Evaluating the Impact of Fiscal Policy on the Household Sector in Trinidad and Tobago in a Static Computable General Equilibrium Framework

Carlos O. Hazel[1]

E-mail: cohazel@gmail.com

And

Patrick Kent Watson

E-mail: patrick.watson@sta.uwi.edu

Sir Arthur Lewis Institute of Social & Economic Studies, University of the West Indies, St. Augustine, Trinidad & Tobago

Tel: +1 (868) 662-6965

Fax: +1 (868) 645-6329

Abstract

How may fiscal policy be used to influence household activity and, indirectly, economic growth and development in the coming years in an emerging economy such as that of Trinidad & Tobago? This paper is an attempt to answer such a question through the construction and simulation of a static Computable General Equilibrium (CGE) model for Trinidad and Tobago. The model is calibrated on a micro Social Accounting Matrix (SAM), disaggregated into 52 industries, 52 commodities, 14 households, 3 factors and 4 government accounts, along with 1 enterprise, 1 accumulation and 1 rest-of-the-world account and it is used to simulate the impact of changes in taxation and other fiscal measures on household groups in Trinidad and Tobago. Data for the model are drawn from various sources including the National Accounts, the Supply and Use Tables (2000), the Survey of Living Conditions (2005) and the Household Budgetary Survey (2008) for Trinidad and Tobago.

Key Words: Computable General Equilibrium model; Social Accounting Matrix, Trinidad and Tobago; Fiscal Policy, Policy Simulations.

[1] Corresponding author.

Table of Contents

1. Introduction

Policy decisions are often made devoid of any analysis of wider social implications. This may not reflect of a lack of concern but merely a lack of the appropriate tools with which to conduct such analyses. The interconnections of markets within an economy and the link between the choices of economic agents and the social and even environmental implications would suggest that a general approach would provide a better view than a partial approach.

A general equilibrium approach was there adopted to better understand the structure if the economy in Trinidad and Tobago and how this explains the generation, distribution and use of incomes.

This paper seeks to address three main questions:

1. How do changes in fiscal policy affect the distribution of income among households groups in Trinidad and Tobago?
2. How do changes in fiscal policy affect use of income among households groups in Trinidad and Tobago?
3. How do results obtained above differ with changes in any assumption adopted?

To answer these questions a Computable General Equilibrium (CGE) model framework is employed, calibrated on data obtained from a disaggregated Social Accounting Matrix (SAM) for Trinidad and Tobago.

The paper consists of six (6) sections including the introduction. Section 2 gives a review of the literature on CGE modelling with primary focus on the construction of the model. Section 3 looks at the data and methodology used in this study and is followed by Section 4 which looks at eight (8) simulations of fiscal interventions under two different assumptions about capital. Section 5 looks and the results of the simulations and Section 6 the conclusion.

2. Review of CGE Modelling

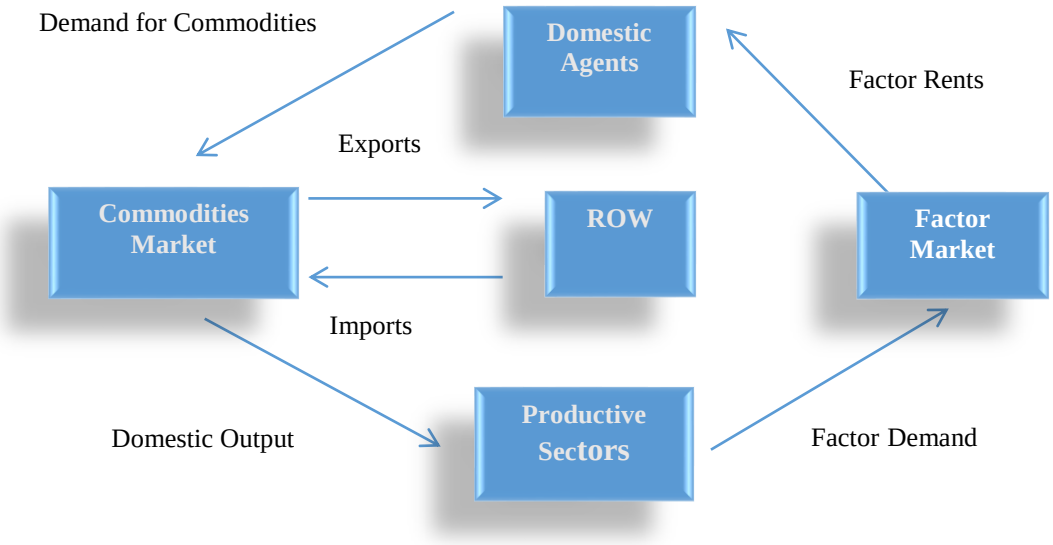
2.1 What is a CGE Model?

A CGE model is a mathematical depiction of an economy, which captures the behaviour of economic agents engaged in the process of production and utilisation of goods and services. It sets out the rules which force markets towards equilibrium within a wider macro-economic framework (Sadoulet and de Janvry 1995, 1-2). The economy is modelled as a non-linear system of equations whose solution is a unique vector of relative prices, outputs and incomes when there is general equilibrium. This implies that the markets for factors and commodities are simultaneously in equilibrium. The model acknowledges the interdependence between these markets, as changes in the conditions which obtain in one market lead inevitably to changes in others. Producers within the model are assumed to be concerned primarily with maximising their profits and consumers their total utility.

At the very foundation of CGE model is the concept of the circular flow of income as depicted in **Figure 2.1** below. One is able to capture the movement of income from the productive sectors to households; owners of factors used in production. Some of this income makes its way back into the productive sectors as payments for the commodities produced and sold by firms. As primary domestic agents, households and firms are always present within CGE models and play a very active role. Any income not expended in the process of consumption is saved and becomes part of the overall savings stock within a savings-investment account contained in the model. Models also contain government as domestic agent. However, government usually plays a passive role in the model; collecting revenues from taxation and making disbursements via transfers or subsidies. For economies involved in international trade the model will also contain a non-domestic agent which represents the rest of the world (Sue Wing 2004, 2-4).

Economies which contain activities that are not measured or do not formal part of the formal productive sectors will have income which may enter the circular flow but cannot be link to any particular sector. Such may be the case in states where there is an extensive underground economy involving transactions related to drug trafficking and money laundering. The CGE model does not capture such activities so it is possible that all incomes are not matched to an official productive sector.

Figure 2.1: Circular Flow of Income



Like the SAM, a CGE model could be designed to reflect unique distinguishing features within categories of producers, consumers and factors (Cohen 2002, 112). This feature fits a SAM naturally in the process of constructing a CGE model. It represents general equilibrium within an economy at a particular period referred to as the base. This initial equilibrium is used by the CGE model as a point of reference in measuring the effect of changes in conditions which differ from those existing at the base period (Yusuf 2006, 5). The SAM forms as a consistent data source from which the modeller can derive a numerical solution of the model (Sue Wing 2004, 7). CGE models may also be developed for regions within a country or for groups of countries and may be either static or dynamic.

Cohen (2002); Xie and Saltzman (2000) and Cattaneo (2002); credit Johansen[2] for the development of the first CGE model. This was constructed in the 1960s for the Norwegian economy. Since then the use of CGE models has grown immensely in developed and especially in developing countries.

[2] Johansen, Leif. 1960. *A multisectoral study of economic growth.* Amsterdam: North-Holland.

CGE models are categorised as analytical, stylized or empirical models. Analytical models are used for the purpose of understanding causal linkages or for closer focus on underlying assumptions. In such models economic relationships are simplified. Given the non-linearity common in many economic relationships, these models are more appropriate for marginal analysis (Böhringer et al 2003, 2). Stylized models help in understanding problems which may be too difficult to be solved analytically; they are used to provide preliminary insights. These models are slightly more complex than the analytic models as they seek to capture more of reality. Devarajan et al (1990) and Robinson et al (1999) offer good illustrations of their use. Aside from in their use in teaching, stylized models have been use to effectively inform policy decisions when used to complement empirical models, making them more easily understood (Devarajan et al 1990, 625-627; Devarajan and Go 2003, 11).

Empirical models examine a wider range of issues and are usually more general in nature. As greater realism is introduced, the degree of complexity of the model is increased. Features such as rigid price structures, factor immobility or other market imperfections may be depicted in empirical models, relaxing the assumption of perfect competition. Although some assumptions in a model are modified the basic Walrasian equilibrium conditions are usually maintained[3] (Catteneo 2002, 14-15).

2.2 Steps in CGE Modelling

In an effort to determine the most appropriate design for the model as well as the data requirements, CGE model development should begin with a study of the issues. The next step is to organise the data for the model. This is followed by the formulation of a numerical model, which requires a consistent database organised in the form of an IO table or a SAM. Beside the information provided in the SAM, additional information will be required on the elasticities of substitution for inputs used in production and also those for goods consumed. Such data may be obtained from existing studies during the literature review process (Sadoulet and de Janvry 1995, 341-371). In the absence of such empirical information, econometric estimates may be derived once sufficient data are available. More often than not, these estimates are taken from elsewhere, since data deficiencies may not allow for econometric estimation in the economy being studied (Sapkota and Sharma 1998, 22).

[3] These conditions imply an equalization of supply and demand in all markets (Walras 1954).

The next step is to use economic theory to specify an analytical model. The model is then calibrated. In the process of calibration the values of the parameters and exogenous variables within the model are generated by replicating the benchmark equilibrium. This will indicate that the economy depicted by the SAM is fully reflected by the CGE model developed. After calibration simulations are carried out and these are often followed by sensitivity analyses in order to determine the effect of changes in parameters or assumptions (Learmonth et al 2006, 14-23).

The choice of functional forms of the production and utility functions and the nesting structure of substitution possibilities for both consumers and producers are very important. Production functions may be specified as either as Leontief, Cobb-Douglas (CD) or constant elasticity of substitution (CES) functions - single stage or nested. For the CD, primary factor substitution elasticities are implicitly unitary whereas for the CES these elasticities of substitution could be different from unity. The Leontief production function assumes that fixed proportions of composite primary factors and composite intermediate inputs are employed. In such functions there can be no substitution between primary inputs and intermediate inputs. Nested functions allow differences in elasticities among different sets of factors (Löfgren et al 2002, 8-17).

In the commodity market, CES functions can be used as aggregation functions allowing for the assumption of imperfect substitutability between among differentiated output. In a similar manner, CES are used to capture imperfect substitutability between imports and domestically produced goods. Imperfect transformability between domestic sales and exports may be captured using a constant elasticity of transformation (CET) function. This is referred in the literature as the Armington assumption. Household demand for commodities may be represented by a linear expenditure system[4] function, the almost ideal demand system[5] function or the Rotterdam model[6] (Löfgren et al, 2002, 17-20).

[4] Stone, R. 1985. The Disaggregation of the Household Sector in the National Accounts. In G. Pyatt and J. I. Round (Eds.), *Social Accounting Matrices: A Basis for Planning*, World Bank Symposium, 145-162. Washington, DC.
[5] Deaton, A. and J. Muelbauer. 1996. *Economics and Consumer Behaviour*, Cambridge University Press: New York.
[6] Theil, H. 1965. The Information Approach to Demand Analysis, *Econometrica*, 33: 67-87.

When specifying the model, equations and behavioural assumptions must be entered for each group of agents. This process of clearly defining the behaviours of respective agents is believed to have originated with was started by Johansen (Dixon and Rimmer 2010, 3). Producers are usually assumed to maximise their profits subject to technology constraints and consumers their total utility subject to budget constraints (Löfgren et al, 2002, 8). The model specification must also include the following equilibrium conditions:

- market clearance - all goods produced will be demanded by consumers and all factors supplied will be required by producers;
- zero profits – no abnormal profits may be made in any market because of the assumption of perfect competition;
- income balance – income is just sufficient to meet demands on its use.

Some of the features outlined above led to the popularity of CGE modelling in policy analysis vis-à-vis other approaches like the IO and linear programming (Xie and Saltzman 2000, 454).

Model equations of a CGE follow a sequence which mirrors the income generation process. There are usually:

1. price system equations for goods and factors;
2. output and value-added generating equations;
3. equations linking value added to institutional incomes;
4. equations linking institutional income to productive sectors;
5. equations of systemic constraints - both equilibrium and macro-economic closure conditions (Robinson et al 1999, 8)

Sadoulet and Janvry (1995) consider the macro-economic closure conditions to include the external balance (balance of payments), savings-investment equilibrium, the internal balance (fiscal or government balance) and factor market equilibrium. Some authors such as Devarajan et al (1990) and Löfgren et al (2002) see only the first three as macroeconomic closures; the fourth is determined as a feature of productive activities in the economy. Different combinations of macroeconomic conditions are generically labeled in the literature, each suited to different types of analysis. The Johansen closure is investment-driven; it combines fixed foreign savings with fixed levels of real investment and government consumption. It is best for avoiding the unrealism that results from inaccurate

measurement of welfare effects in static models. The neoclassical closure is savings-driven; the overall level of savings - private, government and foreign - is determine by the level of investment. The balanced closure allows for simultaneous adjustment of foreign savings, government consumption and real investment. This is useful for analysis of exogenous shocks and policy changes. While the former there closures assume no links between the macro variables and the aggregate level of employment, the Keynesian closure assumes that there is such a link. It fixes the level of real investment but allows flexibility in the real wage in order to generate the level of employment and consequently, the level of income and savings necessary to meet the investment needs (Löfgren et al 2002, 14-17).

