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MACROECONOMIC IMPLICATIONS OF DEMOGRAPHIC CHANGES IN KENYA

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Abstract

This research study attempts to quantify probable macroeconomic effects of demographic changes in Kenya given the available evidence that Kenya is going through a demographic transition. First, the study establishes linkages between demographic variables and sectoral government expenditures through the OLS estimation method. Next, the estimated equations are used to project three expenditure profiles based on three population scenarios generated from different assumptions on changes in fertility. Finally, the projected expenditures are used in a macroeconomic model of the Kenyan economy to simulate their effects on five key macroeconomic variables: inflation, rate of growth of output, balance of payments, budget deficit and rate of growth of investment.

The results suggest that demographic changes in Kenya can produce significant effects on the economy. The results also suggest that other factors such as real per capita income, relative price of public to private goods, and external debt obligations influence growth of some government expenditure categories. The results of the study have some important implications for policy: (1) active pursuit of a population policy by government can contribute significantly to a stable macroeconomic environment; (2) cost-sharing measures in education should apply more to higher education since the results of the study suggest a higher demand (public preference) for primary education; (3) pursuit of prudent macroeconomic policy has significant payoffs, as it avoids further external indebtedness and further constraints on government provision of essential social services, such as health services; (4) the rate of urbanization in Kenya affects many categories of government expenditure, and therefore government policy of directing investment to rural areas is likely to have significant payoffs in terms of easing the rate of urbanization and reducing pressure on government expenditure.

I. Introduction

Recent demographic surveys, such as the Kenya Demographic and Health Survey (KDHS) of 1989 (NCPD, 1989) and KDHS of 1993 (NCPD, 1993), report significant drops in total fertility rates, confirming that Kenya is going through a demographic transition. The 1993 KDHS reported a total fertility rate of 5.4%; earlier surveys, such as Kenya Fertility Survey (KFS), (CBS, 1978) and the Kenya Contraceptive Prevalence Survey (KCPS) (CBS, 1984), had reported the fertility rate to be 8.2% and 7.7%, respectively.

This research study attempts to quantify the probable macroeconomic effects of demographic changes in Kenya. The study first attempts to establish a link between demographic variables and various categories of government expenditures. This is done by estimating expenditure equations that include demographic variables on the right–hand side. The equations are then used to project three expenditure profiles, based, in turn, on three population scenarios–a base case, an optimistic case and a pessimistic case. Finally, the projected expenditures under the various population scenarios are fitted to an existing macro model of the Kenyan economy to determine their effect on macro variables such the fiscal deficit, rate of inflation, private investment, balance of payments and GDP growth. The population variables used in this research study are from a rural-urban demographic model for Kenya (Short, 1992). The model is based on the 1989 population census and incorporates recent demographic survey data. It extrapolates population estimates for the intercensal years by age groups and projects population up to the year 2020.

In carrying out this study two key assumptions are made. First, in the model's simulation, population variables are assumed to be exogenous; that is, population changes cause economic changes rather than the other way round. While this assumption may appear unrealistic many economic models analysing the effects of population changes have used it (see Birdsall, 1989; Allen, 1988). Further, there is evidence that unlike in the developed countries, where, historically, changes in fertility were brought about by economic growth, in developing countries, demographic changes such as reduction in fertility are caused in large part by technology, e.g., adoption of modern birth control techniques and by active government population policy. Second, it is assumed that supply of government services is elastic, in which case it then becomes possible to project different expenditure profiles and simulate their macro effects on the assumption that government will provide the required services or output.

Past studies have analysed the effects of changes in demographic factors in Kenya and their impact on public expenditure outlays. Among them are Ofosu (1991), Kirori (1992) and Benarroch (1986). These studies did not use regression analysis, however,

but instead relied on cost models where population variables were made to vary while other variables, such as health coverage ratios, school enrolment ratios, and unit costs, either varied or remained constant. An economic-demographic simulation model for Kenya had earlier been developed–Bachue Kenya (Anker and Knowles, 1983)–but was modeled mostly to track the effects of population changes on employment and income distribution. This study thus attempts to improve on the findings of earlier studies as well as to quantify much broader effects of demographic changes through use of a macro model.

Several theories explain growth of government expenditures. Lindauer and Valenchik (1992) and Heller and Diamond (1990) provide a summary of them. Among the theories explaining growth of government expenditure is that of Wagner (1890); referred to as Wagner's Law, which explains growth of government expenditure from the demand side. As income rises, the demand for government goods and services is hypothesized to rise by a greater proportion, due to the needs of increased urbanization and industrialization. Ram (1987) tested Wagner's hypothesis for developing countries, but did not find empirical evidence to support the hypothesis. Longe (1984) tested the hypothesis using data on Nigeria and found the income variable significant and its coefficient above unit value. His results have been contested, however, on the grounds that all of the equations reported exhibited serial correlation, implying omission of important variables and/or model mis-pecification (Garba, 1994). Another important explanation of growth of government expenditure is the public choice school (Mueller, 1987), which attributes growth of government expenditure to interests of public officials who, like private agents, are viewed as pursuing their own self-interest when setting economic policies. Differences in tastes, ideology and preferences of societies have also been used to explain growth of government expenditure. Another view attributes growth of government expenditures to the influence of earlier development theories, which emphasized issues such as provision of basic needs, the need to correct for market failures, etc; all of these are said to encourage greater role of government and result in expansion of public expenditures.

Supply side explanations, such as Baumol's (1967), attribute growth of government expenditures to a lag in productivity characterizing government production. It is argued that productivity growth in service sectors is slower than in non-service sectors; since government production is service intensive, the sector would thus experience increasing cost. Increases in unit cost of government relative to private production have also been attributed to the softer budget constraints characterizing public production (Lindauer and Valenchik, 1992). "Say's Law", which contends that public expenditures are driven by availability of resources, has also been used to explain growth in government expenditures. Peacock and Wiseman's (1961) hypothesis is similar to Say's; they claim that public expenditures are driven by availability of revenue. The "Please, effect" (Please 1967) mentioned in literature on developing countries offers a similar explanation for growth of government expenditures in less developed countries.

Demographic factors have been used to explain growth of government expenditures. Goffman and Mahar (1971) found the age structure of the population to be an important factor explaining growth of public expenditures in some developing countries. Tait and Heller (1982) and Heller and Diamond (1990) analysed growth of different categories of

government expenditures and found demographic variables to be significant in explaining growth in some categories of government expenditures. The Heller and Diamond (1990) study, based on pooled data for developing countries, found the proportion of the population over 65 years to be significant in explaining growth in the share of social security expenditures in GDP, and the proportion of population aged 14 and under to be significant in explaining growth of the share of education expenditures. Their study also found a negative relationship between share of population in urban areas and growth in government expenditure, which they explain by decrease in costs due to economies of scale; the argument is that it is cheaper to provide services to a concentrated population than to a dispersed and less accessible one. Other important explanatory variables used in the Heller and Diamond study were the per capita income variable and the outstanding debt as a percentage of GDP variable. The per capita income variable of countries with an income greater than US$400 was found to be significant in explaining growth of the share of general public services expenditure in GDP. The outstanding foreign debt as a percentage of GDP variable came out with a negative sign, indicating a supply constraint on growth of government expenditure due to competing debt obligations.

Other studies have assessed the relationship between government expenditure and economic growth. Thus Saunders and Klau (1985) found a negative relationship between higher levels of government spending and economic growth for the OECD countries. Gould's (1983) study of industrial countries found a positive correlation between the level of public expenditures and economic growth. Using data for less developed countries, Landau (1986) found a negative relationship between government expenditure and economic growth. Barro (1989) found a negative relationship between government consumption and average annual growth of GDP, although his study excluded government expenditure on education and defense in the measurement of government consumption. According to Dervis and Petri (1987), between 1966 and 1984 the fastest growing developing countries were the ones with the lowest shares of government spending in GDP. Ram (1986) used cross-section data for 1960–1970 to detect a positive relationship between government size and economic growth. Apart from these studies that directly relate government expenditure and economic growth, some research studies have indirectly explored the relationship, for example by relating population growth to GDP growth. Coale and Hoover (1958) found a negative relationship between population growth and economic development. Tung (1984), using an econometric demographic model for Taiwan, noted that a reduction in population increased per capita income. Kidane (1987) suggested a negative relationship between per capita saving and the proportion of young dependents in the population. Then, using an economic demographic model for Ethiopia, Kidane (1991) found that a lower fertility rate increased per capita GDP.

The rest of this paper is organized as follows: Section II analyses trends in government expenditure and the likely impact of demographic variables on various expenditure categories. Section III describes the study's methodology and specification of the expenditure equations. Section IV discusses the equation results and Section V presents summary statistics and projection parameters for the three population scenarios. Section VI outlines the main features of the macro model used for simulation. Section VII concludes by discussing the simulation results and their policy implications.

II. Analysis of government expenditure

Table 1 disaggregates government expenditure into seven categories. The first six–economic services (ES), education (ED), administration (ADM), housing and social services (HSS), health (HLTH), and defense (DEF)–sum up to total government discretionary spending. The expenditure category labeled OTDBT is made up of other expenditures plus debt. A large part of OTDBT consists of debt payments (interest and amortization for domestic and foreign debt); the rest consists of pensions, salaries for certain constitutional offices and subscriptions to international organizations. This component of expenditure (OTDBT) also makes up consolidated fund services payments (CFS). Unlike other expenditure categories, which are budgeted for ministries to spend, CFS payments are effected from the treasury.

Table 1: Government expenditure (1972–1994) K£ million

Year	ES	ED	ADM	HSS	HLTH	DEF	OTDBT	TEXP
1972	64.3	37.0	30.8	9.8	12.5	10.6	26.0	191.0
1973	77.1	43.3	32.5	10.2	13.6	13.1	26.1	215.8
1974	94.1	54.1	36.1	12.0	17.6	16.6	35.3	265.8
1975	115.1	67.1	58.5	13.9	22.5	19.8	40.3	337.3
1976	126.9	76.5	67.9	14.5	26.9	31.8	47.4	391.4
1977	160.3	87.7	77.6	17.6	33.2	61.2	62.6	500.1
1978	212.3	101.8	95.7	21.5	40.0	92.5	80.1	644.0
1979	225.8	123.1	113.1	25.0	48.8	108.8	94.9	739.5
1980	256.9	156.7	145.4	32.3	59.9	117.1	124.7	876.7
1981	302.7	187.0	166.5	38.1	68.2	126.8	174.2	1047.2
1982	291.3	202.1	154.5	41.5	70.4	134.5	262.3	1156.5
1983	293.8	213.3	150.6	42.7	73.0	138.9	312.1	1222.7
1984	359.3	239.9	187.0	50.6	79.5	126.1	353.7	1394.7
1985	389.0	294.8	209.7	61.5	87.7	128.1	432.8	1595.2
1986	427.9	363.1	263.1	80.5	101.5	155.4	489.0	1872.1
1987	454.2	426.6	313.2	95.7	114.1	205.6	548.7	2158.0
1988	516.2	494.9	351.2	94.1	128.5	222.7	789.6	2597.1
1989	659.1	549.0	447.1	87.9	141.7	235.2	995.0	3114.9
1990	732.9	625.9	529.6	90.2	158.6	282.4	1265.1	3684.8
1991	701.7	704.6	573.4	95.6	181.5	263.9	1755.0	4275.6
1992	747.0	788.6	662.2	98.4	211.2	251.4	2547.4	5305.9
1993	922.9	956.9	831.2	106.4	278.6	268.2	4199.1	7563.1
1994	1309.5	1297.4	1299.0	151.3	402.3	317.2	4439.4	9215.9

Source: Economic Survey, Republic of Kenya.

Table 2 shows the shares of the Table 1 expenditure figures in total government spending. As can be noted from Table 2, with the exception of CFS payments, the shares of the rest of the expenditure categories declined over the period 1972 to 1994. The most striking change occurred for the share of the CFS category (OTDBT), whose share in total expenditure rose from 14.2% in 1980 to 55.5% in 1993, before declining slightly to 48.2% in 1994. Another significant change indicated in Table 2 is the decline in the share of government expenditure on economic services; this fell from 33.6% in 1972 to 12.2% in 1993, and then increased slightly to 14.2% in 1994. As indicated by the table, the most rapid increase in CFS expenditures occurred during two periods, 1981–1983 and 1991–1993. Over the 1981–1983 period, the increase in CFS payments was mostly due to increase in external debt service charges as a consequence of the huge increase in external borrowing that had taken place in the previous two years. External debt increased from US$619.8 million in 1978 to US$1.3 billion in 1979. The increase in CFS payments between 1991 and 1993 was partly due to rapid depreciation of the Kenya shilling and increases in the cost of financing short-term domestic debt, following heavy domestic borrowing by the government after suspension of donor assistance to Kenya. A study of government spending in Africa for the 1980s (Gallagher, 1994) found similar crowding out of other types of spending by debt payments in total government expenditure.

Table 2: Expenditure shares

Year	ES	ED	ADM	HSS	HLTH	DEF	ODTBT
1972	33.6	19.4	16.1	5.1	6.5	5.6	13.6
1973	35.7	20.0	15.0	4.7	6.3	6.1	12.1
1974	35.4	20.3	13.6	4.5	6.6	6.3	13.3
1975	34.1	19.9	17.4	4.1	6.7	5.9	12.0
1976	32.4	19.6	17.3	3.7	6.9	8.1	12.1
1977	32.1	17.5	15.5	3.5	6.6	12.2	12.5
1978	33.0	15.8	14.9	3.3	6.2	14.4	12.4
1979	30.5	16.6	15.3	3.4	6.6	14.7	12.8
1980	29.3	17.9	16.6	3.7	6.8	13.4	14.2
1981	28.9	17.9	15.9	3.6	6.5	12.1	16.6
1982	25.2	17.5	13.4	3.6	6.1	11.6	22.7
1983	24.0	17.4	12.3	3.5	6.0	11.4	25.5
1984	25.8	17.2	13.4	3.6	5.7	9.0	25.4
1985	24.4	18.5	13.1	3.9	5.5	8.0	27.1
1986	22.9	19.4	14.1	4.3	5.4	8.3	26.1
1987	21.0	19.8	14.5	4.4	5.3	9.5	25.4
1988	19.9	19.1	13.5	3.6	4.9	8.6	30.4
1989	21.2	17.6	14.4	2.8	4.5	7.5	31.9
1990	19.9	17.0	14.4	2.4	4.3	7.7	34.3
1991	16.4	16.5	13.4	2.2	4.2	6.2	41.0
1992	14.1	14.8	12.5	1.9	4.0	4.7	48.0
1993	12.2	12.7	11.0	1.4	3.5	3.5	55.5
1994	14.2	14.1	14.1	1.6	4.4	3.4	48.2

Source: Derived from Table 1.

