum of imports financed under CIP and FFF.

$$M = M_G + M_U \quad (16)$$

The primary determinant of the relevant price indices is the change in the money supply (MS). For simplicity we shall assume that the change in the money supply is due solely to the GVN deficit. This is not strictly true in Vietnam because some of the change in the stock of money is due to activities in the private sector. However, changes in the money supply brought about in the private sector are miniscule in comparison with those caused by the government sector.

$$\Delta MS = D \quad (17)$$

The crucial equation in the system is the one that defines the price index of domestic production, P_Y . The price level for local production, stated as an index, depends upon previous changes in the stock of money adjusted for other changes in the economy which affect the velocity of circulation.¹⁵ The problem is to work the

15. Some of these variables, notably income and population changes and increased reliance upon the monetary mechanism, were discussed a half century ago by Irving Fisher in The Purchasing Power of Money, New York, The Macmillan Company, 1922, and more recently in Clark Warburton, "The Secular Trend in Velocity," The Quarterly Journal of Economics, LXIII (February 1949) and Phillip Cagan, "The Demand For Currency Relative to the Total Money Supply," The Journal of Political Economy, LXVI (August 1958).

adjustments into the model in a way that does not place excessive demands upon data, which are very scarce. We assume that we can account for much of the effect of velocity on prices by placing a trend parameter, r , in a conventional equation showing the relationship between prices and money:

$$\frac{\Delta P_Y}{P_Y} = rn \frac{\Delta MS}{MS} \quad (18)$$

and

$$\frac{\Delta P_M}{P_M} = rm \frac{\Delta MS}{MS} \quad (19)$$

Equations 18 and 19 are identical with the exception of the two parameters n and m which relate changes in the specific indexes P_Y and P_M to changes in the stock of money. In general, n and m are expected to have different values since the principal factors affecting them are the supply elasticities of domestic production and imports respectively. If those elasticities differ, n and m will differ accordingly. In fact, prices of domestically produced goods have risen faster than import prices because the supply elasticity of the latter is greater than for domestic production.¹⁶ Thus, Eqs. 18 and 19 are expressed in a way that allows changes in the quantity of money to be the determining factor in changing domestic and import prices, but at the same time it allows these prices to change relatively more or less than changes in the stock of money.

In a static environment the value of r would be expected to be unity, a result that follows from the rigid Quantity Theory of Money approach. In other words, the velocity of circulation of money would be constant. If data on the determinants of velocity were available, we could follow the Neo Quantity Theory approach¹⁷ and allow velocity

16. See Appendix A4 for the derivation of the values of n and m .

17. See Milton Friedman, "The Quantity Theory of Money: A Restatement," Studies in the Quantity Theory of Money (Milton Friedman, ed.) Chicago, University of Chicago Press, 1956.

to be entered explicitly as a variable. Instead, we take an in-between approach by predetermining the value of r and then placing that value in Eqs. 18 and 19 as a constant. A value of r less than unity implies that there has been a decline in the trend in velocity due to environmental or institutional changes and/or an increase in real per capita income. In fact, for the war years in Vietnam, r was less than one, apparently about .9.¹⁸ A value less than unity is credible and can be explained readily. Prices did not rise as fast as the money supply because some of the new money was absorbed into increased money balances as the economy became increasingly monetized and real output grew. Our approach assumes that this trend will continue to have the same influence on the price-money relationship in the forecasting period as it had in the period for which the estimate was made.

The equations given above define the structural relationships and definitions pertinent to the system we wish to examine. With this model it is possible to estimate the values of the variables in which we are interested, domestic production, consumption, and the price indices, as functions of the level of troop strength and foreign aid using certain assumptions about other variables such as investment and GVN expenditures.

18. This value was calculated in a previous study by Douglas C. Dacy, "Inflation in Vietnam," (unpublished working paper, Institute for Defense Analyses, February 1968).

III

INTERPRETATION OF THE MODEL

A. PRICE LEVEL

The price index for domestic production when written as a simple function of the money supply is given in Eq. 18. A given percent increase in the stock of money outstanding will lead to a rise in prices with the exact relationship depending upon the values assigned to the parameters r and n . The change in the money supply, however, is a function of a number of different variables and parameters, some of which are determined by US policy. When the price index is written as a function of the most important variables involved in changes in money supply it becomes:¹

$$P_Y = \frac{MS_0 + rn[(1 - k)G^* - g(U + X) - (1 - u)A - 0]}{MS_0 - rn(kG^* - T_d^*)} \quad (18a)$$

which is considerably less complicated than it looks. If one wished to know precisely how the price level was likely to vary as a function of each variable on the right hand side of the equation, it would be necessary to differentiate the function with respect to each of them. However, one can determine the direction of change merely by looking at the equation.

Government expenditures appear in both the numerator and the denominator with positive and negative signs, respectively. Thus, an increase in GVN expenditures, which increases the deficit, is inflationary.

An increase in exports, which appear with a negative sign in the numerator, is deflationary; this must be true since each dollar earned

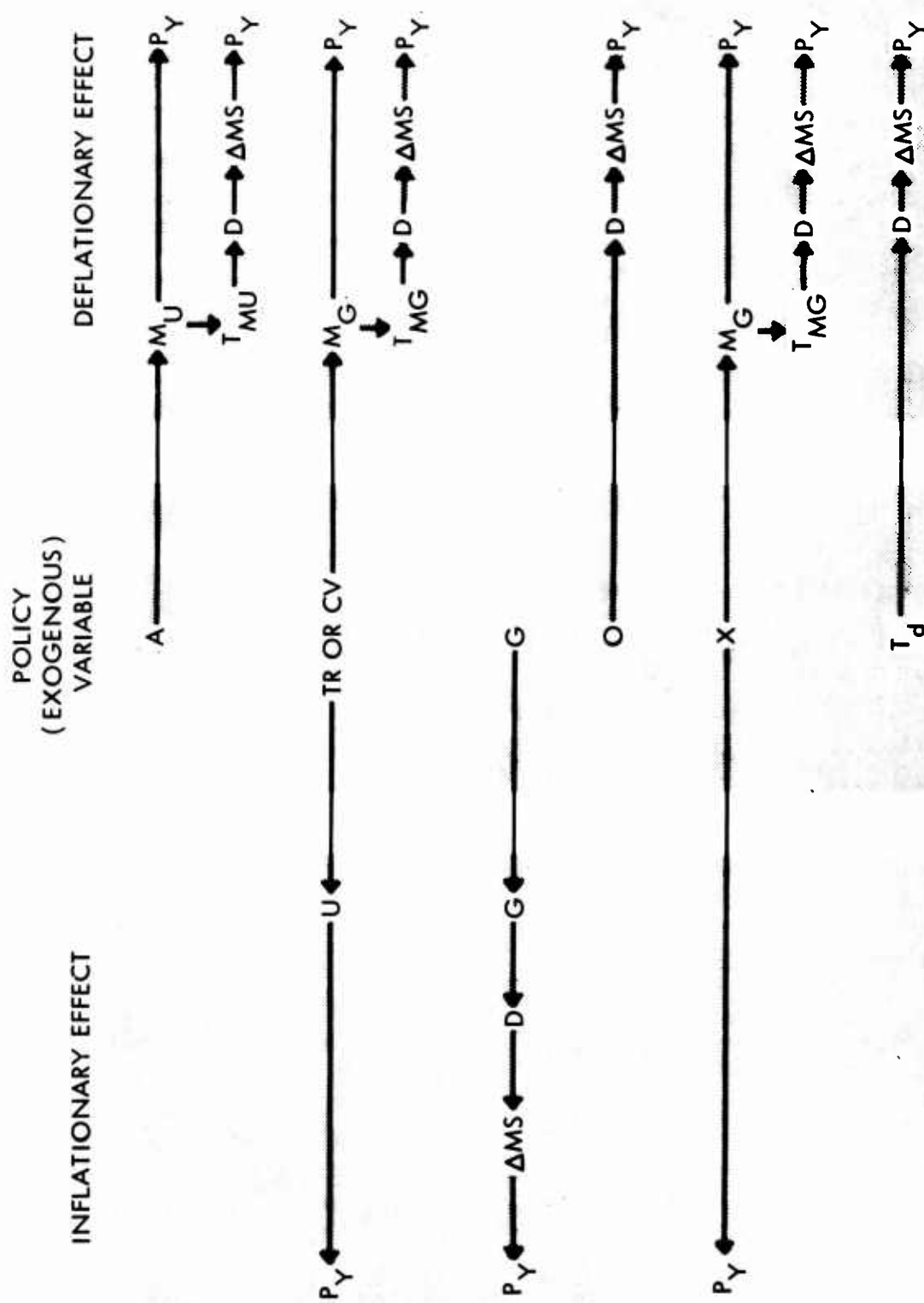
1. See Appendix B1 for the derivation of this formula.

by exporting allows imports to increase by the same amount but, in addition, the tax on imports contributes toward reducing the government deficit.