Once the process of constructing the model is complete checks for consistency should be carried out to ensure that the model will work as expected. First is the check to ensure there are no leakages in the model. Then there is the check to ensure that the original data fed into the model is the same as that of solutions generated in the calibration phase. Finally the model is checked to ensure that it is homogeneous to degree zero in all prices (Robinson et al 1999, 28-29).

2.3 CGE and other kinds of models

Some other models used in economy-wide analysis include the econometric models, linear and non-linear programming models and IO models. Econometric models are not suited for complex policy analysis; they are better suited for analysis within a single sector (Piermartini and Teh 2005, 3-10). When they attempt estimate a more general equilibrium; defined as systems of equations using two-stage least squares (TSLS), instrumental variables (IV) or even generalized method of moments (GMM), they may suffer problems of identification and do not capture welfare effects. Econometric models are used in providing estimates of parameters used in CGE models but on their own they do not provide a much detail as would a CGE model.

Linear programming models are useful for optimizing systems of equations subject to technological constraints but are not grounded in economic theory. They are restricted to solving linear functions and may produce unrealistic results in dynamic models. Use of non-linear models such as the CGE has addressed the linearity issue but increased model complexity.

IO models are based on the assumption of excess productive capacity so that production can be increase without increasing input prices. They also assume that there are constant returns to scale in production and that there is no substitution among inputs. These assumptions are rather unrealistic. Further, they do not contain information on the distribution of income among institutions. However, researchers have still been able to use IO as the basis for CGE models. Since the focus only on industries, productive sectors could be fully disaggregated. Using detailed sales data from an IO, Adams and Dixon (1996) constructed a disaggregated CGE forecast for 780 commodities based on aggregated CGE forecast for 114 commodities. In addition to the use of sales data, they have also used macro-econometric forecasts of business analysts, those of sector specialists and forecasts of changes in both taste and technology.

CGE models are superior to partial equilibrium models in that they are able to capture the interactions between various markets and are not restricted to the analysis of an individual market. CGE models represent an improvement over IO and linear programming models since it is not restricted to fixed price assumptions and are also more adaptable to the requirements of modern policy evaluation. In CGE models prices are allowed to vary and there are also opportunities for substitution in productions and consumption decisions. CGE models provide enormous details on the effects policy and exogenous shocks may have on an economy. Used in micro-macro simulation models they provided richer information allowing more specific targeting of policy interventions and a greater level of effectiveness. They allow the researcher to take into consideration realistic assumptions that are specific to a particular situation. Dixon (2006) provides a good account of reasons for increasing interest in CGE modelling over other approaches.

2.4 Selected Applications involving the Use of a CGE

CGE models are quite useful for an economy-wide analysis of policies and external shocks. They have been used in policy analyses in many different areas. Some studies include: Aristy-Escuder (1999) and Yúnez-Naude and Paredes (1999) in trade liberalization, exchange rate and fiscal policy; Devarajan and Sussangkarn (1992) in effective rate of protection; de Melo and Robinson (1990) in externalities and productivity; Devarajan et al (1993) in purchasing power parity; Devarajan et al (1990) and Devarajan et al (1997) trade; Ianchovichina et al (2001) in trade liberalization;

Cardenete and Sancho (2002) in tax reform ; Löfgren et al (2003) in poverty and inequality; King and Handa (2003) in balance of payment liberalization and poverty; Hallaert (2007) in regional integration; Alarcón et al (2000); Xie and Saltzman (2000); Sue Wing (2004); Nijkamp et al (2005); and Paltsev and Reilly (2006) in environmental issues.

Devarajan and Robinson (2002) selectively reviewed the use of CGE models in informing policy. They show that CGE have been extremely beneficial in areas of free trade, public finance, structural adjustment and income distribution. They also found that despite the benefits, there have been some abuses in the use of CGE models and there are also limitations to their use. Bergman and Henrekson (2003) provide an insightful review of 'environmental' CGE models used in policy and resource management analyses.

2.4.1 The Environment

Xie and Saltzman (2000) incorporated environmental concern into the economy by introducing an additional productive sector for pollution abatement. They also included pollution related investment and payment for clean-up activities. Household expenditure reflected taxes for pollution emitted, government expenditure included pollution control subsidies. These measures compensated for pollution generated or provided incentives to reduce pollution. They were introduced via the creation of an extended SAM for China, based on 1990 data. This was used to develop an environmental CGE model. The model succeeded in integrated the environmental and the economic features within the Chinese economy. It contained 7 economic production sectors but identified 3 types of pollution which necessitated the inclusion of 3 pollution abatement sectors. From this model they were able to simulate specific environmental policy options such as increasing emission taxes on waste water, introduction of a tax on household garbage and sewerage and subsidizing waste water treatment. They found the model useful for analysing the economic impact of environmental policy as well as the environmental impact of economic policy.

Paltsev and Reilly (2006) in a somewhat different approach augmented the national accounts to include market and non-market effects which result from quality modifications to the environment. They measured the effect of these on agricultural yield and trading patterns and also on the health of the population. This approach linked the standard SAM to satellite tables containing physical and biological flow indicators of environmental change. The model provided estimates of the benefits of air pollution regulations and the economic impact of uncontrolled air pollution in the US

and China for period 1975 to 2000. Alarcón et al (2000) employed a similar approach; using physical indicators based on data of Bolivia for the year 1989.

In an extensive model, Nijkamp et al (2005) evaluated the impact of global climate change international trade. They extended a Global Trade Analysis Project (GTAP) model to include instruments of climatic change. The source model was itself a static CGE model[7], extended for wide scale policy analysis.

Learmonth et al (2006) used a regional CGE to assess the economic and environmental effects associated with population expansion on the island state of Jersey. The environmental data used in the model were contained in satellite accounts.

2.4.2 Fishing

CGE models have been used to evaluate policy and other structural changes on the fishing sector. Sun et al (2002) did a comparative evaluation of the impact of a 35.5% tariff reduction on the Taiwanese fishing sector. There compared the results of a multi-sector ORANI CGE model[8] and a single-sector, multi-activity partial general equilibrium model. The CGE model was based on data from a 160-sector IO table for Taiwan from 1996. Production in this model was formulated a four- level nested structure: a the top level is a Leontief function of aggregate intermediate and primary inputs; at the second level is a CES function of imported and domestic products; at the third is a constant ratio of elasticities of substitution homothetic (CRESH) function of primary factors; and at the fourth a CES function of skilled and unskilled labour.

The tariff reduction was look at in two scenarios: the first assumes full employment in the long-run; holding employment exogenous, it also makes the small country assumption that world price cannot be affected by domestic production levels. The second scenario assumes a fixed nominal wage and hence periodic unemployment. The results show increases in both the import and export volumes, with greater increases for scenario one. Average employment and real GDP decline for scenario two when tariffs were reduced. The results from the partial equilibrium model were

[7] This model is a multi-region model, with multiple sectors that was developed in 1992 at Purdue University.

[8] Model developed at Monash University in Australia (Dixon et al 1982; Dixon et al 1992).

vastly different from the CGE model, for the former the impact of a tariff reduction on the fishing sector is more severe.

Floros and Failler (2004) use a dynamic regional CGE model to explain the links between economic features within the fishing sector of Salerno, Italy and ecological and biological aspects relating to the fish stock.

2.4.3 Poverty and Inequality

Robilliard et al (2001) used a combination of a standard CGE and a micro-simulation model to evaluate the effects the 1997 financial crisis in Indonesia on poverty and income distribution. The combined model was also used to assess the comparative impacts of social policy interventions to deal with the crisis. The CGE is based on a SAM for 1995 and provides the prices wages and employment data for the micro-simulation model which is itself based on sub-sample of a 1996 survey and contain about 10,000 households.

The CGE model included activities depicting CES production technology for value-added and fixed Leontief technology for intermediate inputs. It assumes imperfect substitutability between imports and domestically products goods. The composite good is a CES aggregation of import and domestically produced goods while the composite good produced is a CET aggregation exports and domestically demanded goods. A balanced macro-closure was used in the model, as such, both government spending and aggregate investment are assumed to be fixed. Two scenarios were looked at; the first involved changes to macro variables based on historical data and the second involved changes in policy. In scenario a 25% drop in self-employment income in rural and 20% drop in self-employment income in urban sectors were simulated. Also a 45% drop in self-employment income in rural and 40% drop in employment income in urban sectors were simulated. The results showed a 164% increase in poverty. The effect was more pronounced in the rural sector. In scenario 2 they simulated the effect of the financial crisis through a 20% real devaluation, a 25% increase in the marketing cost of food and a 20% cut in the availability of domestic credit. They also simulated the effect of the El Niño drought by a 5% decrease in agricultural factor productivity. The combined effect was a reduction in real GDP with the credit crunch having the greatest relative effect. Poverty and inequality also increased. Taken alone, the drought shock resulted in a reduction in poverty since agricultural households benefitted from a rise in relative food prices.

Chitiga et al (2007) studied the impact of trade liberalization on poverty and income inequality in Zimbabwe. In this approach there was emphasis on the importance of heterogeneity among households, each modeled explicitly. The model, calibrated on the 1995 SAM for Zimbabwe was based on EXETER+ model. It contains 14,006 households derived from the 1995 Poverty Assessment Study Survey (PASS). The macro closure in the model assumes fixed government spending, aggregate investment and a current account deficit. Liberalization was simulated by a total removal of import tariffs. The results showed the largest increases of imports in the horticulture and grain sector; two sectors that were traditionally heavily protected. There was also a reallocation of resources towards export-oriented sectors. The simulation had an overall negative effect on total output though some sectors grew. These growth sectors (agriculture and mining) used huge amounts of unskilled labour would have benefited from liberalization. Overall there was a decrease in poverty and although income distribution remained unequal degree of inequality was reduced.

In a slight variation to the last approach, Bibi and Chatti (2006) used a dynamic CGE micro-simulation approach to measure the effects of trade liberalization on poverty in Tunisia. This study was able to track the path of price and income as trade liberalization progressed. It also used a dominance test for measuring poverty in order to avoid arbitrariness associated with measures such as poverty gap, severity and head count approach used in the Chitiga et al's (2007) Zimbabwean study. This model, calibrated on the 1998 SAM for Tunisia, provides data for the micro-simulation model which contains 2500 households based on a 1995 survey. Simulations showed that increasing trade liberalization has the tendency to reduce poverty reduction in the short-run but improves it in the long-run.

Löfgren et al (2003) presents an alternative procedure for analyzing poverty and inequality using a CGE model with representative households. This approach is less time consuming and has lower data requirements than the previous approach (Chitiga et al 2007; Bibi and Chatti 2006). It gives meaningful explanations of the impact of different policies on poverty.

Devarajan and Go(2003) used a combination of a simple static CGE model, short and long term growth models and household survey data to evaluate the effects of external shocks and macroeconomic policy on poverty. They looked at the effects the policy had on income distribution when relative prices and wages change but output is held constant,

and also the effect son economic growth when relative prices and wages are held constant. The approach was a modular - is simple, affordable, easy to implement and produces results that are easy to interpret.

Warr (2006) employed yet another approach to determine the poverty implications of a large scale investment project - the construction of a hydroelectricity dam in Laos. In this study the 1-2-3 CGE model used by Devarajan et al (1993) was modified slightly. The two sectors in the modified model were agricultural and non-agricultural. Four good are produced two export and two non-tradables and four were consumed, two imports and two non-tradables. This model contains 200 households-100 rural and 100 urban - with characteristics drawn for a 2002-03 Laos Expenditure and Consumption Survey (LECS).

Four simulations were conducted, in each case is an annual inflow of $US 50M received by the government for export of electricity:

- **Scenario 1**- all inflows are distributed in equal lump-sum disbursements to the richest 10% of urban households;
- **Scenario 2** - all inflows are distributed in equal lump-sum disbursements to urban households;
- **Scenario 3** - all inflows are distributed in equal lump-sum disbursements to the entire population;
- **Scenario 4** - all inflows are distributed in equal lump-sum disbursements to rural households;

In each scenario the real exchange rate declines, exports contract in all sectors and the resources are shifted to production of the non-tradables. Except in scenario1, real wages increased in all sectors. These results confirm the predictions in the Dutch Disease literature. The effect of the inflows on poverty differed depending on the household to which the transfer was directed. Rural poverty declined only in simulations 3 and 4 where the rural households shared in the transfers. Urban poverty declined in all scenarios.

2.4.4 Trade

In trade, CGE models have been used for several purposes. Devarajan et al (1990) used a 'trade-focused' two-sector model to demonstrate how such models are used to analyse the effectiveness of exchange rate, tariff and other fiscal policy initiatives of governments. Even for such a stylized model the lessons learnt may help in interpreting the results of more extensive models. In another example, Devarajan and Sussangkarn (1992) used a CGE model for Thailand to

estimate the effective rates of protection making the assumption that foreign and domestic goods in the same sector are imperfect substitutes for each other. The resulting estimates were found to be different from standard estimates not only in size but also in ranking and sign. The study provides useful information for the analysis and of tariff structures.

