

**Better Understanding of the Kenyan
Economy: Simulations from the
KIPPRA-Treasury Macro Model**

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ABSTRACT

Since the pioneering work of Tinbergen in the late 1930s, the use of macroeconomic models as vital instruments for policy analysis has gained considerable interest. Based on historical behaviour of an economy, an economic model can simulate various effects of different policies. The KIPPRA–Treasury Macro Model (KTMM) is a macroeconomic model of the Kenyan economy that provides medium-term projections of major macroeconomic variables in a consistent framework. More importantly, KTMM plays a vital role as an instrument for policy analysis by way of policy simulations.

This paper demonstrates how KTMM can be used for policy analysis and for building different policy scenarios. The paper documents and discusses some of the simulations from KTMM for purposes of understanding more fully the mechanism of the model and more importantly how the economy works. In addition, it provides useful insights into how the macro model can be used to test different policy scenarios. The paper attempts to provide a better understanding of the Kenyan economy and an analysis of opportunities for economic growth, by constructing different economic scenarios. Two types of simulations are considered – partial simulations where a specific policy change is analysed, and policy packages with more than one policy. In both cases, we end up with two options: an outcome with and another without the policy impulse. Policy packages could be viewed as growth strategies if their full impact is discussed comprehensively in terms of how they affect the whole economy.

Partial simulations are conducted for the (13) core behavioural equations and semi-behavioural equations. Three growth strategies that constitute policy packages are analysed, that is investment package, outward orientation through an export-led growth strategy and civil service reform. With each simulation, the effects on key variables in the economy are analysed. Policy simulations undertaken show that different policies or strategies have different outcomes, and, therefore, the choice of a particular strategy depends to some extent on the desired development objective.

KTMM can play a significant role in exploring different policies and strategies in the medium term. The simulations help in assessing the implications of adoptable policies before they are actually implemented. This also ensures that there is consistency in the way policies are formulated and implemented. However, whichever strategy or policy chosen, certain actions must be undertaken to achieve the intended objectives. On the whole, policy analysis, if not the best option, is a better alternative to ad hoc decision making.

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ABBREVIATIONS

AGE	applied general equilibrium
AGOA	African Growth and Opportunity Act
ARIMA	auto-regressive integrated moving average
BOP	balance of payments
COMESA	Common Market for Eastern and Southern Africa
CPS	cumulative production structure
DCP	domestic credit to the private sector
EAC	East African Community
ELG	export-led growth
FSP	Fiscal Strategy Paper
GDP	gross domestic product
GoK	Government of Kenya
KIPPRA	Kenya Institute for Public Policy Research and Analysis
KTMM	KIPPRA-Treasury Macro Model
MMC	Micromacro Consultants
MTEF	Medium-term Expenditure Framework
MP	market price
PRSP	Poverty Reduction Strategy Paper
PRGF	Poverty Reduction and Growth Facility
SNA	system of national accounts
VAT	value added tax

1. Introduction

Tinbergen's model building from the late 1930s to the 1960s laid a major foundation for and spurred considerable interest in the construction of structural macroeconomic models (Fair 1994). For over three decades since the 1960s, empirical macroeconomic models have proved their worth as helpful instruments in policy analysis and preparation, and their use has increased rapidly in recent years. Models make a valuable contribution in the forecasting process and as a vehicle for analysing alternative scenarios (Meyer 1997; van Schaaijk 1993). In this age of information technology and increasing globalization and as societies become more sophisticated, ad hoc decision making, gut feelings or instinct cannot be entertained as the basis for decision making. There is dire need for coherent and consistent policy formulation. An economic model is an instrument that can, among other things, simulate various effects of different policies, based on historical behaviour of the economy. Models capture historical regularities and the structure of the economy, identify key assumptions, embody estimates of past effects and future policy actions on the economy and provide a disciplined approach for learning from past errors (Meyer 1997).

Policy making and budgeting in Kenya are increasingly being informed by medium- to long-term strategies such as the 'Poverty Reduction Strategy Paper (PRSP)' (GoK 2001), which is closely linked to the new budgeting approach, the Medium-term Expenditure Framework (MTEF) (Huizinga et al. 2001). However, both the realization of PRSP and the use of MTEF require an overall macroeconomic framework that ensures consistency in defining the aggregate resource envelop and how it will be spent, as well as forecasting major macro aggregates three to four years ahead (Huizinga et al. 2001; Geda et al. 2002).

The KIPPRA-Treasury Macro Model (KTMM) is a macroeconomic model of the Kenyan economy that is an instrument for achieving these

objectives. It provides medium-term projections of major macroeconomic variables in a consistent framework. More importantly, KTMM, like other macro models, is vital for conducting policy analysis by way of policy simulation. This is crucial because it helps policy-makers in assessing the implication of proposed policies on the economy before the policies are implemented. Policy analyses conducted with the aid of such a model avoid partial analysis—and hence partial understanding—of issues of national significance (Huizinga et al. 2001). KTMM's advantage is that it takes all possible interlinkages in the economy that are not easily tractable (Geda et al. 2002); thus, its simulations could lead to responsible, authoritative and concrete policy recommendations (van Schaaijk 1993).

KTMM has been in use since August 2000, and so far its outputs have been used by the Government of Kenya (GoK) as inputs in the preparation of the Fiscal Strategy Paper (FSP)¹ as part of the MTEF process. Indeed, FSP is a key input in the preparation of the country's annual budget (see Kiringai and West 2002).

This paper documents and discusses some of the simulations from KTMM. The main idea is to understand more fully the mechanism of the model and, more importantly, how the economy works.² The paper provides a better understanding of the Kenyan economy and an analysis of opportunities for growth. From this standpoint, KTMM serves as a useful tool for resource allocation to optimize growth opportunities. The paper demonstrates how KTMM can be used for policy analysis and construction of different scenarios.

This paper proceeds as follows: Section 2 provides a conceptual framework, Section 3 outlines the basic structure of KTMM, Section 4 gives a synopsis on dealing with uncertainty in macroeconomic models,

¹ FSP is prepared by the Macroeconomic Working Group.

² The paper is written partly in response to the frequently asked questions about KTMM.

Section 5 presents and describes the simulation results from the model, and Section 6 gives the conclusion and policy implications.

2. Conceptual framework: macro models vs alternative models

Construction and use of macro models date back to the late 1930s with the work of Tinbergen on model building. Using the dominant methodology – the Cowles Commission approach – a structural model is specified based on theory, after which it is estimated, tested and evaluated (Fair 1994). The forecast is made in a coherent and consistent manner. There are different types of simulation models, but structural macro models are the best suited and thus the predominantly used models for medium-term forecasting and policy analysis. There are other categories of models such the Auto-Regressive Integrated Moving Average (ARIMA) model. The ARIMA (p, d, q) model, as summarized in the notation introduced by Box and Jenkins (1976), theoretically is the most general class of models for forecasting time series. It includes three types of parameters – the number of autoregressive terms (p), the degree of homogeneity (the number of times the series must be differenced to produce a stationary series, or the level of integration of a variable) (d), and the number of lagged forecast errors in the prediction equation (q). For example, a model described as an ARIMA (0, 1, 2) contains zero autoregressive parameters and two moving average parameters computed for the series after it has been differenced once. The simplest versions of ARIMA models include random walk [i.e. ARIMA (0, 1, 0)], autoregressive models [ARIMA (1, 1, 0)] and exponential smoothing [ARIMA (0, 1, 1)]. Any homogeneous non-stationary time series can be modelled as an ARIMA process of order (p, d, q) so long as the appropriate values of p, d and q are identified (Pindyck and Rubinfeld 1998). Thus, simple ARIMA models could be used for forecasting some key economic indicators such as inflation.

The advantage of the ARIMA approach is that it is much simpler and less costly than building a full model (Huizinga 2000). However, it has practicability problems. While the forecast for the individual indicators might be appropriate, a problem arises when these forecasts are taken jointly as the forecast for the whole economy: there is no guarantee that the overall forecast is consistent, since the individual forecasts are simply trend extrapolations. Moreover, ARIMA models are a complete black box, since the coefficients have no economic meaning and do not tell us anything about how the economy works (Huizinga 2000). Therefore, it is difficult to use these models for analysis of different policy options or for determination of appropriate policy choices. What these models lack is the basic structure of the economy that can allow the coefficient to have a structural interpretation to guide policy experiments.

Applied general equilibrium (AGE) models are another modelling approach. The problems with AGE models are that they hardly contain dynamics, and that, even though they are highly detailed, they are completely driven by theory. The greater the detail, the more complex they are to non-technicians, therefore the more difficult to understand. These models are calibrated on a single base year and hence are not suitable for analysing historical time series. Moreover, they are not suitable for macroeconomic policy, since they cannot be used to forecast for the medium term or over the budget cycle (Huizinga 2000). Such models have been developed for developing countries; they are useful for static analysis but not for making medium-term policy.

Structural macro models are the best suited for macroeconomic forecasting and policy simulations for the medium term. This is, therefore, the approach followed by KTMM, which is used within the MTEF framework. This does not imply that alternative models are not important. Since different models serve different purposes, their usefulness and suitability depend on the overriding objective. In addition, the key is to choose the level of complexity necessary to answer

the respective policy questions: some questions can be satisfactorily answered with quite straightforward analysis. For instance, for just a quick forecast of inflation, the ARIMA approach would be cost-effective; but if at all the inflation were the outcome of macroeconomic policies, this forecast might be inadequate in general. In fact, the ARIMA approach and analysis using structural regression models can be combined to produce better forecasting (Pindyck and Rubinfeld 1998). Moreover, comparison of the two approaches in forecast evaluation is common.

3. Basic structure of the model

KTMM is built along the fairly familiar aggregate demand–aggregate supply (AD–AS) framework. The real side of the economy in the model contains four types of agents: domestic production (private firms, parastatals and public service sector), households, the government, and the rest of the world. The model contains three types of markets: labour, product and financial. Total demand equals the sum of investment, consumption, government expenditure and exports. Total demand minus imports equals gross domestic product (GDP) at market prices.

Basic prices – that is, the price of goods and services, nominal and real wage, nominal and real exchange rates, and domestic nominal interest rate – are determined endogenously in the model. Wages and prices are determined in the labour and product markets, respectively. The exchange and interest rates are determined in the financial market. A floating exchange rate is assumed so that money supply is available as an exogenous policy instrument. Interest rate moves to clear the money market, while exchange rate clears the market for foreign assets (see Huizinga et al. 2001).

The model is demand driven in the short run, with multiplier effects through consumption and investment. It is assumed that the price system ensures that there is excess capacity so that any demand is actually met. This is justified by the liberalized nature of the Kenyan economy. The

main feedback mechanism in the real economy works through the wage-price spiral, interest rate and real exchange rate. For example, suppose there is a demand increase: this will lead to high capacity utilization of capital and low unemployment rates, which results in wage and price increases. Assuming a non-accommodating monetary policy, the higher inflation leads to higher interest rates and a real appreciation, causing a reduction of investment and exports. The drop in exports and investment reduces demand until equilibrium is restored. Thus, the model has a tendency to return to equilibrium in the medium term and in the long run.

The model consists of 50 primary variables with 13 core behavioural equations from which hundreds of other variables (secondary variables) are calculated automatically and consistently by definitional relationships. There are three types of primary variables: exogenous, behavioural and institutional (also called as semi-behavioural, that is, estimates that relate to the government sector). The model is built on the SNA 93 consistency framework. For a detailed description of the basic theoretical underpinnings of KTMM and the estimation procedure, as well as estimated results, refer to Huizinga et al. (2001) and Geda et al. (2002), respectively.