Owing to the high increase in the share of CFS payments in total expenditure, it was felt that an analysis of expenditure trends that excludes CFS payments, i.e., an analysis of expenditure shares in total government discretionary spending, may be a better way of analysing changes in the expenditure shares over time. Table 3 reports the percentage shares of the various expenditure categories in government discretionary spending. As indicated by the table, the share of government expenditure on economic services in discretionary spending fell from 39% in 1972 to 27.4% in 1994. Over the same period, however, the shares of education expenditure in discretionary spending rose from 22.5% to 27.2%; the share of administration expenditure rose from 18.6% to 27.2%; the share of health expenditures increased from 7.6% to 8.4%; and the share of housing and social services declined from 5.9% to 3.2%. Between 1972 and 1994, the share of defense expenditure in government discretionary spending increased from 6.4% in 1972 to 16.9% in 1979 and fell thereafter to 6.6% in 1994.

Appendix A of this paper consists of tables that further disaggregate the first five expenditure categories of Table 1, in terms of recurrent and development components and, in cases where data are available, in terms of expenditure sub-components. Recurrent expenditures shown in Appendix A are primarily made up of salaries for ministry personnel and other current expenses. However, due to the budgeting system used in Kenya, some minor capital expenditures such as purchase of equipment are also included in the recurrent budget. Development expenditures are mostly capital formation expenditures; part of development expenditure also includes a current component since all donor funding for projects is included in the development budget.

Table 3 indicates that within government discretionary spending the combined share of expenditure on basic social services (education, health, housing and social services) plus expenditure on administration–expenditure categories that are most likely to be influenced by population growth and related demographic changes, such as the rate of urbanization–has been increasing over time, rising from 54.6% in 1972, for example, to 66% in 1994. While such categories of government expenditure are influenced by population variables, the manner and extent of the influence differ. For example, population variables are likely to exert a weaker and less direct influence on government expenditure on economic services compared with other expenditure categories.

As indicated in Table 3, the share of expenditure on economic services within government discretionary spending experienced a long-term decline. This largely reflects the crowding out of the expenditure category by expenditures that are more directly influenced by population changes, such as expenditure on education. As shown in Appendix A, a large part of expenditure on economic services consists of development expenditure. It is thus to be expected that factors other than population variables, such as availability of donor financing, developments emanating from the balance of payments, etc., would play more important roles in determining growth of the expenditure category. It is important to note, however, that despite the decline in the share of expenditure on economic services, some components of the expenditure category–such as those on basic utilities like water supply and electrification of new urban centres–are likely to be influenced by changes in the share of rural to urban population.

Table 3: Shares in discretionary spending

Year	ES	ED	ADM	HSS	HLTH	DEF
1972	39.0	22.5	18.6	5.9	7.6	6.4
1973	40.6	22.8	17.1	5.4	7.2	6.9
1974	40.8	23.5	15.7	5.2	7.6	7.2
1975	38.8	22.6	19.7	4.7	7.6	6.7
1976	36.8	22.2	19.7	4.2	7.8	9.2
1977	36.6	20.0	17.7	4.0	7.6	14.0
1978	37.7	18.1	17.0	3.8	7.1	16.4
1979	35.0	19.1	17.6	3.9	7.6	16.9
1980	33.4	20.4	18.9	4.2	7.8	15.2
1981	34.0	21.0	18.7	4.3	7.7	14.3
1982	32.6	22.6	17.3	4.6	7.9	15.0
1983	32.2	23.4	16.5	4.7	8.0	15.2
1984	34.5	23.0	17.9	4.9	7.6	12.1
1985	33.2	25.2	17.9	5.3	7.5	10.9
1986	30.7	26.1	18.9	5.8	7.3	11.2
1987	28.2	26.5	19.5	5.9	7.1	12.8
1988	28.6	27.4	19.4	5.2	7.1	12.3
1989	31.1	25.9	21.1	4.1	6.7	11.1
1990	30.3	25.9	21.9	3.7	6.6	11.7
1991	27.8	28.0	22.7	3.8	7.2	10.5
1992	27.1	28.6	24.0	3.6	7.6	9.1
1993	27.4	28.4	24.7	3.2	8.3	8.0
1994	27.4	27.2	27.2	3.2	8.4	6.6

Source: Derived from Table 1.

Demographic factors, on the other hand, are likely to exert a much stonger and more direct influence on the rate of growth of expenditure categories such as government expenditure on administration. Other things given, government expenditure on administration would increase at a higher rate as a result of a faster rate of urbanization as new administrative centres are established. As indicated in Table 3, within government discretionary spending, expenditures on administration recorded the fastest growth. The recent population census (Vol III, 1989) shows a sharp increase in the number of urban centres. Between 1969 and 1989, the number of urban centres with populations of 100,000 and above rose from 2 to 6, those with populations of between 20,000 and 99,999 increased from 2 to 21, and those with populations of between 2,000 and 19,999 increased from 90 to 241.

As in the case of government expenditure on administration, demographic variables are expected to exert a strong influence on government expenditure on housing and social services. As shown in Table A6 of Appendix A, expenditure on housing and social services consists of two main components–expenditure on housing and community welfare and expenditure on social welfare. The first component consists mostly of expenditure on construction and maintenance of housing for government employees and is thus

unlikely to be influenced by demographic variables. The latter expenditure component, however, consists of expenditures on activities such as adult literacy programmes, family life training programmes for women, vocational rehabilitation programmes, and other community programmes related to social welfare and recreation. All these are expected to be strongly influenced by demographic variables. Despite the decline in the overall share of expenditure on housing and social services in government discretionary spending indicated by Table 3, the sharp increase in the relative share of social welfare expenditures within the expenditure category, as shown in Table 6A of Appendix A, suggests a strong influence of population factors on the social welfare component of government expenditure on housing and social services.

The influence of demographic variables on government expenditure is also expected to differ in the case of other important expenditure categories. For example, changes in the age structure of the population, such as in the proportion of the population of school age would strongly influence growth of government expenditure on education. Table 3 shows an increase in the share of this expenditure category in government discretionary spending over time. A report on government expenditures in Kenya (World Bank, 1994) indicates that primary education receives the largest share of the education budget. The report also indicates that, on average, the government finances about 69% of the total direct cost of primary education per child, mostly in the form of teacher's salaries.

Demographic variables also affect other social expenditures such as government expenditure on health. This may not be evident from the data reported in Table 3, which shows only a modest increase in the share of health expenditure in government discretionary spending–from 7.6% in 1972 to 8.4 % in 1994. The modest increase in the face of high population growth of the past decades–suggests that over time, while government continued to expand its health facilities and coverage, the quality of the health services it provides has been declining (implied by the decline in per capita health spending). It is likely that population growth and changes in the age structure of the population would continue to exert pressure on growth of this expenditure category, especially when it is considered that a large proportion of Kenya's low income population relies on government health institutions.

III. Equation specification

The specification shown below is used to estimate equations for five expenditure categories: administration (CEXADM), health (CEXHLT), education (CEXED), housing and social services (CEXHSS), and economic services (CEXECON). The equations serve as a basis for projecting government expenditure. Projected expenditures are in turn fed into a macroeconomic model of the Kenyan economy for simulation purposes. CFS expenditures are projected internally by the macro model. Defense expenditures are assumed to be a constant share (4%) of total expenditure throughout the projection period.

The general specification of the expenditure equations is:

$$Exp = f(Pop, Pcy, Rltp, Rtubr, Dbt)$$

where

Exp	= expenditure category
Pop	= population variables
Pcy	= per capita income
Rltp	= relative price of public to private goods
Rtubr	= ratio of urban to rural population
Dbt	= debt service as a proportion of GDP

In estimating the equations using this general specification, a lagged dependent variable is also introduced on the right-hand side to test for serial dependence in public spending. The equations are also estimated using a time trend variable as an additional explanatory variable.

The equations are estimated in log-linear form using the ordinary least squares (OLS) method. Annual data (in constant 1982 prices) are used to estimate all the equations. The sampling period used for most of the equations is 1972 to 1994. The sources of data for most of the variables used are publications of the Central Bureau of Statistics (CBS, Republic of Kenya). The Rltp variable uses the deflator for public sector GDP as a proxy for the price of public goods and the consumer price index as a proxy for the price of private goods. The public sector deflator is used to deflate nominal expenditure categories and the CPI to deflate nominal per capita income.

Except for the debt variable, the signs of all right-hand side variables are expected to be positive. An increase in population or in the population of a specified age bracket implies increased demand for government services and results in an increase in expenditure. The per capita variable increases expenditure from the demand side; its coefficient in the equation measures the income elasticity of the particular public good or service. The relative price variable captures the effect of an increase in the cost of providing the goods and services making up the expenditure category. The ratio of urban to rural population variable increases government expenditure from the demand side. Finally, the sign of the Dbt variable is expected to be negative, as the variable is expected to act as a constraint on real growth of expenditure categories.

Section II discussed the manner in which the demographic variables (both population and the ratio of urban to rural population) affect the various government expenditure categories. In modeling government spending by sector, the effect of other explanatory variables is also expected to vary across expenditure categories. For example, the influence of the per capita variable (Pcy) is expected to be relatively weak in categories such as government expenditure on education and relatively strong in the case of categories such as expenditure on housing and social services, economic services, and administration. It is expected that the effect of the Pcy variable on government expenditure on education would be weak because in many developing countries, such as Kenya, the provision of such services is policy determined, and largely "free and universal" and thus to an extent independent of income. The demand for such services, instead of being income driven, would therefore be largely determined by changes in the demographic set-up. The Pcy variable is expected to exert a stronger influence in the latter three expenditure categories (i.e., housing and social services, economic services, and administration) mostly because as per capita income rises, the demand for services such as rural electrification, access roads and utilities such as piped water, etc., is expected to rise, contributing to growth of government expenditure on economic services. Similarly, as income rises, the demand for government provision of social services such as family life training programmes for women and other community programmes related to social welfare and recreation is expected to rise, contributing to growth of government expenditure on housing and social welfare. Finally, as income rises and society becomes more urban and relatively more complex, administrative expenditures and expenditures on security and on public order and safety would experience upward pressure.

It is expected that government sectoral spending would be driven by changes in the volume as well as the cost of producing government services. The relative price variable (Rltp) is expected to capture the cost of provision of public goods and services relative to market provision of such goods and services. As in the case of other explanatory variables, the influence of the Rltp term is expected to vary across expenditure categories. For example, it is expected that government would have a lower cost advantage in the provision of economic services compared with the provision of education services. Appendix A shows, for example, that personnel costs (which the government has control over) make up a larger proportion of education compared with expenditure on economic services.

Finally, the Dbt variable is introduced to test the hypothesis that external debt service obligations constrain public spending. The influence of the variable is expected to vary across the various expenditure categories. It is expected that the variable would strongly constrain growth of administrative expenditures rather than expenditures on economic services, in part reflecting societal preferences but mostly because a larger proportion of government expenditures on economic services is met by the external donors.

IV. Equation results

Tables 4 to 8 present the equation results of the five expenditure categories.

Table 4 shows the results for government expenditure on administration. In general, estimation of this equation using both a lagged dependent variable and a time trend variable tends to worsen the equation results in that many of the other explanatory variables lose significance. Equation 5 of the table presents the results when only the Rtubr variable is included with the lagged explanatory and time trend variable. As shown in the table, the results improve when the equations are estimated without the lagged dependent and time trend variables. The results suggest that government expenditure on administration is strongly influenced by changes in the ratio of urban to rural population; the estimated elasticities suggest that, other things remaining constant, a one percentage increase in the ratio results in about a three percentage real growth in government expenditure on administration. The other variables that appear to influence growth of administration expenditures are the Rltp and Dbt variables.

Equation 2 of the table produced the most reasonable projections of government expenditure on administration. The dummy variable for 1980/81 used in the equation captures the effect of introduction of the district focus policy, which resulted in unusual increase in administrative expenditures. The equation explains government expenditure on administration as a function of population growth, changes in real per capita income and changes in external debt. The elasticities suggest that a 1% increase in population results in a 2.7% growth in real government expenditure on administration, other things remaining constant. The results further suggest that increases in external debt constrain real growth of government expenditure on administration. Finally, the equation suggests that increases in real per capita income influence growth of government expenditure on administration, though by a lesser proportion (the estimated coefficient of Cpcy variable turned out to be less than 1).

Table 5 presents the results of government expenditure on economic services. In general, estimation of the equations using both a lagged dependent variable and time trend variable worsens the equation results. Equation 6 of the table reports the results when only the Rtubr variable is included with the lagged dependent and time trend variable. As indicated by the table, the results improve when the lagged and time trend variables are dropped from the equation specification. The results suggest that government expenditure on economic services is influenced by changes in the ratio of urban to rural population (Rtubr), in real per capita income (Cpcy) and in the relative price of public to private goods (Rltp). The Dbt variable did not turn out to be a significant explanatory variable, suggesting that competing demands of debt service do not constrain growth of government expenditure on economic services.

Table 4: Expenditure on administration (CEXADM) equations

	LnCEX A DM_1	LnCEX A DM_2	LnCEX A DM_3	LnCEX A DM_4	LnCEX A DM_5
Constant Term	3.573 (1.222)	-6.304 (-3.537)	4.923 (2.240)	6.710 (2.940)	5.043 (2.142)
LnCEXADM(-1)	-	-	-	0.185 (0.586)	0.442 (2.116)
LnPOP	0.663 (1.273)	2.736 (10.001)	0.452 (1.036)	-	-
LnRTUBR	3.181 (4.168)	-	3.592 (6.615)	3.060 (2.290)	1.289 (1.54)
LnCPCY	0.256 (0.780)	0.748 (3.278)	-	-0.130 (-0.350)	-
LnRLTP	0.837 (1.840)	-	(3.941)	(1.221)	-
LnDBT	-0.107 (-2.162)	-1.695 (-3.003)	-0.103 (-1.919)	-0.063 (-1.188)	-
TIME	-	-	-	-	-
D80/81	-	0.239 (3.528)	-	-	-
R^2	0.975	0.964	0.973	0.962	0.955
F-Stat	127.30	114.18	150.15	79.93	129.43
DW	2.071	1.739	1.983	1.680	1.491

This may be explained by the fact that a significant proportion of expenditure on economic services is met by donors and may not immediately place pressure on foreign exchange reserves.