Ianchovicha et al (2001) analyzed the effect of trade liberalization in Mexico combining prices obtained from simulations of a GTAP CGE model and household survey data. The model is a static CGE model and assumes full employment. Survey data were obtained from the 1996 Mexican National Household Income and Expenditure Survey. The results showed that the welfare effect of low tariff protections was a positive and that the greatest benefit accrued to the poorer household groups.

Cockburn (2002) developed a micro-simulation CGE model to study the effects of trade liberalization on income distribution and poverty in Nepal. Using data from 1986 SAM of Nepal and 1995 Nepalese Living Standards Survey (NLSS). In the model overall production is modelled as a CET combination of production in different regions. Private consumption is modelled by a LES expenditure function. Imports and domestic goods are imperfect substitutes of each other in consumption. Prices of both exports and imports are fixed at the world market level (small country assumption).

Simulation results of an elimination of tariffs show that trade liberalisation encourages a transfer of resources form the agricultural sectors to the services and manufacturing sector. This favours the households in the urban areas and results in a reduction in urban poverty and an increase in rural poverty. The net result is an increase in the disparity between the urban rich and the rural poor.

Dixon (2006) looked at the long-run effects of removing major US tariff restraint using a 500-industry model generated by USAGE-ITC[9]. These restraints took the form of tariff and quota restrictions on 45 commodities. The results showed that the net long-run effect on the US economy would be small. Some industries will experience contractions in output

[9] This is the US Applied General Equilibrium – International Trade Commission model. It is similar in structure to the MONASH built for Australia.

– sugar and butter more than 10% and textiles 5-10% . Export-oriented industries will experience negligible increases in their output.

Hallaert (2007) used a GTAP model based on 2001 figures for the global economy to analyze the impact of the Southern African Development Community Free Trade Area (SADC FTA) on the Madagascan economy. The database was first updated to account for the liberation of trade in clothing and textiles in 2005. The full implementation of SADC FTA is simulated under two scenarios. The first assumes complete flexibility of prices and wages and the second assumes fixed wages for skilled and unskilled labour. The results showed negligible impact on real GDP and welfare in Madagascar under both scenarios. While the welfare effects on the entire Community are positive, the distribution of these benefits are not clear. Though Madagascar stands to benefit from increased trade with South Africa there is a likely decline in trade with other countries. The simulations did not measure the fiscal effects nor did they consider dynamic effects and may consequently understate the full economic impact of integration on the Madagascan economy.

2.4.5 Economy-wide models

Using the 1991 SAM for Guatemala Yúnez-Naude and Paredes (1999) constructed a small static CGE model. The model assumes imperfect substitutability between domestically produced goods and goods produced elsewhere. The composite good is aggregated by Constant Elasticity of Transformation (CET) function. Inputs were assumed to be generated by Leontief function, while goods were generated by Cobb-Douglas function. Household utility is also based on a Cobb-Douglas utility function.

Policy simulations are conducted for trade liberalization under two alternative macroeconomic closures:

1. flexible foreign exchange rate, fixed foreign savings and government revenue, fixed public spending;
2. fixed foreign exchange rate, flexible foreign savings and government revenue, fixed public spending.

The reduction or complete removal of tariffs in the context of the first closure results in changes in the pattern of income distribution away from urban capitalist households and in favour of other household categories. This leads to a fall in private savings owing to reduced incomes among groups with higher propensities to save. With fixed foreign

savings and negligible increases in public savings aggregate savings fell and so did investments. There were unsustainable increases in corporate taxes in order to compensate for the reduction in government revenues. There were also modest increases in real GDP. In the case of second closure, tariff reductions results in an increase in private consumption and in the dependence on foreign savings. The tax proceeds resulting from income and consumer taxes also decreased.

Policy simulations of reductions in government expenditure were also considered in two alternative macro closures:

1. flexible exchange rate, flexible foreign savings with fixed aggregate investment and government expenditure;
2. fixed exchange rate, flexible foreign savings with fixed aggregate investment and government expenditure.

Reductions in government expenditure under the first alternative result in increases in public savings and a reduction in the reliance on foreign savings. Factor prices unskilled labour, land and capital increases, but fell for other factors. There was a nominal depreciation in the value of the currency resulting in the growth of the productive sectors, an increase in exports and a fall in imports. Under the second alternative the results were similar. There was a deflation in the consumer price index (CPI) creating a real exchange rate depreciation.

Finally policy simulations of currency devaluation were also considered in two alternative macro closures:

1. fixed aggregate investment, flexible foreign savings and government revenue, flexible corporate savings but fixed government expenditure;
2. flexible aggregate investment, flexible foreign savings and government revenue, fixed corporate savings but fixed government expenditure;

The first alternative resulted on increased inflation and a contraction in real GDP, with positive growth on in three export sectors. There was overall growth in exports and a fall in imports resulting in improved balance of trade. This meant increased outflows of foreign savings therefore corporate savings had to increase to maintain fixed investment levels. There is also increased redistribution of income from capitalist to other households. This resulted in a net

decline in private consumption. The second alternative produced similar results, the only exception being a decline in investment to match reduced savings created by increase outflows given fixed corporate savings.

King and Handa (2003) developed a static neoclassical CGE using data from the 1993 SAM for Jamaica. This was used to analyze effects of balance of payment liberalization on poverty and income distribution. The model uses Armington production functions and a "savings-driven" macroeconomic closure. They simulated three scenarios:

1. current account liberalization only;
2. capital account liberalization only;
3. current and capital account liberalization.

In the first scenario they applied a universal tariff reduction. In the second, they introduced a new commodity which was described as rent-seeking; to capture the welfare loss associated with the imposition of capital restrictions. The premium obtained by foreign exchange offered on the black market was used as a proxy for the value of the rent seeking commodity. Reductions in this premium were representative of capital account restrictions. Scenario three was of combination of the two previous scenarios.

The result of scenario one showed a negligible increases in both exports and imports and unemployment and GDP remaining unchanged. There was a slight worsening of the fiscal balance and a small reduction in price. There were no major sectorial adjustments. The simulation therefore showed no dramatic changes in the income distribution or in poverty.

The result of scenario two was different in that there were more significant increases in imports and exports, employment also increased and the fiscal balance improved. Sectorial adjustments and changes in labour use were more pronounced. There was a shrinking in the services sector and an expansion in manufacturing. This meant that there were changes in the income distribution and some reduction in poverty. In scenario three, the combined effect of current and capital account liberalization has shown a dominance of the effects of capital account liberalization.

For a deeper analysis of the distributional impact the results of the CGE simulations were used for micro level simulation using the labour market profiles and data obtained from a survey of living conditions.

In a similar manner Essama-Nssah et al (2007) assessed the impact of an oil price shock on the South African economy especially as it relates to income distribution and poverty. They used a disaggregated CGE model and micro-simulation analysis of household surveys. The model contained 43 productive sectors, some activities such as mining and petroleum refining were specified using CES functions, others were specified using translog functions. The micro-simulations employed data from the 2000 Labour Force Survey and the 2000 Income and Expenditure Survey. Two simulations were considered: a 125% increase in the world price of imported crude and refined oil; and a 125% increase in the world price of imported crude and refined oil, coupled with a 30% increase in the world price of imported basic chemical and 6% increase in the world price of all other imported goods. The result was a depreciation in the value of the currency in both scenarios; the second being more severe. This had the effect of increasing exports but imports and real GDP declined. There was a reduction of employment in the services sector and labour moved towards agriculture and industry activities. This reduction affected mostly unskilled and semi-skilled workers. There was a general decline in real wages. The price of food and transportation increased but those of many other goods and services declined. Poorer households normally spend a greater proportion of their income on food and were therefore more adversely affected by the price shocks. Lower skilled individuals were more likely to be impoverished by the price shocks.

3. Data and Methodology (Model)

The data for the CGE model was obtained from the SAM for Trinidad and Tobago (Hazel and Watson 2012, 4-16). The structure of the SAM was modified to match that of the PEP-1-1 model (Decaluwé et al, 2012a). The CGE model is a single country static version adopted from PEP-1-1 Model (Version 2.0) with some modifications. This model contains fifty-two (52) productive sectors, fifty-two (52) commodities, four (4) factors, fourteen (14) households, four (4) government sectors, one representative firm, and saving-investment account, a change in inventory account and a rest of the world account. The elasticities as seen in **Table 3.1 and 3.2** were obtained from the literature on empirical studies in similar type economies (Nganou 2005,1-16; Tafere et al 2010, 21-22; Decaluwé et al, 2012a, 22-23) The macro-economic closure adopted is the Johansen closure.

Table 3.1: CES and CET Elasticities

Elasticity CES - Composite labour	0.8
Elasticity CES - Composite Capital	0.8
Elasticity CES - Composite Commodity	2.0
Elasticity CES - Value Added	1.5
Elasticity CET - Local Sales and Export	2.0
Elasticity CET - Total Output	2.0
Elasticity of Demand for Exported Commodities	2.0

Source: Adopted from Decaluwé et al, 2012a.

Table 3.2: LES Parameters

FRISCH = -1.5	SERCON = 1.3	PRIN = 0.9	WAT = 1.1
CAFAM = 0.3	QUARRA = 1.3	PACON = 0.9	CON = 1.3
PIFAM = 0.3	SUGFAC = 0.4	WOOD = 1.2	REST = 1.3
COCPROD = 0.3	MPROC = 0.4	CONMAT = 1.2	HOTGH = 1.3
COFPROD = 0.3	POPROC = 0.4	HCHEM = 1.4	TDISTR = 2.0
CITPROD = 0.3	DFAC = 0.4	HAPPL = 1.4	COMM = 2.0
RCROPROD = 0.3	FVPROC = 0.4	IROST = 0.6	FIN = 2.0
RICPROD = 0.3	FIPROC = 0.4	PGREF = 2.3	INS = 2.0
CANFAM = 0.3	AFFMIL = 0.4	GAPROC = 2.3	ABUS = 2.0
OTHAGR = 0.3	BAK = 0.4	PETRO = 2.3	GOV = 0.8
FORES = 0.3	MIFMAN = 0.4	PLAPROD = 0.9	EDUC = 0.8
FISH = 0.3	ALSTOB = 0.45	OTHMAN = 0.8	HEALTH = 0.8
OGASPROD = 2.3	TEXT = 0.9	ELEC =1.1	PERSER = 1.3

Source: Adopted from various sources in the literature

The calibration and simulation was conducted using the General Algebraic Modeling System (GAMS)[10] software with the PATHNLP solver[11] . Results of the values at the base year will then be compared to those obtained during simulations to determine the impact a given simulation is likely to have on the use and distribution of income among households.

[10] A user friendly guide provided by Brooke, A., D. Kendrick, A. Meeraus, and R. Raman. 1998. *GAMS: A User's Guide.* Washington, D.C.: GAMS Development Corporation.

[11] Dirkse, Steven, P. and Michael, C. Ferris. 1995. The PATH solver: A non-monotone stabilization scheme for mixed complementarity problems. *Optimization Methods and Software 5: 319-345*

4. Simulations

Eight (8) simulations were conducted to determine the impact of fiscal policy on the various household groups. First all simulations were run on the assumption that capital is mobile then the same simulations were conducted on the assumption that capital is sector-specific. The simulations were as follows:

Simulation 1: A 20% increase in the average indirect tax rate.

Simulation 2: A 50% reduction in the average indirect tax rate.

Simulation 3: A 20% increase in the level of government spending.

Simulation 4: A 20% reduction in the average rate of taxes and duties on imports.

Simulation 5: A 20% increase in the taxes and duties on imports of alcohol and tobacco products.

Simulation 6: A 30% increase in the tax on oil and gas commodities.

Simulation 7: A 20% reduction in the production tax on other manufacturing.

Simulation 8: A 20% increase in the marginal direct tax on firms.

5. Results

5.1 Effect on Income Distribution

First we examine the change in household income distribution resulting from each simulation under the mobile capital assumption as compared with that under the sector-specific capital assumption.

5.1.1 Simulation 1

Under the mobile capital assumption when indirect taxes were increased by 20% it resulted in a fall in the income for all except the three lowest income households. In general, the income reductions were greater for the higher income households than for those of lower income. The change in income ranged from -0.45% to 0.44%. This is seen in **Figure 5.1** and **Appendix I**. Under the sector specific-capital assumption the same change in indirect taxes resulted in a fall in the income of the five highest income household and a rise in income of all other groups. In general, the magnitude of the income increase was greater and the income decrease smaller than under the mobile capital assumption. The change in income ranged from -0.19% to 1.07%. This is seen in **Figure 5.2** and **Appendix II**.