An increase in foreign aid, which is also in the numerator with a negative sign, decreases the deficit by the value of the increased foreign aid plus the value of the taxes collected on the additional imports that the aid is used to pay for. The increased aid is thus deflationary. Other government income appears in the numerator with a negative sign and, since it reduces the deficit, is deflationary. An increase in domestic taxes reduces the deficit and is deflationary. These show up with a positive sign in the denominator.

The last, and perhaps most important variable, is US expenditures. This is found in the numerator with a negative sign, implying that an increase in US troops or civilian personnel that results in an increase in personnel expenditures has an overall deflationary effect. Conversely, withdrawal of troops is inflationary. The rationale for this is that an increase in US expenditures provides foreign exchange which permits an offsetting amount of goods to be imported. In addition, however, the GVN deficit is reduced by the amount of taxes collected on the imports. Thus, the net effect of an increase in US expenditures is deflationary, given the structural equations of the model. In other words, US expenditures are treated as an export since, in fact, they derive from Vietnamese export of services. The way in which US expenditures and other variables affect the price level is shown schematically in Figure 1.

Note that T_d^* appears in the denominator of Eq. 18a. T_d^* is related to Y^* : $T_d^* = sY^*$ where s is the domestic tax rate. Thus it can be substituted in the equation for T_d^* to determine the effect on the general price level of a change in real income or any other variable that affects real income as well as the domestic tax rate. The rather intuitive answer that a rise in real income has a depressing effect on the price level is confirmed in the equation. Also a rise in the tax rate is deflationary.



P1-9-70-1

FIGURE 1. Schematic Representation of the Effects of Policy Variables Upon the Price Level

B. REAL INCOME

The equation expressing equilibrium real income as a function of the parameters and variables that determine it is written:²

$$Y^* = \frac{P_T a^* + P_I I^* + (1-k)G^*}{P_Y(1-b+bs)} - \frac{P_M \left[(1-c)CIP^* + (1-d)FFF^* + M_G^* \right] - P_X X^*}{P_Y(1-b+bs)} + \frac{U + kG^*}{1-b+bs} \quad (20)$$

The effect on Y^* of changes in various parameters is, for the most part, readily discernible. An upward shift in the consumption function that leaves its slope unchanged, e.g., an increase in a^* with no change in the total price level P_T , would result in higher equilibrium income. An increase in the domestic tax rate would have two effects. A direct effect would be to reduce income by reducing consumption. As shown in Eq. 20, an increase in s increases the denominator and thereby reduces equilibrium real income via the multiplier. An indirect effect would operate through reducing the deficit and the price level to increase real income. Which effect predominates depends upon the strength of the influence of a reduction in the deficit upon the domestic price level. That in turn depends upon the sizes of the deficit, the money stock, and national income.³ If income velocity is low, a given percentage increase in the tax rate will have a weaker impact on prices than if velocity were higher. Thus, in low velocity situations, the multiplier effect might dominate the price effect; but before a precise answer can be given, one would have to specify the magnitudes under question.⁴

The direction and magnitude of the effect of a change in real GVN expenditures is considerably more difficult to assess since GVN

2. For a derivation of Eq. 20 see Appendix B2.

3. As a first approximation let $\rho = D/M$ where ρ is the rate of inflation and $D = \Delta MS$. Suppose $D = G - sY$, then $\rho = G/M - s(Y/M)$. If G/M is given, then the relative price level response to changes in s depends upon income velocity, Y/M .

4. This analysis is correct insofar as the relative change in P_Y is a more proper focal point than an absolute change.

expenditures appear in two places and also enter in the determination of the price level. The result that obtains is critically affected by the value of the parameter k , the ratio between the rate of price increase for government expenditures and that for domestically produced goods. If the government price level goes up at approximately the same rate as that for domestic goods so that the ratio is one or close to it, aggregate real income is increased by an increase in government demand. If the ratio of price rises is below a certain critical point, however, aggregate real income would decline. This is because the government output is being valued at a lower price than is the output of the private sector so that the conversion of resources from the private sector to the government sector lowers total real income. Perhaps the best example of this kind of phenomenon would be a case in which the GVN decided to increase the size of the army. Since it has control over army pay scales, it can clearly prevent them from rising as rapidly as the general price level. A shift of one individual from the private sector where his output is valued at a high level to the government sector where the output is valued at a low level will therefore reduce the total real product. If, instead, the government were simply purchasing goods produced in the private sector so that the valuation of these goods were no different for it than for the private economy, there would be no reason why the GVN price index should be different from the domestic price index and the usual multiplier effect would come into play and, if the economy were capable of expansion, real production would be increased.

An alternative way of explaining the result that increased government expenditure reduces real product is to consider separate government and private sector production functions. If the marginal product of an additional person in government employment is less than the marginal product of that person in the private economy, then the total real product will decline as government expenditures increase, in the absence of any offsetting element. Our model does not explicitly incorporate this kind of mechanism.

The effect of an increase in foreign aid is an interesting question to explore. Equation 20 needs to be rewritten as Eq. 20a in order to show how changes in aid affect real income.

$$Y^* = \frac{P_T a^* + P_I I^* + (1-k)G^*}{P_Y (1-b+bs)} + \frac{P_M (cCIP^* + dFFF^* - M_G^* - A^*) + P_X X^*}{P_Y (1-b+bs)} + \frac{U^* + kG^*}{1-b+bs} \quad (20a)$$

The direct effect of an increase in A^* is to decrease real income because of the substitution effect between domestic production and US imports. However, there are two offsetting indirect effects. Indirectly, the two components of aid, CIP and FFF, affect consumption and investment and through them change the real resources demanded. Available resources change by a like amount because of the change in imports due directly to aid and the change in domestic output due to the change in real investment. Note, however, that this indirect effect alone cannot completely offset the direct effect if c and/or d is less than one; and c most certainly is less than one. Again indirectly aid reduces the deficit and P_Y and that implies an increase in real income. Without knowing specific relationships, we cannot say whether the overall effect of aid is to increase or decrease domestic income.

The composition of the aid imports could also have considerable influence on the growth rate and future income levels of the country. Aid largely composed of investment goods would presumably increase potential future production and thus raise the growth rate but at the expense of current consumption.

C. CONSUMPTION

The consumption function used in the model is:

$$C^* = a^* + b(Y^* - T_d^*) + cCIP^* + dFFF^* \quad (6)$$

T_d^* is a fairly constant percentage of GNP and also of Y^* .⁵ Since we

5. See Appendix A3.

state that $T_d^* = sY^*$ in Eq. 13, C^* can be expressed as a function of Y^* and US financed imports.

$$C^* = a^* + b(1 - s) Y^* + cCIP^* + dFFF^* \quad (6a)$$

The marginal propensity to consume out of domestically produced income is $b(1 - s)$. This coefficient should be relatively low because of the substitution effects of CIP and FFF imports. We assume that all of FFF imports go for consumption since by far the largest share of FFF is edible food. Thus, consumption is raised directly by increasing FFF imports and indirectly because an increase in aid lowers the deficit (and with it the price level) and raises real domestic income and also the consumption component due to domestic income. A similar reasoning applies to CIP, only the strength of the consumption effect is slightly reduced in comparison with FFF imports.

D. EMPLOYMENT

Our model contains no explicit production function and, consequently, it cannot be used to predict employment effects. We have assumed that the economy will continue to utilize fully its manpower resources given the most probable policy changes. This assumption certainly is valid when incremental changes are being considered.

IV PARAMETER ESTIMATES

Everything up to this point has been stated in general terms. To tie the model explicitly to the economy of Vietnam requires specific values in place of the generalized parameters we have discussed in previous sections. Parametric estimation is largely a technical problem and we have confined our discussion of some of these problems to Appendix A. Here we only give the results, or the values of the parameters as they apply to Vietnam.

