

## ABSTRACT

Macroeconomic Stabilization and Economic Growth: Analysis of Reform Policies in Tanzania<sup>1</sup>

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We develop a model for the analysis of macroeconomic management that are caused by failures in the private banking system. Our analysis is applied to Tanzania, a country that faces significant difficulties from a banking system that holds large quantities of non-performing assets.

We have constructed a dynamic general equilibrium model that is solved numerically. As initial examples, we have first simulated the model, using historical exogenous parameters, and have compared endogenous macro outputs with corresponding historical outcomes. Assuming all exogenous parameters remain constant for eight years of the simulation, the banking system begins to become insolvent by the final year.

We then impose a program that attempts to increase the productivity, and hence solvency, of the private sector by increasing government expenditures on infrastructure, which are, in turn, financed by foreign capital flows. This experiment leads to a small improvement in real income, but does nothing to enhance the solvency of the banking system. Finally, we impose an improvement in the efficiency of public utilities. This change appears to offer an avenue for improving the solvency of the banking system, the goal of our study.

JEL # C68, 023

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<sup>1</sup> This paper was written for a project on Tanzania sponsored by the World Bank. The views expressed here are our own and do not necessarily reflect the opinions of the World Bank. We would like to thank Shahid Yusuf for suggesting the project, and Zafar Ahmed for many helpful suggestions. We also thank Petia Stoytcheva for excellent research assistance.

## Macroeconomic Stabilization and Economic Growth: Analysis of Reform Policies in Tanzania

### I. Introduction

In this paper we develop a model for the analysis of macroeconomic management that is caused by failures in the private banking system, a difficulty that confronts a number of developing countries.<sup>1</sup> Our analysis will be applied to Tanzania, a country that faces significant difficulties from a banking system holding large quantities of non-performing assets.

Tanzania, after years of maintaining a highly protected economy, is now in the process economic restructuring. Former state owned enterprises are being privatized, fiscal and financial reforms are being instituted and the economy is moving towards a more liberal trade regime. The essential aim of these reforms is to make the domestic economy more efficient. We will show that such increased efficiency may well have the important additional benefit of improving the solvency of the banking system. In particular, we show that improving efficiency of state enterprises has a greater effect on bank solvency than does for example, the increased provision of foreign lending.

The paper develops a dynamic model that can generate endogenous bank failures, and allows for alternative fiscal and monetary policies. Among these policies are the provisions of discount loans from the central bank to compensate for non-performing assets, and the use of fiscal instruments to reduce interest rate pressures on debtors. We also permit alternative exchange rate regimes, and allow the type of devaluation policies that are typical of developing countries confronting financial crisis.

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<sup>1</sup> Blejer, Feldman, and Feltenstein (2000) develop a model of insolvencies generated by bank panics, and motivate this model by considering certain recent experiences in Latin America.

In the next section we provide a brief overview of the type of model we will develop, emphasizing applications to developing countries. Section III discusses some of the relevant issues in Tanzania. Section IV will develop the theoretical structure of our model. Section V describes the data sources for the parameterization of the model along with numerical policy simulations. The final section has a discussion of the simulation results and concluding remarks.

## II. Computational Models for Developing Countries and the Tanzanian Context

Computational general equilibrium models are widely used for the evaluation of government policies. Among the many different types of models that have been employed by a variety of researchers, two general types stand out. The first of these employs large scale, highly detailed static structures representing the production and consumption technologies of a particular economy. The second formulation incorporates smaller scale models with less sectoral detail and is the approach adopted here. These latter models have intertemporal structures which permit the evaluation of a wide variety of macroeconomic policies effecting growth, inflation and investment, while still being able to examine the sectoral implications of these policies. Additionally, this approach (in common with the first one), permits the study of the impact of policies on differing consumer groups.

Of the large-scale models applied to developing countries, the interested reader may see among others, Adelman and Robinson (1988), Benjamin and Devarajan (1985), Narayana, Parikh, and Srinivasan (1991), Shoven and Whalley (1984), and Taylor (1990). Dixon (1984), although not specifically applied to developing countries offers also a useful paradigm for many of these models.

The model we develop for Tanzania is of the second type with a considerable amount of sectoral detail. Its key feature will be the incorporation of financial instruments to evaluate banking issues. Feltenstein (1992) constructs a simple two period model that incorporates financial assets. The model is used to analyze the Dutch disease phenomenon in Mexico. A similar model with financial assets is used in Feltenstein and Shah (1993) to study investment tax credits in Pakistan. Here, following this strand of the literature, we develop a multi-period model with substantial financial content at the expense of exhaustive sectoral detail for Tanzania. In particular, we have a domestic banking sector that may realize unanticipated difficulties in its asset portfolio. The model allows us to endogenously evaluate outcomes of alternative government policies along with their impact on the banking sector.

### III. Issues and Application to Tanzania<sup>2</sup>

a. **Background:** For the past decade Tanzania has been implementing a reform program intended to dismantle the system of controls that pervaded the country's economy since independence. Despite considerable liberalization, the country still faces a variety of problems. There are severe problems in the budgetary management of the public sector. As a consequence, Tanzania faces persistently large trade deficits, and finances domestic investment largely from foreign capital inflows.