Figure 5.1: Change in Household Income Resulting from a 20% Increase in Indirect Taxes under the Mobile Capital Assumption

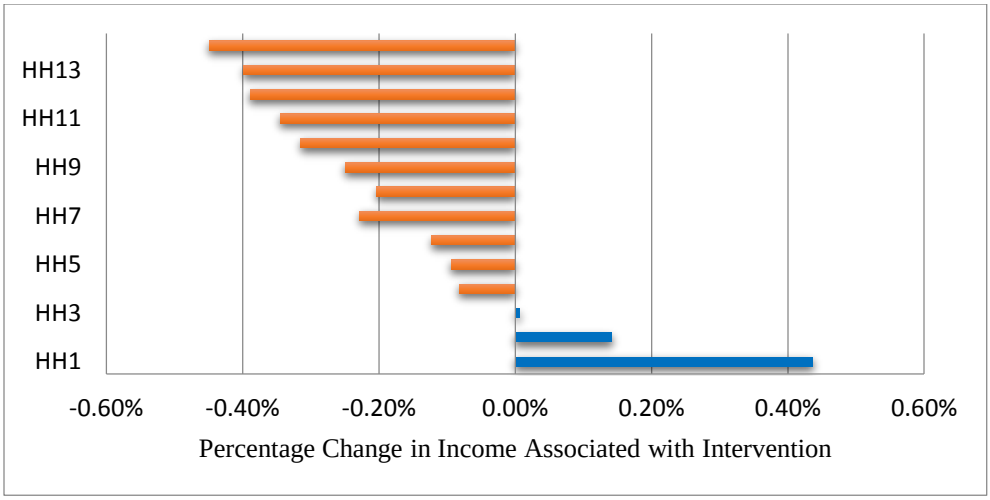
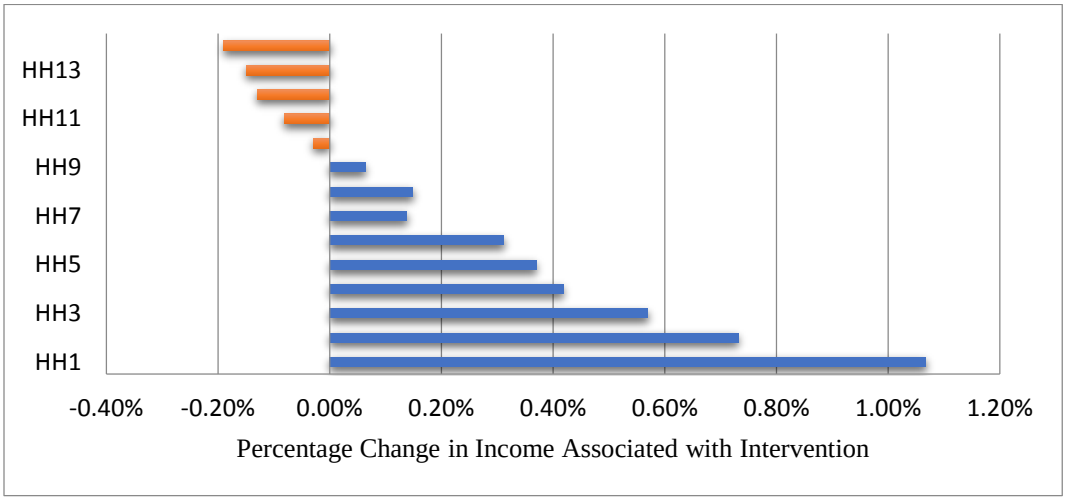


Figure 5.2: Change in Household Income Resulting from a 20% Increase in Indirect Taxes under the Sector-specific Capital Assumption



5.1.2 Simulation 2

Under the mobile capital assumption when indirect taxes were decreased by 50% it resulted in a rise in the household income of all household groups. The income increase was greatest for the top (HH14) and bottom (HH1) household income groups than for any other group. The increase in income ranged from 0.38% to 1.12%. This is seen in **Figure 5.3** and **Appendix I**. Under the sector specific-capital assumption the same reduction in indirect taxes results in the similar patterns of increases in the income as the under the mobile capital assumption but in greater magnitudes. Now the increase in incomes ranged from 0.86% to 1.61%. This is seen in **Figure 5.4** and **Appendix II**.

Figure 5.3: Change in Household Income Resulting from a 50% Decrease in Indirect Taxes under the Mobile Capital Assumption

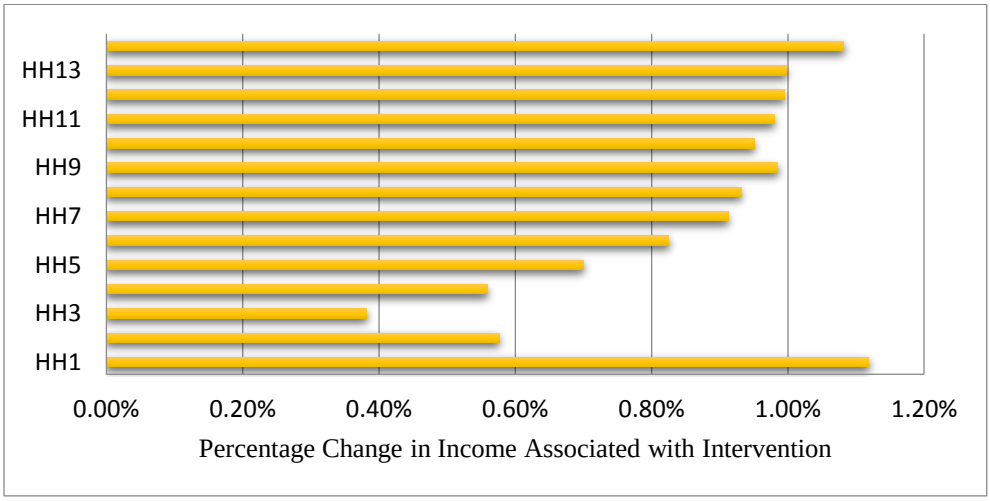
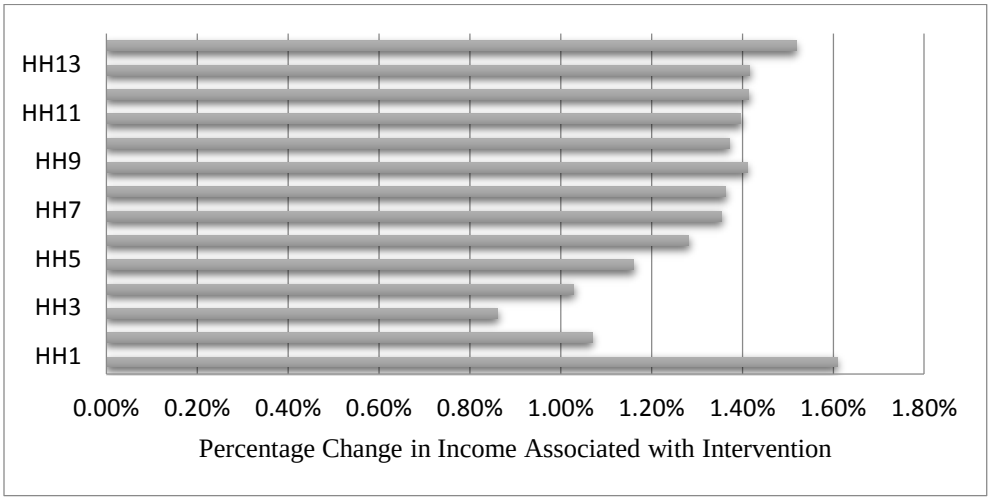


Figure 5.4: Change in Household Income Resulting from a 50% Decrease in Indirect Taxes under the Sector-specific Capital Assumption



5.1.3 Simulation 3

Under the mobile capital assumption when government spending is increased by 20% it resulted in a rise in the income for all households groups. In general the income increase was greater for the lower income household than for those of higher income groups. The increase in income ranged from about 1.46% to 5.40%. This is seen in **Figure 5.5** and **Appendix I**. Under the sector specific-capital assumption the same increase in government spending results in the identical patterns of increases in the household income as the under the mobile capital assumption but the increases are moderately greater than they were under the mobile capital assumption. The increase in incomes ranged from 2.21% to 6.72%. This is seen in **Figure 5.6** and **Appendix II**.

Figure 5.5: Change in Household Income Resulting from a 20% Increase in Government Spending

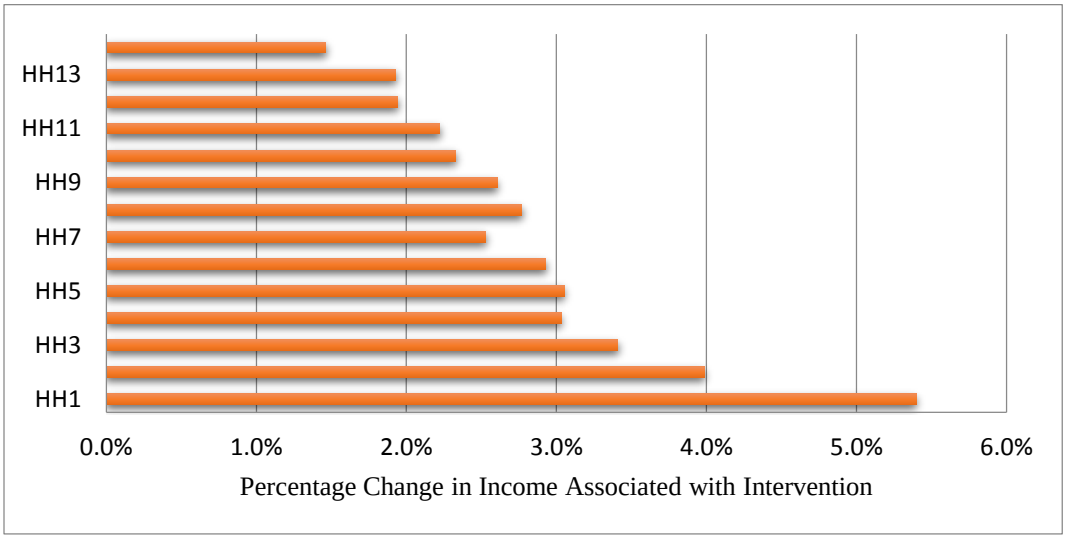
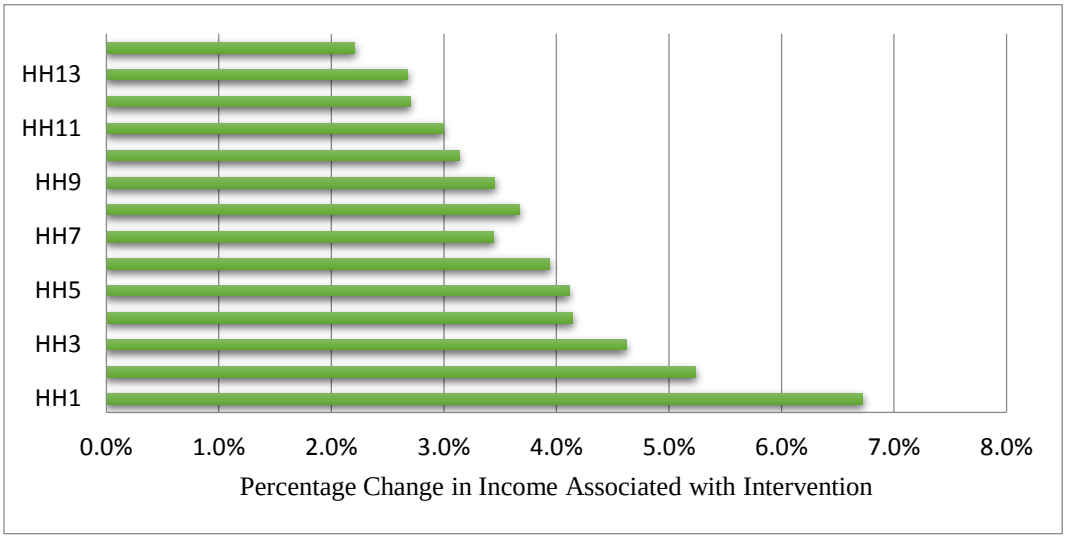


Figure 5.6: Change in Household Income Resulting from a 20% Increase in Government Spending



5.1.4 Simulation 4

When taxes and duties on imports were decreased by 20% under the mobile capital assumption it resulted in a rise in the income for all households income groups. The income increase was highest for the lowest income household. For the top six (6) household groups the increase was approximately the same. This fiscal intervention resulted in the largest increases in income ranging from 12.94 % to 17.77%. This is seen in **Figure 5.7** and **Appendix I**. For the sector-specific capital assumption similar patterns of income increases were seen but in greater magnitudes. The increase ranges from 13.97 % to 18.69%. This is seen in **Figure 5.8** and **Appendix II**.