The Rltp initially came out with a negative sign (Equation 1 of Table 5) and not significant. Since the government GDP deflator used as proxy for the price of public goods is largely influenced by price changes (such as changes in public sector wages), it was felt that it might be an inappropriate price to use, as capital formation expenditures account for the larger part of this expenditure category. A new proxy for the price of public goods was used in re-estimating the equations. Two price indexes were combined to obtain this price, the unit value of developing countries imports in terms of Kenya

shillings (0.6 weight) and the deflator for government GDP (0.4 weight). As indicated in Table 5, the re-defined relative price variable (equations 2-5) turned out significant and with the expected positive sign and significantly improved the equations' fit. Equation 4 produced the best projections considering past growth trends of the dependent variable. The results suggest that government expenditure on economic services is influenced by changes in population, in real per capita income and in the relative price of public to private goods. The dummy variable for 1978 captures the unusual growth of expenditure on economic services following a surge in government spending over the coffee boom period. The dummy variable for the year 1987/88 captures the effect of a slump in government investment after the coffee boom.

Table 5: Expenditure on economic services (CEXECON) equations

	LnCEXEC ON$_1$	LnCEXEC ON$_2$	LnCEXEC ON$_3$	LnCEXEC ON$_4$	LnCEXE ON$_5$	LnCEXE ON$_6$
Constant Term	4.152 (4.969)	1.253 (0.963)	1.087 (0.716)	-8.322 (-3.034)	1.969 (1.307	3.253 (1.826)
LnCEXECON(-1)	-	-	-	-	0.542 (2.855)	0.605 (4.380)
LnPOP	-	-	-	1.648 (7.256)	0.171 (0.587)	-
LnRTUBR	1.357 (3.115)	2.215 (11.44)	2.193 (9.993)	-		0.539 (0.841)
LnCPCY	1.286 (4.914)	0.922 (5.023)	0.917 (4.841)	0.875 (4.946)	0.303 (0.723)	-
LnRLTP	-0.622 (-1.49)	0.732 (2.235)	0.761 (2.116)	1.033 (2.685)	-0.308 (-0.743)	-
LnDBT	-	-	0.008 (0.229)	-	-	-
TIME	-	-	-	-		-0.007 (0.54)
D78	-	-	-	0.194 (2.505)	0.141 (1.654)	
D87/88	-	-	-	-0.141 (-2.529)	-0.023 (-0.400)	
R^2	0.916	0.926	0.927	0.862	0.888	0.861
F-Stat	65.74	75.58	53.72	17.56	19.85	37.15
DW	1.812	2.000	2.010	1.649	1.613	1.71

Table 6 reports equation results for government expenditure on education. In general, the use of a lagged dependent variable (Equation 7) and a time trend variable (not shown in table) worsen the fit of the equations. As can be noted from the table, the primary-school-age population (5–14 years) turned out to be strongly significant in explaining growth of government expenditure on education. The 15–24 year age group (the secondary and tertiary education age group) had lower levels of significance in most of the equations estimated. However, when the equation was estimated using a different sampling period (1975–1994) the population of 15–24 variable turned out as significant (Equation 6). Neither the Rtubr nor the Dbt variables were significant explanatory variables of government expenditure on education.

The Cpcy gave mixed results. In equations that dropped the relative price term (Equation 4), its t-ratio improved and lost significance with the inclusion of the term (Equation 2). Use of a dummy variable for the years 1980 and 1981 significantly improves the equations. The dummy variable accounts for large increases in government expenditure on education due to the introduction, around that time, of free primary education and the school milk programmes, as well as creation of two ministries of education–one for basic and the other for higher education. Equation 6 of Table 6 was used in projecting government expenditure on education. The equation explains government expenditure on education as a function of growth of the two population age groups–the primary school age group (5–14 years) and the secondary and tertiary age group (15–24 years). The equation further explains growth of government expenditure on education as a function of the Rltp variable.

Table 7 reports the results for government expenditure on housing and social services. As shown in Equation 4 of the table, the use of a lagged dependent variable worsens the equation fit. In general, the equations for this expenditure category turned out with very low DW statistics. However, use of a time trend and dummy variables for the years 1976 and 1977, and 1990 and 1991, to account for real declines in expenditure during the years, improves the equations. As indicated in the table, the per capita income variable turned out to be significant in most of the equations for this expenditure category. In most of the equations estimated, total population turned out significant. The Rtubr variable was not significant, suggesting that it does not influence govenment expenditure on housing and social services. This need not be suprising since as noted earlier most of the expenditure on housing within this expenditure category is on housing for public employees. The other variables such as the debt variable (Dbt) and the relative price (Rltp) variables came out with unexpected signs.

Equation 4 is the one used to obtain projections for government expenditure on housing and social services, since it produced the most reasonable projections when account is taken of past growth of government expenditure on housing and social services. The equation explains growth of government expenditure on housing and social services as a function of changes in real per capita income and population growth. The elasticity of Cpcy variable suggests that a 1% growth in real per capita income results in a 1.3% growth in real government expenditure on housing and social services, other things remaining constant. Similarly, the equation suggests that a 1% growth in population results in a 2% growth of real government expenditure on housing and social services.

Table 6: Expenditure on education (CEXED) equations

	LnCEXE D_1	LnCEXE D_2	LnCEXE D_3	LnCEX ED_4	LnCEX ED_5	LnCEX ED_6	LnCEX ED_7
Constant Term	-10.087 (-6.103)	-11.100 (-9.357)	-10.850 (-8.521)	-8.549 (-11.202)	-9.205 (-11.161)	-9.060 (-11.443)	-3.599 (-2.023)
LnCEXED(-1)	-	-	-	-	-	-	0.522 (3.312)
LnAVPOP(5-14)	1.632 (11.109)	1.733 (19.695)	1.736 (16.409)	1.261 (5.784)	1.348 (7.779)	1.196 (6.277)	0.573 (1.528)
LnAVPOP(5-24)	-	-	-	0.309 (1.326)	0.281 (1.556)	0.415 (2.170)	0.140 (0.727)
LnRTUBR	0.251 (0.865)	-	-	-	-	-	-
LnCPCY	-	0.251 (0.167)	-	0.103 (1.315)	-	-	-
LnRLTP	0.409 (3.271)	0.322 (1.879)	0.293 (3.157)	-	0.143 (2.039)	0.159 (2.355)	0.025 (0.337)
LnDBT	-	-	-0.009 (-0.566)	-	-	-	-
D80/81	-	-	0.066 (3.450)	0.089 (3.283)	0.086 (3.399)	0.088 (3.657)	0.072 (2.504)
R^2	0.993	0.993	0.996	0.994	0.994	0.994	0.992
F-Stat	787.41	753.27	971.21	615.79	700.74	628.21	551.83
D.W	1.615	1.562	1.856	1.451	1.547	1.225	1.360

Table 8 reports equation results for government expenditure on health. Equation 5 of the table shows the results when a lagged dependent variable is introduced as a regressor. Total population (Pop) turned out to be significant but with a negative sign. The ratio of urban to rural population turned out significant with the expected positive sign. Of the various age group regressors experimented with, the sum of the population aged 4 years and under, and those aged above 65 years (Popdpn) gave the best results. In estimating the equations for this expenditure category the Rltp variable did not turn out as significant in most of equations. The debt variable was significant and with the expected signs in most of the equations for this expenditure category, suggesting that debt service charges constrain real growth of government expenditure on health.

Table 7: Expenditure on housing and social services (CEXHSS) equations

	$LnCEXHSS_1$	$LnCEXHSS_2$	$LnCEXHSS_3$	$LnCEXHSS_4$
Constant Term	-5.405 (-1.243)	-30.057 (-7.487)	-8.623 (-5.761)	4.472 (1.846)
LnCEXHSS(-1)	-	-	-	1.049 (6.864)
LnPOP	1.143 (1.482)	11.265 (6.177)	1.982 (10.530)	-0.969 (-1.796)
LnRTUBR	-0.470 (-0.413)	-	-	0.920 (1.361)
LnCPCY	0.876 (1.345)	1.088 (4.862)	1.280 (6.378)	-
LnRLTP	-0.016 (-0.197)	-	-	-0.063 (-0.197)
LnDBT	0.250 (3.318)	-	-	
TIME	-	-0.332 (-5.030)	-	-
D76/77	-	-0.152 (-2.592)	-0.255 (-2.569)	-
D90/91	-	-0.144 (-2.569)	-0.258 (-2.854)	-
R^2	0.874	0.964	0.892	0.912
F-Stat	19.45	85.95	37.26	55.388
DW	0.994	1.750	1.333	1.467

Equation 4 of the table is the one used for projecting government expenditure on health. It explains government expenditure on health as a function of changes in population of those under 4 and above 65 years of age, changes in real per capita income, increases in the rate of urbanization (the log of the ratio of urban to rural population), and changes in external debt. The dummy variable for 1980/81 accounts for increases in health expenditure during the years 1980 to 1981 due to major extensions of all provincial hospitals and out-patient departments in 1980, and the opening of an extension of Kenyatta National Hospital in 1981.

Table 8: *Expenditure on health* (CEXHLTH) equations

	LnCEX HLTH$_1$	LnCEX HLTH$_2$	LnCEX HLTH$_3$	LnCEX HLTH$_4$	LnCEX HLTH$_5$
Constant Term	11.323 (5.794)	-7.714 (-1.582)	-4.604 (-1.863)	-4.180 (-1.070)	3.739 (1.510)
LnCEXHLTH(-1)	-	-	-	-	0.829 (6.328)
LnPOP	-1.138 (-3.264)	-	-	-	-
LnPOPDPN	-	1.601 (3.087)	1.637 (6.237)	1.029 (2.338)	-0.201 (-0.665)
LnRTUBR	4.101 (7.044)	1.167 (1.909)	2.353 (3.573)	1.154 (3.926)	0.518 (1.486)
LnCPCY	-	-	-	0.505 (3.584)	0.066 (-0.568)
LnRLTP	0.645 (2.055)	0.205 (0.600)	-	-	
LnDBT	-	-0.177 (-2.737)	-0.085 (-2.703)	-0.103 (-2.193)	-0.051 (-1.542)
TIME	-	-	-0.052 (-6.881)	-	-
D80/81	-	0.176 (2.868)	0.108 (3.573)	0.146 (3.206)	0.046 (1.233)
R^2	0.953	0.964	0.991	0.978	0.983
F-Stat	122.92	81.51	362.39	146.134	204.20
DW	0.784	1.034	1.535	1.358	1.361

V. Population projection parameters

Tables 9 to 13 show population parameters for the three senarios used in this research study. The parameters are from Short's population projection model (1992). The model has an advantage over earlier population projection models such as Shah and Willekens (1978), CBS (1983), Milne, Barber and Brown (1989), and Short, Aoko and Barber (1991), in that it incorporates the most recent survey data on fertility as well as the effect of HIV prevalence on mortality rates. The model projects population by five-year cohorts, by gender and by place of residence up to the year 2020, and is flexible enough to allow for variations of various parameters, e.g., fertility, migration and mortality rates, to project various population scenarios.

Table 9 reports the projected fertility rates for the period 1995 to 2005. The base case scenario shown in the table assumes declines in both urban and rural fertility rates. In this scenario, between 1995 and 2005, rural fertility rates decline from 5.17 to 4.021 while urban rates fall from 2.992 to 2.46; the result is a total fertility rate decline from 4.647 to 3.582 by the year 2005. The optimistic scenario assumes even more rapid decreases in fertility rates than the base case. In this scenario, between 1995 and the year 2005, rural and urban fertility rates decline from 4.647 to 3.582 and from 4.648 to 3.684, respectively, resulting in total fertility rate declining from 2.699 in 1995 to 2.338 in 2005. The pessimistic scenario assumes no change in either urban or rural fertility rates. In this scenario, between 1995 and 2005, urban and rural fertility rates remain constant at 3.798 and 6.225, respectively. Total fertility rates still decline marginally from 5.673 in 1995 to 5.530 in 2005, however, mostly because the weights used in combining the two rates, namely the rural-urban female shares in the population, are changing with time.

Mortality rates for urban areas are generally lower than those for rural areas since urban areas have higher average incomes and better access to medical services, water and sanitation, factors that contribute to lower mortality rates. However, as indicated in Table 10, urban crude death rates are projected to be higher than those for rural areas under all three population scenarios because the model assumes higher HIV prevalence for the urban population. The optimistic scenario assumes lower urban and rural crude death rates compared with the base case, while crude death rates are lower in the base case than in the pessimistic case.

Table 9: Fertility rate

	Base case			Optimistic case			Pessimistic case		
Year	R	U	T	R	U	T	R	U	T
1995	5.170	2.992	4.647	4.648	2.699	4.169	6.265	3.798	5.673
1996	5.030	2.917	4.519	4.538	2.627	4.061	6.265	3.798	5.620
1997	4.894	2.844	4.393	4.430	2.557	3.955	6.265	3.798	5.607
1998	4.762	2.773	4.270	4.324	2.488	3.852	6.265	3.798	5.595
1999	4.633	2.704	4.150	4.221	2.421	3.750	6.265	3.798	5.585
2000	4.523	2.659	4.045	4.137	2.406	3.672	6.265	3.798	5.574
2001	4.415	2.615	3.944	4.055	2.391	3.596	6.265	3.798	5.564
2002	4.310	2.571	3.846	3.974	2.376	3.523	6.265	3.798	5.555
2003	4.207	2.528	3.751	3.895	2.362	3.452	6.265	3.798	5.547
2004	4.107	2.486	3.659	3.818	2.347	3.382	6.265	3.798	5.538
2005	4.021	2.460	3.582	3.684	2.338	3.276	6.265	3.798	5.530

Source: Short (1992).