The other chronic problem is the failure of the banking system, financially weak and highly concentrated, to adequately evaluate the credit-worthiness of borrowers. Large portions of the assets of the banking system are currently non-performing, and there has been a resulting need for government infusion of new capital into the banks. Budgetary

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<sup>2</sup> Much of this section is derived from Tanzania: The Challenge of Reforms: Growth, Incomes and Welfare.

expenditures are skewed in favor of current, rather than capital expenditure, leading to the inadequacy of productive infrastructure. Private savings have been meager, in the face of low or negative real interest rates. Since public revenues are very limited, the ability to finance development from anything other than foreign funds has been inadequate.

b. **Banking Issues:** Tanzania has experienced significant banking sector problems since 1988. The financial system is concentrated and banks have little competition. Till the early 1990s a single bank held more than 75% of the assets of the entire system, while foreign banks were allowed in the country only in 1992. The state-owned commercial banks, accounting for over 95% of the system, are effectively insolvent. At the end of 1993, 60 to 80 percent of all bank loans were non-performing and the losses of the largest bank were equivalent to 70% of its deposits. In 1994, the government contributed to recapitalizing this bank, as well as to the reorganization of the country's second largest bank. There was a run on a small state bank in 1994, leading to its eventual failure in 1995. The Tanzanian subsidiary of Meridian BIAO also failed in 1995.

We thus see that the government of Tanzania faces major problems with insolvent banks. While a variety of remedial policies have been suggested we consider two such policies here. The first of these will be the use of foreign capital inflows to finance new investment and debt service.<sup>3</sup> The second will be the imposition of greater efficiency in the operation of state enterprises that are currently the major source of non-performing loans. We will not explain how such efficiency improvements might arise. The policy changes will be instituted after first generating a simulated bank failure. The resulting

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<sup>3</sup> We do not attempt to explain how such financing will be obtained. Rather, we assume that it will come from exogenously determined inter-governmental bank flows.

outcomes will allow us to compare the results of alternative regimes. Let us now turn to the model we will use to address these issues.

#### IV. Model Structure

In this section we will develop the analytical structure of our model much of which is designed to permit a numerical implementation. The model has  $n$  discrete time periods. All agents optimize in each period over a 2 period time horizon. That is, in period  $t$  they optimize given prices for periods  $t$  and  $t+1$  and expectations of prices for the future after period  $t$ . When period  $t+1$  arrives, agents re-optimize for period  $t+1$  and  $t+2$ , based on new information about period  $t+1$ . For example, there may have been a technology shock or certain banks may have become insolvent. We will now describe the specific structure we employ in carrying out our numerical simulations.

##### 1. Production

We consider 8 factors of production and 3 types of financial assets. In particular we allow for 5 types of capital (corresponding to the five aggregate non-agricultural productive sectors<sup>4</sup>, land, and rural and urban labor as the factors of production. The financial assets are domestic currency, bank deposits and foreign currency. Each of these factors and financial assets is replicated in each period and, accordingly, has a price in each period. Period 1 domestic currency is the numeraire.

An input-output matrix,  $A_t$ , is used to determine intermediate and final production in period  $t$ . Corresponding to each sector in the input-output matrix, sector specific value added is produced using capital and urban labor for the non-agricultural sectors, and land

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<sup>4</sup> The choice of 5 types of capital is essentially arbitrary, as we could have more or less capital types.

and rural labor in agriculture.<sup>5</sup> In our numerical examples, we use a 27 sector matrix, which, in fact, represents Uganda. We have chosen to use this matrix, from an other country, in the absence of an up to date matrix for Tanzania. Our implicit assumption is thus that the two countries have similar technologies, an assumption that is, of course, open to question. The model is calibrated later to lend credibility to this assumption. These sectors were chosen so as to correspond to available surveys of demand data, and keeping the specific purpose of the model in mind.

We allocate the different factors across the 26 sectors (imports being the last sector) on the basis of their production requirements.<sup>6</sup> These 26 sectors were further divided into six categories all of which have subsectors similar to each other. For example, category 3 contains textiles, building materials and chemicals, while the factor inputs are urban labor and type 2 capital. The five different types of capital are perfectly mobile across subsectors in a given category, but are immobile across categories. As we shall see, labor, on the other hand, may migrate from the rural to the urban sector.

The specific formulation of the firm's problem is as follows. Let  $y_{Ki}^j$ ,  $y_{Li}^j$  be the inputs of capital and urban labor to the  $j$ th non-agricultural sector in period  $i$ . Let  $Y_{Gi}$  be the outstanding stock of government infrastructure in period  $i$ . The production of value added in sector  $j$  in period  $i$  is then given by  $va_{ji} = va_{ji}(y_{Ki}^j, y_{Li}^j, Y_{Gi})$  where we assume that public infrastructure augments productivity of private production.

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<sup>5</sup> The use of neo-classical value added functions "sitting above" an input-output matrix is common. The reader may wish to see Shoven and Whalley (1984) for papers that use this approach. An application and detailed description of functional forms is given in Feltenstein (1986).