Figure 5.7: Change in Household Income Resulting from a 20% Decrease in Taxes and Duties on Imports under the Mobile Capital Assumption

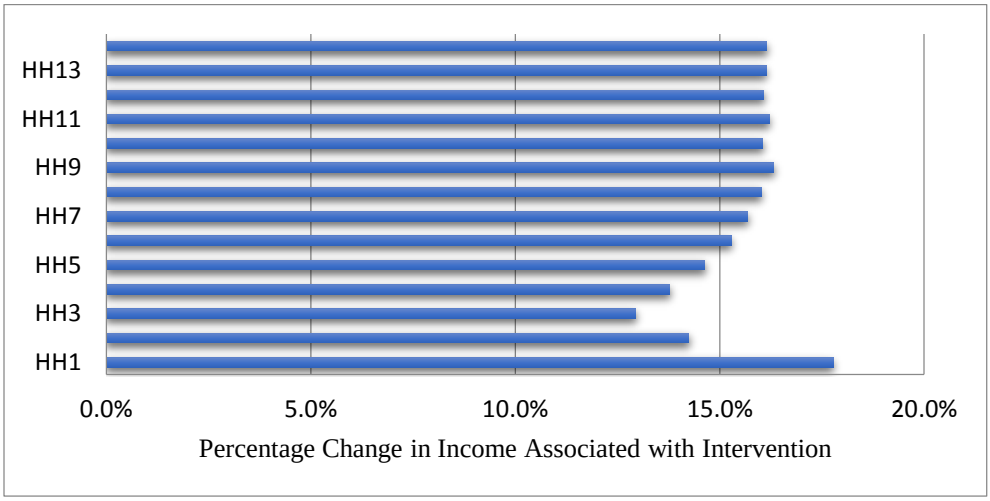
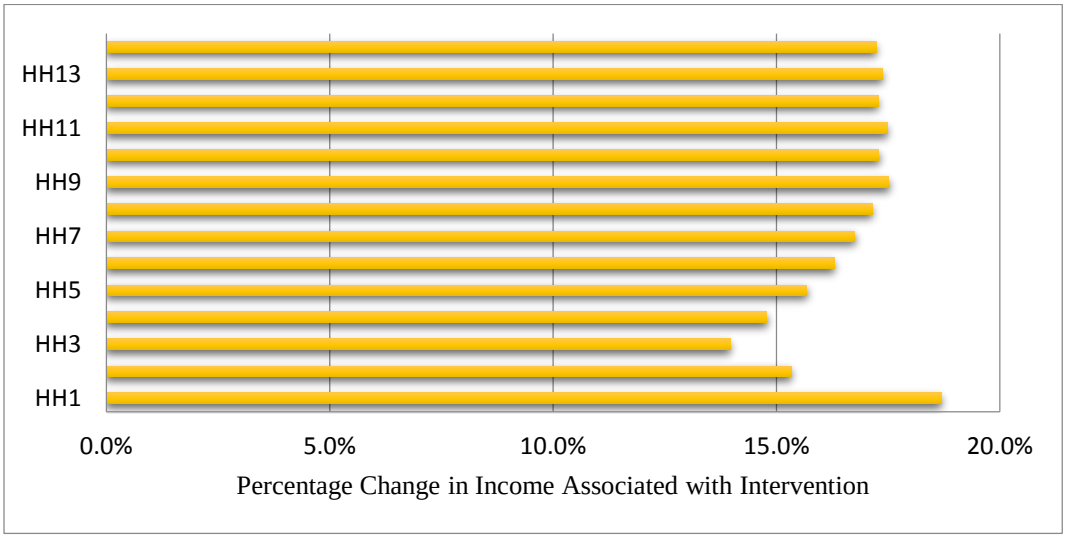


Figure 5.8: Change in Household Income Resulting from a 20% Decrease in Taxes and Duties on Imports under the Sector-specific Capital Assumption



5.1.5 Simulation 5

When taxes and duties on the import of alcohol and tobacco products were increased by 20% under the mobile capital assumption this resulted in a rise in income for all households groups. The increase was generally larger for the lower than for the higher income group. The increase in incomes ranges from about 0.02% to 0.67%. This is seen in **Figure 5.9** and **Appendix I**. Though there were similar increases in income under this assumption, the distribution patterns were different, in that a greater proportion of groups had increases exceeding 0.2% than under the mobile capital assumption. The increase in income ranged from about 0.33% to 1.27%. This is seen in **Figure 5.10** and **Appendix II**.

Figure 5.9: Change in Household Income Resulting from a 20% Increase in Taxes and Duties on Imports of Alcohol and Tobacco Products under the Mobile Capital Assumption

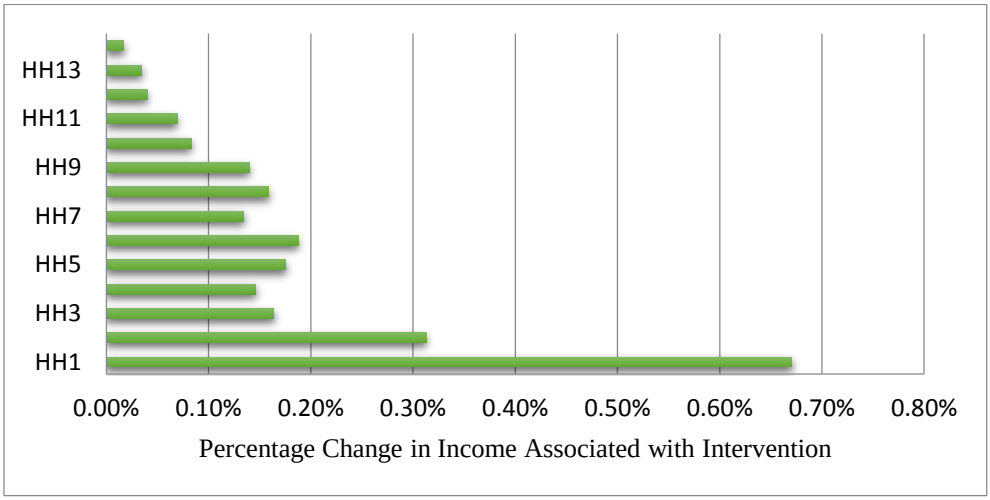
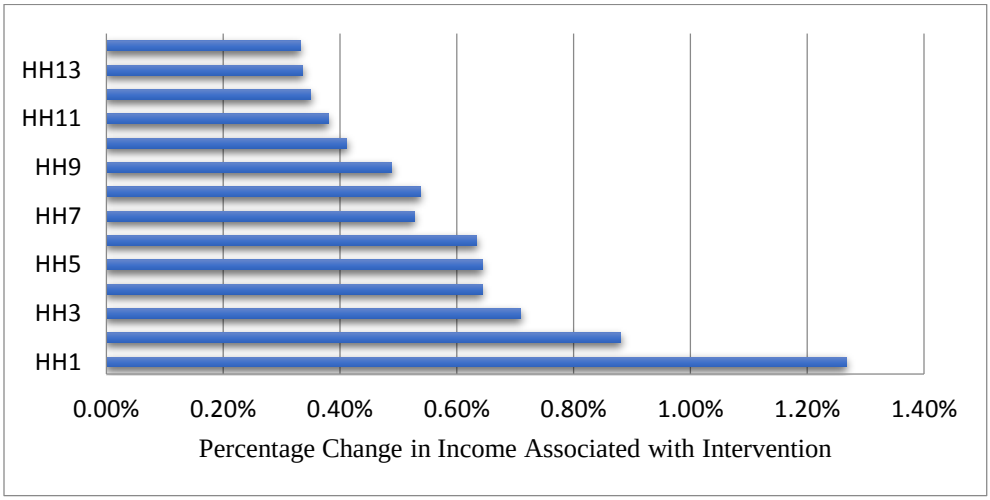


Figure 5.10: Change in Household Income Resulting from a 20% Increase in Taxes and Duties on Imports of Alcohol and Tobacco Products under the Sector-specific Capital Assumption



5.1.6 Simulation 6

Under the mobile capital assumption when taxes on oil and gas commodities were increased by 30% it resulted in a fall in the income for all except the two lowest household groups. The income reduction was generally greater for the higher income household than for those of a lower income. The change in incomes ranges from -0.56% to 0.47%. This is seen in **Figure 5.11** and **Appendix I** Under the sector-specific capital assumption this fiscal intervention resulted in a fall in the income for the top five (5) households and income increase for all other groups. The income reductions were generally smaller and the increases greater than under the mobile capital assumption. The change in income ranges from -0.26% to 1.18%. This is seen in **Figure 5.12** and **Appendix II**.

Figure 5.11: Change in Household Income Resulting from a 30% Increase in Taxes on Oil and Gas Commodities under the Mobile Capital Assumption

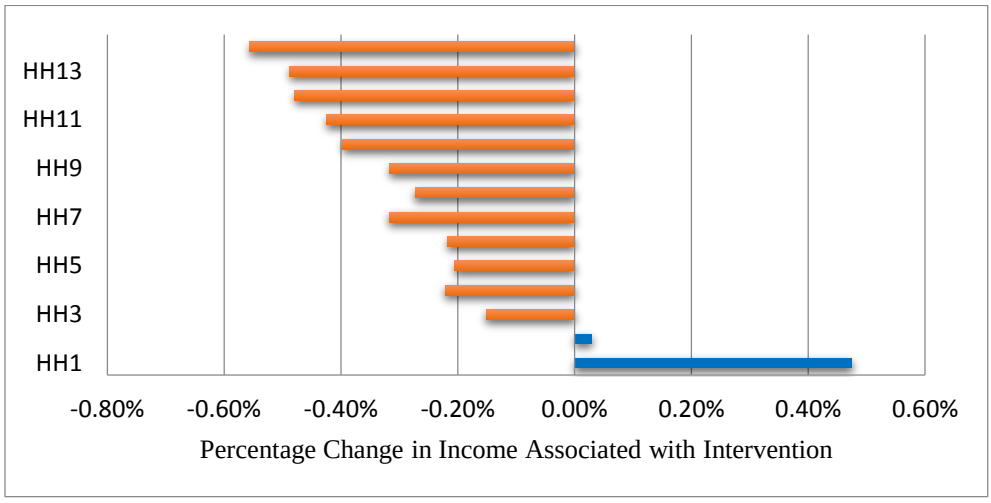
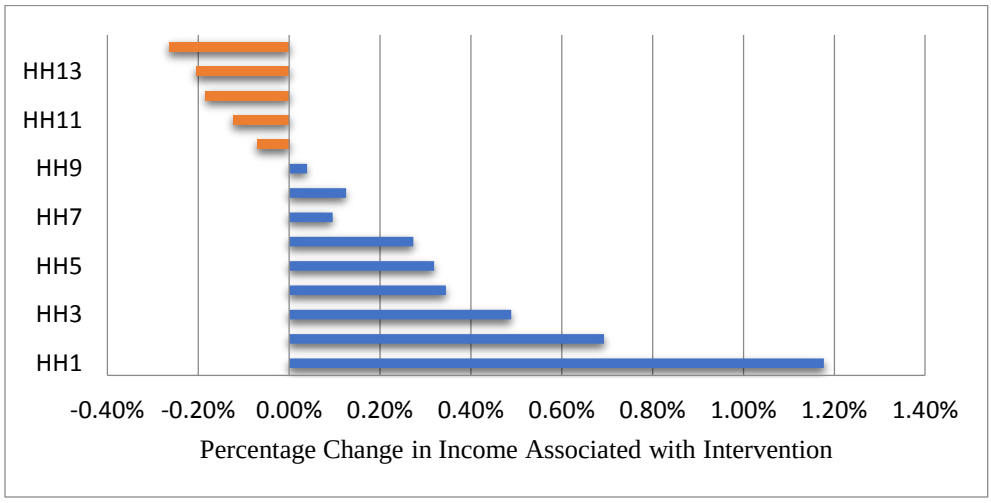


Figure 5.12: Change in Household Income Resulting from a 30% Increase in Taxes on Oil and Gas Commodities under the Sector-specific Capital Assumption



5.1.6.1 Simulation 7

When production taxes on other manufacturing were decreased by 20% under the mobile capital assumption it resulted in a rise in the income for all except the two highest income groups. The increase for the lowest household group was immensely larger than for other groups. The change in income ranges from -0.02% to 0.64%. This is seen in **Figure 5.13** and **Appendix I**. However, under the sector-specific capital assumption, no income reductions associated with this intervention with income increases ranging from 0.29% to 1.22%. This is shown in **Figure 5.14** and **Appendix II**.