The twenty equations of the model contain nineteen (no necessary relation) parameters which have to be estimated if the model is to be useful for calculating the effects of specific policy changes. Our estimates of these parameters are given in Table 1.

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Table 1

PARAMETER ESTIMATES REQUIRED FOR THE COMPUTATION OF THE VIETNAM MACROECONOMIC MODEL

Symbol	Equation No.	Description	Unit of Measure	Value
a*	6	Consumption function intercept	\$VN (bil)/1960	39.6
b	6	MPC out of domestic income	ratio	.32
c	6	MPC out of CIP	ratio	.44
d	6	MPC out of FFF	ratio	1.00
e*	7	Investment function intercept	\$VN (bil)/1960	1.85
f	7	Percent investment of GVN imports	ratio	.11
h	7	Percent investment of CIP	ratio	.56
k	4	Avg. $\Delta P_G/P_G \div \Delta P_Y/P_Y$	ratio	.5
q	8	US expenditure function intercept	\$VN/bil	38.0
t	8	Marginal expenditure per US troop	\$VN (bil)/1000/year	.024
v	8	Marginal expenditure per US civilian	\$VN (bil)/1000/year	1.45
g	12a	Avg. customs rate on GVN imports	ratio	1.27 ^a
u	12b	Avg. customs rate on US financed imports	ratio	.66 ^a
r	18, 19	Avg. $\Delta P/P \div \Delta MS/MS$	ratio	.9
n	18	Avg. $\Delta P_Y/P_Y \div \Delta P_T/P_T$	ratio	1.13
m	19	Avg. $\Delta P_M/P_M \div \Delta P_T/P_T$	ratio	.66 ^b
s	13	Domestic tax rate	ratio	.05
w	5	Weight of P_Y in P_I	ratio	.33 ^b
z	1a	Weight of P_Y in P_T	ratio	.74 ^b

a. See Appendix A8.

b. We do not actually use these values anywhere in our calculations.

V

MANIPULATION OF THE MODEL

The twenty structural equations and definitions described in Section II appear to be somewhat forbidding. Actually the equations can be combined easily into "reduced form" equations which show the variables to be determined as functions of all predetermined variables and parameters. For example, Eq. 18a is a kind of reduced form equation which allows one to calculate the price level if he knows the values of all the variables and parameters on the right hand side.

To demonstrate how the model can be used to examine the consequences of policy decisions, let us consider the following hypothetical question: What is the effect on the price level of a withdrawal of 100,000 US troops plus 1,000 US civilians? To answer this question, we need first to use Eq. 18a which requires information on MS , G^* , X , A , O and the parameter estimates on r , n , k , g , and u .

Suppose that the current levels are

$$\begin{aligned} MS_0 &= 160 \text{ bil } \$VN \\ G^* &= 180 \\ X &= 10 \\ A &= 26 \\ O &= 18 \\ T_d^* &= 25 \\ U &= 60. \end{aligned}$$

From Table 1 we take the following parameter estimates:

$$\begin{aligned} r &= .9 \\ n &= 1.13 \\ k &= .5 \\ g &= 1.27 \\ u &= .66 \end{aligned}$$

$$t = .024 \text{ bil } \$\text{VN}/\text{year}/1000$$

$$v = 1.45 \text{ bil } \$\text{VN}/\text{year}/1000$$

$$P_{Y(t)} = \frac{MS_0 + rn [(1-k)G^* - g(U+X) - (1-u)A - O]}{MS_0 - rn(kG^* - T_d^*)} \quad (18a)$$

Using the values above

$$P_{Y'} = \frac{98.9}{94.8} = 1.043^1$$

To calculate the effect on US government purchases (U) of a withdrawal of 100,000 troops and 1,000 civilians, we need to use the parameters t and v found in Eq. 8. A withdrawal of this number of persons results in a reduction of dollar conversions (into piasters) of tTR + vCV or .014 x 100 + 1.45, a total of approximately 2.85 billion piasters. Thus U will decline from 60 to 57.15 billion piasters. Using the new figure of 57.15 billion, we recalculate P_Y using Eq. 18a. Call it $P_{Y''}$.

$$P_{Y''} = \frac{102.6}{94.8} = 1.082^2$$

The percent change in price resulting from the above hypothesized change is .039/1.043 or 3.7 percent.

While these calculations were given purely as an example, the assumed values do not vary much from the actual values in 1970. Thus,

1. This number is an index where the value in the previous period is 1.0. Thus, under the assumed conditions, the general price level would be expected to rise by 4.3 percent.

2. A withdrawal of the order given in this example requires an addition to the money stock of 3.6 billion piasters, i.e., $g \times \Delta U$ if the GVN is to maintain its desired level of expenditures. That increase would imply a price level change of 2.2 percent given the values of rn and MS_0 . However, this increase of 2.2 percent would mean that government expenditures would rise by 1.1 percent (since $k = .5$). This, in turn, requires an addition to the deficit of approximately 1.95 billion piasters when adjusted for the slight rise in domestic tax receipts. This process would continue until the final additional price increase of 3.7 percent was reached.

there is a very important conclusion to be drawn from the results:
Policy questions regarding US troop and civilian withdrawals have
a very small price impact, even though, on balance, withdrawal is
inflationary. The price impact is sufficiently small to allow one
to ignore it.

VI

SOME IMPLICATIONS OF THE MODEL

One important implication of our model has already been pointed out: US policy regarding troop strength in South Vietnam may have significant political consequences, but its effect upon the stability of the economy is practically nil. Pulling troops out of Vietnam does not require that we alter significantly our economic stabilization policy. Yet, since a troop withdrawal is slightly inflationary, we shall now investigate a way by which US policy can exactly offset that inflationary impact.¹

A. US EXPENDITURES COMPARED WITH FOREIGN AID

The price level and income effects of the withdrawal of US troops and civilians can be offset by US government policies designed to replace the loss of foreign exchange following from the cutback. The most obvious way to provide an offset is to increase foreign aid. First we shall examine the effectiveness of this offset in general and then analyze the various forms in which foreign aid might be dispensed.

The variables which generate foreign exchange for the Vietnamese are US piaster expenditures in Vietnam, exports, and foreign aid. These variables appear in the numerator of Eq. 18a. Associated with each variable is a coefficient that indicates the tax (customs)

1. The major conclusions of this section depend upon an assumption which ought to be explicitly stated now: There are no reallocation costs associated with changing patterns of consumption. For example, when we state that a dollar spent by US personnel for local goods can be offset by a dollar's worth of imports to be consumed by Vietnamese, we are assuming that local goods purchased by Americans can be replaced by imports purchased by Vietnamese without any additional resource cost.

revenues derived from the imports which each source of foreign exchange supports. Replacing one form of imports by another would have no effect on the price level so long as revenues were unchanged. However, if the tax coefficients are different, substituting one form of imports for another will result in some change in taxes. If the GVN desires to spend a predetermined sum, then the substitution of an import that yields less taxes than the type it replaced will create a larger deficit and prices will rise. Thus, if the goal is to keep prices from rising faster than they would anyhow, more than a dollar's worth of one kind of imports might have to be substituted for a dollar's worth of some other kind.

The total tax revenues on imports supported by US piaster expenditures is gU and on foreign aid it is $(1-u)A$. A substitution of aid (A) for US local expenditures (U) that would not disturb prices requires that $g\Delta U = -(1-u)\Delta A$. The minus sign simply means that an increase in one balances off a decrease in the other. Hence, the value of additional aid required to offset one dollar's decrease in US expenditures in Vietnam is:²

$$\Delta A = - \frac{g}{1-u} \Delta U \quad (21)$$

Thus, the actual aid offset for a one dollar reduction in US expenditures depends only upon the average customs rates on GVN and US financed imports, i.e., g and u .

Taking the parameter values of g and u that we use in this study³ (1.27 and .66 respectively), we find that

2. Specifically we are concerned with "tied" aid, including both CIP and FFF aid. In this derivation we assume that the increase in tied aid is distributed on a pro rata basis between CIP and FFF imports so that the average import tax on US financed imports remains constant, or that u is a constant.