<sup>6</sup> Details of the different sectors and allocation of inputs to them is available from the authors on request.

Sector  $j$  pays income taxes on inputs of capital and labor and agriculture is taxed on its use of labor.<sup>7</sup> Hence the effective price of inputs also depends on the tax rates. Thus the prices charged by enterprises,  $P_i$ , are given by

$$P_i = va(P, Y_{Gi})(1+t)(I-A)^{-1} \quad (1)$$

where  $va(P, Y_{Gi})$  is the vector of cost-minimizing value-added per unit of output and  $t$  is the tax rate.

We suppose that each type of sectoral capital is produced via a sector-specific investment technology that uses inputs of capital and labor to produce new capital. Investment is carried out by the private sector and is entirely financed by domestic borrowing.<sup>8</sup> The investor may receive an investment tax credit (denoted by  $k_i$ ) well as a depreciation allowance (denoted by  $d_i$ ) in period  $i$ . In period  $i$  he also pays a capital, or profit tax (denoted by  $t_{K_i}$ ), on the returns to his investment. Note that these three variables are expressed in percentage terms. Also,  $r_{K_i}$  is the return to capital in period  $i$ .

Let  $C_{Hi}$  be the minimum cost of producing the quantity of capital,  $H_i$  in period  $i$ . Then future debt obligations must equal the return on new capital. Hence:

$$C_{Hi}(1-k_i-d_i) = \frac{(1-t_{K(i+1)})P_{K(i+1)}}{1+r_i} \quad (2)$$

where  $r_i$  is the interest rate in period  $i$ , given by  $r_i = 1/P_{Bi}$  and  $P_{Bi}$  is the price of a bond in period  $i$ . Accordingly, the investor takes out a loan from the banking system to cover this costs. This loan then becomes an asset of the banking system.

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<sup>7</sup> The interpretation of these taxes is thus as a profit tax and a personal income tax that is withheld at the source.

<sup>8</sup> We assume that all foreign borrowing for investment is carried out by the government, so that, implicitly, the government is borrowing for the private investor but the debt thereby incurred is publicly guaranteed.



We make one further assumption about investment and the individual firm. If investment, as a percentage of the existing sectoral capital stock, falls below some predetermined minimum percentage, then the sector is unable to pay its new debt obligations that were incurred to finance this investment. Accordingly, the bank that holds these assets now holds corresponding bad debts.<sup>9</sup> This situation might occur if the interest rate rose sufficiently so as to reduce the sector's investment. The assumption reflects the notion that each firm, or sector, has a lower bound for its operations, reflected by its level of investment, below which it cannot operate.

## 2. Banking

The banking sector in our model is simple but is meant to capture some of the key features and problems of the current system in Tanzania. We assume that there is one bank for each non-agricultural sector of the economy and it lends predominantly to the sector with which it is associated. The banks are, however, not fully specialized in the sector to which they correspond. We will make the simplifying assumption that each bank holds 50 percent of the outstanding debt of its particular sector and 12.5 percent of the debt of each of the remaining four sectors. Hence bank 3, for example, holds 50 percent of the debt of sector 3, and 12.5 percent of sectors 1, 2, 4, and 5. Similarly, it makes 50 percent of its loans to sector 3 and 12.5 percent of the loans to the other four sectors each.<sup>10</sup> We make this assumption of diversification of assets in order to avoid a possible situation in which the insolvency of a particular sector leads to the automatic insolvency of its related bank. We

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<sup>9</sup> We thus claim that a bankrupt firm does not invest, while a solvent firm does. The fall of capital formation below some predetermined rate may be used as a proxy for bankruptcy.

<sup>10</sup> Clearly these percentages are arbitrary and have been used only for illustrative purposes. We could have any initial pattern of distribution of bank assets across the different sectors.

could, of course, have a single bank that lends to the entire economy, or, indeed, any other banking structure.

We next impose a solvency requirement on the banking system. Namely, if 8 percent of a bank's assets are in default, caused by a corresponding insolvency among its borrowers, then the bank is declared insolvent and the government seizes all its assets.<sup>11</sup> The depositors in this bank find their assets frozen and the bank ceases to lend. The bank's supply of loans, and hence its assets, is determined by the demand for loans from the productive sectors of the economy. Of course its supply of loans is restricted by the existing capital. The demand for loans is, in turn, determined by the investment equations described in the previous section. The banks' deposits, and hence liabilities, are determined by the consumers' savings behavior, determined from the intertemporal optimization which we will now develop.

### 3. Consumption

There are two types of consumers, representing rural and urban labor. We suppose that the two consumer classes have demands for the different types of goods that are given by constant fractions of their incomes. These fractions, derived from Cobb-Douglas utility functions, are normally different across consumers. The consumers also differ in their initial allocations of scarce resources and financial assets.