4. Dealing with uncertainty in macroeconomic models: expert opinion and simulation properties

As we all know, uncertainty is a fact of life. Ensuring forecasting quality is a general problem of macro models throughout the world, and KTMM is no exception. Even the best macro models are far from perfect (Huizinga 2000). There are various sources of uncertainty that could lead to forecasting error. These include non-policy exogenous variables such as world trade, preliminary data and exogenous shocks, aside from the inherently complex nature of the economy and human interaction. For instance, a study of the forecasting quality of the Dutch CPB macro

models identified four sources of uncertainty and computed the share of each in the total forecast error. The results showed that preliminary data were responsible for 5% of the error, model coefficients for 15%, non-policy exogenous variables for 50%, and shocks in the individual equations for 30% (Huizinga 2000). To improve forecasting, KTMM is not used by itself but jointly with expert opinion, which provides additional information. In other words, a macro model needs to be supplemented with specific information. This information could be based on events that have just been encountered and that have effects on the immediate future, such as a new retrenchment programme or a forecast of drought in the horizon.

Also, expert opinion from different parts of the government may be incorporated into the macro model's forecast, such as opinion from specialists on government expenditure, revenue and different sectors of the economy. Another way of accessing recent information is frequent monitoring of changes in variables (such as consumer price and interest and exchange rates) using monthly or quarterly data where possible. In practice, incorporating available recent and relevant information significantly reduces forecast uncertainty, especially in the short run (Huizinga 2000). In sum, a model is not a panacea but an instrument for analysis and simulations, and supporting it with opinion from pertinent specialists is essential (van Schaaijk 1993).

KTMM is still young, and it might be too early to objectively evaluate its forecasting quality.³ However, its performance has so far been impressive over the last two years: it has generated forecasts that have eventually been comparable with the actual figures realized. Nevertheless, as Huizinga (2000) warns, even in the best of circumstances the degree of uncertainty in forecasting remains very high. Consequently, merely

³ It is approximately two years since the model became operational.

constructing a single baseline is in itself a risky operation for not only the modelling team but also the government that relies on the model to formulate policies. But in practice, uncertainty is much less of an issue when considering the simulation properties of the model. Thus, the second important use of KTMM is to draw different policy scenarios. In practical use, models play a far more dominant role in simulations than in forecasting (Huizinga 2000), and KTMM may be fairly reliable in formulating alternative scenarios around the baseline and policies based on informed choices.

Policy analysis implies not only examining the implications of a particular policy on the economy but also exploring different policy options before reaching a decision point. KTMM is useful in regard to such an exercise. Policy-makers can experiment with different policy instruments that could bring about the desired outcome. The model can provide different scenarios for each instrument or combination of instruments. Combined with expert opinion, this can inform policy decisions and greatly improve the quality of proposed policies. For instance, KTMM has been used in constructing pessimistic and optimistic growth scenarios in the assessment of the effect of the withholding of external financing and the drought and energy crisis that occurred in 2000, among others.

5. Methodology

Simulation analysis involves making a run (called a variant or a simulation) using a model and comparing the results with those of another run with the same model, called a baseline or base run (MMC 2002). In a simulation one compares the model's outcomes – on the assumption that a particular event happens (say, a change in expenditure or value added tax – VAT) – with the baseline. The difference represents the model's response to this particular event, driven by the model's coefficients. This implies that only uncertainty about the coefficients matters (MMC 2002).

This section briefly expounds the methodology of policy simulations as explained in Whitley (1994). The reduced form of KTMM can be expressed as a standard linear model—

$$\mathbf{y}_t = \Pi \mathbf{z}_t + \mathbf{v}_t$$

where \mathbf{y}_t is a vector of the endogenous variables, if the forecast horizon is the current year, or a matrix of endogenous variables, if the forecast horizon is H years, in which case the standard linear model may be expressed as

$$\mathbf{y}_{t+h} = \Pi \mathbf{z}_{t+h} + \mathbf{v}_{t+h} \quad \text{for } h = 1, 2, \dots, H$$

The interest of policy simulations is the outcome of the endogenous variables. \mathbf{z}_t is a matrix of exogenous variables, and P represents the set of policy multipliers driven by the estimated coefficients of the equations system of the model.

Policy simulation analysis starts with a benchmark—also called the base run—and it is often equated with a forecast. A base run (or reference path) is a forecast of the model without any policy impulse. The base run basically gives the model's own dynamics. Since KTMM is used mainly for short- to medium-term forecasting, the forecast horizon spans a period of four to six years. In this paper the focus is on 2001 to 2004 (or year 1 to year 4).⁴

⁴ The period 2001–2004 is used for reference purposes and was chosen because when this study was carried out, the model version used to generate the simulations had been updated with the actual data up to 2000, implying that the forecast begin in 2001. Similar simulations can be carried out with other updated versions of the model—e.g. where there is actual data up to 2001, or with a model version with a revised equation.

The base run or the control equation is given by

$$\hat{\mathbf{y}}_t + \Pi \mathbf{z}_t = 0$$

with the error term equal to its mean value of zero. Replacing the set of exogenous variables \mathbf{z} with $\mathbf{z}_t + \delta_t$, the perturbed solution then is

$$\tilde{\mathbf{y}}_t + \Pi(\mathbf{z}_t + \delta_t) = 0$$

Note that δ is a vector of policy changes, and it can vary over time. Consequently, the effect of the policy can be calculated as

$$\tilde{\mathbf{y}}_t - \hat{\mathbf{y}}_t$$

This represents the deviation of the new model solution from the base run. It is the solution that is usually of interest when different policy options are being considered. Once a proposed policy or a package of policies is identified and fed into KTMM, it would provide the impact of the policy as deviations from the base run, both in percentage and absolute figures.

The policy simulations use either step or growth change in policy instrument δ :

- An example of a step change is where government expenditures are raised by a constant amount relative to the base solution.
- An example of a growth change is where government expenditure is permanently higher than in the base simulation.

As shown in this paper, policy analysis may change one policy instrument at a time, in which case only one element of δ would be non-zero. Alternatively, changes in more than one instrument at a time give a policy scenario with more than one element of δ as non-zero.

In some instances, given that

$$(\tilde{\mathbf{y}}_t - \hat{\mathbf{y}}_t) + \Pi \delta_t = 0$$

it is possible to solve for δ in order to find the required change in policy

instrument(s) to produce the desired change in the endogenous (target) variables. This framework is applied in some models where policy-makers would set targets, for example for real GDP growth, inflation, interest rate, etc., and require the modeller to determine how those targets could be achieved. It would be necessary to add that this approach works well in an economic management environment where populist policies are not the norm. Otherwise the tendency would be to set policy targets that are ambitious, with the danger that the changes required in the policy instrument(s) become significantly unrealistic in most cases, leading to the undesirable result of undermining the credibility of the model.

Two other points are worth mentioning in regard to policy analysis. Policy analysts who use a model like KTMM are often faced with two situations. First, the policy instrument or variable may not be found in the model or may not be directly identifiable. This may be the case where the government proposes a completely new policy or if the policy change is similar to but not defined by the exogenous variables in the model. If the policy is new, it is necessary to make the adjustment to the most relevant structural equation in the model. This would correspond to the variable(s) where the initial impact of the policy is expected to be felt. As an example, suppose there is a new policy on quantitative import restrictions. The import quotas would be a new policy instrument; but since a model like KTMM does not contain quantitative restrictions variables, the best way to analyse this policy would be to apply the adjustment of the proposed policy to the import equation. Another example is if a new tax is being introduced in the country. Since this would be a completely new policy instrument, the best way to analyse its implications through simulations would be to determine the most relevant price. If a relevant price exists, then one can augment this variable by the value of the size of the tax increase. In most cases, the policy analyst has to rely on information that is not available in the model.

Second, the policy proposal may not be specified in sufficient detail. In this situation a relevant policy instrument or variable is included in the model but important features of the transmission mechanism are not distinguished. An example would be to simulate the effect of an increase in government investment directed towards housing. The transmission mechanism of such a policy may not be specified in sufficient detail since most of the materials required for the housing investments may need to be imported, and the model may lack this link in the investment structure.

These two instances pose challenges to policy analysts. This would be the case if a model like KTMM were used to analyse the implications of a drought on the economy. In such a situation, expert opinion becomes very important, as the transmission mechanism of some of the drought-mitigating policies may not be obvious in a macro model like KTMM.

6. Simulation analyses

Kenya's economic performance has been deteriorating, especially in the recent past. Therefore, one of the major challenges facing the country is stimulating economic growth. To aid in the thinking towards this process, we provide a number of simulations from the model, which also help us understand the mechanism of the model. With each simulation, information about the effect on key variables in the economy is presented and discussed. Two types of simulation are carried out: partial simulations where a specific policy change (only one variable) is analysed, and a group of simulations where KTMM is used to analyse a package of policy measures (more than one variable) undertaken simultaneously. Examples under the first option could be analysis of the impact of an increase in VAT rate, of a reduction in import duties, or of an increase in government expenditure on major macro variables such as GDP, inflation, consumption, exchange rate, etc. In the second option, one may talk of 'development strategies' if the policy packages are directed at realizing development objectives. By carrying out policy

simulations, we arrive at two scenarios: an outcome with and another without such a policy or policies.

6.1 Partial simulations

The following simulations consider the effect of a change in the variant variable on the other variables. The partial simulations help us to understand how the economy works and to test the model and the plausibility of results, leading to model improvement, where necessary. Most coefficients derived from regression analyses may exhibit high inaccuracy margins. Partial simulations also help us avoid losing track when a complete package of policy measures (changing more than one variable) is taken into account. For the purpose of this exercise, a sudden increase of 5% for each variable is analysed. The base year is 2001 (year 1); we assume that the change occurs in 2001 (a one-off shock) but remains in the base where applicable, affecting subsequent years. Appendix tables 1–5 show the outcomes on key economic indicators for selected variables of the simulation variant in deviation from the reference path (baseline).

6.1.1 Gross investment of businesses

The investment function is a combination of the flexible accelerator, profitability, investment price, government (public) investments and domestic credit to the private sector (DCP). Investments (both private and public) have been falling in the recent past. Some of the factors that have been associated with this include high capital cost, poor infrastructure, insecurity and the lack of investor confidence (GoK 2001).