Table 10: Crude death rate

	Base case			Optimistic case			Pessimistic case		
Year	R	U	T	R	U	T	R	U	T
1995	11.70	16.62	12.74	11.11	16.04	12.18	12.82	17.52	13.81
1996	11.94	17.85	13.21	11.34	17.23	12.66	13.18	18.74	14.39
1997	12.19	19.09	13.72	11.61	18.44	13.18	13.55	19.96	14.97
1998	12.44	20.26	14.22	11.88	19.56	13.71	13.89	21.09	15.54
1999	12.67	21.24	14.68	12.14	20.48	14.20	14.21	22.03	16.04
2000	12.87	21.94	15.05	12.38	21.14	14.60	14.48	22.70	16.45
2001	13.04	22.33	15.33	12.57	21.49	14.91	14.70	23.05	16.74
2002	13.15	22.36	15.48	12.72	21.50	15.10	14.84	23.07	16.91
2003	13.19	22.07	15.50	12.80	21.19	15.14	14.92	22.78	16.93
2004	13.18	21.51	15.40	12.82	20.62	15.07	14.93	22.25	16.85
2005	13.11	20.69	15.18	12.78	19.79	14.87	14.87	21.48	16.63

Source: Short (1992).
R = Rural
U = Urban
T = Total

As can be noted from Table 11, the three scenarios start with almost similar projected rural-urban population shares in the year 1995. In the base case, the urban population share is projected to rise from 21.0% to 27.4% between 1995 and 2005. Under the pessimistic and optimistic scenarios, the urban shares rise from 21.1% to 26.7%, and from 21.6% to 29.7% respectively. The projected larger urban share under the optimistic scenario is consistent with the resulting lower projected population as fertility rates for urban areas are lower than for rural areas.

Table 11: Rural/urban share of total population

	Base case		Optimistic case		Pessimistic case	
Year	Rural	Urban	Rural	Urban	Rural	Urban
1995	79.0	21.0	78.4	21.6	78.9	21.1
1996	78.4	21.6	77.7	22.3	78.3	21.7
1997	77.8	22.2	76.9	23.1	77.8	22.2
1998	77.2	22.8	76.2	23.4	77.2	22.8
1999	76.6	23.4	75.4	24.6	76.6	23.4
2000	76.0	24.0	74.6	25.4	76.1	23.9
2001	75.3	24.7	73.8	26.2	75.5	24.5
2002	74.7	25.3	72.9	27.1	74.9	25.1
2003	74.0	26.0	72.0	28.0	74.4	25.6
2004	73.3	26.7	71.2	28.8	73.8	26.2
2005	72.6	27.4	70.3	29.7	73.3	26.7

Source: Short (1992).

Table 12 shows the population growth rate under the three scenarios, and Table 13 indicates that total population in the base case increases from 26.0 million in 1995 to 33.2 million by the year 2005.

Table 12: Growth rate of population

	Base case			Optimistic case			Pessimistic case		
Year	R	U	T	R	U	T	R	U	T
1995	1.93	5.54	2.67	1.43	5.77	2.34	2.46	6.12	3.21
1996	1.88	5.45	2.63	1.40	5.72	2.33	2.51	6.04	3.25
1997	1.82	5.38	2.59	1.34	5.68	2.31	2.55	5.98	3.29
1998	1.76	5.32	2.55	1.28	5.64	2.29	2.57	5.94	3.32
1999	1.69	5.28	2.51	1.22	5.61	2.26	2.59	5.91	3.35
2000	1.62	5.24	2.47	1.15	5.57	2.23	2.60	5.89	3.37
2001	1.57	5.18	2.44	1.09	5.55	2.22	2.61	5.83	3.38
2002	1.51	5.12	2.40	1.03	5.52	2.21	2.62	5.77	3.39
2003	1.44	5.05	2.36	0.97	5.47	2.19	2.62	5.69	3.39
2004	1.38	4.96	2.31	0.91	5.40	2.17	2.62	5.60	3.39
2005	1.31	4.87	2.26	0.84	5.34	2.14	2.61	5.52	3.37

Source: Short (1992).
R = Rural
U = Urban
T = Total

Table 13: Total population

Year	Base case	Optimistic	Pessimistic
1995	26.031	25.826	26.454
1996	26.716	26.428	27.315
1997	27.409	27.039	28.213
1998	28.109	27.658	29.150
1999	28.815	28.285	30.126
2000	29.526	28.917	31.141
2001	30.245	29.560	32.196
2002	30.970	30.213	33.288
2003	31.701	30.874	34.417
2004	32.434	31.543	35.583
2005	33.168	32.217	36.783

Source: Short (1992).

Note: Under the optimistic scenario, total population increases from 25.8 million to 32.2 million, and in the case of the pessimistic scenario, from 26.4 million to 36.8 million.

VI. Structure and description of the macro-model used for simulation

Simulations to determine how the three population scenarios affect government expenditure and their impact on the macro economy are done using the macroeconomic planning policy model for Kenya (GOK, 1994). The model consists of a set of simultaneous equations that incorporate the major definitional and behavioural links connecting various macroeconomic variables. It uses 368 variables, 52 of which are exogenous and the remaining 316 endogenous. Most of the endogenous variables are generated by definitional relationships using other endogenous variables or other exogenous input data. Some 47 of the model equations are behavioural. Among the model's exogenous variables are world market price of crude oil, tea, coffee, etc., international inflation, and industrial countries' GDP growth rates. Other major exogenous variables are policy instrument variables such as the Kenya shilling versus U.S. dollar and SDR rates, tariff rates, and parameters such as the extent of wage compensation. The data sets are given in Apendix B. Appendix C lists some of the model's equations.

The model projects real GDP in terms of five national account sectors: non-monetary (Equation 12 in Appendix C), agriculture (Equation 7), industry (Equation 9), services (Equation 10) and government GDP (Equation 11). The major variable used on the supply side in the sectoral GDP equations is the capital stock, which is projected separately for the traditional, private and government sectors. Other supply side variables used in projecting real GDP are fertilizer input in the equation for agriculture GDP, and real imports in the equation for industry GDP. The explanatory variables used in the equation for real private sector investment are real private sector credit, lagged ratio of exchange reserves to imports, lagged real exports and lagged GDP growth. The balance of payments block projects both real merchandise exports and imports by four SITC groups. The BOP block also includes equations that project service exports and imports. For example, real export of tourist services (Equation 16a) is explained by changes in industrial countries GDP growth and changes in the real exchange rate. In the capital account, repayments of government and other public sector capital are projected separately, so are private long-term and short-term capital inflows. These, together with the current account balance, give the overall balance. Capital transactions with the IMF are shown as a separate item. The overall balance, special IMF finance, valuation adjustments and change in external debt arrears, together, determine the change in foreign exchange reserves and the level of reserves.

The model projects government revenue by tax categories such as income tax, excise duty, value added tax, import duty, other taxes and other non-tax revenue. Government ministry expenditure is treated as an exogenous policy variable; however, CFS payments

such as expenditure on domestic and foreign interest payments, as well as pension payments, are projected by the model's equations. Gross fiscal deficit is defined in the model as the excess of ministry expenditure and CFS payments over total revenue, and the net deficit is defined as the gross deficit minus grants. Net fiscal deficit is financed by net external and net internal borrowing. Net external borrowing is obtained from the model's BOP block. The residual is net borrowing from domestic sources. A major weakness of the model in its present form is that changes in net domestic borrowing do not affect the money supply or private sector credit, since growth rates of both of these variables are treated as target variables, linked to expected growth in real GDP and the GDP deflator.

Since the model projects GDP components in real terms, its equations also project deflators to convert the constant price variables to nominal values. Separate equations are used to project the deflator for the five sectoral GDPs. Forecast values for export and price indexes for the separate SITC categories are used to convert real export and import variables to nominal terms. Similarly, the model uses equations to project the deflator for other constant price variables such as real export of tourist services. The model also projects a capital formation deflator used to convert real investment in nominal terms. The GDP deflator is obtained by dividing nominal and real GDP. Total constant price GDP at factor cost (used in the formulas for obtaining the GDP deflator) is obtained by adding the five sectoral GDPs projected in the model. Current price GDP is obtained from the expenditure side, however. Since all the sectoral deflators are freely determined, total nominal GDP obtained from adding the sectoral nominal GDPs differs from total nominal GDP obtained from the expenditure side. To ensure consistency, the model uses a scaling factor generated from a formula (which determines the extent of variation in the two nominal GDP with respect to constant price GDP) to adjust the sectoral deflators.

Projections for the other price variable, the CPI, are obtained through an equation that explains changes in the CPI by changes in the ratio of lagged M2/GDP, the nominal exchange rate between the Kenya shilling and the U.S. dollar, the unit wage cost, and changes in capacity utilization ratio. To ensure equality between availability and use of aggregate resources, any excess supply of real resources, positive or negative, in the model is allocated to private consumption and inventory–accumulation–in proportion to their exante values estimated from the respective equations. Due to its relatively higher magnitude most of the allocation goes to private consumption in real terms. To simulate the effect of demographic changes on the macro economy the model's projection period was extended beyond the year 1998, to the year 2005 by using forecast values of all exogenous variables for the projection period. Appendix D shows the forecast values of some of the exogenous inputs and policy variables used to extend the model's projection period.

Economic theory suggets that changes in government expenditure are likely to affect the macro economy through the fiscal deficit; such changes also directly affect the macro economy by influencing changes in other macro variables such as public sector capital formation and government sector GDP. Depending on the mode of financing, increases in the fiscal deficit are likely to crowd out private investment as well as increase money supply through creation of high powered money; this, in turn, affects other macro variables

such the domestic price level, the real exchange rate and the BOP. As indicated in Appendix C, the model incorporates some of the links suggested by economic theory. For example, the inflation equation (Equation 19 in Appendix C) is affected by a lagged money variable (M2), while changes in the real exchange rate affect the BOP through equations that project merchandise and service exports. Private investment (Equation 1) is affected by changes in private credit, which in turn affect private capital stock used in determining sectoral GDPs. All these links suggest that one can use the macro model to simulate macro effects emanating from changes in the fiscal deficit.

VII. Simulation results and policy conclusions

Appendix E shows the forecast values of the exogenous variables used in extending the macro model projection period. Appendix F shows the exogenous values for expenditure projections.Tables F1 to F3 report projected expenditures for the five expenditure categories (in constant 1982 prices) for the period 1995 to 2005. The tables indicate that by the year 2005 projected government expenditure is 34% higher (in real terms) under the pessimistic population scenario than under the optimistic scenario. As expected, the differences are more pronounced in expenditure categories that are more susceptible to demographic influences. For example, by the year 2005 projected government expenditure on education is 50% higher under the pessimistic than under the optimistic scenario. The tables also indicate that by 2005 expenditure projections under the pessimistic scenario (based on higher fertility rates), compared with the optimistic scenario, are 43% higher in the case of administration expenditures, 30% higher in the case of government expenditure on housing and social services, and 17% higher in the case of expenditure on economic services.

Tables F4 to F6 present simulations showing the behaviour of selected macroeconomic variables under the base case, optimistic and pessimistic scenarios. The simulations are obtained by fitting the projected expenditure profiles shown in tables F1 to F3 in the government finance block of the macro model. The definition of the variables shown in tables F4–F6 are as follows: GDEFF (gross budget deficit), NDEFF (net government budget deficit excluding grants), OVBAL (overall balance-BOP), NGPMP (nominal GDP at market price), CURBL (current account balance-BOP), CRBLXG (current account balance excluding grants), INNBF (net internal borrowing by government), CPIFL (CPI inflation rate) and GRDFF (government GDP deflator). In reading the simulations results shown in the tables it should be noted that the negative signs for GDEFF, NDEFF and INNBF variables indicate a surplus position.

As indicated in the tables, initially higher government expenditures under the pessimistic scenario induce slightly higher GDP growth rates–mostly because of higher growth of government sector GDP. However, as indicated in Table F6 the higher GDP growth is accompanied by higher budget deficit (GDEFF) and higher internal borrowing (INNBF). Over the long run, the simulations indicate that lower projected government expenditures (under the optimistic scenario) result in higher real GDP growth (RGPFC). The higher GDP growth over the long run indicated in Table F5 is supported by a surplus position in net internal borrowing (INNBF), indicating higher resources available for investment to the private sector due to lower public borrowing (because of lower expenditures due to lower projected population). Equation 1 of Appendix C shows that

private sector investment depends on availability of private sector credit. Equations 7a, 9 and 10 of Appendix C also indicate that private sector capital stock (which is enhanced by private sector investment) is one of the explanatory variables for growth of agriculture sector GDP, industry sector GDP and services sector GDP.

A comparison of Tables F4 and F6 shows that over the long run higher government expenditure under the pessimistic scenario worsens both the budget (GDEFF) and the current account deficits (CURBL). The outcome has negative implications for the internal and external debt position of the country. As indicated in Section IV, higher external debt charges constrain growth of important social expenditures such as on health.

The simulations of tables F4–F6 further indicate that over the long run the pessimistic scenario contributes to higher inflation. The higher inflation implies worsening of balance of payments through appreciation of the real exchange rate and reduction in exports. Equations 15a.2, 15a.3, 15b, 16a and 16b of Appendix C show that exports of both goods and services are explained by changes in the real exchange rate.

The equation results shown in Section IV and the simulations of the macro economy shown in tables F4–F6 suggest that changes in fertility rates bear important policy implications, first on growth of specific categories of government expenditures and second on the long-run growth of the economy. The results of this study suggest that government policy to control population growth has important implications for growth of government expenditure. For example, the study suggests that lower population growth by the year 2005 will result in 50% lower expenditure on education under a scenario that assumes a lower rate of population growth. The study further suggests that government expenditure on education in Kenya is driven largely by demand for primary education. Within the context of Kenya's current cost-sharing measures in social sectors, the result suggests that cost-sharing measures in the education should apply more to the higher education subsector. A higher proportion of government subsidy on primary education is preferable, given that this level of education has the highest rates of social return (World Bank, 1991).

The study also suggests that the rate of urbanization in Kenya affects many categories of government expenditure. Government policy of directing investment to rural areas is therefore likely to have significant pay-offs in terms of reducing rural-urban migration and consequently moderating growth of administrative services needed to cope with urban related environments. The study also suggests that growth in real per capita income, as suggested by Wagner's law, contributes to growth in government expenditure. For example, the coefficient of the Cpcy variable registered high values in the case of expenditure categories such as government expenditure on housing and social services. The results also confirm that growth of government expenditure in Kenya is also due to the cost induced by inefficiency in government provision of services. The results suggest that this inefficiency is lowest in public provision of education services (suggested by lower coefficient value of the Rltp term). The constraint of the Dbt variable on growth of social expenditures such as health suggests the need for policy to focus on measures to reduce external debt. One such measure could be the debt-for-nature swaps used by some developing nations to effect reductions in external debt.