The consumers maximize intertemporal utility functions, which have as arguments the levels of consumption and leisure in each of the two periods. As in Feltenstein (1992), we permit rural-urban migration, which depends on the relative rural and urban wage

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<sup>11</sup> This figure of 8% is simply taken to correspond to standard bank regulations. The average ratio of capital to total assets in the banking system is approximately 8%. Hence an 8% loss of assets would be tantamount to a total liquidation of capital. Of course other numbers could be used for the purpose of simulations.

rate.<sup>12</sup> The consumers maximize these utility functions subject to intertemporal budget constraints. The consumer saves by holding money, domestic bank deposits, and foreign currency. He requires money for transactions purposes, but his demand for money is sensitive to changes in the inflation rate. In addition, the consumer's demand for bank deposits is sensitive to his perception of the solvency of the banking system. In particular, as banks increasingly incur bad loans, the consumer's interest elasticity of money declines, causing him to reduce his bank deposits.<sup>13</sup>

#### 4. The Government

In our model the government collects income, profit, and value added taxes, as well as import duties. It pays for the production of public goods and subsidies. In addition, the government must cover both domestic and foreign interest obligations on public debt. The government finances its budget deficit by a combination of monetization, domestic borrowing, and foreign borrowing. We assume that foreign borrowing in period  $i$  is exogenously determined by the lender. The government then determines the face value of its bond sales in period  $i$ , and finances the remainder of the budget deficit by monetization.

#### 5. The Foreign Sector and Exchange Rate Determination

The foreign sector is represented by a simple export equation in which aggregate demand for exports is determined by domestic and foreign price indices, as well as domestic real income. The change in the dollar value of exports in period  $i$  can then be

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<sup>12</sup> This approach is motivated by the Harris and Todaro (1970) model of rural-urban migration, in which movement to the city depends upon relative urban/rural wage rates, as well as the probability of finding work in the city. Feltenstein (1992) estimates such a migration model for Mexico.

<sup>13</sup> This reflects the notion that the consumer worries about the safety of his own deposits as he sees the banks become progressively more insolvent.

written as a function of the change in the relative price ratio and change in domestic real income where each of the two components is weighted by their respective elasticities. The combination of the export equation and domestic supply responses then determines aggregate exports. Demand for imports is endogenous and is derived from the domestic consumers' maximization problems. Foreign lending has not been modeled, but has been taken to be exogenous. Thus gross capital inflows are exogenous, but the overall change in reserves is endogenous.

The government also attempts to adjust the exchange rate. The supply of foreign reserves available to the government in period  $i$  is modeled as a function of private capital flows and exogenous foreign borrowing by the home government. The government's demand for assets is assumed to be determined by an exchange rate rule. The government selects a critical level of foreign reserves in period  $i$  that is set exogenously, and in our simulations is arbitrarily taken to be the value of three months of imports. It adjusts the exchange rate if the stock of reserves differs from its chosen target. When reserves exceed the government's target, the government leaves the exchange rate as is, or appreciates it only slightly, and when reserves are below the target, it devalues the exchange rate substantially.

Finally, changes in the money supply in period  $i$ ,  $\Delta M_{Si}$ , are now given by:

$$\Delta M_{Si} = \Delta y_{Mi} + \Delta OMO_i + e_i y_{FGi} - e_{i-1} y_{FG(i-1)} \quad (3)$$

where  $\Delta y_{Mi}$  is determined by the government's financing its budget deficit, and  $\Delta OMO_i$  represents money created via open market operations. The remainder of the right hand side represents the domestic currency value of the balance of payments where  $e_i$  is the

exchange rate and  $y_{FGi}$  is the supply of foreign exchange reserves available to the government in period  $i$ , respectively.

## V. Applications to Tanzania

In order to simulate our model we have used a variety of data sources and parameter estimates. We first describe these sources and then discuss the parameter estimates. This is followed by the policy simulations.

### 1. Data Sources

**Production:** The input-output structure of intermediate and final production is derived from the Input/Output Table for Uganda, 1992. The government is assumed to have a Cobb-Douglas production function whose coefficients are those of the aggregate economy.<sup>14</sup> In the absence of direct estimation of investment functions, we have taken the functions to be the same for each type of capital.<sup>15</sup> The coefficients of these functions are taken to be those of the value added function for the construction industry.

**Taxes:** Tax rates are derived in the following ways. The effective indirect tax rate is calculated as the ratio of total indirect taxes to consumption for 1995-96. These figures are taken from International Monetary Fund's Recent Economic Developments for Tanzania (RED, 1996). Direct taxes enter the model as taxes levied upon capital and labor as inputs to production. Effective rates are calculated as the ratios of the total capital and personal income tax revenues to the corresponding incomes. As with indirect taxes, the direct tax rates are assumed equal across sectors. We derive the shares of

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<sup>14</sup> Clearly a more precise government production function should be estimated as a subject of future research.

<sup>15</sup> Even though the functions are the same, the levels of investment may differ across capital types as investment depends on the interest rate and the rate of return to capital, which may differ across capital types.

capital and labor in GDP from the Uganda input-output matrix. These shares are then applied to the Tanzania GDP to give corresponding incomes. Labor and capital taxes are then taken as the corresponding direct taxes from the RED (1996), Table 12.