Suppose there was an improvement in one of these conditions, say security, leading to an extra 5% in investment value in 2001. The impact on selected key macroeconomic indicators would be as summarized in Appendix table 1. Notice that a 5% increase in investment in 2001 results in an increase of more than 5% in investment in the same year. This is because of the multiplier effect in the economy: the initial impulse of 5% stimulates economic growth and profitability, which in turn stimulate

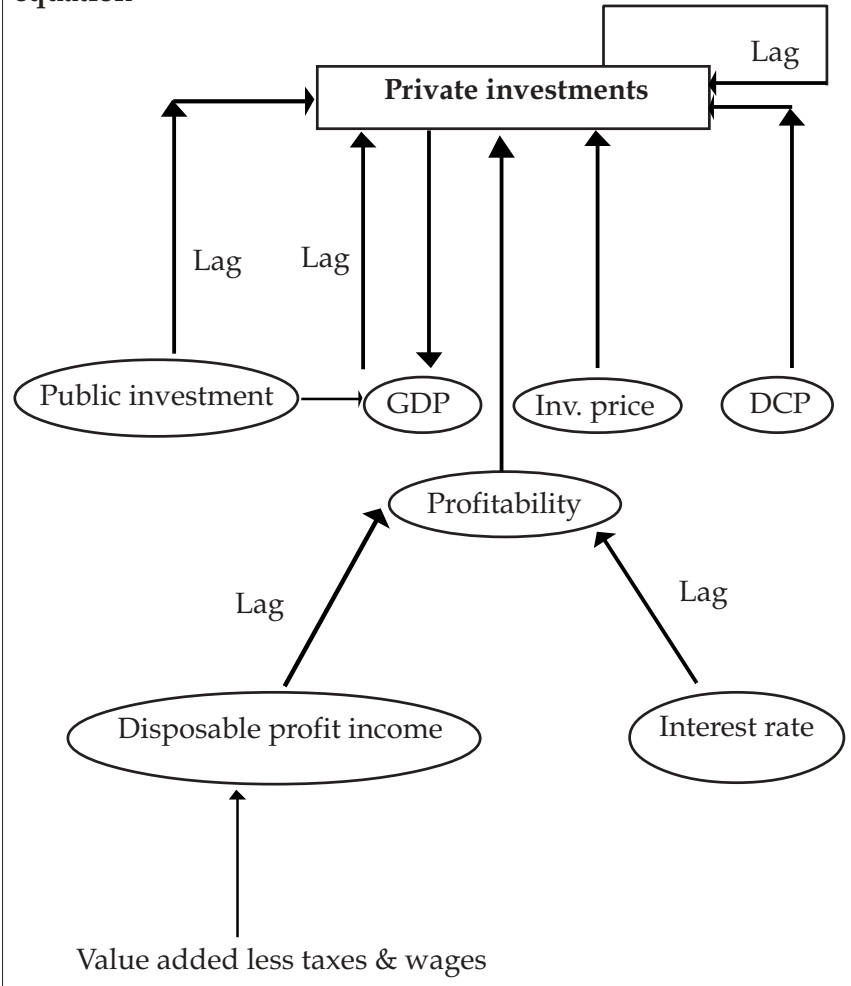
more investments. This directly results in extra value added and profits for businesses. Higher investments lead to more employment and therefore a rise in the wage bill of businesses. Value-invested capital also goes up, as does domestic credit to the private sector. Exports remain at the same level in 2001 but increase (by 1%) in 2002. By default, most of the investments are geared towards the domestic market. However, a part of these investments requires additional imports (of inputs or intermediate goods), therefore, imports go up. This leads to a deteriorating balance of payments, as indicated by the decrease in foreign exchange reserves. Real GDP increases by 0.7% and 0.3% in 2001 and 2002, respectively, but the positive impact dies out in later years. This is mainly because the impulse is given for only one year (base year) but not subsequent years.

We can also assume a case where there is additional investment each year for the entire period – a fairly stable economic growth path – and this will yield different results. There is an initial increase in money supply in line with growth in GDP. More revenue is generated due to the higher economic growth, causing a decline in domestic debt, which leads to a decline in domestic financing and a budget surplus. Figure 1 illustrates part of the transmission mechanism to private investments. A change in any of the explanatory variables in the investment equation – for example public investments, credit to private sector or interest rates – directly affects investments. In addition, a change in any other variable in the model related to these variables will indirectly affect investment. For instance, an increase in wage rate has implications for profitability and, therefore, investment.

6.1.2 Exports of goods and services

In KTMM, export of goods and services is a function of export price, income of trading partners, relative prices and the private investment-GDP ratio. Suppose, for instance, that the African Growth and Opportunity Act (AGOA) initiative results in an additional increase in

Figure 1: Transmission mechanism for private investment equation



exports of 5% in 2001 from the previous level. This results in extra investments, profits, consumption and tax revenue. Real GDP increases by 1.6, 1 and 0.7 percentage points from the previous levels (the baseline) in 2001, 2002 and 2003, respectively (Appendix table 1). As with investments, the resulting increase in exports is more than the initial impulse of 5%, owing to the multiplier effect. The additional exports result in an inflow of foreign exchange, leading to improvement in the balance of payments account. Thanks to the higher economic growth,

more revenue is generated, leading to a decline in domestic financing or debt and a budget surplus. Money supply also increases with the increased economic activity. Note that imports also grow as a result of the increased consumption and investment levels, part of which is import dominated. In the current version of KTMM the total exports of goods and services is aggregated in one equation, but for sectoral analysis there is need to disaggregate total exports into major categories. That way, specific promotion policies targeted at, say coffee, tea or tourism etc. could easily be analysed.

6.1.3 Imports

Imports are a function of real final demand (re-weighted by import intensity based on cumulative production structure (CPS) matrix)⁵ and relative prices (import price less domestic consumer price). A sudden increase of imports could be harmful to economic growth and negatively influence foreign exchange reserves. Imports are considered a leakage from the domestic economy; therefore, an increase in imports leads to a decline in real GDP of -3.7, -2.2, -1.7 and -0.3 percentage points from the base for 2001, 2002, 2003 and 2004, respectively (see Appendix table 2). The extra imports of goods and services cause deterioration in the balance of payments (BOP) initially, but this improves from 2003 onwards owing to the slight increase in exports resulting from currency depreciation. The lower economic growth also results in a decline in money supply, investments and revenues. In practice, increases in imports follow changes in other major macro aggregates such as investment, or export boom and expansionary fiscal policy. This simulation shows the implication of an abrupt or exogenous increase in imports that does not result from these changes.

⁵The CPS matrix is derived from Kenya's input-output tables. The matrix enables one to compute the import intensity and other components of aggregate demand.

6.1.4 Export price

Export price in KTMM is specified as a function of wage costs, import price, world trade price (competitors price) and real interest rate. Assume that the export price for Kenyan exports of goods and services is higher than assumed in the reference path; the effect of this change on key macroeconomic variables is given in Appendix table 3. A higher export price (by 5%) implies deterioration in competitiveness, leading to a decline in the value and volume of exports – a decline of 8.2 percentage points in 2001. It also implies an initial decline in consumption (as both disposable wage and profit decline) and private investment (as GDP and profitability) fall.

An increase in export price is also accompanied by an increase in import price, leading to a decline in imports. Because of the fall in real GDP, investments – and consumption – also fall. Wage employment decreases as well. Since the exchange rate is a function of price differentials (that is, growth in world price less export price), the shilling depreciates against the dollar following a decline in export price.⁶ This encourages exports for subsequent years, counteracting some of the effects of a decline in export price on exports. Consequently, real GDP does not decline substantially in the subsequent years. Real GDP deviates negatively from the reference path by -1.9% and -0.4% in 2001 and 2002, respectively, stays the same in 2003 and improves thereafter – by 0.6% in 2004 as investments and exports pick up (due to the depreciation of the shilling). The decline in economic growth is accompanied by falling revenues, and this results in a deficit.

⁶ See Were et al. (2001) for details on the impact of current account balance on the exchange rate.

6.1.5 Import price

Changes in import price are determined by changes in world trade price and the pressure of indirect tax (VAT and import duty) on imports. A 5% increase in import price—for example resulting from an oil price shock—leads to a decrease in investments (-2.9%), consumption (-3.1%) and exports (-0.8%) (see Appendix table 3). This is mainly due to the higher prices, since import price is also a determinant of consumer, export and investment prices. Consequently, consumption demand falls, as part of consumption originating from imports is cut back, and disposable profit income falls owing to deterioration of investments. Exports fall as demand for imported inputs and intermediate goods is reduced. High import costs (of, say, intermediate and capital goods) lead to higher production costs and decline in profitability and GDP growth, which result in a decline in investments (see Appendix table 3). Initially (in 2001), the current account deteriorates, as indicated by the declining reserves. Also note that imports decline by about 4% in real terms in 2001. Overall, real GDP declines by -1.1%, -1.8% and -1.4% in 2001, 2002 and 2003, respectively.

6.1.6 Wages in government (remuneration of government employees)

This variant assesses the impact of a 5% increase in wages and salaries of civil servants. The government has in the recent past raised salaries, wages and allowances of different categories of public service—judges, medics and civil servants—and there has been intense pressure from the Kenya National Union of Teachers to raise salaries of teachers. The extra earnings boost consumption owing to the increase in disposable wage income. This stimulates economic growth, which in turn promotes investment (as per the accelerator principle). Profits, and therefore investments, go up. However, GDP increases just marginally, by 0.4%, for the period 2001–2003. Intuitively, a larger proportion of the extra earnings goes directly into consumption goods and services than to

investment goods. Owing to rising consumption, demand for imports goes up, which leads to deterioration in foreign exchange reserves and in balance of payments. As a result of the extra expenditure, there is a budget deficit, which implies higher domestic financing or borrowing requirements, leading to an increase in the domestic debt.

6.1.7 Government investments

The model assumes, as would be expected, that government investments are investments in productive activities such as infrastructure, which, among other things, crowd in private investment. Both private investment and consumption improve as profitability goes up. However, the maximum impact of public investment on investment is realized in consequent years, due to the expected lagged effects (see Appendix table 2). But imports also go up, competing away some of the growth. Thus, a 5% increase above the level in the base leads to an extra 0.2 percentage points in real GDP each year from 2001 to 2003. The growth in GDP stimulates further public investments. But the need to finance these investments causes a bigger budget deficit.

6.1.8 Other government goods and services

These refer to government expenditure on goods and services other than wages and salaries. An extra 5% increase in these results in a marginal real GDP growth of 0.4%, 0.2%, 0.2% and 0.1% above the reference path for 2001, 2002, 2003 and 2004. The extra expenditure results in extra consumption, and, through the multiplier effect, leads to some increase in economic growth. Note that the increase in expenditure is accompanied by a rise in imports (government's demand for imports) and, therefore, results in deterioration in BOP. It also results in a budget deficit owing to the need to finance the deficit.

6.1.9 Labour productivity

Labour productivity has implications on the performance in any economy. However, improving labour productivity requires long-term investment in human capital and other factors that affect productivity, such as technological advances. Also, it takes time before the effects of these investments can be realized in the form of increased productivity. If we can quantify how these investments improve productivity, we can use KTMM to determine their impact on GDP and on the economy in general. Labour productivity in KTMM is basically defined as the growth in output (value added) divided by total wage employment (output per worker). However, to capture the positive lagged effects on economic performance, another variable – labour productivity trend – is defined as an index variable, which grows with the five-year moving average growth rate of actual labour productivity. This implies that an investment in, say, education will still be felt five years later. Suppose in this case that as a result of investments in education labour productivity increases by 5%; the results would be as shown in summarized form in Appendix table 4. There would be an increase in economic performance in general. Investments, consumption and exports in volume terms go up by nearly 2 percentage points. And there would be an additional 1.8% growth in real GDP. This boosts investments further (as a result of the accelerator principle) and improves competitiveness by lowering export, consumer and investment prices. Note that due to improved productivity, businesses can do with fewer employees, and thus there is a reduction in wage employment, implying a decline in wage costs. But wage rate rises in 2001 as a result of increased productivity. Money supply increases and current account balance also improves. More revenue is generated, leading to a reduction in domestic financing and to a budget surplus.