Figure 5.13: Change in Household Income Resulting from a 20% Decrease in Production Taxes on Other Manufacturing under the Mobile Capital Assumption

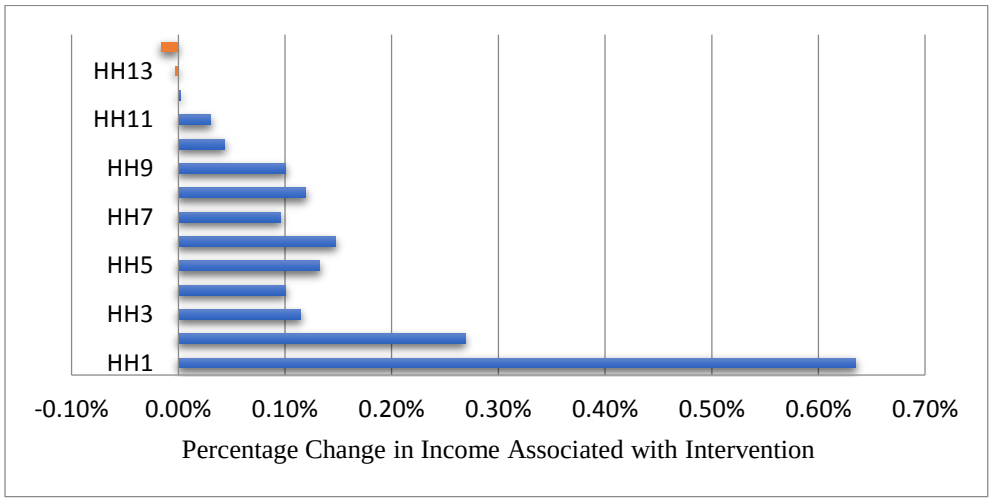
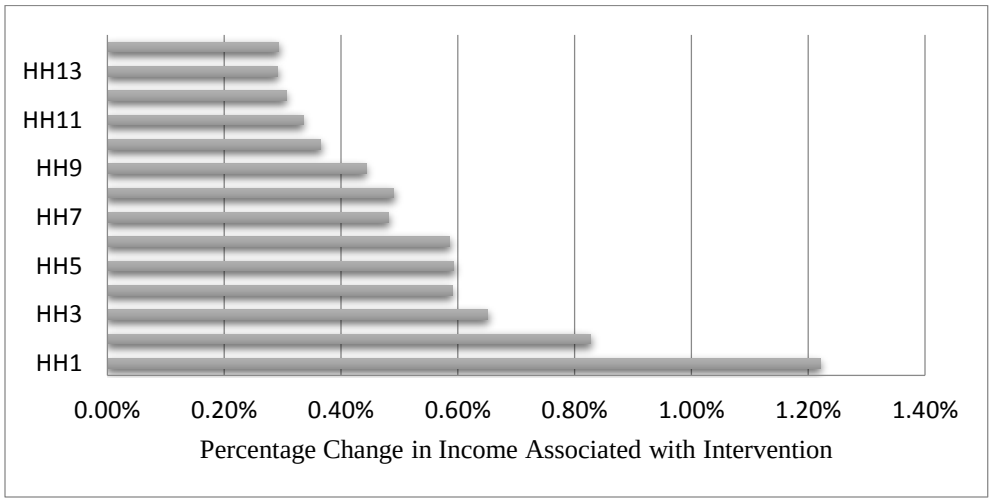


Figure 5.14: Change in Household Income Resulting from a 20% Decrease in Production Taxes on Other Manufacturing under the Sector-specific Capital Assumption



5.1.7 Simulation 8

Under the mobile capital assumption when marginal direct taxes on firms are increased by 20% it results in a fall in the income for all except the two lowest household groups. Higher income households suffer a greater loss of income than lower income groups while the biggest income gains were attained by the lowest household groups. The change in income ranges -1.35% to 0.82%. This is seen in **Figure 5.15** and **Appendix I**. Under the sector-specific capital assumption only the top eight (8) income groups suffered income reductions. The change in income ranges from -1.23% to 1.42%. This is seen in **Figure 5.16** and **Appendix II**.

Figure 5.15: Change in Household Income Resulting from a 20% Increase in Marginal Direct Taxes on Firms under the Mobile Capital Assumption

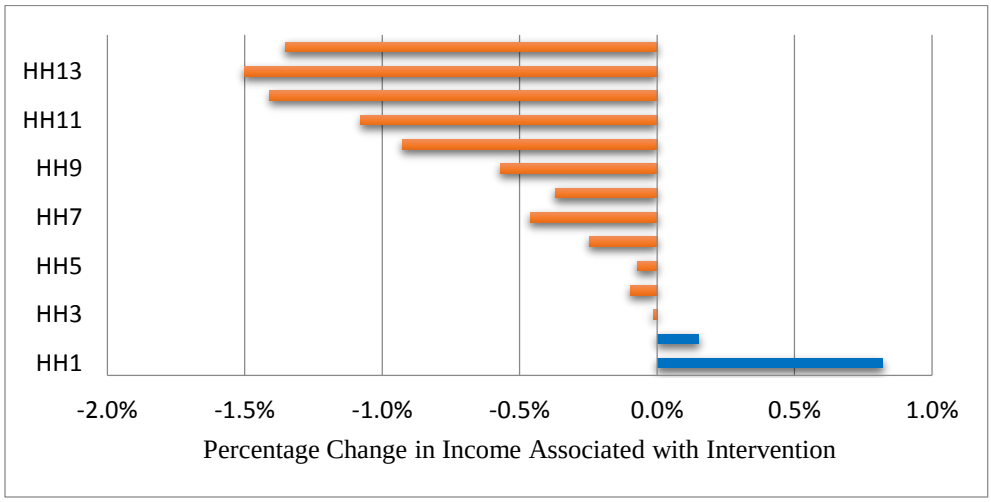
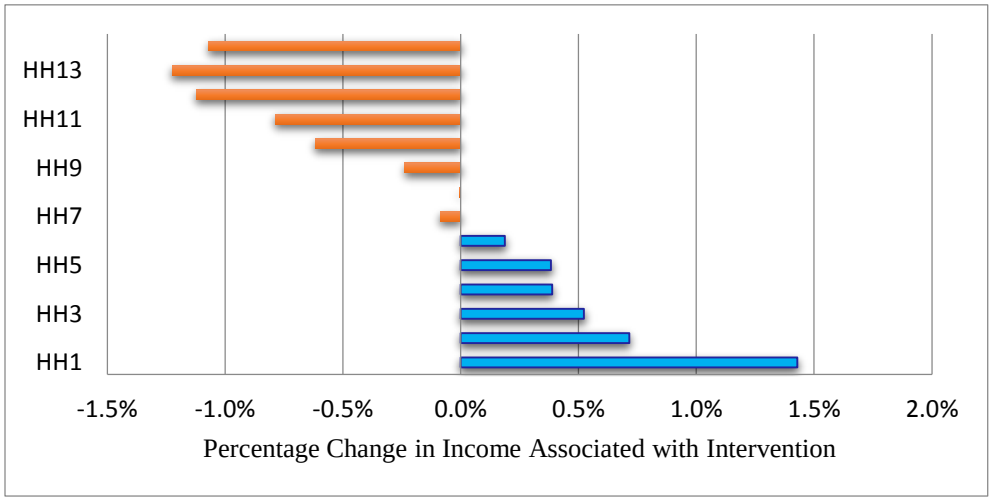


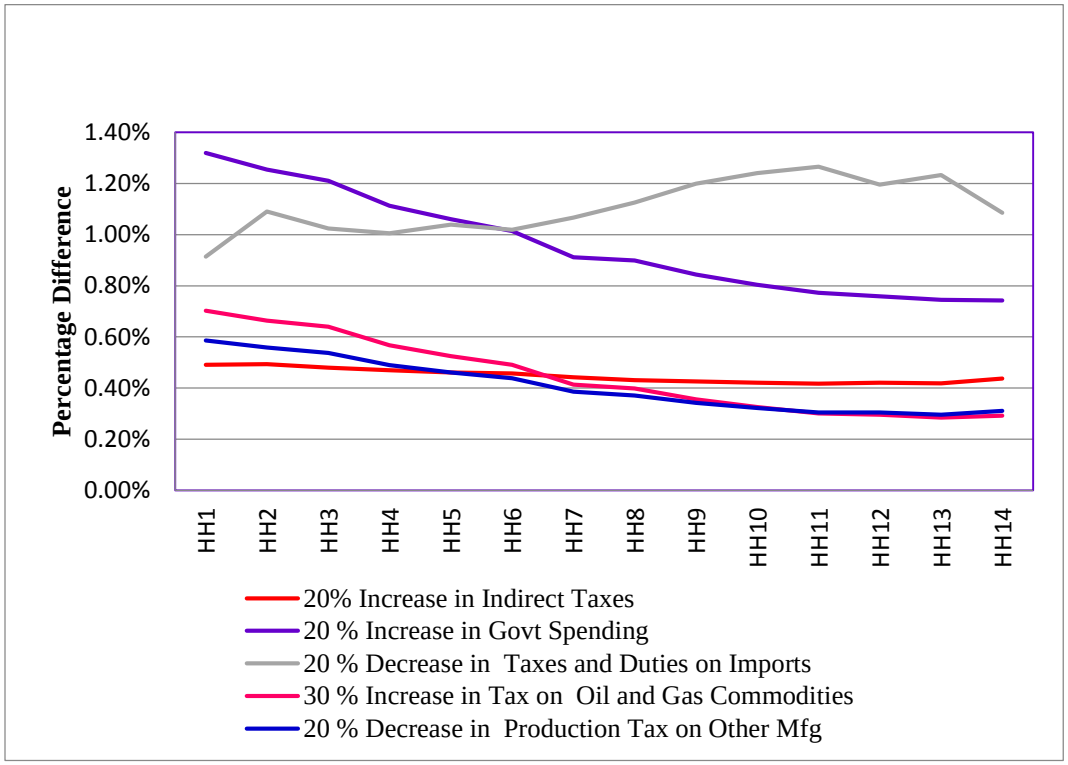
Figure 5.16: Change in Household Income Resulting from a 20% Increase in Marginal Direct Taxes on Firms under the Sector-specific Capital Assumption



Looking at the difference in income between the two assumptions, all simulations except the 20% decrease in taxes and duties on imports resulted in greater differences for the lower income groups than for the higher income group. For the increase in government spending and the decrease in taxes and duties on imports the difference between assumptions was generally larger than for the other interventions. With the 50% decrease in indirect taxes the difference between assumptions was approximately the same of all households. The difference in output was greatest

for the 20% increase in government spending and smallest for the 20% decrease in taxes and duties on imports. These can be seen in **Table 5.17** and **Appendix III.**

Figure 5.17: Income Difference between Assumptions in Response to Fiscal Measure Adopted



5.2 Effect on Household Expenditure

Now we examine change in household expenditure resulting from each simulation under the mobile capital assumption as vis-a-vis the sector-specific capital assumption.

5.2.1 Simulation 1

With a 20% increase in indirect taxes, expenditure on health services did not decline. The expenditure of lower income groups was generally greater than for higher income groups under both assumptions about capital. Generally the expenditures were lower under the sector- specific capital assumption. This is seen in **Figure 5.18** and **Appendix IV**. For the same increase in indirect taxes expenditure on confectionary and other foods were lower for all household groups except HH1. The greatest expenditure cuts were in the middle lower income households (group 7 and 8). For the lower income groups the mobile capital assumption produced greater expenditure reductions than the sector-

specific assumption. Whereas for the higher income groups the sector-specific assumption produced greater expenditure reductions than the mobile capital assumption. This is seen in **Figure 5.19** and **Appendix V** below.

Figure 5.18: Change in Expenditure on Health Services resulting from a 20% Increase in Indirect Taxes

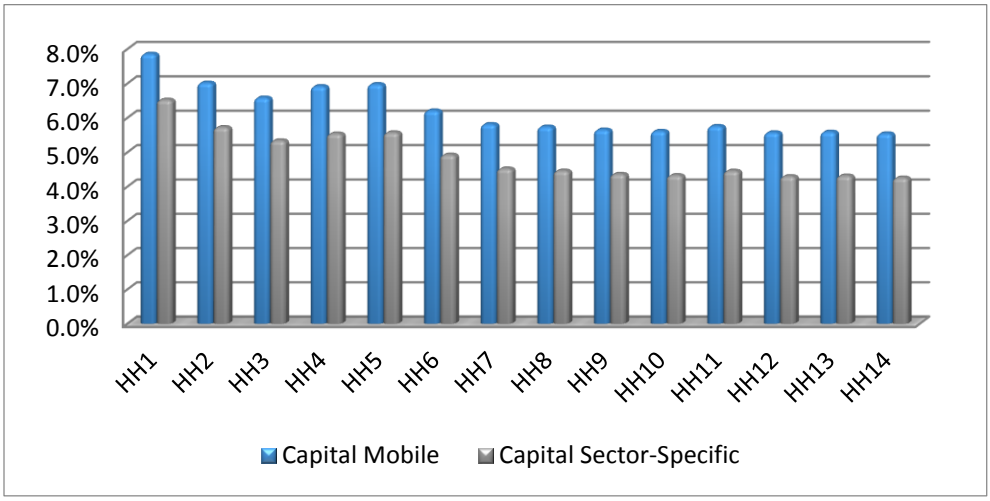
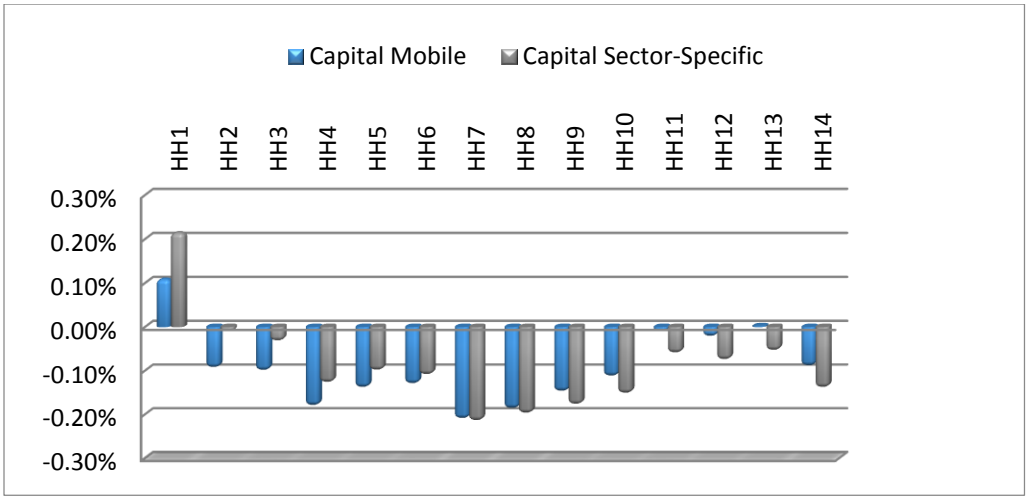


Figure 5.19: Change in Expenditure on Confectionary and Other Foods resulting from a 20% Increase in Indirect Taxes



5.2.2 Simulation 2

With a 50% decrease in indirect taxes expenditure on communication services for the higher income households were generally greater than for lower income groups under both capital assumptions. The expenditure changes were lower under the sector specific-capital assumption. This is seen in **Figure 5.20** and **Appendix VI**. The same increase in indirect taxes resulted in greater expenditure on sugar, molasses and honey for the middle income groups. The greatest expenditure change were in made by household income groups 7 and 8. Expenditure increases were greater under the sector-specific capital assumption. The differences between both assumptions were more evident for the lower income households. This is seen in **Figure 5.21** and **Appendix VII**.