3. These are not the values implied by the official customs rate schedule. Our calculated rates are only 70 percent of those officially published. Based upon past evidence it is clear that the published rates are not actually collected. See Appendix A8. In the following calculations we shall assume that the same degree of customs evasion applies to all classes of imports. In other words, we use values that are 70 percent of the official customs value for every class of imports.

$$\Delta A = - .77 \Delta U.$$

If the United States wished to neutralize the price effect of troop withdrawal, it could do so by supplying approximately 58 cents in CIP aid plus 19 cents in Food for Freedom for each dollar it reduces piaster purchases due to the withdrawals.⁴

The United States has a number of options regarding the manner in which it gives aid. It can supply assistance through any combination of (1) the Commercial Import Program, (2) Food for Freedom Program, or (3) outright dollar grants. However, the way it dispenses aid in order to neutralize any disruption caused by troop withdrawal determines the dollar cost. We shall investigate the costs of the three alternatives.

Aid given through Food for Freedom is a relatively inefficient way to neutralize the price effect of troop withdrawal. The average duty rate on P.L. 480 imports is only 15 percent including rice and 30 percent excluding rice. Let $u = .15$. Using Eq. 21, it appears that to offset a one dollar reduction in US military expenditures we require an expenditure of \$1.10 in FFF aid. The economic explanation for this inefficiency is as follows: Troop expenditure of one dollar creates a demand against resources (injection of purchasing power) of one dollar. If the GVN imports with the dollar of foreign exchange it earns, then availability (absorption of purchasing power) increases by one dollar. In addition, the GVN taxes the imports at 127 percent resulting in an additional absorption of \$1.27. The net absorption is \$1.27. Now, if the troop expenditure is removed, so is the net absorption. In its place, a dollar's worth of FFF creates a dollar's worth of absorption in the form of imports plus 15 cents as the tax on imports for a net absorption of only \$1.15. Thus, if the previous net absorption of \$1.27 is to be just exactly offset, the US will have to supply \$1.10 of FFF aid.

4. .58 and .19 have the same relationship as .75 and .25, the weights for CIP and FFF imports we used in calculating the average import tax rate on US financed imports. See Appendix A8.

CIP imports are a much more efficient offset than FFF imports. The average duty rate on CIP goods (including the perequation tax but excluding fertilizer imports) is 83 percent. Following the same reasoning set forth in the previous paragraph, net absorption created by one dollar in CIP aid is \$1.00 in imports plus \$0.83 in taxes. This will more than offset the dollar reduction in troop expenditure. In fact the net absorption due to a conversion of one dollar for troop expenditure can be offset by an expenditure of 69 cents in CIP aid, i.e., \$1.27/\$1.83.

In comparison to tied aid, "free" dollars would be a relatively cheap way of neutralizing the inflationary effect of US troop withdrawal from Vietnam. The import tax rate on GVN financed imports is 127 percent. Assuming that the GVN used the "free" dollar to import goods, the net absorptive effect of that dollar would be \$2.27, and it would require a transfer of only 56 cents of untied aid to counterbalance the deflationary effect of a dollar's expenditure by US troops in Vietnam.

B. EFFECTS OF THE AUSTERITY TAX MEASURE OF OCTOBER 1969

On October 23, 1969 the GVN raised the austerity tax rate on imports.⁵ The average scheduled rate on GVN imports was raised from 86 piasters per dollar of imports to 214, and on CIP goods (excluding fertilizer) from 43 piasters per dollar to 140. Our calculations indicate that the numerator in Eq. 21 is net absorption due to US military spending while the denominator measures net absorption that would result from some alternative activity. When US aid is the alternative to military spending, the value of the import is not cancelled by an injection; hence the fixed value of 1 in the denominator. Altering the import duties will, in general, change the ratio in Eq. 21. For example, a doubling of all import duty rates will increase the ratio because the denominator will not double whereas the numerator will double. Put in less abstract terms, an increase in

5. See Appendix C, Table C4.

the import duty raises the absorptive value of a dollar of military spending and, thus, increases the cost of offsetting it.

Table 2 shows the compensatory cost per dollar of military expenditure before and after the October 23 austerity tax measure went into effect. The calculations in Table 2 should not be interpreted as a criticism of the austerity tax since the deflationary impact of the additional tax revenues is far greater than almost any measure the United States could have undertaken on its own.

Table 2

COST OF OFFSETTING ONE DOLLAR OF US MILITARY SPENDING IN VIETNAM
BY VARIOUS AID PROGRAMS
(in dollars)

Program	Before October 23	After October 23
CIP and P.L. 480	.47	.77
P.L. 480	.52	1.10
CIP (excluding fertilizer)	.46	.69
Direct dollar grants	.36	.56

C. THE PIASTER EXPENDITURE REDUCTION PROGRAM

Another implication of the model relates to the US military policy to reduce personal expenditures of US troops. In July of 1966 the Department of Defense instituted the Piaster Expenditure Reduction Program in an attempt to curb inflationary pressure in Vietnam.⁶ The objective of the program is to reduce piaster expenditures by US troops and civilians. The program was designed to operate through persuasion rather than coercion by providing banking facilities, opportunities for saving at high interest rates, an attractive R&R program, and well-stocked post exchanges. According to statistics, the program has been successful in reducing per capita piaster expenditures from \$23.18 in January 1967 to \$7.40 in December 1968.

6. SECDEF memo of 13 July 1966.

Apparently the direct objective has been attained. Yet, there is a question about whether or not reducing piaster expenditures by US personnel is, in fact, deflationary. The usual explanation of why US piaster expenditures are inflationary is simply that US demand, when added to the local demand for domestic goods and services, can only help to drive up the price level.

However, if one works through a somewhat more complete model of the way in which US piaster purchases affect the GVN foreign exchange balance, GVN imports, and GVN tax collection, he must come to the opposite conclusion; that increases in US piaster expenditures are in fact deflationary rather than inflationary. The rationale for this conclusion is as follows: In order to provide Americans with piasters, the US government purchases them from the GVN at a fixed exchange rate of 118 per dollar. This transaction is merely an exchange of assets and has no economic effect in and of itself. The piasters are then spent on domestic goods adding to the demand for these goods and tending to push up their prices. At the same time, however, the GVN issues import licenses in an amount equal to the value of the dollars it has received (assuming no change in GVN holdings of foreign balances and no taxes). If these imported goods are as attractive to the Vietnamese as domestic goods, local demand for domestic goods declines by precisely the same amount as US demand increases. The inflationary pressure is completely offset. An increase in US piaster expenditures would have no inflationary effect whatever.

Even if local demand for domestic goods does not decline by an amount equal to the increase in US demand, the overall rate of price increase, if measured correctly, would not be affected because prices of imports would rise less rapidly than prices of domestic goods as more imports were brought into the country.

The above analysis ignores the effect of US piaster expenditures on GVN import taxes. Since a major source of revenue for the GVN are the duties collected on imports, an increase in US piaster expenditures which permits an increase in imports leads to increased tax collection

which reduces the GVN deficit and the money supply below what they would be otherwise. This reduction in the money supply taken by itself, is deflationary. Thus, the total effect of an increase in US piaster expenditures is deflationary contrary to the assumptions underlying the piaster expenditure reduction program.

It is possible to estimate the net effect of the piaster expenditure reduction program on the price level in Vietnam. For the estimate, we shall assume that civilian personnel expenditures are unaffected by the program so that the only calculations that need be made are the estimated differences between actual and potential personal expenditures of military people. The average per capita expenditure for military persons declined from \$105 for the first six months of 1967 to \$36 for the last six months of 1968. If per capita expenditures would have remained at approximately \$100 throughout the second half of 1967 and all of 1968⁷ instead of some lower figure, GVN dollar earnings would have been larger than they were and GVN financed imports would have been larger under the assumption that the GVN did not desire to build up its foreign exchange reserves. Import duties would have been larger than they were and the deficit reduced. The money supply would have been increased more slowly and the price level would have increased about 4 percent less than it did in 1968.⁸

This calculation and the analysis depends crucially upon the assumptions made earlier that the GVN permits imports to expand as its foreign exchange earnings go up rather than increasing its foreign exchange balances. If it does the latter, then any increase in piaster expenditures will be inflationary because no offsetting inflow of imported

7. This figure probably is the maximum expenditure to be expected. From mid 1967 through the end of 1968, the black market rate for a dollar increased from 160 to 200 piasters. This 25 percent increase could have encouraged some US servicemen to exchange their dollars on the black market rather than through official windows. Depending upon the responsiveness of servicemen to use the black market, the official exchange of dollars for piasters could have fallen below \$100 per half year period even without a piaster expenditure reduction program. Thus, our calculation of the extent to which the PERP raised the general price level should be taken as the maximum.