6.1.10 Long-term interest rates

The high cost of capital, partly attributed to the relatively high interest rates, has been considered one of the impediments to investment in Kenya. Long-term interest rates determine borrowing and loan repayment requirements. Suppose interest rates increase by 5% in 2001; there would be no change in the volume of investment in 2001. However, because of the one year lag, private investments decline significantly, by 17.6%, 16% and 11% in 2002, 2003 and 2004, respectively (see Appendix table 4). The high interest rates result in lower profitability as a result of the high cost of capital. Consequently, GDP goes down by 2.1%, 3.2% and 2.8% in the same period, leading to a further decline in investments. The volume of imports declines as a result of the decline in investments. Consumption also falls as a consequence of the decline in disposable wage and profit income. The volume of exports remains unchanged in 2000 and 2001 but declines thereafter. There are marginal increases in consumer and export prices (from 2003 onwards), reflecting the worsening competitiveness of the economy associated with the higher interest rates. This scenario is also accompanied by a budget deficit and, thus, by increased domestic borrowing and a decline in money supply from 2002 onwards. The budget deficit worsens with the increased interest payment costs for the government.

6.1.11 Short-term (Treasury-bill) rate

In Kenya, the Treasury-bill rate forms a benchmark for other interest rates. Suppose there is a jump in the Treasury-bill rate resulting from a sudden increase in domestic borrowing by the government arising from unforeseen circumstances. From the simulations, this leads to a reduction in investments but does not appear to have a significant impact in comparison with long-term interest rates. Investment and consumption volumes decline by 1% and 0.4% in 2001, but because exports grow by about 2.3%, real GDP grows marginally by 0.4% in 2001 but declines by

0.2% in subsequent years. Short-term interest rates are targeted mainly for speculative purposes or short-term investment in securities.

6.1.12 *Capital account balance*

With the free movement of international capital flows, the country could experience a sudden capital inflow, for example as a result of economic stability or domestic interest rates being higher than foreign interest rates. A 5% increase in the capital account balance in 2001 – the equivalent of an inflow of about Ksh 892 million – would result in extra foreign exchange, improving the BOP. The real sector remains unchanged in real terms except for a negligible decline of 0.1% in investments volume of businesses, mainly as a result of the decline in domestic credit to the private sector (computed as broad money supply less net foreign assets less domestic credit to the government). Nominal private consumption also declines marginally owing to the fall in disposable income (wage and profit). There is negligible impact on real GDP for the entire period. This is understandable, since no assumption is made regarding investment of capital inflows into the productive sector. Money supply also declines.

6.1.13 *Wages in the business sector*

Business wages are a function of growth in wage employment for the business sector (three-year average), inflation (consumer price), labour productivity trend and informal sector rate. In Kenya, wage employment forms a relatively small proportion of the economy compared with informal sector employment. This variant shows that an increase of 5% in the wage bill will affect competitiveness of the economy (refer to Appendix table 5). Gross investments decrease due to the decline in profits and labour productivity. Investments also decrease with declining economic growth. There is a decline in the return on investment partly as a result of falling profitability. Nominal private consumption and transfer to households go up, but consumption in real terms declines by

-1.5% from the base mainly owing to the sharp increase in consumer price (3.2%) brought about by increased labour costs.⁷ Overall, volume growth in private consumption declines because, although disposable wage income increases, disposable profit income decreases and prices go up. Exports and imports increase by 0.8% and 0.6%, respectively, in 2001 but decline in 2002 and 2003 before they recover slightly in 2004. The extra growth in exports is explained by the decline in export price (increased competitiveness).

Overall, real GDP declines by -1.6% in 2001 and -2.2% in 2002. But real wage and purchasing power go up in the initial year (2001) before declining thereafter. The deterioration in BOP is attributed to the rise in imports (in 2001 and 2004). Money supply declines in line with the declining growth of GDP. The implication of this partial simulation is that wage inflation has a tendency to dampen growth in the economy. In this regard, the relatively higher wage rates experienced in recent years may have had a negative impact on profitability, partly explaining the poor performance of the economy. These results, therefore, suggest a wage restraint policy and an effective monetary policy.

6.1.14 Consumer price

Changes in consumer price (inflation) are a function of wage costs, import price and indirect tax pressure. A rise in consumer price has adverse effects on consumption. For instance, a 5% increase in consumer price in 2001 reduces private consumption by 4.1 percentage points in the same year (see Appendix table 5). Note that the 5% increase in consumer price results in a price increase of 6.1% in 2001, because the initial increase in consumer price leads to higher wage costs, which in turn lead to a higher

⁷At the moment, it appears that the effects of the wage cost on consumption price are considerable in spite of the fact that the formal sector comprises only a small percentage of the economy in comparison to the vibrant informal sector. Therefore, in-depth analysis of the informal sector's labour market is crucial.

price (this process is known as the 'wage-price spiral').⁸ Consumer price merely declines by -0.7% and -0.3% in 2002 and 2003, respectively, because the 5% increase in consumer price occurs only in 2001. Private investments decline by -1.5% in 2001 but gradually increase for subsequent years from 0.5% in 2001 to 5.1% in 2004 as the wage rate declines (partly due to the higher labour productivity), leading to higher profitability. Overall, real GDP declines by -3.2%, -1.3%, -0.8% in 2001, 2002 and 2003, respectively, but increases slightly, by 0.5%, in 2004.

6.1.15 Exchange rate

Exchange rate is well known as a volatile variable to predict, especially in a liberalized market economy that is driven by other factors such as expectations. That notwithstanding, exchange rate changes in KTMM are determined by changes in price differential (domestic price minus world trade price) and interest rate differential (domestic interest rate minus short-term foreign interest rate).⁹ An overvalued exchange rate is at times not desirable for an economy such as Kenya's, since this discourages exports. Suppose that the Kenya shilling depreciates by 5% against the dollar, say as a result of capital flight, which could be instigated by domestic or exogenous factors. This increases competitiveness, leading to extra growth in export volumes of about 8.3% in 2001, assuming there are no supply constraints. Real consumption and investment decline by -1.2% and -3.5%, respectively, partly as a result of a rise in consumer price (2.5%) and in investment price (3.7%). Real GDP increases by 1.6% in 2001 but declines by -0.6% in 2002 partly due to a decline in exports in the subsequent year as export price goes up. Although the depreciated currency boosts exports, import prices go up (6.4%), discouraging imports (see Appendix table 6).

⁸ Refer to footnote number 6.

⁹ An attempt has been made to improve the exchange rate equation in the subsequent versions of KTMM by incorporating other variables such as the current account balance and net external inflows (see Were et al. 2001).

6.1.16 Short-term foreign interest rates

Let us consider an exogenous shock, such as a 5% rise in foreign (USA) short-term interest rates, that results in the shilling depreciating by about 1–2 shillings against the dollar (1–2.5% depreciation). There is growth in exports, but slight decline of 1%, 0.4% and 0.5%, respectively, in investments, private consumption and imports in 2001. However, growth in exports is only temporary, as it declines by 0.8% in 2002 and remains unchanged in 2003 (see Appendix table 6). Real GDP improves slightly by 0.4% but declines by about 0.2% in subsequent years. There is an improvement in the current account.

6.1.17 Indirect taxes¹⁰

Indirect taxes are categorized into VAT (local VAT and VAT on imports), import duties and excise duties.

Local VAT

For future years, collection of local VAT grows in line with growth in total consumption (private and government). An increase (of 5%) in indirect taxes leads to a higher consumer price and, therefore, to lower consumption. It also lowers the demand for imports, but this leads to an improvement in BOP. Private investments decline as consumption and GDP decline. Money supply, profits and value added also fall. Consequently, there is a slight decline in real GDP over the 2001–2004 period. The impact on revenue and, therefore, the budget is positive (see Appendix table 7).

VAT on imports

This is projected by multiplying its level in the preceding year by the growth in imports of goods and services. The extra tax burden (of 5%)

¹⁰ Estimation of tax elasticities for different categories has been finalized, and the coefficients will be incorporated in subsequent versions of the model.

leads to a decline in domestic consumption and demand for imported goods and services. Consequently, GDP decreases marginally by about 0.1%.

Import duties

Import duties grow by the growth rate of imports of goods and services. An increase in import duties implies a fall in imports, consumption and investments. It, however, improves the current account. The extra revenue reduces domestic financing, leading to a budget surplus. The real GDP declines marginally over the period.

Excise duties

Revenue from excise duties grows (or declines) with the growth rate of GDP in current market prices (nominal GDP), that is, the previous value of revenue from excise duties multiplied by the growth rate of nominal GDP. An increase of 5% has more or less similar effects as import duties.

6.1.18 *Direct taxes on corporate profits*

In KTMM, direct taxes on corporate profits are defined as the value of the previous year's tax multiplied by the growth in gross profit income. A 5% extra tax on profits leads to a decline in private consumption, as disposable profit income is reduced, negatively affecting investment in consequent years, mainly as a result of reduced profits, declining growth and reduced domestic credit to the private sector. GDP decreases marginally by about 0.1% from the base. The results are summarized in Appendix table 7.

6.1.19 *Direct taxes on wages (pay as you earn)*

In the KTMM version used in this paper, taxes on wages are projected by multiplying the previous year's taxes by the change in wage income. Higher direct taxes (with the extra 5%) cause a decline in disposable incomes and subsequently in consumption. However, a budget surplus results from this extra revenue. Foreign exchange reserves improve, as

part of the decline in consumption is attributed to a reduction in the demand for imported goods. Money supply declines in line with the declining economic activity. Although the volume of investments may remain the same in the base year, it declines in consequent years. The overall effect is a cutback of about 0.2 percentage points in real GDP.

6.2 Simulations for policy packages

In this section, the model is used to analyse a few policy packages (more than one variable is shocked) that are motivated by ongoing economic debate about growth stimulation. Apparently, these are more intuitive scenarios, since in real life more than one policy could be required, implying that some variables change simultaneously. Thus, based on partial simulations one can design various policy packages. However, in such a scenario some policies may dampen the effect of other policies on economic performance. It is also worth acknowledging that the real economy is more complex than what is captured by a macro model. Furthermore, there are many non-quantitative characteristics of the economy that the model does not take into account, for example institutional weaknesses and inefficiencies. This notwithstanding, simulations are crucial for analysing policy options and making choices. With that in mind, the following packages or strategies are considered.

6.2.1 *Investment package*

Both domestic and foreign investments have been declining in the recent past. To reverse the trend, suppose that Kenya deliberately adopts an investment-led development strategy aimed at building a strong industrial base. Some of the reasons attributed to low investment include high interest rates, poor infrastructure, low investor confidence, lack of external funding, insecurity and uncertainty. Although assumptions can be made, it is difficult to verify the effects of all these factors on investment using a macro model. Nonetheless, the impact of some of these factors on investment and general economic performance is analysed. For

instance, a reduction in interest rates is assumed—long-term interest rates fall by -3%. As indicated under partial simulations, public investments, for example in infrastructure, also are important, since they crowd in private investments. Thus, assume an increase in public investment of about Ksh 2 billion. This could be financed either externally or domestically. However, given the implications on the economy of high domestic public debt, it is reasonable to assume that these investments can be financed through concessional external loans if not through grants.

There has also been concern about the high domestic taxes in comparison with other countries in the region and even globally. Suppose, as an incentive for investment growth, direct taxes on corporate profits and wages are lowered slightly by 2 percentage points. This leads to a reduction in direct taxes amounting to about Ksh 1.1 billion in 2001. But this is compensated for by an increase in indirect taxes amounting to Ksh 1 billion in 2001, rising to Ksh 3.4 billion, 6.5 billion and 9.7 billion in 2002, 2003 and 2004, respectively. Moreover, the reduction in direct taxes occurs for only the first two years for corporate taxes and for three years for household taxes, but revenues increase thereafter as economic performance improves. Since, as has been observed, only a small segment of the economy pays direct income taxes, measures to broaden the tax base and improve compliance could go a long way in increasing tax revenues. Coupled with other factors such as political and economic certainty, this could also act as an incentive to attract foreign direct investment. Thus, assume there is capital inflow of about Ksh 3 billion in the form of foreign direct investment.