**Consumption:** There are two domestic consumer categories, urban and rural, in our current model version. We take consumption weights on each of the 27 input-output goods as the expenditure shares in the input-output matrix. There is a single foreign consumer, representing the rest of the world. This consumer's demand weights are given by the export expenditure shares.

**Initial Stocks:** Finally, for our simulations, all initial allocations of factors and financial assets are taken to be stocks at the end of 1993. These are largely derived from the RED (1996). Stocks of urban and rural labor are taken by applying the shares of income going to urban and rural labor, derived from the Uganda input-output matrix, to 1993 Tanzania GDP, taken from Table 3. Money stocks are taken as M2 (Table 16), while initial holdings of interest bearing assets are taken as total government domestic debt (Table 14). Foreign assets, which are the initial dollar expenditures on Tanzanian exports by the rest of the world, are derived from Table 21, as export plus service receipts. The stock of land is taken to be the real value added to agriculture and is taken from the Uganda input-output matrix as the gross operating surplus of the agricultural sector (columns 1-4). Finally, capital stocks are determined as the gross operating surpluses of the corresponding 5 aggregate sectors in the Uganda input-output matrix.

## 2. Estimation of Behavioral Equations

This section deals with the estimation techniques and data sources used to characterize the relevant behavioral parameters for the Tanzanian economy using models

that have been known to work for other developing countries. Lack of adequate time series data constrains us to estimating simple econometric models.

**Money Demand:** The demand for money is estimated using a formulation suggested by Khan (1980). Using a (semi) log-linear model based on portfolio allocation theory that allows for adaptive expectations in inflation and partial adjustment in money demand, the demand for money of the representative consumer is given by

$$\log m_t - (1-b)\log m_{t-1}^d = \lambda a_0 + \lambda a_1[\log y_t - (1-b)\log y_{t-1}] + \lambda a_2 b \pi + (1-\lambda)[\log m_{t-1} - (1-b)\log m_{t-2}] \quad (4)$$

where  $m_t^d$  is the desired level of real money balances,  $y_t$  is the real income of the economy, and  $\pi_t$  is the rate of inflation at time t. This equation was estimated using annual data for the years 1966-1994 taken from the International Financial Statistics. Since the equation is non-linear in parameters, a search was carried out for the values of  $b$  in the range  $0 \leq b \leq 1$  with the objective of maximizing the log-likelihood function of the estimated equation. The value of  $b$  was allowed to vary in increments of 0.01, and it was found that  $b=0.85$  maximized the log-likelihood function. The estimated equation corresponding to this value of  $b$  was found to be

$$m^* = -3.617 + 0.334y^* - 0.10\pi^* + 0.921m_{t-1}^*$$

(-3.965) (4.499) (-5.915) (15.407)

$$DW=2.218 \quad \text{adj. } R^2 = 0.934$$

where the numbers in the parenthesis are the  $t$ -statistics and the starred variables represent the variables shown in equation (4). All the terms in the estimated equation are significant at the 5% level and have the correct signs. The magnitudes of the estimated

coefficients are broadly consistent with those reported for a group of developing countries in Khan (1980).

**Export Supply:** Tanzania is primarily an exporter of agricultural products with coffee being the single largest commodity. The export supply equation estimated here is based on Goldstein and Khan (1979). The supply of exports is assumed to be a log-linear function of relative prices and an index of the productive capacity of the country.

$$\log X_t^S = B_0 + B_1 \log(PX_t / P_t) + B_2 Y_t$$

where  $X^S$  is an index of the volume of exports, PX is an index of the unit value of exports, P is an index of consumer prices, and Y is the log of real GDP. Since agriculture forms the major share of GDP it is reasonable to use GDP as a proxy for the index of domestic capacity. The data for this was obtained from Country Economic Memorandum on Tanzania prepared by the World Bank and from the IFS tables. The equation was estimated for the years 1981-1994 using simple OLS where the numbers in the parenthesis are the  $t$ -statistics.

$$\log X_t^S = 0.633 - 0.008 \log(PX_t / P_t) + 0.529 Y_t$$

(0.422)            (0.041)            (2.735)

$$DW=0.944 \qquad \text{adj. } R^2 = 0.489$$

Note that the price term in this regression is not significant and the adjusted  $R^2$  does not explain a lot of the variability in the data. However, the F-test for overall significance is satisfied at the 5% level and the Durbin-Watson statistic is in the permissible range. One possible reason for the price ratio being insignificant is that the export of cash drops does not depend on relative prices but on the production in the current year. This also explains why the GDP coefficient is significant. At this stage we



are not able to estimate an import equation that exhibits any systematic pattern due to insufficient data.

### 3. A Base-Case Simulation

In order to use our model for counter-factual simulations, it is first necessary to see how well it replicates historical outcomes. Accordingly, we have incorporated the various estimated parameters described above and have then run the macroeconomic model for the years 1994 to 2001, taking 1993 as the base year. We also suppose that the Central Bank wishes to maintain a level of reserves equal to three months of the level of imports in 1993. However, the Central Bank does not maintain a pure float to achieve this goal. Rather, if the level of reserves falls below its target level, then the slope of the Central Bank's devaluation is set equal to  $-2.0$ . If the level of reserves rises above the target level, then the Bank revalues with a slope of  $-0.5$ . Clearly these numbers are also arbitrary, but they offer an example of a possible policy exercise. Table 1 reports the simulation outcomes of macroeconomic variables, with actual historical values in parenthesis.