Figure 5.20: Change in Expenditure on Communication Services resulting from a 50% Decrease in Indirect Taxes

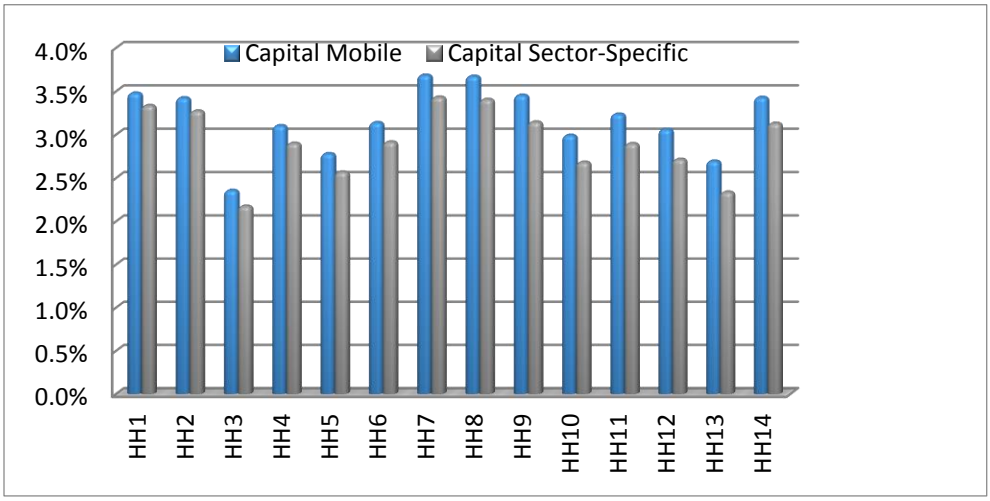
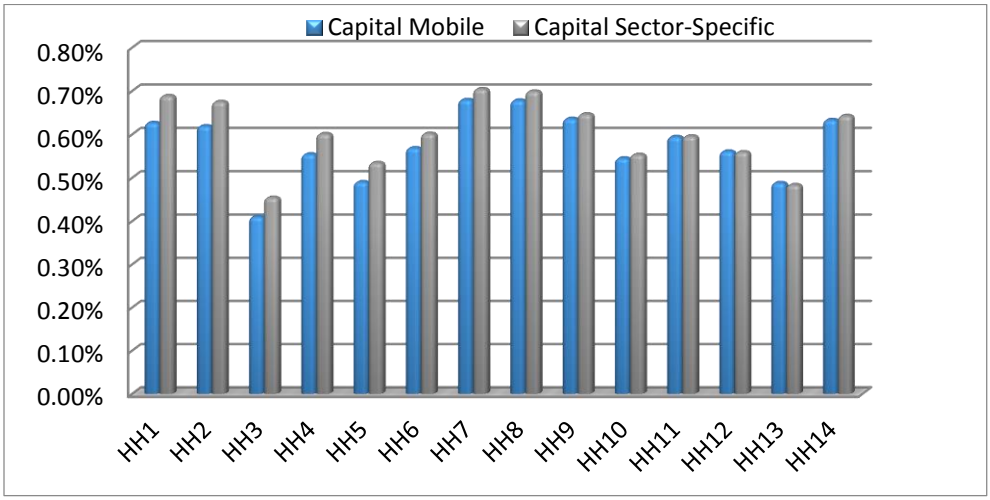


Figure 5.21: Change in Expenditure on Sugar, Molasses and Honey resulting from a 50% Decrease in Indirect Taxes



5.2.3 Simulation 3

When government spending is increased by 20% it resulted in expenditure increases on educational services for the lowest five (5) household groups but expenditure reductions of all other income groups. Where expenditures increased, the increases were greater under the mobile capital assumption, whereas in cases where expenditures decreased, the decreases were greater under the sector-specific capital assumption. This is seen in **Figure 5.22** and **Appendix VIII**. The same fiscal injection resulted in expenditure increases on electricity for all but the highest three (3) household income groups. The sector-specific capital assumption resulted in higher increases in all income groups except the upper middle income groups (HH8, HH9, HH10 and HH11). This is seen in **Figure 5.23** and **Appendix IX**

Figure 5.22 : Change in Expenditure on Educational Services resulting from a 20% Increase in Government Spending

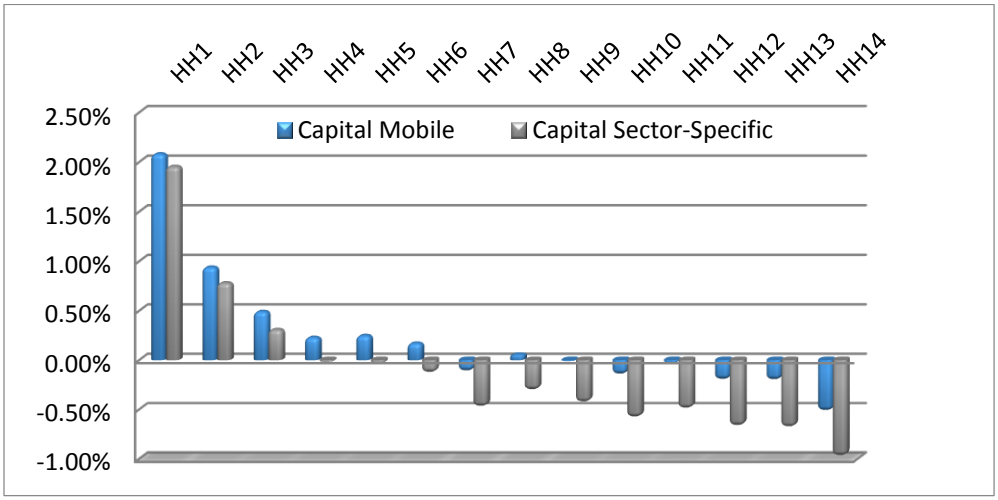
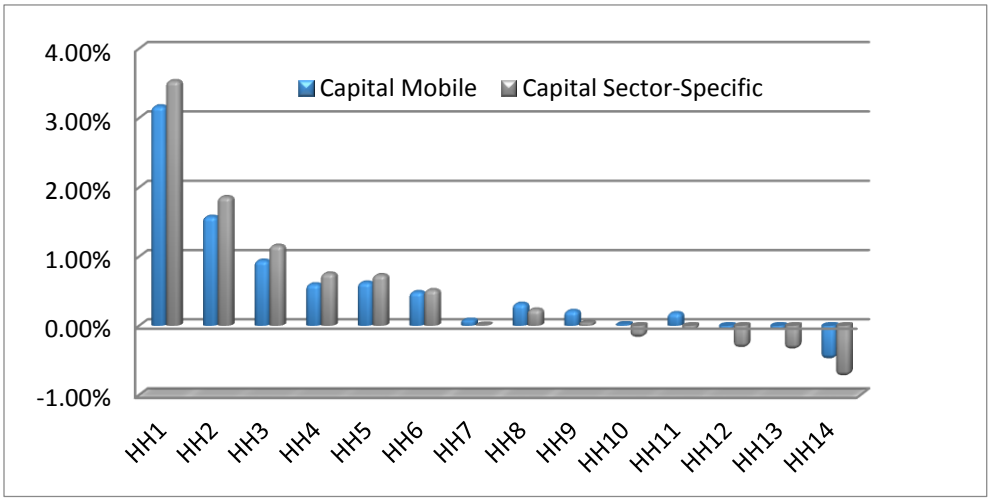


Figure 5.23: Change in Expenditure on Electricity resulting from a 20% Increase in Government Spending



5.2.4 Simulation 4

When taxes and duties on imports were decreased by 20% it resulted in expenditure increases on construction services for all income groups but the increases were greater for the lower income households. Generally increases were greater under the mobile capital assumption. This is seen in **Figure 5.24** and **Appendix X**. This same fiscal measure resulted in similar increases in expenditure on household appliances especially for the lower income households. The increases were greater under the sector-specific capital assumption. This is seen in **Figure 5.25** and **Appendix XI**.

Figure 5.24: Change in Expenditure on Construction Services resulting from a 20% Decrease in Taxes and Duties on Imports

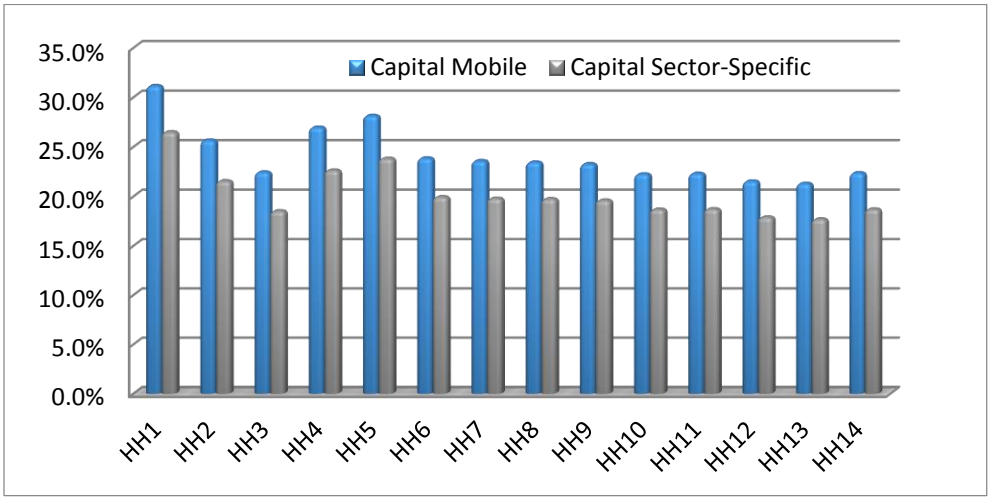
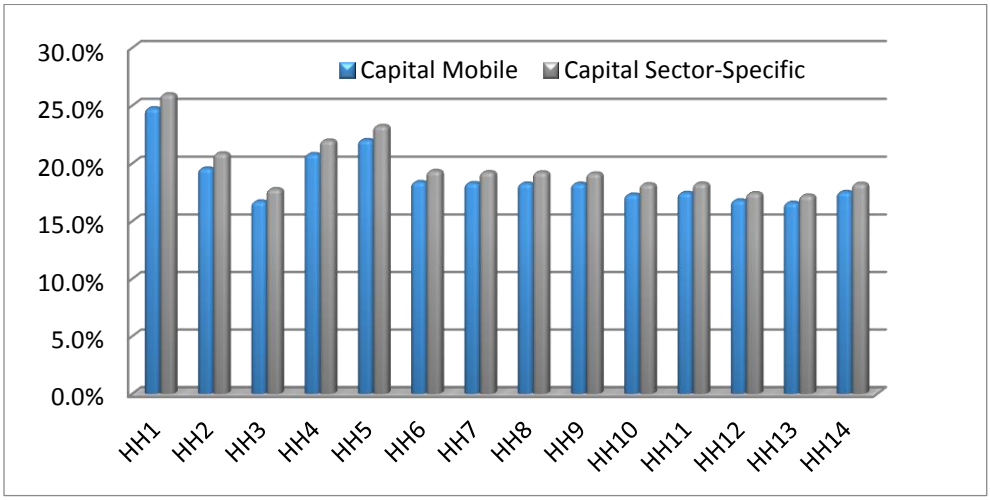


Figure 5.25: Change in Expenditure on Household Appliances resulting from a 20% Decrease in Taxes and Duties on Imports



5.2.5 Simulation 5

A 20% increase in taxes and duties on the import of alcohol and tobacco products resulted in reductions in expenditures on alcohol and tobacco products for all household groups. The reductions were higher for the lowest three (3) income groups under the mobile capital assumption but in all other groups the sector-specific capital assumption resulted in greater reductions. This is seen in **Figure 5.26** and **Appendix XII**. A 20% Increase in taxes and duties on imports

resulted in increased expenditures in health. The increases were greater for the lower income than the higher income groups and under the mobile capital assumption. This can be seen in **Figure 5.27** and **Appendix XIII**.