The additional investments are likely to be accompanied by some additional imports, such as intermediate goods; therefore, assume an increase of Ksh 2 billion.¹¹ Productivity issues cannot be ignored: better

¹¹ One could use the import intensity of investments to determine the level of imports.

infrastructure and importation of goods with some technological content, and better working conditions, among other things, could boost productivity in the short run. However, since productivity gains are likely to be maximized in the long run, we assume an increase in productivity of only 0.5% in the initial year. With regional economic integration initiatives such as the East African Community (EAC) and the Common Market for Eastern and Southern Africa (COMESA), it is also sensible to presume that some of the products resulting from the additional investments, for example manufactures and food processing will be exported, resulting in additional export value of about Ksh 1 billion.

The combined effect of these simulations on the key macro variables is summarized in table 1 below. Most of the proposed policies have lagged effects on private investments, leading to relatively higher investments, and thus resulting in higher real GDP in subsequent years (2002 and 2003) compared with the base year. Volume investments increase substantially by 4.1%, 11.6%, 7.9% and 4.4% in 2001, 2002, 2003 and 2004, respectively. Growth in investments is accompanied by growth in consumption and export of goods and services, further boosting economic growth. Exports increase by less than 1% in the first two years but increase faster, by 2.2% in 2003 and by 1.4% in 2004. Part of the positive effect of additional foreign investments and public investments is dampened by the increase in imports. As a result of a combination of all these factors, there is an additional GDP growth of 0.7%, 1.8%, 2.3% and 1.7% in 2001, 2002, 2003 and 2004, respectively. Wage employment declines by -0.2% initially but increases by an average of about 1% in subsequent years. There is a decline in the current account balance as a proportion of GDP, but the package leads to more revenue and therefore to lower budget deficit. This package can be adjusted to produce different outcomes depending on the measures undertaken. The outcomes also depend on whether the changes occur in only one year or for each year for the entire period.

Table 1. Impact of investment package and export-led growth (ELG) strategy on key indicators (percent deviation from the base)

% change	Investment package				Outward orientation – ELG			
	Year 1	Year 3	Year 3	Year 4	Year 1	Year 2	Year 3	Year 4
Real GDP growth	0.7	1.8	2.3	1.7	2.5	0.6	0.2	-0.5
Consumption (private)	0.6	1.7	2.4	1.9	1.1	1.1	0.7	0.1
Investments (business)	4.1	11.6	7.9	4.4	3.2	4.0	-0.3	-2.0
Exports of goods and services	0.7	0.6	2.2	1.4	9.9	-0.5	-0.2	-1.2
Imports	1.8	2.7	3.0	2.3	4.0	1.4	0.7	0.1
Wage employment (businesses)	-0.2	0.6	1.1	1.0	0.3	0.4	0.4	-0.6
Labour productivity	1.1	1.6	1.6	0.9	2.6	0.4	-0.1	0.1
Consumer price	-0.3	-0.3	-0.3	-0.2	-0.7	-0.9	-1.0	-1.0
Purchasing power of average earner	0.6	0.2	0.6	1.0	0.8	0.7	0.9	1.0
Current account balance (% GDP)	-0.4	-1.1	-1.5	-1.9	0.0	-0.4	-0.4	-0.5
Financial deficit (% GDP)	0.0	0.3	0.7	1.1	0.2	0.3	0.3	0.1
Return on investment	0.4	2.1	3.7	4.4	0.6	0.9	0.6	-0.1

6.2.2 *Outward orientation through an export-led strategy*

With globalization, outward orientation through export-led growth strategy has become the most glorified development strategy. The Poverty Reduction Strategy Paper (PRSP) envisages export-led growth as the strategy to help Kenya attain the 'newly industrialized country' status by the year 2020 (GoK 2001). Unfortunately, no clearly defined strategies are outlined. That notwithstanding, there is potential for promoting export growth, holding other factors constant. One option could be to increase competitiveness by lowering export prices, for example for coffee, tea, horticulture and tourism. In the case of tourism, lower prices could give Kenya an edge, given the stiff competition, especially from other African countries such as South Africa, Uganda and Tanzania. In this scenario, it is assumed that the export price declines by -5%. Besides lowering the price, export earnings could be increased through intensive marketing abroad of products and services (for example tourism), improving security in general and in parks (in the case of tourism), offering high quality products (for example processing them before exporting) and packaging them better, and better services, etc. The Coffee Act 2001 is hoped to help revive the coffee sector and increase coffee exports.

Assume an additional increase in export earnings of Ksh 10 billion (about 5% increase from the 1999 value). Increasing exports might require some additional investments (for example, semi-processing and manufacturing industries). With the African Growth and Opportunity Act (AGOA) initiative, for instance, investments in the textile industry are likely to increase; therefore, assume additional investments of Ksh 1 billion. In addition, one cannot rule out the fact that additional exports will require some additional imports such as intermediate goods. Thus, additional imports worth Ksh 2 billion are assumed. Like in the case of investments, a 0.5% increase in productivity is incorporated.

The results of the combined simulations also are summarized in table 1. There is additional volume growth in exports and imports amounting to about 10% and 4%, respectively, in 2001. Consequently, real GDP increases by 2.5% that year from its previous level. However, the effect of the impulse dies out in subsequent years, leading to a marginal increase in real GDP of 0.6% and 0.2% in 2002 and 2003, respectively, unless an assumption is made that exports will remain competitive, i.e. there will be a lower export price of the same magnitude (-5%) for the entire period. To fully understand these results, it is important to comprehend the effects of specific partial simulations. For instance, an initial reduction in export price (without a change in other variables) leads to an appreciating currency, which discourages exports in subsequent years, thereby dampening a part of the increase in exports. In addition, in this simulation the 5% reduction in export price occurs only in 2001 (initial year) and, therefore, the export price for subsequent years declines by a mere 1%. A decline in export price is accompanied also by a decline in import price, leading to additional imports besides the Ksh 2 billion worth of imports added. Like in the case of investment, this package is accompanied by more revenue and, therefore, by a budget surplus (lower deficit).

6.2.3 Civil service reform¹²

It has been argued that the civil service is bloated, resulting in high recurrent expenditures on salaries and wages and inefficiencies, among other things. There have been attempts in the recent past to downsize the civil service. Assume that there is agreement between the government and the international financial institutions, notably the International Monetary Fund, ensuring resumption of financial inflows (for example through the Poverty Reduction and Growth Facility – PRGF), enabling

¹² The numbers used here are hypothetical and should not be interpreted as part of the current civil service reform

the programme to progress further. Suppose 5000 employees (about 1% from 2000) were to be retrenched at a cost of about Ksh 3250 million (roughly Ksh 650,000 per person). This is assumed to occur in 2001. The remuneration expenditure for government employees increases by Ksh 3250 million, which is financed by external sources. These amounts then go to households as transfers, resulting in higher disposable incomes and, therefore, higher consumption.

The resultant effect of the above is summarized in Appendix table 8. Real GDP increases only marginally, mainly driven by the extra consumption and investments. Imports increase in line with the increase in consumption and investment. The extra increase in real GDP is 0.7%, 0.8%, 0.8% and 0.4% for 2001, 2002, 2003 and 2004, respectively.

7. Conclusion

This paper sought to provide better understanding of how KTMM works – and, by implication, how the economy works – by describing some simulations. In the process, the paper demonstrates how KTMM can be used for policy analysis and for building different scenarios. Two types of simulations have been considered – analysis of a specific policy, and of a set of policies. By undertaking policy simulations, two options are arrived at: one with the policy impulse and the other without it. The advantage is that one is able to survey and explore all the possible policy choices and their implications on the economy before adopting a particular one. This also ensures that there is consistency in the way policies are formulated and implemented.

If discussed exhaustively and all alternatives sought (for example, with relevant stakeholders), scenarios based on different policy packages may be viewed as some sort of economic growth strategies. Thus, KTMM can play a significant role in exploring different strategies in the medium term. Policy simulations undertaken show that different policies or strategies have different outcomes; therefore, to some extent the choice

of a particular strategy depends on the desired development objective. However, whichever strategy is chosen, certain policies or actions must be undertaken to achieve the intended objectives. This is because the model can oversimplify the real world by making it appear quite easy on paper. Another danger in this simplicity is to assume that KTMM can provide all the answers to economic problems. The ELG development strategy, for instance, implies that competitiveness in the world market must be ensured, and the goods produced must have a market (in other words, their demand should be high). There are also risks involved, such as huge price falls in the world market, for example for agricultural products, as has happened with coffee and tea. If ELG is chosen as a development strategy, there is need to adopt measures that mitigate the risks. Some of these measures include mitigating low world prices through diversification, moving towards processing of primary products, increasing the base of manufactured exports, and introducing measures that ensure that the country maintains its competitiveness, for instance reducing the cost of production. On the whole, if not the best option, policy analysis is a better alternative than ad hoc decision making.

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Appendix: The impact of simulations on selected key macroeconomic indicators

Appendix Table 1. Impact of an increase in private investments and exports on key macroeconomic indicators