Finally, the results of this study suggest that active pursuit of population policy by

government over the long run can contribute significantly to bringing about a stable macroeconomic environment; this works mostly by moderating pressure on the government deficit and releasing resources for private sector investment, which contributes to higher output growth over the long run. Lower population growth would further enhance macro stability by ensuring lower inflation, a more conducive real exchange rate, faster growth of exports, and long-run sustainability of the balance of payments and the country's internal and external debt position.

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Appendix A: Government expenditure data

The tables in this appendix present a breakdown of five expenditure categories used in this study. The expenditure breakdown is done in terms of recurrent and development expenditure; for the categories for which data are available, it is also in terms of sub-components. Current expenditures are primarily made up of salaries for ministry personnel and other current expenses. Development expenditures are mostly capital formation expenditures. However, due to the budgeting system used in Kenya, some minor capital expenditures such as purchase of equipment are also included in the recurrent budget. Part of development expenditure also includes a current component, since all donor funding for projects is included in the development budget.

Table A1 shows trends in government expenditure on administration. This expenditure category includes expenditures on general administration, external affairs, and public order and safety. As can be noted from Table A1, recurrent expenditures account for the bulk of this expenditure category, on average about 70% of the total. Table A1 also indicates that large increases in this expenditure category occurred in 1975, 1989 and 1993. In 1975, government expenditure on administration increased by 61% over the previous year due to a huge increase in development expenditures on administration. The large increase in administration expenditures in 1989 was due to the 1989 population census and in 1993 it was mostly a result of high inflation.

Table A2 shows a breakdown of this expenditure category into its three sub-components, general administration, external affairs, and public order and safety. As can be noted from the table, expenditure on general administration accounts for the largest part of this expenditure category, followed by expenditure on public order and safety. Expenditure on external affairs accounts for the smallest share of this expenditure category. In 1976, expenditure on general administration took about 60% of the total, expenditure on public order and safety about 35% and expenditure on external affairs 5%. By 1993, their shares were 63%, 29% and 8%, respectively. It is important to note that the bulk of this expenditure category, other things given, is likely to be highly influenced by population changes and other related demographic changes. An increasingly urbanized population, for example, is likely to increase public expenditures on administration, due to the establishment of more administrative centres.

Table A1: Trends in government expenditure on administration

	Values (K£ million)			% Shares-	
Year	R	D	T	R	D
1973	28.44	4.01	32.45	87.64	12.36
1974	30.42	5.72	36.13	84.18	15.82
1975	41.05	17.48	58.53	70.13	29.87
1976	46.55	21.36	67.91	68.54	31.46
1977	57.15	20.40	77.55	73.70	26.30
1978	72.94	22.81	95.74	76.18	23.82
1979	82.78	30.35	113.13	73.17	26.83
1980	98.91	46.49	145.40	68.03	31.97
1981	120.67	45.87	166.54	72.46	27.54
1982	120.84	33.68	154.52	78.20	21.80
1983	121.86	28.72	150.57	80.93	19.07
1984	146.92	40.11	187.02	78.56	21.44
1985	161.07	48.60	209.67	76.82	23.18
1986	177.55	85.58	263.13	67.48	32.52
1987	212.77	100.46	313.22	67.93	32.07
1988	260.39	90.80	351.19	74.14	25.86
1989	297.49	149.63	447.11	66.54	33.46
1990	336.91	192.71	529.61	63.61	36.39
1991	395.08	178.32	573.40	68.90	31.10
1992	473.97	188.67	662.16	71.50	28.5
1993	600.38	230.81	831.19	72.20	27.80
1994	831.12	467.78	1298.90	63.99	36.01

Source: Economic Survey, CBS Republic of Kenya.
R = Recurrent expenditure
D = Development expenditure
T = Total expenditure

Tables A3 and A4 show trends in government expenditure on economic services. Table A3 indicates that development expenditures account for the larger share of this expenditure category, on average about 57% of the total. This expenditure category includes government expenditure on the following activities: general administration (GA); agriculture, forestry and fishing (AFF); mining, manufacturing and construction (MMC); electricity, gas, steam and water (EGW); roads (R); other transport and communications (OT); and other economic services (OES). Table A4 shows a breakdown of this expenditure category by these sub-components. As can be seen from the table, a large part of this expenditure category is accounted for by expenditure on agriculture, forestry and fishing. By 1993, the share of agriculture, forestry and fishing in the total for this category was about 42%. The other large items of this expenditure category are expenditure on roads and on general administration of economic services.

Table A2: Recurrent and development expenditure on administration sub-components values (K£ millions)

	General administration			External affairs			Public order and safety		
Year	R	D	T	R	D	T	R	D	T
1976	21.6	19.4	41.0	2.6	0.3	2.8	22.4	1.7	24.1
1977	27.1	17.6	44.7	3.3	0.5	3.9	26.7	2.2	29.0
1978	35.8	19.4	55.2	5.0	0.7	5.7	32.1	2.8	34.9
1979	42.4	26.0	68.4	6.4	0.7	7.2	34.0	3.6	37.6
1980	47.8	39.9	87.7	7.8	0.5	8.3	43.3	6.1	49.4
1981	58.4	37.8	96.2	9.5	0.3	9.8	52.8	7.8	60.5
1982	65.4	26.2	91.6	11.2	0.2	11.5	44.2	7.2	51.4
1983	63.5	21.8	85.3	13.0	0.2	13.3	45.3	6.7	52.0
1984	74.3	31.4	105.7	14.7	1.1	15.8	57.9	7.6	65.5
1985	77.6	37.4	114.9	18.9	1.3	20.2	64.6	10.0	74.6
1986	76.8	72.1	148.8	24.8	0.9	25.7	76.0	12.6	88.6
1987	89.6	86.7	176.2	28.2	1.0	29.2	95.0	12.8	107.8
1988	107.9	77.0	184.9	31.6	2.1	33.7	121.0	11.5	132.6
1989	118.9	132.5	251.4	38.4	3.3	41.7	140.2	13.7	154.0
1990	136.3	170.0	306.3	47.0	2.8	49.8	153.5	19.9	173.5
1991	166.9	157.0	323.9	56.3	1.8	58.1	171.9	19.6	191.4
1992	210.4	168.8	379.2	64.8	3.3	68.1	198.4	16.0	214.4
1993	259.9	213.1	472.9	93.2	4.4	97.6	247.3	13.4	260.7
1994	395.8	447.2	843.0	104.4	4.6	109.1	330.9	16.0	346.9

Source: Economic Survey, CBS, Republic of Kenya.

A report on public expenditures in Kenya (World Bank, 1994) that analysed the shares of the functional units in the development expenditures of the Ministry of Agriculture for the fiscal years 1987/88 to 1993/94, indicates that the bulk of the development expenditure in agriculture (which in our economic classification of expenditure accounted for 42% of this ependiture category in 1993) goes into crop development, land and farm development, integrated agricultural development projects, and agricultural extension services. The extent to which population changes may influence government expenditure on economic services is limited. Even though the share of this expenditure category in government expenditure declined, some components of the category such as infrastructure expenditure on roads in new urban centres and water supply and electrification are likely to be influenced by changes in the share of urban to rural population.

Table A3: Recurrent and development expenditures on economic services

	Values (K£ millions)			% Shares	
Year	R	D	T	R	D
1973	31.20	45.91	77.11	40.46	59.54
1974	36.48	57.65	94.13	38.75	61.25
1975	42.90	72.20	115.09	37.27	62.73
1976	46.93	80.00	126.92	36.97	63.03
1977	55.12	105.18	160.29	34.38	65.62
1978	68.81	143.53	212.34	32.40	67.60
1979	80.10	145.69	225.79	35.48	64.52
1980	107.52	149.40	256.92	41.85	58.15
1981	128.47	174.24	302.71	42.44	57.56
1982	130.86	160.46	291.32	44.92	55.08
1983	143.14	150.62	293.76	48.73	51.27
1984	175.64	183.63	359.26	48.89	51.11
1985	198.43	190.60	389.03	51.01	48.99
1986	234.49	193.36	427.85	54.81	45.19
1987	243.32	210.86	454.17	53.57	46.43
1988	227.51	288.69	516.20	44.07	55.93
1989	257.87	401.21	659.08	39.13	60.87
1990	292.60	440.30	732.89	39.92	60.08
1991	318.95	382.73	701.68	45.45	54.55
1992	368.00	378.97	746.97	49.30	50.70
1993	425.63	497.26	922.89	46.29	53.80
1994	538.73	770.72	1309.45	41.10	58.90

Source: Economic Surveys, CBS, Republic of Kenya.

Table A4: Recurrent and development expenditure of the economic services subcomponent (K£ million)

Year	GA	AFF	MMC	EGW	R	OT	OES
1976	10.4	42.6	7.2	16.1	27.8	16.7	6.3
1977	10.8	49.0	10.4	25.8	31.7	24.8	7.8
1978	14.4	59.8	14.4	36.6	38.6	36.7	11.8
1979	17.2	66.2	17.8	35.6	49.8	25.5	13.8
1980	22.7	88.1	27.6	37.3	57.0	9.2	15.1
1981	25.0	106.2	32.2	42.9	67.5	10.9	18.0
1982	21.2	104.7	27.1	37.5	71.8	12.2	16.8
1983	25.9	99.8	30.3	37.3	66.7	11.7	22.1
1984	50.9	117.3	42.5	40.9	63.3	11.6	32.7
1985	52.7	144.5	42.3	39.4	56.3	12.7	41.2
1986	30.0	191.3	39.4	51.8	51.9	14.7	48.8
1987	52.7	191.0	42.4	56.1	51.0	14.7	46.3
1988	92.4	161.3	58.1	64.4	79.1	13.1	47.8
1989	145.5	171.9	80.9	86.7	103.1	15.9	55.1
1990	165.5	182.4	83.2	89.2	103.5	24.6	84.6
1991	123.1	204.0	64.3	76.1	103.5	20.4	110.4
1992	88.4	271.5	57.1	71.5	116.9	18.7	123.1
1993	101.4	395.9	76.6	78.8	144.5	16.6	109.2
1994	130.0	482.2	165.8	146.3	233.4	86.7	65.10

Source: Economic Surveys, CBS, Republic of Kenya.

Tables A5 and A6 show trends in government expenditure on housing and social services. Government expenditure in this area includes expenditures on housing, community welfare and social welfare. Table A5 shows that development expenditures account for a slightly larger share of this expenditure category, constituting on average about 53% of the total. Most of development expenditures on housing go into building and maintenance of housing for public employees, and some of the government expenditure on housing goes to finance the National Housing Corporation (NHC), which is responsible for construction of residential buildings for the private sector. A large part of expenditure on housing comes from the budget of the Ministry of Public Works and Housing. Social welfare expenditures in this category are mostly on activities such as adult literacy progrmmes, family life training programmes for women, vocational rehabilitation programmes, and other community development programmes related to social welfare and recreation. A large part of social welfare expenditure comes from the budget of the Ministry of Culture and Social Services.

Table A5: Recurrent and development expenditure on housing and social services

	Values K£ million			% shares	
Year	R	D	T	R	D
1977	8.36	9.26	17.62	47.45	52.55
1978	10.16	11.33	21.49	47.27	52.73
1979	12.00	13.04	25.04	47.92	52.08
1980	14.69	17.59	32.28	45.50	54.50
1981	17.23	20.85	38.07	45.25	54.75
1982	19.07	22.39	41.46	46.00	54.00
1983	21.99	20.70	42.68	51.51	48.49
1984	25.38	25.25	50.63	50.13	49.87
1985	28.25	33.26	61.51	45.92	54.08
1986	31.16	49.35	80.51	38.71	61.29
1987	36.09	59.63	95.71	37.70	62.30
1988	40.28	53.85	94.12	42.79	57.21
1989	41.45	46.45	87.90	47.16	52.84
1990	44.12	46.11	90.22	48.90	51.10
1991	49.06	46.49	95.55	51.34	48.66
1992	53.94	44.49	98.43	54.80	45.20
1993	59.26	47.12	106.38	55.70	44.30
1994	73.92	77.38	151.30	48.90	51.10

Source: Economic Survey, CBS, Republic of Kenya.

Table A6 shows a breakdown of this exenditure category into its two main components, on housing and community welfare and on social welfare. As can be noted from the table, expenditure on social welfare has generally been higher than that on housing and community welfare; its share, especially after 1982, became progressively larger, so that by 1993 it was ten times as large as expenditure on housing and community welfare. It is likely that this expenditure categoy would be influenced by changes in population and related demographic factors. For example, a high rate of population growth implies a rise in this expenditure category. Even though the share of this expenditure category in government discretionary spending fell, the increase in the relative share of expenditure on social welfare within the expenditure category suggests that past increases in population have exerted higher demands on social expenditures in this category.

Table A6: Recurrent and development expenditure on housing and social services sub-component (K£ million)

	Housing			Community & social welfare		
Year	R	D	T	R	D	T
1977	1.46	6.49	7.95	6.90	2.77	9.67
1978	1.74	7.68	9.41	8.42	3.65	12.07
1979	1.95	7.77	9.72	10.05	5.27	15.32
1980	2.41	10.52	12.93	12.28	7.07	19.35
1981	2.71	11.94	14.65	14.52	8.91	23.42
1982	2.87	9.63	12.49	16.21	12.76	28.97
1983	3.03	5.23	8.26	18.96	15.47	34.42
1984	3.22	2.97	4.71	22.16	23.77	45.93
1985	3.07	13.54	9.84	25.18	26.49	51.67
1986	2.41	12.36	14.77	28.76	36.99	65.74
1987	2.29	7.63	9.92	33.80	52.00	85.80
1988	3.39	10.40	13.78	36.89	43.45	80.34
1989	3.74	13.04	16.78	37.71	33.41	71.12
1990	3.72	11.23	14.95	40.40	34.88	75.27
1991	4.42	11.29	15.71	44.65	35.20	79.85
1992	4.52	7.13	11.65	49.42	37.36	86.78
1993	4.44	5.65	10.09	54.82	41.47	96.29
1994	6.35	10.51	16.86	67.57	66.87	134.44

Source: Economic Surveys, CBS, Republic of Kenya.