It may be worth making a few remarks concerning the simulated and actual values. First, notice that our model generates rates of growth in real GDP that are slightly lower than historical values for the years for which comparisons have been made. Exports track actual data reasonably accurately. We under estimate imports for two reasons. First, the use of the Uganda input-output matrix reflects the lower use of imports in Uganda. Second, the semi-floating exchange rate that we use tends towards a trade balance equilibrium. Government expenditures and tax revenues are in line with historical reality. The continuous increase in government expenditures over the eight years of the

simulation is caused by the rise in the domestic interest rate, as well as the depreciation of the exchange rate. Both of these changes cause the government's debt service, both domestic and foreign, to rise. Inflation is in somewhat lower than the actual rate, as we attribute all foreign lending to deficit financing. Finally, the simulated exchange rate generates a real depreciation, rather than the real appreciation that actually was realized. We see that the real interest rate remains slightly positive, and there are no bank defaults. We thus conclude that our model, with the exception of imports, generates a reasonably accurate approximation of Tanzanian reality.

## 5. Policy Changes

Let us now turn to counterfactual policy simulations. These simulations have been chosen on account of their relevance to the Tanzanian economy and have been designed to analyze the relationship between the financial sector and the current reforms. Hence, we first provide a brief overview of the recent happenings in the Tanzanian economy and then present the results of two simulations.

**a. Background:** In 1993, Tanzania established the Parastatal Sector Reform Commission (PSRC) to coordinate and implement the privatizations of parastatals. Almost 60% of the about 400 parastatal enterprises earmarked at the beginning of the privatization process had been divested by mid-1998. Of these about 50% of the entities were divested through share or asset sales and 31% were liquidated. Although data by enterprise are not available, according to the PSRC, the financial performance of these enterprises seems to have improved following privatization (RED, 1999). This has also been accompanied by a burst of activity in the private sector. Of the 1537 new businesses

registered between September 1990 and June 2000, 47% were started by domestic investors, 21% by foreign investors and 32% as joint ventures.

In 1991, following the Nyirabu Commission's report the government of Tanzania initiated a financial sector reform program.<sup>16</sup> By June 1998, the financial sector comprised of 17 (operating) commercial banks, 9 nonbank financial institutions, 105 foreign exchange bureaus, and a number of informal intermediaries. In spite of the changes, the financial sector is still dominated by commercial banks and quite concentrated as in our model. Of the 17 commercial banks, three – the National bank of Commerce (NBC), the National Microfinance Bank (NMB) and the People's Bank of Zanzibar (PBZ) remain under government control and together control 40% of domestic credit and 55% of deposits. The six largest banks together still hold 90% of all assets. The next major steps in the reform process involve privatization of the government owned banks and public utilities. In fact, the government has made considerable progress with the preparations for the privatization of the utilities (see RED, 1999).

**b. Simulation I (*Fiscal Policy change*):** Suppose now that the government carries out a simple fiscal policy change. Namely, it increases the target for capital expenditure of the government, as a percent of GDP, by 3 percentage points. The aim of such an increase in public infrastructure (compared to the base case) will be to improve the productivity of the private sector, thereby reducing bankruptcies. At the same time, however, we will suppose that two thirds of this increase is financed by foreign capital inflows, in the form of government grants. This simulation will thus reflect the type of

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<sup>16</sup> Since Section III already provides an overview of the banking sector, here we review only the current happenings in the financial sector as a background for our simulations.

ratio of foreign to domestic financing currently being proposed by the donor countries. Table 2 gives the result of this experiment.

We observe a number of changes, as compared to Table 1. There is a small, but significant, increase in real GDP, amounting to about one percentage point in all periods. The price level rises somewhat, as the price effect of an increased budget deficit is partially mitigated by private capital's increased productivity. There are small increases in final sectoral capital stocks in two of the five sectors, and, an increase in the real interest rate caused by the budget deficit increase, tends to reduce private investment, despite the foreign capital inflows. As a result there is no improvement in the solvency of the banking system and banks 2 and 5 still fail. We thus conclude that the increase in expenditure on public infrastructure, financed by foreign capital, does nothing to relieve the pressure on the banking system.

**c. Simulation II (*Efficiency Improvement in Utilities*):** Suppose then the government tries another policy to improve the productivity of the private sector, thereby increasing their ability to repay their debts. Namely, let us suppose that there is an improvement in the efficiency of public utilities. We do not attempt to explain how such an improvement might be brought about. Rather, we will assume that Sector 13 – electricity and water, and Sector 20 – communications (of the input output matrix), require 20 percent less real value added per unit of output than in the original input output matrix.<sup>17</sup> Otherwise, all parameters remain the same as in the benchmark simulation. Thus, this simulation supposes that the same infrastructure can be provided to the private

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<sup>17</sup> These three utilities have been chosen since their privatization has very high priority on the government's reform agenda (RED, 1999).

sector as before, but the costs in terms of required inputs, are reduced. The results are given in Table 3.