Selected macro indicators	Investments (5% increase)					Exports (5% increase)				
	2001	2002	2003	2004	2005	2001	2002	2003	2004	2005
Gross investments (Ksh m)	5624	4811	3937	1764	-1043	280	6971	10316	11764	10486
Exports of goods and services (Ksh m)	-6	1951	1762	1139	11	10443	10642	13907	15623	16285
International (% changes)										
Trade volume (trade partners)	0	0	0	0	0	0	0	0	0	0
World trade price (Ksh)	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0
Long-term interest rate (USA)	0	0	0	0	0	0	0	0	0	0
Short-term interest rate (USA)	0	0	0	0	0	0	0	0	0	0
Wages and prices (%)										
Real wage rate (urban-based CPI)	0.0	0.1	0.2	0.2	0.0	0.0	0.4	0.6	0.7	0.6
Wage rate (businesses)	0.0	0.1	0.3	0.3	0.2	0.0	0.4	0.7	1.1	1.1
Consumer price (change)	-0.1	0.0	0.1	0.2	0.2	0.0	-0.1	0.1	0.4	0.5
Export price (change)	0.0	-0.1	0.0	0.0	0.1	0.0	-0.1	-0.1	0.0	0.2
Import price (change)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.0
Investment price (change)	0.0	0.0	0.1	0.1	0.1	0.0	0.1	0.2	0.4	0.4
Price of output 	0.0	0.0	0.1	0.2	0.2	0.0	-0.1	0.1	0.4	0.5
Labour costs per production unit	-0.7	0.0	0.6	0.7	0.4	-1.4	-0.3	0.5	1.1	1.2
GDP MP deflator	0.0	0.0	0.1	0.2	0.1	0.1	0.0	0.1	0.4	0.5
Volumes (%)										
Volume consumption (households)	0.6	0.4	-0.1	-0.5	-0.6	1.4	1.1	0.6	0.0	-0.6
Investments (businesses)	5.3	-0.5	-1.6	-2.4	-2.3	0.3	6.1	1.8	-0.6	-2.8
Export volume of goods and services	0.0	1.0	-0.1	-0.4	-0.6	5.0	0.0	1.1	0.1	-0.5
Import volume of goods and services	1.1	0.3	-0.2	-0.6	-0.7	1.8	1.6	1.0	0.2	-0.5
Gross value added (businesses)	0.9	0.3	-0.2	-0.6	-0.7	2.0	1.2	0.8	0.0	-0.7
Real GDP (1982 MP)	0.7	0.3	-0.2	-0.5	-0.6	1.6	1.0	0.7	0.0	-0.6
Wage employment (% change)	0.2	0.2	0.1	-0.3	-0.5	0.5	0.6	0.6	0.0	-0.5
Labour productivity	0.7	0.1	-0.3	-0.3	-0.2	1.4	0.6	0.2	0.0	-0.2
Purchasing power of average earner	0.1	0.1	0.2	0.1	0.0	0.0	0.4	0.5	0.7	0.5
Rates (%)										
Current account balance (% GDP MP)	-0.4	-0.2	-0.2	-0.1	0.0	0.7	0.2	0.1	0.1	0.3
Import cover	-0.2	-0.3	-0.4	-0.4	-0.3	0.1	0.0	-0.1	-0.2	-0.1
Financial deficit—GFS basis (% GDP MP)	0.1	0.2	0.2	0.1	0.0	0.3	0.6	0.8	0.9	0.9
Public expenditure (% GDP MP)	-0.2	-0.3	-0.2	-0.2	0.0	-0.4	-0.7	-0.9	-1.0	-0.9
Taxes and social security contribution (% GDP MP)	-0.1	0.0	0.0	0.0	0.0	-0.2	-0.1	-0.1	0.0	0.0
Informal and traditional sector rate	0.0	-0.1	-0.1	0.0	0.0	-0.1	-0.1	-0.2	-0.2	-0.2
Labour income share	-0.3	-0.3	0.0	0.2	0.3	-0.8	-0.8	-0.7	-0.3	0.0
Government domestic debt (% GDP MP)	-0.3	-0.6	-0.7	-0.7	-0.6	-0.6	-1.5	-2.4	-3.3	-4.0
Long-term interest rate	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Short-term interest rate (91-day T-bill)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Return on investment	0.7	0.8	0.5	0.0	-0.5	1.4	1.9	2.0	1.6	0.7
Labour years (millions)										
Total wage employment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Informal sector	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Traditional sector	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1	-0.1
Financial deficit (-) central government (GFS basis)	1066	1915	2035	1305	104	2318	5566	8239	10039	10739
Total foreign exchange reserves	-4581	-7781	-10691	-12213	-11971	7041	7841	7869	7648	9147
Broad money supply (M3X)	3243	4869	4356	2028	-1279	7260	12751	17325	18722	16800
Ksh per dollar (index)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1

Note: = businesses, GFS = government finance statistics, = Ksh = Kenya shillings, MP = market price

Appendix Table 2. Impact of an increase in imports and public investments on key macroeconomic indicators

Selected macro indicators	Imports (5% increase)					Public investments (5% increase)				
	2001	2002	2003	2004	2005	2001	2002	2003	2004	2005
Imports of goods and services (Ksh m)	8557	-1550	-8780	-12283	-10984	757	1694	2642	3423	4181
Public investment (Ksh m)	61	39	-54	-319	-683	1136	1191	1262	1355	1467
International (% change)										
Trade volume trade partners	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
World trade price (Ksh)	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Long-term interest rate (USA)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Short-term interest rate (USA)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wages and prices (%)										
Real wage rate (urban-based CPI)	0.0	-0.9	-1.2	-1.6	-1.4	0.0	0.1	0.1	0.1	0.1
Wage rate (businesses)	0.0	-0.7	-1.4	-2.4	-2.5	0.0	0.0	0.1	0.2	0.2
Consumer price (change)	0.0	0.2	-0.2	-0.7	-1.0	0.0	0.0	0.0	0.1	0.1
Export price (change)	0.0	0.2	0.2	0.0	-0.3	0.0	0.0	0.0	0.0	0.0
Import price (change)	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Investment price (change)	0.0	-0.2	-0.4	-0.9	-0.9	0.0	0.0	0.0	0.1	0.1
Price of output 	0.1	0.2	-0.2	-0.8	-1.1	0.0	0.0	0.0	0.1	0.1
Labour costs per production unit	3.0	0.9	-0.8	-2.1	-2.5	-0.2	-0.1	0.0	0.1	0.2
GDP MP deflator	0.3	-0.1	-0.3	-0.8	-1.0	0.0	0.0	0.0	0.1	0.1
Volumes (%)										
Volume consumption (households)	-3.2	-2.6	-1.7	-0.5	0.7	0.2	0.3	0.2	0.1	0.1
Investments (businesses)	-0.4	-14.3	-5.8	0.3	6.3	0.4	1.1	0.6	0.2	0.1
Export volume of goods and services	0.0	0.2	-2.6	-0.7	0.9	0.0	0.1	0.2	0.1	0.0
Import volume of goods and services	3.0	-3.5	-2.5	-1.0	0.7	0.3	0.3	0.3	0.2	0.1
Gross value added (businesses)	-4.0	-2.8	-2.1	-0.4	1.1	0.3	0.3	0.2	0.1	0.0
Real GDP (1982 MP)	-3.7	-2.2	-1.7	-0.3	0.9	0.2	0.2	0.2	0.1	0.0
Wage employment (% change)	-1.1	-1.3	-1.4	-0.2	0.9	0.1	0.1	0.1	0.1	0.0
Labour productivity	-3.0	-1.5	-0.6	-0.2	0.2	0.2	0.2	0.1	0.1	0.1
Purchasing power of average earner	-0.2	-0.9	-1.2	-1.5	-1.3	0.0	0.1	0.1	0.1	0.1
Rates (%)										
Current account balance (% GDP MP)	-1.2	0.2	0.3	0.4	0.2	-0.1	-0.2	-0.2	-0.2	-0.3
Import cover	-0.5	-0.2	0.3	0.6	0.7	0.0	-0.1	-0.2	-0.4	-0.5
Financial deficit—GFS basis (% GDP MP)	-0.2	-1.0	-1.5	-1.7	-1.6	-0.1	-0.1	0.0	0.0	0.0
Public expenditure (% GDP MP)	1.0	1.6	2.2	2.4	2.3	0.1	0.0	0.0	0.0	-0.1
Taxes and social security contribution (% GDP MP)	0.8	0.6	0.6	0.5	0.5	0.0	0.0	0.0	0.0	0.0
Informal and traditional sector rate	0.1	0.3	0.5	0.5	0.4	0.0	0.0	0.0	-0.1	0.0
Labour income share	2.0	2.3	2.0	1.3	0.6	-0.1	-0.2	-0.2	-0.1	-0.1
Government domestic debt (% GDP MP)	0.9	2.4	4.4	6.3	7.6	0.1	0.1	0.0	0.0	-0.1
Long-term interest rate	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Short-term interest rate (91-day T-bill)	0.0	0.0	0.0	-0.1	-0.2	0.0	0.0	0.0	0.0	0.0
Return on investment	-3.2	-4.4	-5.1	-4.5	-3.0	0.2	0.4	0.5	0.5	0.4
Labour years (millions)										
Total wage employment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Informal sector	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Traditional sector	0.0	0.1	0.2	0.3	0.3	0.0	0.0	0.0	0.0	0.0
Financial deficit (-) central government (GFS basis)	-1392	-8018	-13092	-16516	-17687	-881	-556	-258	-73.3	9.9
Total foreign exchange reserves	-11149	-6600	1001	11203	20628	-1112	-3488	-6675	-10711	-15810
Broad money supply (M3X)	-14904	-26834	-37447	-42532	-41486	1143	2286	3470	4319	4991
Ksh per dollar (index)	0.0	0.0	0.1	0.2	0.2	0.0	0.0	0.0	0.0	0.0

Note: = businesses, GFS = government finance statistics, = Ksh = Kenya shillings, MP = market price

Appendix Table 3. Impact of an increase in export price and import price on key macroeconomic indicators

Selected macro indicators	Export price (5% increase)					Import price (5% increase)				
	2001	2002	2003	2004	2005	2001	2002	2003	2004	2005
International (% changes)										
Trade volume trade partners	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
World trade price (Ksh)	1.0	1.2	1.4	1.6	1.8	0.0	0.3	0.4	0.6	0.7
Long-term interest rate (USA)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Short-term interest rate (USA)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wages and prices (%)										
Real wage rate (urban-based CPI)	-0.3	-0.7	-0.7	-0.8	-0.6	-1.2	-0.1	-0.8	-1.0	-1.1
Wage rate (businesses)	0.2	0.0	0.0	0.0	0.5	0.8	0.8	0.0	-0.7	-1.0
Consumer price (change)	0.4	0.7	0.8	0.8	1.1	1.9	1.0	0.7	0.4	0.1
Export price (change)	5.3	0.8	0.9	1.0	1.1	0.4	1.1	0.7	0.6	0.5
Import price (change)	1.2	1.4	1.6	1.9	2.1	5.0	0.3	0.5	0.7	0.8
Investment price (change)	0.7	0.8	0.9	1.0	1.4	2.9	0.5	0.4	0.2	0.1
Price of output 	1.5	0.5	0.5	0.4	0.7	0.2	1.2	0.7	0.3	0.0
Labour costs per production unit	1.9	0.2	-0.2	-0.1	0.6	2.3	2.4	0.7	-0.4	-1.0
GDP mp deflator	1.3	0.4	0.4	0.4	0.6	-0.2	0.9	0.6	0.2	-0.1
Volumes (%)										
Volume consumption (households)	-0.8	-0.8	-0.4	0.0	0.1	-3.1	-1.7	-1.4	-0.7	0.1
Investments (businesses)	-1.1	-3.4	0.4	1.7	1.9	-2.9	-7.4	-4.6	-0.6	3.1
Export volume of goods and services	-8.2	0.7	0.4	1.3	1.7	-0.8	-1.5	-1.8	-0.7	0.4
Import volume of goods and services	-2.5	-1.2	-0.6	-0.1	0.2	-4.0	-2.0	-1.7	-0.9	0.1
Gross value added (businesses)	-2.2	-0.5	0.0	0.6	0.8	-1.8	-2.1	-1.7	-0.7	0.4
Real GDP (MP 1982)	-1.9	-0.4	0.0	0.6	0.8	-1.1	-1.8	-1.4	-0.5	0.4
Wage employment (% change)	-0.5	-0.3	-0.2	0.5	0.9	-0.2	-0.6	-0.9	-0.4	0.4
Labour productivity	-1.7	-0.2	0.2	0.1	-0.1	-1.5	-1.5	-0.7	-0.3	0.0
Purchasing power of average earner	-0.3	-0.7	-0.7	-0.7	-0.6	-1.3	-0.2	-0.8	-1.0	-1.1
Rates (%)										
Current account balance (% GDP MP)	-0.3	0.0	0.1	0.2	0.2	-0.5	0.1	0.2	0.3	0.2
Import cover	0.0	0.1	0.1	0.2	0.2	-0.2	0.0	0.2	0.5	0.6
Financial deficit—GFS basis (% GDP MP)	-0.3	-0.4	-0.4	-0.2	0.0	0.0	-0.5	-0.8	-1.0	-0.9
Public expenditure (% GDP MP)	0.3	0.4	0.4	0.3	0.1	0.4	0.7	1.1	1.2	1.2
Taxes and social security contribution (% GDP MP)	0.0	0.0	0.0	0.0	0.0	0.4	0.3	0.3	0.2	0.2
Informal and traditional sector rate	0.1	0.1	0.1	0.1	0.0	0.0	0.1	0.2	0.3	0.2
Labour income share	0.2	0.1	-0.2	-0.5	-0.6	1.2	1.7	1.7	1.3	0.8
Government domestic debt (% GDP MP)	0.4	0.9	1.2	1.2	0.8	0.3	1.0	2.1	3.1	3.8
Long-term interest rate	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Short-term interest rate (91-day T-bill)	0.0	0.1	0.2	0.3	0.4	0.2	0.3	0.4	0.4	0.4
Return on investment	-0.6	-0.7	-0.4	0.2	0.8	-1.8	-3.2	-3.9	-3.8	-2.9
Labour years (millions)										
Total wage employment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Informal sector	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Traditional sector	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.1	0.2	0.2
Financial deficit (-) central government (GFS basis)	-2579	-3572	-3697	-2266	534	-323	-4160	-7661	-10057	-10710
Total foreign exchange reserves	-2675	73	5129	12934	23300	4503	-2140	3257	10884	19166
Broad money supply (M3X)	-8235	-11014	-12076	-10402	-7459	6767	-15691	-24081	-29169	-29933
Ksh per dollar (index)	0.8	1.8	2.9	4.2	5.8	0.0	0.2	0.6	1.1	1.7