Table A7 shows trends in government expenditure on education, which includes all categories of education: primary, secondary, university, polytechnics, teachers training colleges and other government training institutions. As can be noted from Table A7, recurrent expenditures account for the bulk of exependiture on education, on average constituting about 90%, of the total of this expenditure category. Primary education receives the largest share of the recurrent budget to meet teachers' salaries. The remainder of recurrent expenditures goes to the school milk and feeding programmes, Kenya school equipment scheme, and grants to schools. Over the past five years secondary schools' share of recurrent expenditure on education has been between 15% and 17% (similar to that for university education). This expenditure category is likely to be influenced by changes in population and related demographic factors. Demographic changes such as changes in the age composition of the population, e.g., an increase in the school-age population,, are likely to affect this category. A report on public expenditure for Kenya (World Bank, 1994) indicates that primary education receives the largest share of the central government's recurrent expenditure on education; the share has been between 55% and 60% of total education expenditure. The bulk of government recurrent expenditure on primary education, an average of around 90%, consists of grants to the Teachers Service Commission (TSC) for teachers' salaries and allowances. Recurrent

expenditure in other areas, such as the school equipment scheme and grants to boarding schools, has been very small–about 2.5% of total net recurrent expenditure in 1992/93.

The World Bank (1994) report also indicates that, on avarage, government expenditure, both recurrent and development, per primary school student in 1992/93 was Ksh1,506 compared with Ksh690 average expenditure by households. Thus, on average, the government financed about 69% of the total direct cost of primary education per child, mostly in form of teachers' salaries. At present, net enrolment rates are 81% for male children of primary-school age and 83% for female children of primary-school age. As in the case of primary education, the bulk of government recurrent expenditure on secondary education has consisted of grants to the TSC, around 85%–95% since fiscal yer 1989/90. Between 1990 and 1993 real expenditure on primary and secondary education remained stable, while real government expenditure on university education decreased sharply.

Table A7: Recurrent and development expenditure on education

	Values K£ million			% Shares	
Year	R	D	T	R	D
1973	40.09	3.17	43.26	92.67	7.33
1974	49.80	4.27	54.06	92.11	7.89
1975	62.81	4.31	67.12	93.58	6.42
1976	72.59	3.94	76.53	94.85	5.15
1977	82.68	4.98	87.66	94.32	5.68
1978	95.31	6.50	101.81	93.62	6.38
1979	112.04	11.04	123.08	91.03	8.97
1980	142.46	14.22	156.68	90.92	9.08
1981	171.48	15.52	187.00	91.70	8.30
1982	186.37	15.68	202.05	92.24	7.76
1983	201.33	11.93	213.25	94.41	5.59
1984	227.93	12.01	239.94	94.99	5.01
1985	279.60	15.15	294.75	94.86	5.14
1986	342.45	20.65	363.09	94.31	5.69
1987	401.02	25.55	426.57	94.01	5.99
1988	454.48	40.38	494.86	91.84	8.16
1989	500.54	48.47	549.01	91.17	8.83
1990	571.53	54.42	625.94	91.31	8.69
1991	641.56	63.03	704.58	91.06	8.94
1992	723.47	65.04	788.51	91.75	8.25
1993	891.00	65.89	956.89	93.10	6.90
1994	1194.18	103.23	1297.41	92.04	7.96

Source: Economic Surveys, CBS, Republic of Kenya.

Table A8 shows trends in government expenditure on health. This expenditure category includes expenditures on government hospitals, medical research institutions, and government health programmes such as child immunization, rural health projects, etc. As shown in Table A8, a large part of this expenditure category goes to recurrent expenditures, almost 60% of which is wages of health personnel. Out of the non-wage recurrent expenditure, about 12% is for drugs and dressings. On average 70% of total recurrent expenditure on health went to curative health services. The large proportion of recurrent expenditures on health for labour costs has varied between 58% and 63% over 1988–1991 and between 25% and 28% for operating expenses over the same period. In the case of development expenditures on health, capital exenditures took the bulk share, 75%–84% in 1988–1990, compared with 11%–22% for operating expenditures over the same period. This trend was reversed in 1992, following a budget rationalization policy of the government that brought the share of operating expenses to 54%, compared with 37% for capital expenditure.

Table A8: Recurrent and development expenditure on health

	Values (K£ million)			% Shares	
Year	R	D	T	R	D
1973	11.35	2.25	13.60	83.46	16.54
1974	14.48	3.08	17.56	82.48	17.52
1975	18.19	4.30	22.49	80.88	19.12
1976	20.39	6.54	26.93	75.73	24.27
1977	25.23	8.00	33.23	75.94	24.06
1978	32.29	7.72	40.01	80.70	19.30
1979	39.55	9.25	48.80	81.05	18.95
1980	48.16	11.72	59.88	80.43	19.57
1981	56.22	11.99	68.21	82.42	17.58
1982	60.91	9.51	70.41	86.50	13.50
1983	63.22	9.78	73.00	86.60	13.40
1984	68.43	11.08	79.51	86.06	13.94
1985	75.59	12.13	87.72	86.17	13.83
1986	87.15	14.34	101.49	85.87	14.13
1987	99.76	14.35	114.10	87.43	12.57
1988	110.72	17.74	128.46	86.19	13.81
1989	118.42	23.24	141.66	83.59	16.41
1990	126.38	32.24	158.62	79.67	20.33
1991	142.92	38.55	181.47	78.76	21.24
1992	163.87	47.27	211.14	77.61	22.39
1993	201.21	77.36	278.57	72.22	27.78
1994	269.72	132.61	402.33	67.03	32.97

Source: Economic Surveys, CBS, Republic of Kenya.

The report on government expenditure (World Bank, 1994) indicates that between fiscal years 1988 and 1992, the share of health expenditures on curative services fell from 80% to 70%. Figures for fiscal year 1988 indicate that district hospitals accounted for the largest share of recurrent health expenditures–57% on curative health services, followed by provincial general hospitals with 23% and Kenyatta National Hospital (KNH), 15%. In fiscal year 1992, these shares shifted slightly in favour of district hospitals, whose share rose to 60%, and against provincial hospitals and Kenyatta National Hospital, whose shares declined to 22% and 13%, respectively. Even though the share of health expenditure in discretionary spending remained almost constant for the period 1972 to 1993, it is likely that future population growth will exert pressure on this expenditure category, especially considering that a large proportion of Kenya's population with low incomes relies on government health institutions such as government health centres and dispensaries.

Appendix B: Data sets

Year	POP 5-14	POP 15-24	POPDPN	RTUBR	RLTP	PPB
1972	3373.35	2313.46	2687.31	0.129	158.299	44.900
1973	3492.01	2392.57	2792.27	0.136	157.362	46.900
1974	3614.84	2474.39	2902.22	0.143	133.032	48.900
1975	3742.00	2559.00	3016.73	0.150	125.273	53.300
1976	3948.89	2618.32	3145.94	0.157	123.272	57.800
1977	4167.25	2679.07	3281.00	0.164	121.210	64.200
1978	4397.73	2741.28	3422.17	0.171	118.025	70.200
1979	4641.00	2805.00	3569.74	0.178	117.129	75.600
1980	4851.00	2938.00	3724.00	0.181	113.060	82.300
1981	5061.00	3082.00	3862.00	0.185	112.196	91.900
1982	5271.00	3237.00	3999.00	0.188	100.000	100.000
1983	5476.00	3401.00	4129.00	0.192	90.127	103.300
1984	5635.00	3569.00	4291.00	0.195	88.397	110.400
1985	5866.00	3747.00	4373.00	0.196	91.274	123.900
1986	6097.00	3931.00	4441.00	0.199	97.182	143.100
1987	6331.00	4122.00	4497.00	0.202	96.766	154.900
1988	6550.00	4317.00	4548.00	0.205	94.687	170.300
1989	6751.00	4512.00	4598.00	0.208	90.593	184.857
1990	6957.00	4703.00	4590.00	0.219	85.186	201.080
1991	7151.00	4890.00	4587.00	0.229	78.743	222.350
1992	7322.00	5079.00	4598.00	0.241	69.901	251.329
1993	7452.00	5275.00	4638.00	0.248	65.179	293.397

Year	CEXHLTH	CEXED	CEXHSS	CEXECON	CEXADM
1972	27.840	82.517	21.826	143.096	68.489
1973	29.565	94.022	22.283	167.609	70.544
1974	35.583	110.327	24.438	196.421	75.787
1975	41.933	125.704	25.235	219.606	105.910
1976	46.626	132.439	24.308	219.637	117.474
1977	51.791	136.604	27.414	249.688	120.794
1978	57.051	145.014	30.627	302.493	136.396
1979	64.021	162.831	33.730	298.677	149.669
1980	72.236	190.462	39.793	312.151	176.671
1981	74.211	203.536	41.458	329.380	181.230
1982	70.400	202.065	41.455	291.325	154.540
1983	69.210	206.438	41.317	284.371	145.780
1984	70.661	217.337	44.861	325.417	169.402
1985	70.799	237.893	49.641	313.987	169.221
1986	70.922	253.735	56.257	298.983	183.875
1987	73.660	275.381	61.785	293.218	202.227
1988	75.432	290.578	55.284	303.127	206.233
1989	76.632	296.988	47.548	356.532	241.868
1990	78.884	311.289	44.868	364.477	263.383
1991	81.612	316.881	42.973	315.572	257.882
1992	84.011	313.760	39.558	297.214	268.071
1993	99.877	338.049	40.353	369.77	325.020

Year	DBT	RLPT	CPCY	PRP	POP	POPDPN
1972	3.50000	105.51	193.478	28.364	12.0910	2687.31
1973	3.50000	113.04	206.549	29.232	12.5040	2792.27
1974	2.40000	109.981	189.360	36.758	12.9350	2902.22
1975	2.80000	105.34	190.617	42.547	14.4130	3016.73
1976	2.50000	107.02	202.390	46.888	13.8420	3145.94
1977	2.30000	102.86	222.086	52.966	14.3140	3281.00
1978	5.30000	97.06	208.194	59.479	14.8060	3422.17
1979	5.20000	99.33	205.498	64.544	15.3290	3569.74
1980	5.60000	102.06	197.749	72.793	15.9670	3724.00
1981	9.10000	108.32	195.334	81.910	16.6220	3862.00
1982	12.3000	99.99	176.298	100.000	17.2960	3999.00
1983	13.1000	98.51	168.662	114.616	17.9690	4129.00
1984	13.0900	95.71	166.470	124.891	18.6440	4291.00
1985	12.7600	96.72	168.664	135.745	19.3220	4373.00
1986	15.6300	91.85	173.631	147.250	20.0060	4441.00
1987	18.4600	90.79	170.488	160.086	20.6950	4497.00
1988	17.0500	89.23	168.526	179.855	21.3810	4548.00
1989	18.4600	89.78	164.086	204.052	22.0650	4598.00
1990	14.6100	87.45	156.282	236.049	22.7100	4590.00
1991	20.3200	85.30	144.633	282.373	23.3600	4587.00
1992	17.2900	77.40	126.991	359.551	24.0180	4598.00
1993	7.02000	94.10	122.422	450.144	24.6840	4638.00

Appendix C: Simulation model equations

Private sector investment

1. $\ln PRINVM = 0.2998 + .5008 \ln RXTL_{-1} + 0.2319 \ln RFRM_{-1} + 0.2307 \ln ARPRCD + 3.6854 \ln(RGDP_{-1}/RGDP_{-2})$
   (-1.96) (4.71) (3.11) (2.82) (2.61)

   $+ 0.2238\ D81 - 0.2849\ D84 - 0.1609\ D86$
   (4.48) (-5.25) (-3.07)

   $R^2 = 0.9307$; $RBAR^2 = 0.8866$; DW = 2.36

Government investment

2. $\ln GOVINV = 1.9625 + 0.5230 \ln RDEVXF - 0.2408 D7576 - 0.3133 D83 + 0.3807 D88$
   (3.45) (5.15) (-2.80) (-2.70) (3.33)

   $R^2 = 0.8133$; $R^2 = 0.7667$; DW = 2.23

Other public sector investment

3. $\ln OPBINV = 3.4502 + .1943 \ln OPEXLF + .1795 \ln OPNGLF + 3.0326 \ln(RGDP_{-1}/RGDP_{-2}) + .1469 D8081 - .2540 D87$
   (-2.46) (10.75) (3.04) (3.44) (1.83) (1.92)

   (4.15) + 0.3493D9192
   $R^2 = 0.8756$; $RBAR^2 = 0.8135$; DW = 2.59

Non-monetary sector investment

4. $\ln RNMNV = 3.9145 - .0567T - .0046T^2 + .1311 D8990 - .4280 D93$
   (194.72) (-10.60) (-11.82) (2.78) (-5.83)

   $R^2 = 0.9538$; $RBAR^2 = 0.9430$; DW = 1.83

Inventory investment

$CHSTK = 36.8775 + 0.8179(RGDP - RGDP_{-1}) + 0.0993(RIMP-RIMP_{-1}) + 104.139D85 - 123.99D86$

(3.02) (8.69) (2.17) (4.59) (-5.04)

$R^2 = 0.9442$; $RBAR^2 = 0.9163$; DW = 2.06

Capital formation deflator

6. $lnKFDF = -0.8271 + 0.8817lnDFGDP_{-1} + 0.3212lnPM$
(-5.27) (10.02) (5.71)

$R^2 = 0.9980$; $RBAR^2 = 0.9978$; DW = 2.08

Agriculture; sector GDP

7a. $lnRGPAG = -7.8277 + 0.6259lnTTAGR_{-1} + 0.0654lnFTZNP + 1.3183lnPVKST - 0.0538D81,84 - 0.0910D93$
[SMPL 78-93] (-3.07) (2.09) (2.48) (7.49) (-2.28) (-2.59)

$R^2 = 0.9621$; $RBAR^2 = 0.9431$ DW = 2.05

7b. $lnPNPUT = 0.6876 + 0.3605lnXCHU\$ + 0.4903lnPFTLZ - 0.1345D86$
[SMPL 77-93] (3.50) (3.33) (3.62) (-1.99)

$R^2 = 0.9823$; $RBAR^2 = 0.9782$ DW = 2.29

7c. $lnPPDAG = 0.2281 + 0.0936lnPNPUT + 0.8557lnCPIRL + .0323D81 + .0185D89 - .0597D93$
[SMPL 76-93] (7.48) (4.98) (63.60) (4.57) (2.64) (-7.37)

$R^2 = 0.9999$; $RBAR^2 = 0.9999$ DW = 2.34

7d. $lnCPIRL = 1.0896 + 0.8502lnCPI + 0.0622D84T86 - 0.1033D89T92$
[SMPL 78-93] (24.40) (82.80) (4.09) (-6.26)