We see that real GDP rises by approximately 1.3 percent by the final year, as compared to Table 2, in response to the efficiency improvement. As might be expected, the budget deficit declines in the absence of the increased infrastructure spending, combined with the increased efficiency of public infrastructure. The general increase in GDP has increased the rates of capital formation, so that final capital stocks are equal or greater to their levels of Table 2 in four of the 5 sectors. As a result, only sector 2 is now below the threshold for being able to repay its debts, and, accordingly, no bank now falls below the 8 percent capital asset ratio for insolvency.

We see that measurable improvements in the real economy can be achieved by increasing the efficiency of public utilities. Perhaps more importantly, it appears to offer an avenue for improving the solvency of the banking system, the goal of our study. We conclude that increased public spending on infrastructure, even when partially financed by foreign funds, does little for the banking system. Increased efficiency of public enterprise does have an impact on bank solvency, however.

## V. Discussion and Conclusion

We have constructed a dynamic general equilibrium model and applied it to Tanzania. The model contains a disaggregated banking sector that can incur non-performing assets. Besides being the first model that explores the interaction between the banking sector and the macro-economy for Tanzania, we believe it mirrors the current Tanzanian reality quite well. The Tanzanian government intends to privatize all parastatal enterprises and the state owned banks. Our CGE framework automatically treats all firms

and banks as private entities, thereby allowing us to analyze the implications of such a process. The findings therefore are of considerable policy significance.

Our model suggests that increased public spending on infrastructure will not improve the solvency of a concentrated banking sector even though it is decentralized and follows prudential regulations. Further, it also suggests that foreign aid is not a panacea for Tanzania. How the aid is utilized is just as important as the simple provision of aid for a sound macro-economy. Aid, tied or otherwise, that results in increased government spending on infrastructure, given the current banking sector in Tanzania, will lead to insolvencies further down the road.

Our simulations also suggest that an improvement in the efficiency of public utilities does not have negative consequences on the concentrated banking industry. This implies that, in the process of privatizing these companies, the government must ensure that the change leads to more efficient enterprises. Indeed, the evidence in Tanzania from the other privatized parastatals indicates efficiency improvements in the post privatization phase (RED, 1999). This augers well for the economy, compared to the base case simulation. Nonetheless, it seems that the privatization process needs to be implemented rapidly in order to relieve pressure on the banking sector, thereby enhancing efficiency. One final lesson seems to be that government policies need to take into account the concentrated nature of the banking industry while determining the set of feasible policies that are available to the public sector in countries like Tanzania.

Our model can be used to address a variety of issues, from budgetary policies to changes in lending behavior. It highlights the consequences of a concentrated private banking industry, suggesting that this area requires further research. This is of particular

importance for many developing countries, where the banking sector is often concentrated and does not necessarily follow prudent regulations as in our counterfactual simulations. We therefore believe that such a model will be a useful tool for policy makers.

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**Table 1. Base Case: 1994-2001**

	1994	1995	1996	1997	1998	1999	2000	2001
Nominal_GDP 1/	100.0 (100.0)	111.5 (123.1)	129.2	147.7	174.8	206.5	257.1	305.7
Real GDP 1/	100.0 (100.0)	101.1 (104.5)	106.8	105.9	112.2	111.0	117.8	115.6
Price level 1/	100.0 (100.0)	110.3 (117.7)	121.0	139.5	155.8	186.0	218.3	264.4
Government revenues 2/	14.4 (14.8)	14.3 (14.5)	14.7	14.7	14.9	14.8	15.0	14.9
Government expenditure 2/	22.5 (22.7)	23.0 (21.4)	26.4	29.0	30.0	33.7	32.0	36.0
Budget deficit 2/	8.1 (7.9)	8.7 (6.9)	11.7	14.3	15.1	18.9	17.0	21.1
Exchange rate (\$/T)	100.0 (100.0)	120.0 (112.8)	137.0	167.2	190.7	243.4	289.2	371.2
Interest rate 3/	7.4	16.5	18.9	40.9	50.8	54.9	55.2	60.2
Exports 2/	32.0 (25.4)	34.0 (30.1)	33.6	35.5	34.2	36.6	34.6	37.1
Imports 2/	38.9 (52.3)	39.0 (50.4)	40.6	40.8	41.8	41.7	42.7	42.5
Trade balance 2/	-6.9 (-26.9)	-5.0 (-20.3)	-7.0	-5.3	-7.6	-5.1	-8.1	-5.4
Net capital stock at end of period 8 4/	Rate of capital formation (I/S) in period:			Percent of bank assets in default at end of period				
	4	6	8		4	6	8	
Sector 1	100.0	15.8	12.8	10.9	Bank1	0.5	0.6	3.3
Sector 2	100.0	0.3	0.4	0.4	Bank2	4.9	6.5	14.4
Sector 3	100.0	11.2	9.5	8.5	Bank3	0.7	1.0	5.0
Sector 4	100.0	29.0	20.5	15.6	Bank4	0.9	1.2	6.1
Sector 5	100.0	6.3	5.7	5.6	Bank5	1.1	1.4	23.9

1/ These are index numbers based on period 1.