8. See Appendix A7 for the method employed in this estimate.

goods is permitted. This was true to a large extent in 1966, when prices rose very rapidly, and to a smaller extent in 1969 and 1968. In late 1969, however, we must consider that the Piaster Expenditure Reduction Program is achieving just the opposite effect it was intended to achieve.

A second caveat that should be added to the discussion of the estimated inflationary effects is that the potential increase in piasters is calculated under the assumption that none of the apparent reduction in piaster expenditures are being diverted to the black market. If the reduction in measured piaster expenditures is merely due to diversion to the black market rather than reduced purchases, then the program itself has less inflationary effect than we have indicated.

D. CURRENCY CONVERSION IN THE BLACK MARKET

An increase in the black market rate for dollars, regardless of its cause, will have the effect of driving up the prices of goods and services in Vietnam. As the gap between the official exchange rate and the black market rate widens, a greater number of dollar holders will be tempted to convert their dollars on the street rather than through authorized channels. The result is a contraction in U and also a decline in the amount of dollars made available to the GVN to finance imports. This is the situation that would develop if we assume that some of the dollars illegally purchased go into capital flight or simply are hoarded within the country. As in other cases, the degree of inflation associated with the black market activities can only be looked at in terms of a standard which depends upon GVN tax levies. Nevertheless, increasing volume in the black market for dollars is inflationary because it tends to reduce the volume of imports which increases the government's deficit due to reduced import tax revenues. The mere exchange of dollars for piasters is essentially neutral in its inflationary effect because purchasing power formerly held by Vietnamese is transferred to Americans (unless the piasters would have been hoarded had they not been exchanged for dollars).

Devaluation of the piaster is deflationary for two reasons: (1) It raises the price of imports thereby absorbing additional money and it also helps in transferring to the treasury possible excess profits which importers can realize because they are allowed to buy foreign exchange at a fixed rate while selling their imports at inflated prices. (2) It tends to reduce the disparity between the official and black market rates for foreign exchange. With the narrowing of the gaps, one would expect a heavier flow of dollars into legal channels. This in turn augments the base for imports and import taxes.

Appendix A

PARAMETER ESTIMATES FOR THE STRUCTURAL EQUATIONS

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Appendix A

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Appendix A

PARAMETER ESTIMATES FOR THE STRUCTURAL EQUATIONS

A1 INVESTMENT DEMAND FUNCTION

Generally, investment is considered to be dependent upon those economic variables which determine the way it is rationed. Thus, the rate of interest usually is taken to be the principal variable in the investment demand function. During the war period in Vietnam, the real rate of interest undoubtedly had some effect on the amount of investment, but it probably was not the major restraining factor. We hypothesize that the binding constraint influencing real investment was the volume of imports that the United States and GVN were willing to support.

The above hypothesis makes sense for any underdeveloped country which depends heavily upon imports for its investment goods. An investor must obtain an import license, and it is probably safe to assume that the ease with which he can obtain a license depends upon the foreign exchange condition of the government, or, in the case of Vietnam, on the amount of funds made available primarily through the CIP. In functional form, our hypothesized investment demand equation is, $I = f(M_G, M_{CIP})$. Investment depends upon imports broken down by type of financing, e.g., GVN financed or CIP financed.

To estimate the parameters of the investment demand function requires data on net investment and the import components. That data is given in Table A1 below.

A linear regression of net investment on GVN financed imports and CIP imports gives the following results (standard errors in parentheses):

$$I_{net}^* = 2.48 + .09M_G^* + .55CIP^* \quad (A1)$$

(1.66) (.14) (.24) $R^2 = .74$

or

$$I_{\text{gross}}^* = 1.85 + .11M_G^* + .56CIP^* + .05 GNP^{*1} \quad (A2)$$

(1.24) (.13) (.21) $R^2 = .80$

Table A1

GROSS INVESTMENT, NET INVESTMENT, GVN AND CIP FINANCED IMPORTS
1960 - 1968
(Billion piasters in 1960 prices)

Year	Gross Investment	Net Investment ^a	GVN Imports ^b	CIP	Total
1960	10.3	6.5	1.5	5.9	7.4
1961	6.8	3.1	3.5	4.6	8.1
1962	8.4	4.0	2.8	5.0	7.8
1963	7.7	3.4	2.7	5.4	8.1
1964	11.0	6.9	3.3	5.1	8.4
1965	13.5	9.7	3.0	7.3	10.3
1966	19.5	14.0	9.6	16.7	26.3
1967	18.0	12.3	23.2	18.6	41.8
1968	17.5	11.8	22.9	9.4	33.3

a. See Table C1.

b. National Institute of Statistics, Republic of Vietnam.

The estimates of gross investment calculated from Eq. A2 are given in Table A2 along with the actual value and error terms. This equation explains 80 percent of the variation in gross investment.

A2 THE CONSUMPTION FUNCTION

Equation 6 of Section II states that consumption in Vietnam is a linear function of domestically produced income (less domestic taxes), CIP imports, and Food for Freedom imports all measured in constant prices.

$$C^* = a^* + b (Y - T_d)^* + cCIP^* + dFFF^*$$

1. See Note A3, this Appendix.

Table A2

ACTUAL AND ESTIMATED GROSS INVESTMENT IN VIETNAM, 1960 - 1968
(Billion piasters in 1960 prices)

Year	Actual	Estimated	Error	Error/Actual
1960	10.3	9.4	.9	.087
1961	6.8	8.9	-2.1	.309
1962	8.4	9.4	-1.0	.119
1963	7.7	9.7	-2.0	.260
1964	11.0	10.0	1.0	.091
1965	13.5	11.6	1.9	.141
1966	19.5	17.8	1.7	.087
1967	18.0	20.6	-2.6	.144
1968	17.5	15.4	2.1	.120
Average Absolute Percent Error				.151

This rather unconventional consumption function seems appropriate to the conditions that prevail in South Vietnam. Assuming that the stocks of the imported goods are constant, almost all of the Food for Freedom imports have to be consumed and a large proportion of the CIP imports are consumed. The latter is a fact that can be observed by anyone who cares to look through the list of products and their values which enter Vietnam under CIP. That a large percentage of CIP goods are consumed also follows as a matter of course from our estimate, given in A1, that 56 percent of these goods flow into investment activities. The residual must be consumed. In estimating the consumption function, we began with two predetermined parameters c and d in the above equation, with values of .44 and 1 respectively.

If a significant share of consumption is predetermined by US-Vietnamese official agreements, we can expect to find a relatively small marginal propensity to consume out of domestic income and one that differs considerably from the average propensity to consume. Our task here is to describe the way we estimated a and b in the consumption function.

To determine the values of a and b, we used the National Bank of Vietnam estimates of gross national product and consumption in 1960

prices and our own deflated series on domestic taxes.² GNP is calculated by the National Bank in the conventional manner and, therefore, should differ from national income by the value of depreciation and indirect taxes. By subtracting total domestic taxes from GNP, we obtain the value of personal income plus depreciation.³ The reader should note that GNP in this discussion is the same thing we have designated as Y in the resource availability equation.

Taking $(GNP - T_d)$ as the independent variable and assuming the marginal propensity to consume out of CIP imports and FFF to be .44 and 1 respectively, we derived the following empirical consumption function by least squares regression:

$$C^* = 39.6 + .32 (Y - T_d)^* + .44 CIP^* + FFF^*$$

The estimate of b is lower than we had expected. However, it is not likely that the low estimated MPC is due to chance. The standard error of the regression coefficient (.085) is quite small in relation to the parameter estimate. The coefficient of determination is .67. Actual values of consumption and those estimated with the above consumption function are given in Table A3.

If the marginal propensity to consume is different for different people and differs from the average propensity to consume, i.e., $a \neq b$, and population is changing, then the estimate of b will be different in a per capita consumption function than in the aggregate one we have derived. If $a > 0$, the b applicable to the per

2. See Table C2.

3. Depreciation figures for 1960-1965 are estimated as a separate component in the national income accounts. For those years, the ratio varied between 3.6 and 5.0 percent. See NIS, Vietnam Statistical Yearbook, 1967-1968, Table 307. For four of the six years the ratio varied only slightly, between 4.6 percent and 5 percent. We have assumed, for convenience, elsewhere that the ratio is 5 percent.