$R^2 = .9987$; $RBAR^2 = .9984$; DW = 1.93

7e. $lnPAGR = -5.7029 + 1.0612lnXCHU\$ + 0.5554lnW\$CSH + 0.6129lnW\$FD$
[SMPL 75-91] (-6.35)(28.94) (8.20) (4.65)
$-0.1637D84 + 0.2486D87 - 0.4228D93$
(-2.51) (4.12) (-5.51)

$R^2 = 0.9908$; $RBAR^2 = 0.9862$ DW = 2.07

Industry GDP

9. $lnRGPIN = -5.6897 + 0.8098ln((RGPAG + RGPAG_{-1})/2) + 0.5748lnPVKST + 0.2063ln((RMTL + RMTL_{-1})/2)$
[SMPL 76-93](-13.63) (6.60) (5.47) (6.07)

$R^2 = 0.9934$; $RBAR^2 = 0.9920$ DW = 1.81

Services GDP

10. lnRGPSV = -2.4191 + 0.6032lnPVKST - 0.2713 ln((RXCHM + $RXCHM_{-1}$/2)
[SMPL 75-93] (-10.35) (8.28) (-9.40)
+ 0.7706ln((RGPAG + $RGPAG_{-1}$)/2 - 0.0592D8283 + 0.0395D86
(8.49) (-4.96) (2.44)

R^2 = 0.9980; $RBAR^2$ = 0.9972; DW = 2.31

Government sector GDP

11. ln RGPGV = 2.6673 + 0.3136lnGVKST + 0.4049lnRRCXF - 0.2261lnRAVWG + 0.1517D88T93
[SMPL 73-93] (3.70) (2.85) (3.87) (-3.31) (4.82)

R^2 = 0.9887; $RBAR^2$ = 0.9858; DW = 2.12

Non-monetary sector GDP

12. lnRGPNM = -4.2953 + 1.3253lnNMKST + 0.2436lnPOP + 0.0010T^2 - 0.0368D80T84 + 0.0374D85
SMPL [73-93] (-5.28) (8.58) (3.26) (5.87) (-7.45) (4.45)

R^2 = 0.9992; $RBAR^2$ = 0.9990; DW = 2.37
R^2 = 0.9976; $RBAR^2$ = 0.9971; DW = 1.84

Government GDP deflator

13. lnDFLGV = -0.6610 + 0.2917lnNAVWG + 0.7128lnDFLIN - 0.0565D8384 + 0.0581D87
SMPL [75-93] (-5.38) (5.63) (13.69) (-4.41) (3.27)

R^2 = 0.9992; $RBAR^2$ = 0.9989; DW = 2.05
R^2 = 0.9985; $RBAR^2$ = 0.9981 DW = 1.84

Merchandise imports

2SITC 0 + 1 :
14a. lnRM01 = 7.6039 + 0.9690lnRGPFC$_{-1}$ - 0.8953lnTARPM01 - 0.9757lnQCRL +.4443D82 + .4124D84T87
SMPL [78-93] (3.72) (3.10) (-3.66) (-4.55) (2.43) (4.34)
+.6118D90 + 0.5546D92
(3.47) (3.04)

R^2 = .8776; $RBAR^2$ = .7727; DW = 2.45
SITC 2 and 4:

14b. $\ln RM24 = 0.2559 + 1.0454 \ln RGPIN_{-1} - 0.6027 \ln TARPM24 + 0.3477 D74 + 0.2766 D77 - 0.2235 D79$
SMPL [73-93] (0.33) (15.82) (-5.02) (3.78) (3.15) (-2.63)

$R^2 = .9585$; $RBAR^2 = .9448$; DW = 2.11
SITC 3:

14c. $\ln RM3 = 2.1700 + 0.1815 \ln RGPIN_{-1} - 0.1245 \ln TARPM3 + 0.4449 \ln AQXFL + 0.2549 D74,80 + 0.1211 D90$
SMPL [73-92] (3.27) (2.69) (-3.95) (8.70) (7.64) (2.62)

$R^2 = .9565$; $RBAR^2 = .9410$; DW = 1.65
SITC 5 to 9:

14d. $\ln RM59 = 1.5834 + 1.0850 \ln RINVM - 0.4625 \ln TARPM59 + 0.2818 D74 - 0.2380 D81T83$
SMPL [73-93] (1.70) (8.10) (-8.14) (3.09) (-4.73)

$R^2 = .9249$; $RBAR^2 = .9061$; DW = 1.95

Merchandise exports

SITC 0 + 1:
15a.1. $\ln CFHEC = 11.7048 + .2252 \ln MADPCF_{-3} + 0.0379\ T - 0.0918 D79T81 + 0.0804 D84T87 - .0967 D89T93$
SMPL [77-93] (349.54) (10.41) (13.61) (-4.89) (4.32) (-3.32)
$R^2 = .9921$; $RBAR^2 = .9885$; DW = 2.16

15a.2. $\ln QXCF = -0.5111 + 0.6408 \ln CFHEC + 0.3099 \ln W\$CF - 0.6043 \ln ARXCHA + 0.1335 D8690 - 0.2492 D88912 - 0.3666 D93$
SMPL [75-93] (-0.77) (9.50) (6.17) (-3.37) (3.47) (-5.64) (-4.10)

$R^2 = .9476$; $RBAR^2 = .9214$; DW = 2.42

15a.3. $\ln QXTEA = 6.6284 + .3460 \ln(PXTEA/XCHU\$)_{-1} - .4093 \ln ARXCHA + .0652T - .1864 D8182 + .2038 D79 + .1196 D7789 - .1300 D84$
SMPL [75-93] (10.38) (5.45) (-4.03) (23.14) (-4.91) (4.43) (3.53) (-3.02)

$R^2 = .9947$; $RBAR^2 = .9905$; DW = 2.05

15a.4. $\ln RX01 = 1.1570 + 0.5484 \ln VXTEAC + 0.3284 \ln VXCFC - 0.1565 D7879$
SMPL [72-93] (5.66) (20.61) (9.81) (-4.84)

$R^2 = .9802$; $RBAR^2 = .9769$; DW = 2.25

Export sector

SITC 2 + 4:
15b. lnRX24 = 6.6832 - 0.5608lnARXCHA - 0.0085T - 0.1842D8283 + 0.2229D8586 + 0.2553D88
(11.85) (-4.48) (-3.33) (-3.66) (4.00) (3.68)

R^2 = .8046; RBAR^2 = .7395; DW = 2.10

15c. lnRCX3 =6.3116 + 1.1103lnW$COF - 0.6148lnRLPPP +.3780D81 - 0.3153D8586
SMPL [78-93] (5.17) (8.23) (-2.56) (3.11) (-3.41)

R^2 = .9385; RBAR^2 = .9161; DW = 2.10

SMPL [75-93] (26.83) (5.98) (-27.25) (8.41) (-6.47)

R^2 = .9878; RBAR^2 = .9843; DW = 1.84

Service exports

16a. lnRXTUR = -6.5892 + 2.9328 lnICRGP -0.4696 lnRXCHA - .1487D84 -.1781D9192
[SMPL 73-93] (-8.75) (28.44) (-3.88) (-2.12) (-3.09)

R^2 = .9843; RBAR^2 = .9804 ; DW = 2.20

16b. ln RXOS = 10.3033 + 0.4364lnVOLTR - 1.4380lnRXCHA + .0402T - 0.8414D83 - 0.3937D88
[SMPL 75-93] (9.38) (2.14) (-5.34) (4.74) (-6.48) (-3.14)

R^2 = .9548; RBAR^2 = .9374 ; DW = 1.70

Service imports

17. lnRMNFS = 3.3191 + 0.9453lnRGPFC$_{-1}$ -1.2966ln(100 DFLNFS/DFGDP) +.4403D78 - .3586D84T86
[SMPL 73-93] (1.47) (4.16) (-10.80) (2.34) (-3.35)

R^2 = .9712; RBAR^2 = .9640; DW = 1.81
(CFS)

18a. lnXINTF = -3.5232 + 1.0563lnDTEXB + 0.2929D8182
[SMPL 73/74 - 92/93] (-31.88) (67.65) (4.35)

R^2 = 0.9963; RBAR^2 = 0.9959; DW = 1.67

18b. lnINNTF = -2.6740 + 1.0206lnDTINF + 0.2001lnTBRTE - 0.1422D89 + 0.0780D91
[SMPL 86/87 - 92/93 (-13.64) (27.60) (4.89) (-5.98) (3.12)

R^2 = 0.9996; RBAR^2 = 0.9987; DW = 1.87

18c. lnPNSNF = 3.7761 + 0.1018T + 0.2828D90.92 + 0.3043D91
[SMPL 86/87 - 92/93] (98.44) (9.57) (4.92) (3.66)

R^2 = 0.9797; RBAR^2 = 0.9645; DW = 2.01

CPI

19. lnCPI=1.3090 + .2804ln(M2DEC$_{-1}$/RGPFC) + .2850ln XCHU$
[SMPL 73-93] (3.42) (8.34) (14.80)
+1.0472lnUWCDX$_{-1}$ -1.0331lnUTILR-.0764D7677
(26.94) (-11.93) (-5.88)

R^2 = .9998 RBAR^2 = .9997 DW = 2.11

Modern sector wage employment

20. lnWEMPMS = 2.6024 + 0.6548lnRGPFC - 0.1260lnRAVWG$_{-1}$ - 0.0251D82T84
[SMPL 73-93] (2.98) (10.61) (-2.21) (-2.13)

R^2 = .9940 RBAR^2 = .9929 DW = 1.89

Appendix D: Variables

Variable Name	Description
CFHEC	Hectares (000's) under coffee
CFSF	Consolidated fund services (CFS) payments (fiscal year)
CPIRL	CPI for rural areas
DFLAG	Deflator for agricultural sector
DFLN	Deflator for individual sector
DFLGV	Deflator for government sector GDP
DTEXB	Stock of external debt (of government), beginning of calendar year
DTINF	Stock of internal debt (of government), end of fiscal year
DVEXF	Development expenditure of government (fiscal year)
GVKST	Capital stock in government sector
FTZNP	Fertilizer input in agriculture (index)
ICRGP	Industrial countries real GDP (index)
INNTF	Interest payment on internal loans by government (fiscal year)
M2DEC	Stock of M2 at end of December
M2JUN	Stock of M2 at end of June
MADPCF-3	3-year moving average dollar price of coffee (lagged 3 years)
NAVWG	Nominal average wage
NMKST	Stock of captial in the non-monetary sector
OPNGLF	Net lending by government to parastatals
OPPEXLF	External borrowing by parastatals
OPBINV	On public sector investment
PAGR	Price index of agricultural goods
PFTLZ	Price of fertilizer (index)
PNPUT	Price index of inputs (in agriculture)
PNSNF	Govt. expenditure on pensions, etc. (fiscal year)
POP	Population, mid-year ('000)
PRINVM	Private sector investment
PVKST	Private stock of capital
PXTEA	Export price of tea ('000 shillings per tonne)
QCRL	Quantity of cereal production ('000 Tonnes)

QXCF	Quantity of coffee exports ('000 tonnes)
OXFL	Quantity of petroleum products exports (million litres)
RDVXF	Real development expenditure of government (fiscal year)
REXCS	Real excess supply of resources
RFXRM	Ratio of foreign exchange reserves (end-year) to imports
RGPAG	Real GDP at factor cost in the agricultural sector
RGPDW	Real GDP at factor cost in dwellings
RGPNM	Real GDP in the traditional sector
RGPSV	Real GDP at factor cost in the services sector
RM01	Real imports, SITC sections 0 and 1
RM24	Real imports, SITC sections 2 and 4
RM3	Real imports, SITC section 3
RM59	Real imports, SITC sections 5 to 9
RMGDP	Real monetary GDP at factor cost
RMNFS	Real imports of non-factor services
RNMNV	Real non-monetary investment
RPVCRD	Real private sector credit (from banks), deflated by capital formation deflator
RIMP	Real imports
RXCHA	Two-year moving average of real exchange rate (average of official and market rates)
RX01	Real exports, SITC sections 0 and 1
RX24	Real exports, SITC sections 2 and 4
RX3TL	Real exports of petroleum products, total
RX59	Real exports, SITC sections 5 to 9
RXOS	Real exports of other services
RXTL	Real exports of goods, total
RXTUR	Real export of tourism services
RRCXF	Government expenditure
RAVWG	Real average wage
T	Time trend (1989=1)
TAR01	Average tariff rate on imports, SITC 0 and 1
TAR24	Average tariff rate on imports, SITC 2 and 4
TAR3	Average tariff rate on imports, SITC 3
TAR59	Average tariff rate on imports, SITC 5 to 9
TTAGR	Terms of trade for agriculture
UTILR	(Capacity) utilization ratio
UWCDX	Unit wage cost index
VOLTR	Volume of external trade
WEMPMS	Number (000's) employed in modern sector
W$CF	World dollar price of coffee, current year
W$CSH	World dollar price of cash crops (tea and coffee)
U$	Index of exchange rate for U.S. dollar (shillings/U.S. dollar)

Appendix E: Forecast values of main exogenous variables

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
XINFL	2.000	1.200	1.400	1.600	1.660	1.720	1.720	1.720	1.720	1.720	1.720
XCHUS	453.737	453.737	534.988	576.240	587.765	599.520	599.520	599.520	599.520	640.168	683.571
MUVUS	170.591	172.874	175.414	178.951	182.416	185.428	188.617	191.861	195.161	198.518	201.933
M2DEC	9242.452	9922.829	10825.469	11692.376	12660.245	13858.624	15132.578	16523.640	18042.575	19701.139	21512.166
OLPDX	332.537	335.323	401.574	440.824	457.627	473.460	480.562	487.770	495.086	536.583	581.558
DEPRR	4.200	4.100	4.000	3.934	3.869	3.805	3.742	3.680	3.619	3.559	3.500
W$CSH	138.206	130.963	112.730	109.102	105.463	102.273	106.539	110.993	115.644	120.500	125.571
W$FD	95.163	101.824	105.897	109.921	114.098	118.434	122.934	131.540	136.801	146.377	158.087
PXCOF	220.595	215.595	207.316	230.943	243.288	255.425	263.088	270.981	279.110	306.975	337.621
PXTEA	91.341	93.844	113.603	126.549	133.314	139.965	144.164	148.489	152.944	168.213	185.006
W$COF	4.070	3.740	2.970	2.772	2.574	2.398	2.518	2.644	2.776	2.915	3.061
DFX01	596.137	596.902	639.598	708.669	744.618	779.872	802.086	824.933	848.431	928.720	1016.606
DFX24	458.745	451.501	560.809	636.803	694.419	756.680	810.438	870.407	937.347	1084.042	1256.930
DFX3	252.654	254.771	305.107	334.929	347.694	359.724	365.120	370.597	376.156	407.684	441.855
DFX59	491.340	496.721	574.397	618.501	636.205	652.598	659.007	665.479	672.015	716.085	763.046
PX	476.362	477.266	532.441	588.491	618.024	647.288	666.062	685.783	706.534	775.563	852.057
CFHEC	176.991	182.707	200.942	226.129	246.867	254.781	257.095	259.261	264.999	273.185	284.343
PM01	475.788	470.861	559.158	608.668	626.581	642.846	647.048	651.287	655.564	704.618	757.353
PM24	488.728	481.352	592.140	668.584	726.267	788.362	841.793	901.211	967.321	1111.485	1280.281
PM59	736.161	746.015	890.767	974.943	1009.112	1040.939	1053.430	1066.072	1078.864	1165.836	1259.818
PM	542.549	548.075	655.485	718.664	745.764	771.447	783.102	795.161	807.658	876.273	951.076
ICRGP	139.093	142.570	146.847	151.252	155.487	159.997	164.476	168.588	172.803	177.123	181.551
WCOMP	0.550	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750
FTZNP	111.731	122.904	129.050	136.147	145.678	156.603	169.132	183.508	200.024	219.026	240.928