Note: = businesses, GFS = government finance statistics, Ksh = Kenya shillings, MP = market price

Appendix Table 4. Impact of an increase in labour productivity and long term interest rates on key macroeconomic indicators

Selected macro indicators	Labour productivity (5%)					Long-term interest rates (5%)				
	2001	2002	2003	2004	2005	2001	2002	2003	2004	2005
Labour productivity trend	5	6	8	10	12					
International (% change)										
Trade (volume trade partners)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
World trade price (Ksh)	-0.3	-0.2	-0.4	-0.6	-1.0	0.0	0.0	0.0	0.1	0.1
Long-term interest rate (USA)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Short-term interest rate (USA)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wages and prices (%)										
Real wage rate (urban-based CPI)	5.0	-0.4	0.5	0.7	1.7	0.0	-0.1	-0.5	-1.2	-1.7
Wage rate (businesses)	2.6	-1.8	-2.0	-2.5	-1.3	0.0	0.1	-0.3	-1.1	-2.3
Consumer price (change)	-2.2	-1.4	-2.5	-3.1	-2.9	0.0	0.2	0.3	0.1	-0.5
Export price (change)	-1.7	0.6	-1.1	-1.4	-2.0	0.0	-0.1	0.2	0.3	0.2
Import price (change)	-0.3	-0.2	-0.4	-0.7	-1.2	0.0	0.0	0.0	0.1	0.1
Investment price (change)	-1.3	-1.3	-1.8	-2.1	-1.9	0.0	0.0	0.0	-0.3	-0.8
Price of output 	-2.6	-1.1	-2.7	-3.2	-3.0	0.0	0.1	0.2	0.1	-0.6
Labour costs per production unit	-3.1	-3.0	-3.4	-4.3	-3.1	-0.2	2.2	2.4	0.4	-1.9
GDP MP deflator	-2.4	-1.1	-2.5	-3.1	-3.0	0.1	-0.1	0.0	-0.2	-0.7
Volumes (%)										
Volume consumption households	1.5	0.4	1.4	1.5	1.3	0.6	-1.7	-3.2	-2.9	-1.5
Investments (businesses)	1.6	1.5	1.7	1.7	0.3	0.0	-17.6	-160	-10.9	1.2
Export volume of goods and services	2.7	-1.4	1.6	1.7	2.1	0.0	0.0	-3.4	-2.9	-1.7
Import volume of goods and services	0.7	-0.4	0.3	0.3	0.4	0.3	-3.4	-4.4	-3.8	-1.9
Gross value added (businesses)	2.0	0.3	1.7	1.8	1.6	0.3	-2.6	-3.9	-3.4	-1.4
Real GDP (market prices, 1982)	1.8	0.3	1.6	1.8	1.7	0.2	-2.1	-3.2	-2.8	-1.2
Wage employment (% change)	-3.4	-1.0	0.2	-0.2	-0.4	0.1	-0.6	-1.3	-1.8	-1.0
Labour productivity	5.5	1.3	1.5	2.0	2.0	0.3	-2.0	-2.6	-1.5	-0.3
Purchasing power of average earner	5.0	-0.3	0.5	0.7	1.7	0.0	-0.1	-0.6	-1.2	-1.7
Rates (%)										
Current account balance (% GDP MP)	0.1	0.1	0.2	0.3	0.5	-0.1	1.0	1.6	2.0	2.2
Import cover	0.0	0.1	0.1	0.3	0.5	-0.1	0.5	1.6	2.8	3.9
Financial deficit—GFS basis (% GDP MP)	0.3	0.2	0.5	0.8	1.0	-0.3	-0.7	-1.4	-2.1	-2.4
Public expenditure (% GDP MP)	-0.1	-0.1	-0.2	-0.4	-0.5	0.3	0.8	1.7	2.6	3.0
Taxes and social security contribution (% GDP MP)	0.0	0.0	0.0	0.1	0.1	0.0	0.2	0.3	0.2	0.2
Informal and traditional sector rate	0.4	0.6	0.6	0.6	0.6	0.0	0.1	0.2	0.4	0.6
Labour income share	-0.2	-1.0	-1.3	-1.7	-1.7	-0.1	0.9	2.0	2.1	1.4
Government domestic debt (% GDP MP)	-0.2	-0.2	-0.5	-0.9	-1.5	0.2	1.3	3.5	6.2	8.9
Long-term interest rate	0.0	0.0	0.0	0.0	0.0	5.0	5.0	5.0	5.0	5.0
Short-term interest rate (91-day T-bill)	-0.2	-0.4	-0.6	-0.9	-1.2	0.0	0.0	0.0	0.1	0.0
Return on investment	-1.5	-1.0	-0.2	0.6	0.5	0.2	-2.1	-4.9	-6.9	-7.1
Labour years (millions)										
Total wage employment	0.0	-0.1	-0.1	-0.1	-0.1	0.0	0.0	0.0	0.0	-0.1
Informal sector	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.1	0.1
Traditional sector	0.1	0.3	0.3	0.3	0.4	0.0	0.0	0.1	0.2	0.4
Financial deficit (-) central government (GFS basis)	2202	2244	4818	7404	9980	-2285	-5666	-12379	-20176	-26197
Total foreign exchange reserves	100€	2018	4240	8216	14571	-1508	11072	33402	65557	104119
Broad money supply (M3X)	7648	9591	17920	28279	39393	1254	-9137	-26242	-43245	-53950
Ksh per dollar (index)	-0.2	-0.3	-0.6	-1.1	-2.0	0.0	0.0	0.0	0.1	0.2

Note: = businesses, GFS = government finance statistics, Ksh = Kenya shillings, MP = market price

Appendix Table 5. Impact of an increase in wages and consumer price on key macroeconomic indicators

Selected macro indicators	Wages—business sector (5%)					Consumer price (5%)				
	2001	2002	2003	2004	2005	2001	2002	2003	2004	2005
International (% change)										
Trade volume trade partners	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
World trade price (Ksh)	-0.2	0.2	0.5	0.7	0.7	-0.4	-0.2	0.1	0.3	0.5
Long-term interest rate (USA)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Short-term interest rate (USA)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wages and prices (%)										
Real wage rate (urban based CPI)	2.8	-0.5	-0.6	-0.9	-0.6	-3.8	0.5	-0.7	-0.8	-0.7
Wage rate (businesses)	6.3	1.7	0.1	-1.1	-1.2	2.4	2.8	0.8	-0.1	-0.3
Consumer price (change)	3.2	2.2	0.7	-0.2	-0.6	6.1	2.3	1.5	0.7	0.5
Export price (change)	-0.6	2.2	1.0	0.7	0.2	-1.2	0.8	1.4	0.9	0.6
Import price (change)	-0.3	0.3	0.6	0.8	0.9	-0.5	-0.2	0.2	0.4	0.6
Investment price (change)	3.0	0.7	0.2	-0.2	-0.2	1.0	1.0	0.6	0.3	0.4
Price of output 	3.3	2.7	0.7	-0.3	-0.8	5.5	2.5	1.8	0.8	0.5
Labour costs per production unit	6.6	2.5	-0.3	-2.1	-2.1	5.8	3.8	0.5	-0.4	-0.4
GDP MP deflator	3.1	2.5	0.8	-0.2	-0.7	5.1	2.6	1.9	1.0	0.7
Volumes (%)										
Volume consumption (households)	-1.5	-1.6	-0.4	0.7	1.5	-4.1	-0.7	-0.3	0.8	1.3
Investments (businesses)	-3.0	-3.0	0.6	4.3	5.8	-1.5	0.5	2.9	5.1	5.4
Export volume of goods and services 	0.8	-4.2	-1.5	0.1	1.7	1.6	-2.2	-2.4	-0.6	0.4
Import volume of goods and services 	0.6	-1.1	-0.4	0.4	1.3	0.9	0.6	0.4	1.3	1.7
Gross value added (businesses)	-1.6	-2.4	-0.6	0.9	2.0	-3.4	-1.2	-0.7	0.8	1.5
GDP (1982 MP, % volume change)	-1.6	-2.2	-0.6	0.8	1.8	-3.2	-1.3	-0.8	0.5	1.1
Wage employment (% change)	-1.0	-1.5	-0.8	-0.1	1.0	-0.2	-0.2	-0.9	0.5	1.2
Labour productivity	-0.5	-0.9	0.3	1.0	1.0	-3.3	-1.0	0.2	0.3	0.2
Purchasing power of average earner	2.7	-0.5	-0.6	-0.8	-0.5	-3.8	0.4	-0.7	-0.8	-0.7
Rates (%)										
Current account balance (% GDP MP)	0.0	-0.2	-0.3	-0.5	-0.6	0.0	-0.5	-0.8	-1.2	-1.6
Imports cover by official exchange reserves	0.0	-0.1	-0.2	-0.4	-0.8	-0.1	-0.3	-0.7	-1.3	-2.0
Financial deficit—SNA basis (% GDP MP)	-0.1	-0.6	-0.8	-0.7	-0.3	-0.4	-0.6	-0.8	-0.8	-0.6
Financial deficit—GFS basis (% GDP MP)	-0.2	-0.6	-0.7	-0.6	-0.3	-0.5	-0.6	-0.8	-0.8	-0.7
Public expenditure (% GDP MP)	0.0	0.3	0.5	0.4	0.1	0.2	0.3	0.4	0.2	0.0
Taxes and social security contribution (% GDP MP)	0.0	0.0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.2	-0.2	-0.3
Informal and traditional sector rate	0.1	0.3	0.4	0.5	0.4	0.0	0.1	0.2	0.1	0.0
Labour income share	1.4	1.3	0.8	0.0	-0.6	0.0	0.5	-0.1	-0.7	-1.1
Government domestic debt (% GDP MP)	-0.1	0.4	1.0	1.4	1.3	0.2	0.5	1.0	1.3	1.3
Long-term interest rate	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Short-term interest rate (91-day T-bill)	0.3	0.5	0.6	0.6	0.5	0.6	0.8	1.0	1.1	1.1
Return on investment	-3.4	-4.5	-4.4	-3.0	-1.2	-0.5	-1.8	-1.4	-0.1	1.5
Labour years (millions)										
Total wage employment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Informal sector	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Traditional sector	0.0	0.1	0.2	0.3	0.3	0.0	0.0	0.1	0.1	0.0
Financial deficit (-) central government (GFS basis)	-1301	-5040	-6769	-6368	-3257	-4038	-5755	-8277	-8279	-6602
Ksh per dollar (index)	-0.2	0.0	0.4	1.0	1.6	-0.3	-0.5	-0.4	-0.1	0.3