Table A3

ACTUAL CONSUMPTION AND ESTIMATED CONSUMPTION IN 1960
PRICES, 1960-1968
(billion piasters)

Year	Actual	Estimated
1960	63.7	66.4
1961	66.0	65.6
1962	71.3	68.6
1963	72.5	69.1
1964	76.4	71.7
1965	75.4	74.6
1966	77.6	80.0
1967	87.5	82.1
1968	86.0	78.2

capita function will be smaller than that associated with the aggregate consumption function. However, each would give the same estimate of total consumption if used with the appropriate values for income. Since we have no good data on population change in Vietnam, we were not able to estimate a per capita consumption function.

The usefulness of any consumption function depends upon the stability of income distribution or knowledge about how the distribution of income has changed. We have information on neither of these things. However, in using our consumption function for predictive purposes, we implicitly assume that the trend in income distribution will continue to be the same throughout the period of prediction as it was during the period of observation.

A3 DOMESTIC TAXES AND GNP

The tax system of Vietnam's central government is composed of specific, ad valorem, and progressive taxes.⁴ Inasmuch as the largest

4. See Douglas Dacy, The Fiscal System of Wartime Vietnam, Institute for Defense Analyses, IDA Study S-337 (Arlington, Virginia: February 1969).

share of domestic tax revenues is raised by specific taxes, one would suppose that the system as a whole is regressive with respect to price changes. To determine the response of tax collections to price changes, we fit the data for 1960-1968 to the following function,

$$\frac{\Delta T_d}{T_d} = a + b \frac{\Delta P_Y}{P_Y},$$

so that b can be interpreted as an elasticity. The value of a was zero and b = .96. Stated briefly, the elasticity of domestic taxes with respect to domestic prices over the period 1960-1968 was .96 or virtually unitary. Taxes rose proportionately with prices. Thus, while the tax system appears to be regressive with respect to price changes, it is not so in fact.

If the tax elasticity with respect to price is unity, this means that the system must be regressive with respect to nominal and real GNP if real GNP is growing. This latter condition would appear to be the case if one looks at the entire period from 1960 to 1968. However, as Table A4 shows, domestic tax collections remained a relatively stable percentage of gross national product between 1964 and 1968.

Table A4

DOMESTIC TAX COLLECTIONS AND GROSS NATIONAL PRODUCT, 1960-1968
(billion piasters)

Year	GNP	Domestic Taxes	Percentage
1960	81.8	6.2	7.6
1961	84.5	6.8	8.0
1962	93.7	5.4	5.8
1963	100.3	6.5	6.5
1964	114.3	6.2	5.4
1965	144.8	7.8	5.4
1966	236.2	12.7	5.4
1967	362.3	18.9	5.2
1968	434.0	20.9	4.8

The explanation for this is that during that period the government raised the specific duty rates on beer and carbonated beverages--

including the perequation tax--faster than the rise in the consumer price index.

We assume that revenues from domestic taxes will continue to rise in proportion to GNP and that the ratio will remain at 5 percent.

A4 COMPUTATION OF n , m AND z

A 4.1 Calculation of n :

n is defined as the factor by which annual changes in the domestic component of the general price index exceeds the annual changes in the general price index. If P_T is the general price index (total price index), P_Y the domestic price component of the general index, P_M the import component, and z the weight of the domestic component, then

$$P_T = zP_Y + (1 - z)P_M. \quad (A3)$$

If $\Delta P_Y/P_Y > \Delta P_M/P_M$, which actually has been true in South Vietnam, then it follows that $\Delta P_Y/P_Y > \Delta P_T/P_T$. Algebraically, n is defined as $\Delta P_Y/P_Y \div \Delta P_T/P_T$ or

$$n = \frac{\Delta P_Y}{\Delta P_T} \cdot \frac{P_T}{P_Y}. \quad (A4)$$

Equation A4 shows that n is a conventional elasticity, and it can be estimated easily by regression.

We chose to estimate this elasticity by breaking the problem into two parts: First we estimated the annual rate of price change (compounded) for domestically produced goods. Secondly we performed the same operation for the aggregate price index. The two estimating equations were:

$$\ln P_Y = a_1 + b_1 t \quad (A5)$$

$$\ln P_T = a_2 + b_2 t \quad (A6)$$

b_1 and b_2 are the compounded rates of price changes for domestic and aggregate prices respectively; and $n = b_1/b_2$.

The major problem in the calculation of n is the availability of data. Ideally, one would like to have a breakdown of the middle or working class index into domestically produced goods and services and imported goods. Unfortunately, such a breakdown is not available. The National Institute of Statistics wholesale price index (for Saigon) does have the kind of separation we desire. Our calculation of n is, of necessity, based on that index even though the index leaves much to be desired. For example, the consumer price index for middle income families has risen 50 percent faster than the wholesale price index since January 1965. This is not necessarily a disqualifying reason for using the wholesale index, but it does require that we make an assumption: the relationship between domestic and imported goods in the consumer price index is the same as that which existed in the wholesale index. Actually there is little evidence either to support or reject this assumption.

The ratio of changes in prices, i.e., the b_1 and b_2 above, were calculated by using seventeen quarterly averages starting with the first quarter in 1965 and ending with the first quarter in 1969. Data are given in Table C3.) The regressions gave the following results:

	<u>Quarterly rate</u>	<u>Annual rate</u>
b_1	6.0 %	26.0 %
b_2	5.3 %	23.0 %

$n = b_1/b_2 = 1.13$. The price index for domestic products increased 13 percent faster over the observation period than that for all goods.

A4.2 Calculation of z :

Let

$${}_n P_M = a_3 + b_3 t \quad (A7)$$

Using the same technique as above, $b_3 = 15.1$ percent per year (3.6 percent per quarter). Some weighted average of b_1 and b_3 is equal to

b_2 since the former two values are the only components of the latter. Let z be the weight assigned to b_1 and $(1 - z)$ the weight of b_3 . Then $b_2 = zb_1 + (1 - z)b_3$ and

$$z = \frac{b_2 - b_3}{b_1 - b_3} . \quad (A8)$$

$z = .74$. The weight assigned to the domestic component of the general price index is .74 and the weight assigned to P_M is .26.

A4.3 Consistency Between z , n , and m

z is defined such that

$$\frac{\Delta P_T}{P_T} = z \frac{\Delta P_Y}{P_Y} + (1 - z) \frac{\Delta P_M}{P_M} .$$

P_T is the total (general) price level and it is composed of two components, domestic prices P_Y and import prices P_M . A change in the total price level over any period is a weighted sum of changes in the component prices. Rewrite the above equation:

$$1 = z \frac{\Delta P_Y}{P_Y} \left/ \frac{\Delta P_T}{P_T} \right. + (1 - z) \frac{\Delta P_M}{P_M} \left/ \frac{\Delta P_T}{P_T} \right.$$

$$\text{Define } n = \frac{\Delta P_Y}{P_Y} \left/ \frac{\Delta P_T}{P_T} \right. ; \quad m = \frac{\Delta P_M}{P_M} \left/ \frac{\Delta P_T}{P_T} \right.$$

$$1 = zn + (1 - z)m$$

$$z = \frac{1 - m}{n - m}$$

z is a variable weight. Thus, the expression, $zP_Y + (1 - z)P_M$, which appears in Eq. 1a is an implicit deflator rather than a price index. In this study n and m are determined by regression and the value of z given in A4.2 is an average value over a four-year period.

From A4 above, $n = b_1/b_2$ and $m = b_3/b_2$; therefore,

$$z = \frac{b_2 - b_3}{b_1 - b_3}$$

as above.

A5 COMPUTATION OF k

k is the relationship between the government price index and domestic product prices. Since 1965, when the price level began to go up rapidly, the GVN has consistently been able to prevent the prices of the goods and services it purchases from rising as rapidly as those on domestic products. For the most part, this is the result of the GVN's ability to prevent government and military salaries, which comprise the bulk of its expenditures, from going up in line with other prices. The relative price indices for GVN expenditures and domestic production are shown in Table A5. These are the implicit price deflators applied to the components of GNP.