2/ As a percentage of GDP.

3/ The Tanzanian interest rates are not market determined, so there is little point in making historical comparisons.

4/ The capital stocks are normalized to their net period 2 values in this simulations

**Table 2. Spending on Infrastructure Financed by Foreign Capital \*/**

	1994	1995	1996	1997	1998	1999	2000	2001
Nominal_GDP 1/	99.9	111.4	128.1	146.2	172.9	201.9	248.8	293.9
Real GDP 1/	102.4	102.4	108.4	107.7	112.9	112.4	119.8	117.7
Price level 1/	97.6	108.8	118.2	135.5	151.4	179.6	207.7	249.7
Government revenues 2/	14.1	14.2	14.6	14.6	14.8	14.5	14.9	14.8
Government expenditure 2/	24.2	25.0	27.7	30.4	31.1	34.9	33.5	37.7
Budget deficit 2/	10.1	10.2	13.1	15.8	16.3	20.4	18.6	22.9
Exchange rate (\$/T)	91.3	110.2	124.2	152.0	173.0	217.3	255.5	326.7
Interest rate	7.4	15.1	17.8	37.8	48.4	52.2	53.2	58.7
Exports 2/	29.0	31.2	30.6	32.5	31.3	33.2	31.7	33.8
Imports 2/	38.1	38.4	40.2	40.3	41.2	41.2	42.2	42.0
Trade balance 2/	-9.1	-7.2	-9.6	-7.8	-9.9	-8.0	-10.5	-8.2
Net capital stock at end of period 8 3/	Rate of capital formation (I/S) in period:			Percent of bank assets in default at end of period				
	4	6	8		4	6	8	
Sector 1	1007	16.0	12.8	10.9	Bank1	0.5	0.6	3.2
Sector 2	100.0	0.3	0.3	0.4	Bank2	4.8	6.6	14.3
Sector 3	98.6	10.5	9.0	8.0	Bank3	0.7	1.0	5.1
Sector 4	99.5	28.9	20.0	15.6	Bank4	0.9	1.2	6.0
Sector 5	99.2	6.1	5.8	5.3	Bank5	1.0	1.4	23.5

\*/ We assume that public expenditure on infrastructure (capital) increases by 3 percentage points of GDP. Of this increase, two thirds is financed by increased foreign grants to the Central Government. The remainder continues to be financed from domestic resources.

1/ These are index numbers based on period 1.\

2/ As a percentage of GDP.

3/ The capital stocks are based upon the end of final period stocks in Table 1.

**Table 3. Improved Efficiency of Public Utilities \*/**

	1994	1995	1996	1997	1998	1999	2000	2001
Nominal_GDP 1/	100.0	111.1	127.4	145.4	172.9	202.5	252.0	299.4
Real GDP 1/	102.4	102.4	107.2	106.4	112.9	11.1	121.3	119.2
Price level 1/	99.3	108.8	118.8	136.6	153.2	182.3	207.7	251.1
Government revenues 2/	14.1	14.2	14.7	14.6	14.9	14.8	15.0	14.9
Government expenditure 2/	24.2	25.0	26.2	28.8	29.7	33.3	32.1	36.1
Budget deficit 2/	10.1	10.2	11.5	14.2	14.8	18.5	17.1	21.2
Exchange rate (\$/T)	91.3	110.2	135.3	165.4	189.9	239.3	285.4	365.8
Interest rate	7.4	15.1	18.3	39.8	50.0	54.7	55.6	60.7
Exports 2/	29.0	31.2	33.6	35.6	34.4	36.5	35.0	37.2
Imports 2/	38.1	38.4	40.7	40.8	41.9	41.9	42.8	42.7
Trade balance 2/	-9.1	-7.2	-7.1	-5.2	-7.5	-5.4	-7.8	-5.5
Net capital stock at end of period 8 3/	Rate of capital formation (I/S) in period:			Percent of bank assets in default at end of period				
	4	6	8		4	6	8	
Sector 1	100.2	16.0	12.7	10.9	Bank1	0.5	0.6	0.7
Sector 2	100.0	0.3	0.4	0.4	Bank2	5.0	6.8	7.8
Sector 3	98.3	10.7	9.1	8.1	Bank3	0.8	1.0	1.2
Sector 4	100.5	29.8	20.1	15.6	Bank4	0.9	1.2	1.4
Sector 5	100.5	6.4	5.9	5.7	Bank5	1.1	1.4	1.7

\*/ We assume that public utilities, namely, sector 13, electricity and water, and sector 20, communications, require 20 percent less real value added per unit of output than before. This reduction thus reflects an improvement in the efficiency of these utilities.

1/ These are index numbers based on period 1.

2/ As a percentage of GDP.

3/ The capital stocks are based upon the end of final period stocks in Table 1.