Note: = businesses, GFS = government finance statistics, Ksh = Kenya shillings, MP = market price

Appendix Table 6. Impact of exchange rate depreciation and a rise in short-term foreign interest rates on key macroeconomic indicators

Selected macro indicators	Exchange rate (5%)				Short-term foreign interest rates			
	2001	2002	2003	2004	2001	2002	2003	2004
International (% changes)								
Trade volume trade partners	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
World trade price (Ksh)	5.4	0.7	0.9	1.1	1.5	0.2	0.2	0.3
Long-term interest rate (USA)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Short-term interest rate (USA)	0.0	0.0	0.0	0.0	5.0	5.0	5.0	5.0
Wages and prices (%)								
Real wage rate (urban-based CPI)	-1.6	0.6	0.0	-0.1	-0.5	0.2	0.0	0.0
Wage rate (businesses)	1.0	1.8	1.4	1.4	0.3	0.5	0.4	0.4
Consumer price (change)	2.5	1.2	1.4	1.5	0.7	0.3	0.4	0.4
Export price (change)	1.3	2.2	1.1	1.1	0.4	0.6	0.3	0.3
Import price (change)	6.4	0.8	1.0	1.3	1.8	0.2	0.3	0.4
Investment price (change)	3.7	1.1	1.1	1.3	1.0	0.3	0.3	0.4
Price of output 	0.5	1.6	1.3	1.3	0.1	0.4	0.4	0.4
Labour costs per production unit	0.2	2.8	2.0	1.7	0.1	0.8	0.5	0.5
GDPMP deflator	0.2	1.5	1.1	1.1	0.0	0.4	0.3	0.3
Volumes (%)								
Volume consumption (households)	-1.2	-0.2	-0.8	-1.1	-0.4	-0.1	-0.2	-0.3
Investments (businesses)	-3.5	2.6	-2.4	-2.3	-1.0	0.7	-0.7	-0.6
Export volume of goods and services 	8.3	-3.0	0.1	-0.3	2.3	-0.8	0.0	-0.1
Import volume of goods and services 	-1.7	0.0	-0.5	-0.9	-0.5	0.0	-0.2	-0.3
Gross value added (businesses)	1.5	-0.6	-0.7	-0.9	0.4	-0.2	-0.2	-0.3
GDP (MP, 1982; % volume change)	1.6	-0.6	-0.5	-0.7	0.4	-0.2	-0.2	-0.2
Wage employment (% change)	0.7	0.3	0.0	-0.5	0.2	0.1	0.0	-0.1
Labour productivity	0.8	-0.9	-0.6	-0.4	0.2	-0.3	-0.2	-0.1
Purchasing power of average earner	-1.6	0.5	0.0	-0.1	-0.4	0.1	0.0	0.0
Rates (%)								
Current account balance (% GDP MP)	1.1	0.7	0.9	1.1	0.3	0.2	0.3	0.3
Imports cover by official exchange reserves	0.3	0.4	0.6	0.8	0.1	0.1	0.2	0.2
Financial deficit—GFS basis (% GDP MP)	0.6	0.7	0.7	0.7	0.2	0.2	0.2	0.2
Public expenditure (% GDP MP)	-0.4	-0.4	-0.5	-0.5	-0.1	-0.1	-0.1	-0.1
Taxes and social security contribution (% GDP MP)	0.1	0.2	0.2	0.2	0.0	0.0	0.1	0.1
Informal and traditional sector rate	-0.1	-0.1	-0.1	-0.1	0.0	0.0	0.0	0.0
Labour income share	-0.1	0.4	0.7	0.9	0.0	0.1	0.2	0.2
Government domestic debt (% GDP MP)	-0.9	-1.8	-2.6	-3.3	-0.3	-0.5	-0.7	-0.9
Long-term interest rate	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Short-term interest rate (91-day T-bill)	0.2	0.4	0.5	0.7	0.1	0.1	0.1	0.2
Return on investment	0.5	-0.3	-0.9	-1.6	0.1	-0.1	-0.3	-0.5
Labour years (millions)								
Total wage employment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Informal sector	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Traditional sector	0.0	-0.1	-0.1	-0.1	0.0	0.0	0.0	0.0
Financial deficit (-) central government (GFS basis)	4769	6188	7190	8212	1326	1697	1956	2214
Ksh per dollar (index)	4.2	4.9	5.7	6.7	1.2	1.4	1.6	1.8

Note: = businesses, GFS = government finance statistics, Ksh = Kenya shillings, MP = market price

Appendix Table 7. Impact of changes in taxes on key macroeconomic indicators

Selected macro indicators	Local VAT				Tax on corporate profits			
	2001	2002	2003	2004	2001	2002	2003	2004
International (% change)								
Trade volume trade (partners)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
World trade price (Ksh)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Long-term interest rate (USA)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Short-term interest rate (USA)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wages and prices (%)								
Real wage rate (urban-based CPI)	-0.1	0.0	-0.1	-0.2	0.0	0.0	-0.1	-0.1
Wage rate (businesses)	0.1	0.1	-0.1	-0.2	0.0	0.0	-0.1	-0.2
Consumer price (change)	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Export price (change)	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Import price (change)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Investment price (change)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1
Price of output 	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Labour costs per production unit	0.3	0.3	0.1	-0.1	0.1	0.2	0.1	-0.1
GDPMP deflator	0.1	0.1	0.0	0.0	0.0	0.0	0.0	-0.1
Volumes (%)								
Volume consumption (households)	-0.5	-0.3	-0.3	-0.2	-0.3	-0.3	-0.3	-0.2
Investments (businesses)	-0.1	-1.3	-0.9	-0.4	0.0	-1.2	-1.0	-0.6
Export volume of goods and services 	0.1	-0.1	-0.3	-0.2	0.0	0.0	-0.2	-0.2
Import volume of goods and services 	-0.2	-0.3	-0.3	-0.3	-0.2	-0.3	-0.4	-0.3
Gross value added (businesses)	-0.3	-0.3	-0.3	-0.2	-0.2	-0.3	-0.3	-0.2
GDP (MP, 1982; % volume change)	-0.2	-0.3	-0.3	-0.2	-0.1	-0.2	-0.2	-0.2
Wage employment (% change)	-0.1	-0.1	-0.2	-0.1	0.0	-0.1	-0.1	-0.1
Labour productivity	-0.3	-0.2	-0.2	-0.1	-0.1	-0.2	-0.2	-0.1
Purchasing power of average earner	-0.2	0.0	-0.1	-0.2	0.0	0.0	-0.1	-0.1
Rates (%)								
Current account balance (% GDP MP)	0.1	0.2	0.2	0.2	0.1	0.2	0.2	0.3
Imports cover by official exchange reserves	0.0	0.1	0.2	0.3	0.0	0.1	0.2	0.4
Financial deficit—GFS basis (% GDP MP)	0.1	0.1	0.0	0.0	0.1	0.1	0.1	0.0
Public expenditure (% GDP MP)	0.0	0.1	0.1	0.2	0.0	0.1	0.1	0.2
Taxes and social security contribution (% GDP MP)	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Informal and traditional sector rate	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1
Labour income share	0.2	0.3	0.3	0.3	0.1	0.1	0.2	0.2
Government domestic debt (% GDP MP)	-0.1	-0.1	-0.1	0.0	-0.1	-0.1	-0.1	-0.1
Long-term interest rate	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Short-term interest rate (91-day T-bill)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Return on investment	-0.3	-0.5	-0.7	-0.7	-0.3	-0.4	-0.6	-0.7
Labour years (millions)								
Total wage employment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Informal sector	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Traditional sector	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Financial deficit (-) central government (GFS basis)	1129	730	332	56	1134	899	592	312
Ksh per dollar (index)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Note: = businesses, GFS = government finance statistics, Ksh = Kenya shillings, MP = market price

Appendix Table 8. Package simulations: impact of the civil service reform

	2001	2002	2003	2004	2005
% change					
International					
Trade volume (trade partners)	0.0	0.0	0.0	0.0	0.0
World trade price (Ksh)	0.0	0.0	0.0	0.0	0.0
Long-term interest rate (USA)	0.0	0.0	0.0	0.0	0.0
Short-term interest rate (USA)	0.0	0.0	0.0	0.0	0.0
Wages and prices (%)					
Real wage rate (urban-based CPI)	0.0	0.2	0.4	0.5	0.6
Wage rate (businesses)	0.0	0.2	0.4	0.7	0.9
Consumer price <H> (change)—SNA based	0.0	-0.1	0.0	0.2	0.3
Export price (change)	0.0	-0.1	-0.1	0.0	0.1
Import price (change)	0.0	0.0	0.0	0.0	0.0
Investment price (change)	0.0	0.0	0.1	0.3	0.3
Price of output 	0.2	0.0	0.0	0.2	0.4
Labour costs per production unit	-0.8	-0.4	0.0	0.4	0.7
GDPMP deflator	0.9	0.1	0.1	0.3	0.4
Volumes (%)					
Volume consumption (households)	1.9	1.1	0.9	0.6	0.3
Investments (businesses)	0.5	4.2	2.7	1.3	-0.3
Export volume of goods and services by 	0.0	-0.1	0.7	0.4	0.0
Import volume of goods and services by 	1.2	1.3	1.1	0.8	0.4
Gross value added (businesses)	1.1	1.0	0.9	0.6	0.1
Gross domestic product (SNA 93 chained indices)	1.0	0.9	0.8	0.5	0.1
GDP (MP 1982; % volume change)	0.7	0.8	0.8	0.4	0.1
Wage employment (% change)	0.3	0.4	0.5	0.3	0.0
Labour productivity	0.8	0.6	0.4	0.3	0.2
Purchasing power of average earner	0.0	0.3	0.4	0.5	0.5
Rate (%)					
Current account balance (% GDP MP)	-0.4	-0.8	-0.9	-1.1	-1.1
Imports cover by official exchange reserves	-0.3	-0.9	-1.4	-2.0	-2.4
Financial deficit—SNA basis (% GDP MP)	-0.6	-0.5	-0.3	-0.3	-0.3
Financial deficit—GFS basis (% GDP MP)	-0.7	-0.5	-0.4	-0.3	-0.4
Public expenditure (% GDP MP)	0.5	0.3	0.1	0.0	0.0
Taxes and social security contribution (% GDP MP)	-0.1	-0.1	-0.1	-0.1	-0.1
Informal and traditional sector rate	0.0	0.0	-0.1	-0.1	-0.1
Labour income share	-0.5	-0.7	-0.7	-0.6	-0.5
Government domestic debt (% GDP MP)	0.0	-0.1	-0.3	-0.5	-0.5
Long-term interest rate	0.0	0.0	0.0	0.0	0.0
Short-term interest rate (91-day T-bill)	0.0	0.0	0.0	0.0	0.0
Return on investment	0.8	1.3	1.7	1.8	1.6
Labour years (millions)					
Total wage employment	0.0	0.0	0.0	0.0	0.0
Informal sector	0.0	0.0	0.0	0.0	0.0
Traditional sector	0.0	0.0	0.0	-0.1	-0.1
Financial deficit (-) central government (GFS basis) (millions)	-5627.3	-4647.7	-3848.5	-3423.6	-3651.9
Ksh per dollar (index)	0.0	0.0	0.0	-0.1	-0.1

Note: = businesses, GFS = government finance statistics, Ksh = Kenya shillings, MP = market price

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