Table A5

IMPLICIT GNP PRICE DEFLATORS

Year	Government Expenditures		Domestic Products		Ratio of Annual Increase GVN Price/Domestic Production Price
	Level	Annual Increase %	Level	Annual Increase %	
1960	1.00		1.00		
1961	1.05	5	1.02	2	
1962	1.09	4	1.06	4	
1963	1.11	2	1.12	6	
1964	1.16	4	1.14	2	
1965	1.36	17	1.34	18	
1966	1.56	15	2.19	63	.24
1967	1.88	12	3.11	42	.29
1968	2.10	11	3.98	28	.39

The GVN and domestic product prices both rose together up to 1965. After that, GVN prices rose at a much slower rate. The ratio between GVN price increases and domestic product price increases is shown in the last column of Table A5 and rises from 24 percent in 1966 to 39 percent in 1968. As one would expect, the ratio is rising and will undoubtedly continue to rise as pressure for wage and price increases builds up in the areas where the government spends its budget. In this study we projected that the government would be able to restrain price rises in its sector to 50 percent of the price increase in domestic goods. Thus, the value of the parameter k used in the study is .5.

A6 US PIASTER EXPENDITURE AS A FUNCTION OF PERSONNEL STRENGTH

In order for the model to be useful as a predictor of the effects of US troop and civilian personnel withdrawal from Vietnam, it is necessary to have an explicit function relating US piaster expenditures to the numbers of personnel in Vietnam. We assume that the function should have a constant term (which is independent of numbers of people) and at least two variable terms which are increasing functions of troop strength and civilian personnel respectively. The problem is one of estimating the values of these two parameters.

The piaster expenditures that are directly related to numbers of personnel are composed of two elements, the personal expenditures of individuals on the local economy for things like food and entertainment and the expenditures of the US government or contractor firms for things like housing. The financial section of MACV collects data on personal piaster expenditures for military and civilian personnel employed by the U.S. Department of Defense. The relevant dollar figures are given on a semi-annual basis in Table A6.

The civilian expenditures of dollars that are converted at the official rate have remained relatively constant since mid-1967. In view of the continuing inflation in Vietnam, it seems unlikely that they will decline in the near future unless a larger fraction of

Table A6

AVERAGE PERSONAL EXPENDITURES IN VIETNAM
(Dollars Per Capita)

Period	Civilians Attached to DoD	Military
Jan-Jun 1967		\$105.48
Jul-Dec 1967	\$1383 ^a	96.80
Jan-Jun 1968	\$1144	46.76
Jul-Dec 1968	\$1302	36.03

a. Estimated from data pertaining to the last quarter of 1967.

civilian piaster purchases get converted on the black market. For the purposes of the study, it was projected that personal expenditures per American civilian employee in Vietnam would continue to average \$1300 per half-year. Thus, a reduction in civilian personnel will result in a reduction in total personal spending of \$2600 per person per year.

The military personal expenditures per capita have declined rather drastically over time due at least in part to the Piaster Expenditure Reduction Program initiated by the DoD in mid-1966. The projected average expenditure per military person used in the study is \$40.00 per six-month period or \$80.00 per year.

The second component of expenditures related to numbers of personnel is rent and services furnished by the US government or contractors. An estimate of these figures was obtained using data on piaster expenses collected by the Agency for International Development (USAID). The components of piaster expenses, the numbers of USAID people involved (including those on contract), and the average expense per person are shown in Table A7 on a semi-annual basis. The estimated semi-annual variable expenditure by the US government per civilian person is about \$4800 or about \$9600 per year.

In order to estimate the comparable expense as applied to the military, it is necessary to make some admittedly tenuous assumptions. First, we assume that the variable O&M expenses that apply to USAID personnel also apply to civilian DoD personnel and contractors and that the ratio of total to variable expenses is also the same, i.e.,

Table A7

O&M EXPENSES FOR USAID PERSONNEL
(thousand \$VN)

Half	Year	Ave. No. USAID Personnel	Residential Rents and Furnishings	Miscellaneous Contract Services	Local Employees ^a Salaries	Total	Average \$VN	Average \$
1	1967	1,772	802,255	353,143	54,084	1,209,482	682,740	5,786
2	1967	2,567	623,952	585,240	92,535	1,301,727	507,100	4,297
1	1968	2,547	326,880	692,755	132,471	1,152,106	452,338	3,834
2	1968	2,451	507,301	837,836	161,796	1,506,933	614,824	5,210
1	1969	2,467	534,234	713,568	160,553	1,408,355	570,878	4,838
5-Period Average =							4,800	

a. This figure was arbitrarily set at 70 percent of local employees basic pay in order to allow some of their pay to be counted as a fixed cost.

Table A8

O&M EXPENSES FOR PERSONS ATTACHED TO THE MILITARY
(thousand \$VN)

Half	Year	Ave. No. Civilians Attached to DOD	Estimated Variable O&M Expenditures	Estimated Civilian Total O&M Expenditures	Total DOD O&M Expenditures	Estimated O&M For Military	Ave. No. Military Personnel	Average O&M Expen. Per Troop
1	1967	8,017	\$38,481,600	\$53,874,200	\$ 65,762,700	\$11,888,000	432,584	\$25.60
2	1967	8,388	40,262,400	56,367,360	76,228,800	19,862,000	485,878	40.88
1	1968	8,999	43,195,200	60,473,300	83,322,000	22,849,000	523,721	43.63
2	1968	10,207	48,993,600	68,591,000	101,364,400	32,773,000	548,076	59.80
1	1969	10,978	52,694,400	73,772,000				

roughly 1.4. We can thus obtain an estimate of the O&M expenses that apply to the military. Table A8 shows the figures from which these are derived. The O&M expense per military person that was used in the study was \$60 per half-year or \$120 per year.

To obtain the total variable piaster expenditures per person per year, it is only necessary to add the two categories, personal expenditures, and O&M expenditures for civilians and military separately. For civilians this amounts to \$2600 plus \$9600 for a total of \$12,200 per year. For the military the figures are \$80 and \$120 dollars respectively for a total of \$200 per year. Thus reduction of civilian personnel will reduce piaster expenditures by \$12,200 per person per year while reduction of military personnel is estimated to reduce them by \$200 per year.

Equation 8 of the model is

$$U = q + tTR + vCV$$

The empirical estimates indicate

$$U = 33 + .024 TR + 1.45 CV$$

The value of q is measured in billion piasters per year while t and v are billion piasters per thousand persons per year.

A7 INCREASE IN PRICES DUE TO PIASTER EXPENDITURE REDUCTION PROGRAM

To calculate the price level effect of the Piaster Expenditure Reduction Program requires an estimate of the difference between the number of dollars actually converted into piasters and the number that would have been converted had there been no program. This difference would have accrued to the GVN to finance imports under our assumption that there would be no buildup in foreign exchange reserves. The additional imports would generate (import) revenues equal to 57 percent of the piaster value of imports thereby reducing the government deficit by that amount. Finally, the ratio of the hypothetical deficit reduction to the money supply is the percent price increase that could be attributed to the Piaster Expenditure Reduction Program. The calculations are shown in Table A9.

Table A9

PRICE INCREASES ATTRIBUTED TO PIASTER EXPENDITURE REDUCTION PROGRAM
(1967-1968 by half-year periods)

(1) Period	(2) Actual Personal Expenditures (\$ mil)	(3) Projected Personal Expenditures (\$ mil)	(4) Potential (\$ mil)	(5) Potential Increase (\$VN bil)	(6) Import Duty on Increase (\$VN bil)	(7) Money Supply (\$VN bil)	(8) Price Level Increase
2nd Half 1967	47.0	48.6	1.6	.18	.10	70.6	.14 %
1st Half 1968	24.5	52.4	27.9	3.29	1.88	82.2	2.28 %
2nd Half 1968	19.7	54.8	35.1	4.14	2.36	111.8	2.12 %

Notes:

Column:

- (3) For the first six months in 1967 per capita expenditures for military persons was \$105; it fell to \$36 in the last six months in 1968. Calculations in this column assume that without PERP average expenditure per person would have been \$100 per six month period.
- (4) $(3) - (2)$.
- (5) $118 \times (4)$
- (6) $.57 \times (5)$ since .57 was the average customs rate per piaster on GVN financed imports.
- (7) National Bank of Vietnam, demand deposits.
- (8) $(6) = \Delta MS$, hence $(8) = (6) \div (7)$.

For the first six months in 1968, the working class index advanced by 13 percent and it rose by 11 percent during the last half of the year. Evidently, the PERP was responsible for approximately one sixth of the price increase in 1968.