Appendix F: Exogenous values for expenditure projections

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
CPCY	119.291	117.036	126.694	129.223	131.034	134.909	125.415	122.819	117.325	122.135	127.986
DBT	13.096	7.120	7.000	6.560	12.294	12.108	11.810	11.940	11.640	10.978	10.430
POP:											
Base case	26.031	26.716	27.409	28.109	28.815	29.526	30.245	30.970	31.701	32.434	33.168
Pessimistic	26.454	27.315	28.213	29.150	30.126	31.141	32.196	33.288	34.417	35.583	36.783
Optimistic	25.826	26.428	27.039	27.658	28.285	28.917	29.560	30.213	30.874	31.543	32.217
POP5-14:											
Base case	7645	7694	7733	7761	7783	7814	7849	7899	7976	8039	8149
Pessimistic	7627	7699	7786	8048	8338	8710	9090	9475	9866	10260	10656
Optimistic	7655	7709	7729	7720	7681	7631	7587	7556	7552	7533	7562
POP15-24:											
Base case	5692	5908	6127	6348	6566	6766	6954	7120	7245	7369	7432
Pessimistic	5692	5908	6127	6348	6566	6765	6953	7111	7239	7357	7415
Optimistic	5692	5908	6127	6348	6566	6766	6955	7122	7249	7376	7442
POPDPN:											
Base case	4735	4813	4894	4974	5058	5143	5229	5316	5400	5485	5566
Pessimistic	5176	5407	5645	5885	6132	6382	6637	6894	7151	7409	7662
Optimistic	4520	4511	4528	4565	4630	4716	4805	4899	4994	5092	5190
RLTP	55.62	54.11	50.25	48.52	46.93	46.25	42.71	41.27	39.14	39.68	39.79
RLTP*	71.78	68.13	66.86	65.95	62.26	60.20	53.64	50.77	46.86	46.57	45.61
RTUBR:											
Base case	0.2663	0.2756	0.2853	0.2953	0.3057	0.3165	0.3278	0.3395	0.3516	0.364	0.3767
Pessimistic	0.2675	0.2767	0.286	0.2954	0.3049	0.3147	0.3245	0.3345	0.3445	0.3545	0.3646
Optimistic	0.2758	0.2876	0.2999	0.3128	0.3264	0.3406	0.3557	0.3715	0.388	0.4053	0.4234

Table F1: Base case expenditure projections

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
CEXADM	366.0873	369.8576	407.1145	464.1476	451.1096	494.1203	501.8320	526.1441	544.2951	603.0740	669.8002
CEXECON	369.2446	374.8536	396.2952	431.8792	449.8725	474.2742	459.5754	464.5951	459.9784	488.4684	521.2551
CEXHLTH	103.6524	117.1923	127.9344	142.9350	144.7818	157.9201	163.8354	173.8387	182.6665	201.0181	221.4438
CEXED	351.3486	357.9884	361.3623	366.2641	370.7144	376.2753	377.8079	382.3384	386.3408	393.6003	401.6561
CEXHSS	52.3167	53.7513	58.8222	67.4848	72.1599	78.6102	75.0972	76.6278	75.6879	83.3754	92.5369
Total	1242.6496	1273.6432	1351.5286	1472.7107	1488.6382	1581.2003	1578.1478	1623.5440	1648.9687	1769.5362	1906.6921
% change	2.494	6.115	8.966	1.082	6.218	-0.193	2877	1.566	7.312	7.751	

Table F2: Pessimistic case expenditure projections

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
CEXADM	382.5939	392.9901	440.6259	512.7034	509.5061	571.6244	595.4375	641.0158	681.5689	777.0927	888.9307
CEXECON	376.3612	384.8276	410.0993	450.8853	474.2130	505.1495	494.8898	506.0556	507.0196	545.1238	589.1941
CEXHLTH	114.3880	132.9130	148.7384	170.0293	175.7968	195.4718	206.1584	222.0188	236.3384	262.9840	292.5945
CEXED	350.3594	358.2667	364.3264	382.5213	402.5479	428.4145	450.2872	475.0206	498.0569	526.5897	553.0490
CEXHSS	54.0151	56.1663	62.2913	72.5284	78.8123	87.3612	85.0025	88.4128	89.0807	100.1839	113.5957
Total	1277.7176	1325.1637	1426.0813	1588.6678	1640.8762	1788.0216	1831.7754	1932.5235	2012.0554	2211.9741	2437.3639
% change	3.713	7.615	11.401	3.286	8.967	2.447	5.500	4.115	9.936	10.190	

Table F3: Optimistic case expenditure projections

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
CEXADM	358.2532	359.0508	392.2538	444.0550	428.7689	466.7326	471.3434	491.6997	506.3198	558.8198	618.5547
CEXECON	365.8033	370.0726	389.9675	423.6849	440.0896	462.7112	447.2743	451.1765	445.8016	472.6170	503.6023
CEXHLTH	104.2896	117.0648	127.5288	142.9793	146.2159	161.7158	170.2994	183.5880	196.1427	219.7069	246.6715
CEXED	351.8983	358.8233	361.1387	363.9511	364.9112	365.7603	362.7963	362.6097	361.9905	364.2996	367.5069
CEXHSS	51.5032	52.6090	57.2588	65.3557	69.5531	75.4292	71.7636	72.9601	71.8245	78.8971	87.3522
total	1231.7476	1257.6204	1328.1476	1440.0260	1449.5386	1532.3491	1523.4771	1562.0340	1582.0791	1694.3404	1823.6876
% change	2.100	5.608	8.424	0.661	5.713	-0.579	2.531	1.283	7.096	7.634	

Table F4: Base case simulations

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
GDEFF	626.771	312.971	464.144	597.118	202.194	295.39	-56.334	42.164	-195.324	-420.387	-297.438
NDEFF	351.436	-408.023	-131.888	-35.305	-280.400	-63.730	-417.763	-319.265	-556.753	-790.068	-684.185
GRGPF	3.780	4.530	4.275	6.164	6.352	4.902	3.739	3.057	2.546	2.072	3.320
OVBAL	1643.693	-322.253	-785.565	-407.920	-1105.442	-1394.601	-1579.377	-2492.277	-3442.971	-3746.189	-3756.826
NGPMP	4095.519	26467.886	28425.362	31485.176	34742.815	37769.246	40261.773	41778.116	42663.325	42947.368	43377.483
CURBL	1289.580	-325.592	-609.970	-311.436	-1011.977	-1401.622	-1826.258	-2738.327	-3688.264	-4186.622	-4317.225
CRBLXG	88.689	-1190.429	-1642.750	-1349.881	-1856.030	-2317.474	-2815.797	-3802.011	-4834.845	-5442.392	-5694.244
INNBF	1033.447	-548.547	-44.706	43.702	-216.098	-52.671	-577.567	-598.584	-835.278	-1168.261	-1225.05

Growth rates

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
CPIFL	17.093	11.663	18.370	7.088	9.930	6.077	16.794	9.173	12.185	3.811	5.702
GRDFF	16.429	6.483	3.044	2.627	4.252	4.579	3.812	1.850	-0.075	-1.339	-3.264
RGPNM	0.043	0.090	0.177	0.261	0.345	0.739	1.140	1.542	1.947	2.351	2.754
M2DEC	12.953	6.409	8.673	8.960	7.500	8.835	9.192	9.192	9.192	9.192	9.192
RGPNM	0.043	0.090	0.177	0.261	0.345	0.739	1.140	1.542	1.947	2.351	2.754
RGPAG	8.734	1.916	5.54	9.185	5.144	4.102	2.398	4.012	1.676	1.076	5.349
RGPIN	7.716	8.226	6.782	7.685	8.120	6.419	4.830	4.801	4.891	4.076	5.113
RGPSV	2.884	3.324	4.113	7.967	6.638	4.306	3.216	1.354	0.627	1.391	4.288
RGPGV	5.555	2.552	5.260	4.253	1.945	3.180	2.731	2.450	2.554	1.946	3.740
RGPFC	5.586	3.529	4.996	7.277	5.490	4.345	3.158	2.959	2.145	2.000	4.615

Table F5: Optimistic case simulations

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
GDEFF	612.905	280.774	401.664	494.233	59.519	86.223	-326.354	-311.510	-632.836	-949.912	-964.462
NDEFF	337.571	-440.221	-194.368	-138.191	-423.074	-272.899	-687.782	-672.939	-994.265	-1319.593	-1351.208
GRGPF	3.767	4.498	4.230	6.108	6.341	4.945	3.842	3.232	2.760	2.344	3.633
OVBAL	1641.683	-323.836	-793.480	-407.613	-1094.100	-1386.965	-1561.177	-2473.459	-3449.634	-3718.170	-3720.002
NGPMP	24079.286	26407.232	28269.514	31168.874	34205.531	36918.069	38997.460	39962.254	40065.977	39312.770	38285.527
CURBL	1287.570	-327.175	-617.886	-311.129	-1000.635	-1393.986	-1808.05	-2719.509	-3694.927	-4158.603	-4280.402
CRBLXG	86.678	-1192.012	-1650.665	-1349.574	-1844.688	-2309.838	-2797.597	-3783.193	-4841.508	-5414.373	-5657.420
INNBF	1020.089	-580.745	-107.185	-59.183	-358.772	-261.840	-847.587	-952.258	-1272.790	-1697.786	-1892.074

Growth rates

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
CPIFL	17.131	11.692	18.436	6.855	9.772	5.712	16.452	8.867	11.815	3.745	5.648
GRDFF	16.395	6.367	2.791	2.209	3.660	3.784	2.744	0.418	-2.078	-4.158	-7.123
RGPNM	0.043	0.090	0.177	0.261	0.345	0.739	1.140	1.542	1.947	2.351	2.754
M2DEC	12.833	6.161	8.222	8.277	6.604	7.626	9.192	9.192	9.192	9.192	9.192
RGPNM	0.043	0.090	0.177	0.261	0.345	0.739	1.140	1.542	1.947	2.351	2.754
RGPAG	8.734	1.898	5.522	9.143	5.255	4.185	2.639	4.252	1.958	1.445	5.639
RGPIN	7.716	8.212	6.754	7.648	8.142	6.518	5.012	5.070	5.231	4.472	5.509
RGPSV	2.878	3.309	4.080	7.959	6.716	4.450	3.462	1.660	0.959	1.813	4.717
RGPGV	5.405	2.404	5.075	4.005	1.747	2.921	2.509	2.262	2.383	1.874	3.743
RGPFC	5.560	3.492	4.943	7.218	5.523	4.397	3.310	3.155	2.376	2.312	4.924

Table F6: Pessimistic case simulations

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
GDEFF	669.671	413.277	657.400	965.524	768.664	1195.643	1212.745	1829.098	2175.532	2687.847	3888.938
NDEFF	394.336	-307.717	61.368	333.100	286.070	836.520	851.317	1467.670	1814.104	2318.165	3502.192
GRGPF	3.821	4.626	4.411	6.360	6.443	4.844	3.507	2.610	2.010	1.404	2.540
OVBAL	1649.881	-317.323	-760.941	-411.514	-1154.303	-1442.400	-1663.897	-2595.294	-3460.607	-3864.182	-3898.374
NGPMP	24145.693	26656.357	28909.688	32513.467	36590.996	40889.624	45229.229	49418.812	54325.770	60430.826	69633.565
CURBL	1295.768	-320.662	-585.346	-315.031	-1060.838	-1449.422	-1910.778	-2841.344	-3705.901	-4304.615	-4458.774
CRBLXG	94.876	-1185.499	-1618.126	-1353.476	-1904.891	-2365.274	-2900.317	-3905.028	-48552.482	-5560.385	-5835.792
INNBF	1074.785	-448.241	148.550	412.108	350.372	847.580	691.512	1188.350	1535.578	1939.973	2961.326

Growth rates

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
_CPIFL	16.975	11.576	18.174	7.784	10.451	7.298	17.948	10.017	13.233	3.970	6.054
GRDFF	16.534	6.845	3.826	3.964	6.283	7.492	7.945	7.586	7.958	9.773	11.353
RGPNM	0.043	0.090	0.177	0.261	0.345	0.739	1.140	1.542	1.947	2.351	2.754
M2DEC	13.321	7.180	10.050	11.333	10.844	13.548	9.12	9.192	9.192	9.192	9.192
RGPAG	8.734	1.971	5.623	9.311	4.813	3.843	1.632	3.242	0.864	-0.020	4.478
RGPIN	7.714	8.267	6.871	7.802	8.069	6.144	4.279	3.961	3.853	2.885	3.923
RGPSV	2.899	3.370	4.212	7.989	6.402	3.854	2.433	0.374	-0.377	0.152	3.010
RGPGV	6.019	3.009	5.805	5.292	2.914	4.450	4.023	3.628	3.738	2.919	4.520
RGPFC	5.667	3.641	5.155	7.505	5.455	4.265	2.781	2.443	1.588	1.223	3.840

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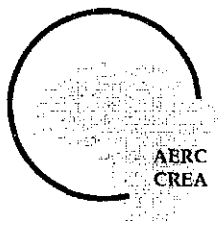

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