A8 ESTIMATION OF g AND u

g and u are the average duty rates on GVN and US financed imports respectively. Since the austerity tax reform of October 23, 1969, the average schedule rate on GVN imports is 332 piasters per dollar, of which 118 is the official exchange rate and 214 the combined duty including perequation tax, austerity tax, and customs duty.⁵ $g = 214/118 = 1.81$. The total exchange rate on P.L. 480 products is given as 143 and for CIP (without fertilizer) 258. If we use the weights of .25 and .75 for FFF and CIP imports respectively, the average rate on US financed imports is 229 piasters per dollar and $u = (229-118)/118 = .94$. It is very unlikely that the official rate will be collected in reality. We need a factor to scale these official rates down to some realistic values.

The pre-October 23 rates were: $g = .81$, $u = .31$. Official rates on GVN imports were higher in 1969 than in 1968, say by 10 percent. Let us, therefore, take the 1968 values of g and u as .74 and .31 respectively. In 1968, US financed imports were valued at 13.9 billion piasters and GVN financed imports at 22.9 billion piasters. Total tax revenues on imports at these rates would be 21.2 billion piasters. Actual collections were about 15 billion piasters. Thus, actual collections were 71 percent of theoretical collections. This figure is very close to one estimated for the period 1962-1965.⁶ Using the above information we shall assume that 70 percent of the official rate will be collected. Hence, our values for g and u are 1.27 and .66 respectively. The reader will note that these estimated rates are

5. See Table C4.

6. Douglas C. Dacy, The Fiscal System of Wartime Vietnam, Institute for Defense Analyses, Program Analysis Division, IDA Study S-337, (Arlington, Virginia: February 1969), p. 16.

consistent with our estimates for other parameters. That is, use of these values in Eq. 18a in conjunction with the other parameter values will yield price level changes which are very close to those actually observed.

Appendix B
MATHEMATICAL APPENDIX

Appendix B

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Appendix B
MATHEMATICAL APPENDIX

B1 DERIVATION OF EQUATION 18a

$$\frac{\Delta P_Y}{P_Y} = rn \frac{\Delta MS}{MS} \quad (18)$$

Let $\Delta P_Y = P_{Y(t)} - P_{Y(0)}$

Then

$$\frac{P_{Y(t)} - P_{Y(0)}}{P_{Y(0)}} = rn \frac{\Delta MS}{MS_0}$$

$$\frac{P_{Y(t)}}{P_{Y(0)}} = rn \left(\frac{\Delta MS}{MS_0} \right) + 1$$

Let $P_{Y(0)} = 1.0$, i.e., $P_{Y(0)}$ is the base year price. Then $P_{Y(t)}$ is a price index in year t

$$P_{Y(t)} = rn \left(\frac{\Delta MS}{MS_0} \right) + 1$$

$\Delta MS = D$.

Using Eqs. 4, 14, and 15 in Eq. 10a

$$D = G^* + kP_{Y(t)}G^* - kG^* - P_{Y(t)}T_d^* - gU - gX - (1+u)A - 0 \quad (10b)$$

Substitute Eq. 10 b into Eq. 17 and Eq. 17 into Eq. 18

$$P_{Y(t)} = rn \left[\frac{G^* + kP_{Y(t)}G^* - kG^* - P_{Y(t)}T_d^* - gU - g\chi - (1+u)A - 0}{MS_0} \right] + 1$$

$$P_{Y(t)} = \frac{MS_0 + rn[(1-k)G^* - g(U+\chi) - (1+u)A - 0]}{MS_0 - rn(kG^* - T_d^*)} \quad (18a)$$

B2 DERIVATION OF EQUATION 20

Using Eqs. 1 and 2

$$Y^* = C^* + I^* + U^* + G^* - M^* - \chi^*$$

$$C^* = a^* + b(Y^* - sY^*) + cCIP^* + dFFF^* \quad (6a)$$

$$Y^* = \frac{a^* + cCIP^* + dFFF^* + I^* + U^* + G^* - M^* + \chi^*}{1 - b + bs}$$

Substitute M_G^* for U^* and $M_G^* + CIP^* + FFF^*$ for M^* in the above equation and rewrite in money values

$$Y^* = \frac{P_T a^* + P_I I^* - P_M [(1-c)CIP^* + (1-d)FFF^* + M_G^*] + P_\chi \chi^* + P_Y U^* + P_G G^*}{P_Y (1 - b + bs)}$$

since $P_g = 1 + k(P_Y - 1)$

$$Y^* = \frac{P_T a^* + P_I I^* + (1-k)G^*}{P_Y (1-b+bs)} - \frac{P_M [(1-c)CIP^* + (1-d)FFF^* + M_G^*] - P_\chi \chi^*}{P_Y (1-b+bs)} + \frac{U^* + kG^*}{1-b+bs}$$

Appendix C
SUPPORTING TABLES

Appendix C

TABLES

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Appendix C
SUPPORTING TABLES

Table C1

INVESTMENT IN SOUTH VIETNAM, 1960-1968
(in 1960 piasters, bil)

Year	Gross Investment ^a	Depreciation ^b	Net Investment ^c
1960	10.3	3.8	6.5
1961	6.8	3.7	3.1
1962	8.4	4.4	4.0
1963	7.7	4.3	3.4
1964	11.0	4.1	6.9
1965	13.5	3.8	9.7
1966	19.5	5.5	14.0
1967	18.0	5.7	12.3
1968	17.5	5.7	11.8

- a. 1960-1962, Vietnam Statistical Yearbook 1967-1968, Vietnam National Institute of Statistics, Table 307; 1963-1968, National Bank of Vietnam.
- b. 1960-1965, Undeclared depreciation was calculated as a percentage of undeclared GNP (see Tables 300 and 302, Vietnam Statistical Yearbook, 1967-1968). This percentage was then applied to de-
clared GNP (same as source a above).
- c. Gross investment minus depreciation.

Table C2

GROSS NATIONAL PRODUCT AND DOMESTIC TAX RECEIPTS IN VIETNAM,
1960 - 1968
(In 1960 piasters, bil)

Year	GNP ^a	Domestic taxes ^b
1960	81.8	6.2
1961	81.2	6.7
1962	88.8	5.1
1963	90.5	5.8
1964	98.8	5.4
1965	105.1	5.8
1966	109.2	5.8
1967	113.2	6.1
1968	113.1	5.3

a. National Bank of Vietnam.

b. Domestic taxes in current prices were deflated by Saigon price index for middle class families without rent. Domestic tax data were taken from: 1960-1961 and 1968, Director General of Taxation, Vietnam; 1962-1967, Douglas Dacy, The Fiscal System of Wartime Vietnam, Institute for Defense Analyses, Study S-337 (Arlington, Virginia: February 1969).

Table C3

WHOLESALE PRICE INDEXES IN SAIGON BY BROAD GROUPS, 1965-1969
(Quarterly Averages, 1949 = 100)

Year	Quarter	General Index	Local Products	Imported Products
1965	1	236	228	254
	2	247	242	259
	3	254	251	260
	4	260	258	263
1966	1	273	272	277
	2	287	293	277
	3	361	374	334
	4	372	384	350
1967	1	411	432	352
	2	430	470	356
	3	440	481	365
	4	443	482	370
1968	1	455	485	343
	2	463	502	389
	3	468	508	394
	4	484	527	404
1969	1	500	543	418

Source: Vietnam National Institute of Statistics, Vietnam Statistical Yearbook, 1966-1967, and 1967-1968, and monthly issues for data after October 1968.

Table C4

EFFECTIVE EXCHANGE RATES, 1960^a
(piasters per dollar)

Type of Goods	Pre-Austerity Rate	Post Austerity Rate
CIP	146	226
CIP w/o fertilizer	161	258
CIP w/fertilizer at ₭100/\$	150	229
P.L. 480	133	143
P.L. 480 less rice	149	169
GVN	214	332
Total	176	262
Total, omitting Group I	195	320
Total, less rice	181	274
Total, less fertilizer	183	274
Total, less rice and fertilizer	185	284
Total, w/fertilizer at ₭100/\$	177	263

- a. Based on "GVN Austerity Tax Measure of October 23, 1969," summary tables as revised by Richmond Allen and Carl Cundiff, October 24, 1969. "Rate" means total import price including the official exchange rate of ₭118/\$, the perequation tax, customs duty, and austerity tax.