Figure 5.26: Change in Expenditure on Alcohol and Tobacco Products resulting from a 20% Increase in Taxes and Duties on Imports of Alcohol and Tobacco Products

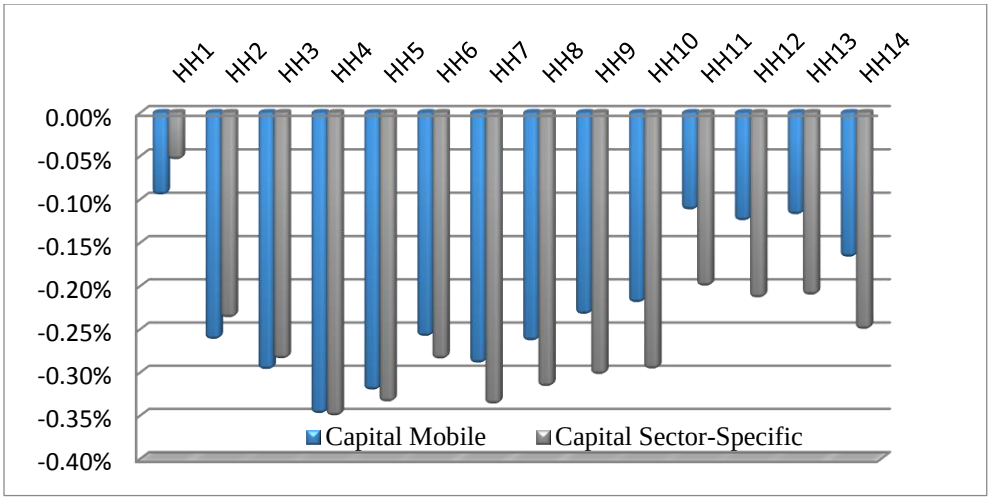
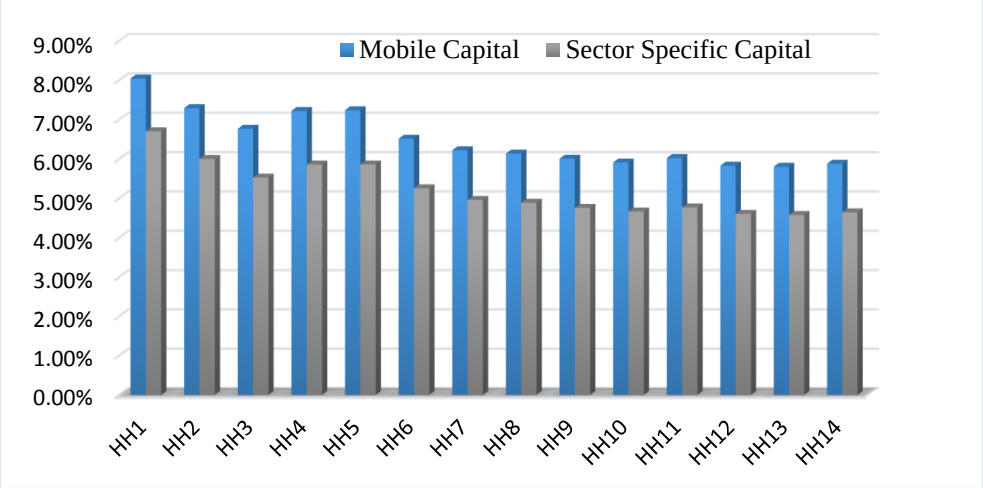


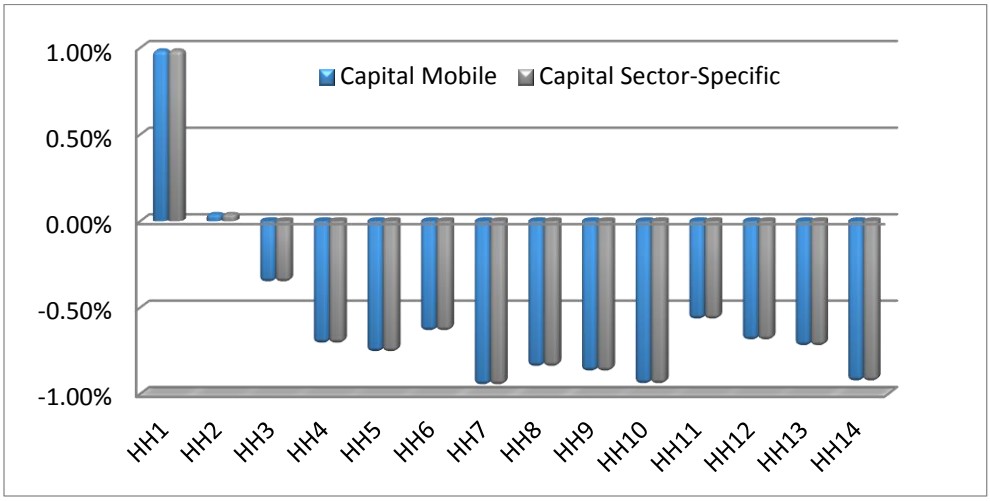
Figure 5.27: Change in Expenditure on Health resulting from a 20% Increase in Taxes and Duties on Imports of Alcohol and Tobacco Products



5.2.6 Simulation 6

When taxes on oil and gas commodities were increased by 30% all income groups except in lowest two (2) reduced expenditures on business services as seen in **Figure 5.28** and **Appendix XIV**. The magnitude of the expenditure change was the same under both assumptions.

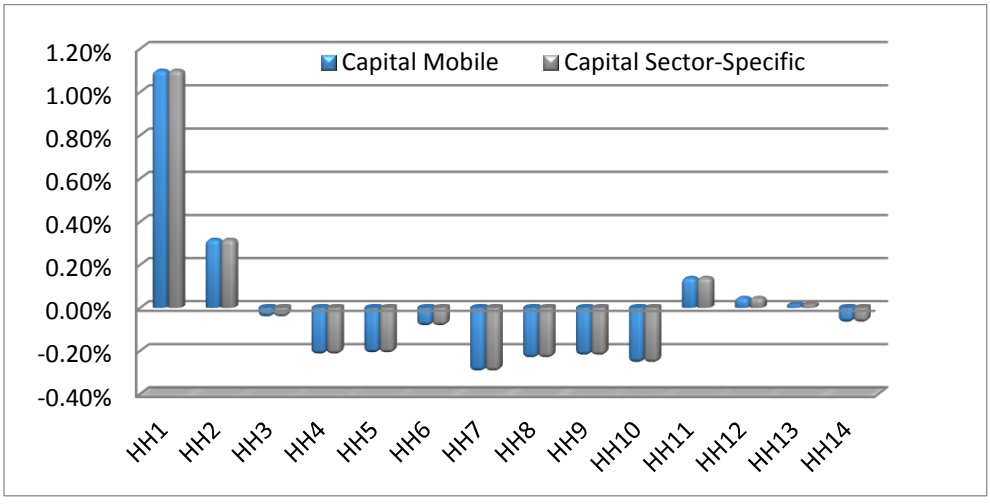
Figure 5.28: Change in Expenditure on Business Services resulting from a 30% Increase in Taxes Oil and Gas Refining



5.2.7 Simulation 7

A 20% reduction in taxes on other manufacturing resulted mixed changes in expenditure on business services. There were increases for HH1, HH2 and HH11. The magnitude of the expenditure change was the same under both assumptions. This is seen in **Figure 5.29** and **Appendix XV**.

Figure 5.29: Change in Expenditure on Business Services resulting from a 20% Decrease in Taxes on Other Manufacturing



5.2.8 Simulation 8

When marginal direct taxes on firms were increased by 20% it resulted in a fall in expenditure on personal services in all except the lowest five (5) household groups. The magnitude of the change in expenditure was greater under the sector-specific capital assumption. This is seen in **Figure 5.30** and **Appendix XVI**. The same fiscal intervention resulted in a fall in expenditure on printing services in all except the lowest six (6) household income groups. The magnitude of the change in expenditure was greater under the sector-specific capital assumption. This is seen in **Figure 5.31** and **Appendix XVII**.

Figure 5.30 : Change in Expenditure on Personal Services resulting from a 20% Increase in Marginal Direct Taxes Firms

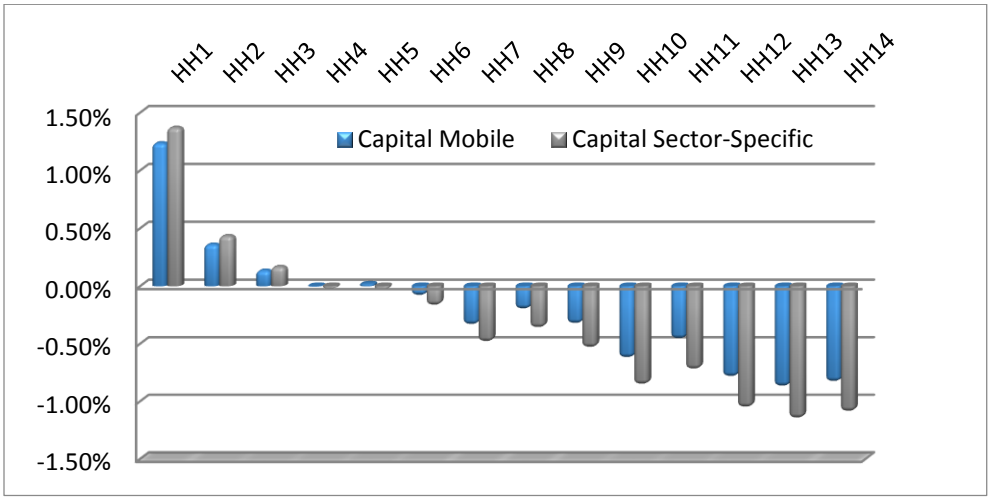
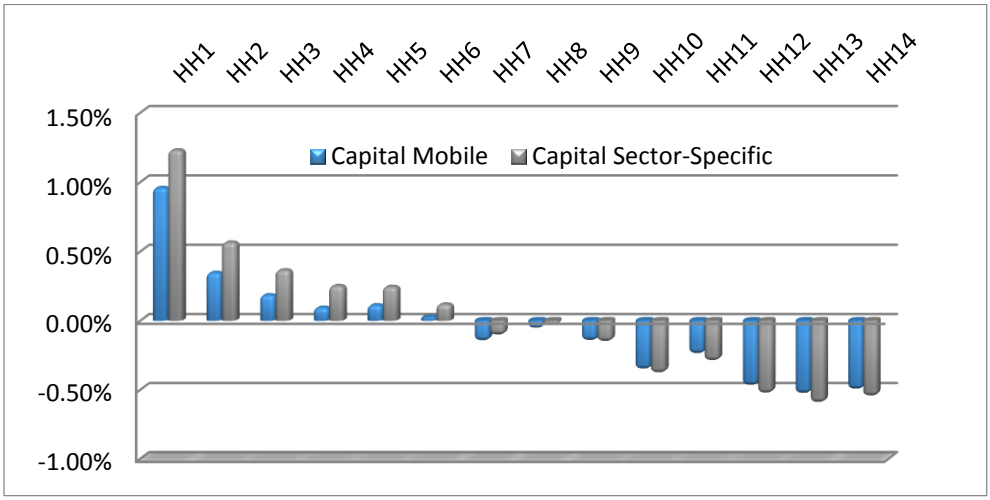


Figure 5.31: Change in Expenditure on Printing Services resulting from a 20% Increase in Marginal Direct Taxes Firms



5.3 Effect on Gross Domestic Product

Looking at the overall impact of the fiscal measures on the gross domestic product under both assumptions the following observations can be made:

a. Of the eight (8) simulations only the increase in government spending and the decrease in taxes and duties on imports resulted in a growth in output.

b. Only the decrease in taxes and duties on imports had an elastic growth effect.

c. Both decreases in the production tax on other manufacturing and larger decreases in the rate of indirect taxes had perverse effects on output growth, resulting in lowering rather than raising output.

d. Though the sector-specific capital assumption resulted in greater positive and less negative growth than the mobile capital assumption but the differences were negligible.

Table 5.3 shows a comparison in the performance of each measure in terms of its effect on output.

Table 5.1: Changes in GDP Resulting from Simulations

Assumption	20 % Increase in Indirect Taxation	50 % Decrease in Indirect Taxation	20 % Increase in Government Spending	20 % Decrease in Average Taxes and Duties on Imports	20 % Increase in Taxes and Duties on Imports of Alcohol and Tobacco Products	30 % Increase in Tax on Commodities of Oil and Gas Refineries	20 % Decrease in Production Tax on Other Manufacturing	20 % Increase in Marginal Direct Tax on Firms
Capital Mobile	-0.6%	-2.2%	1.1%	23.6%	-1.0%	-1.1%	-1.1%	-1.0%
Capital Sector-Specific	-0.1%	-1.6%	2.3%	23.7%	-0.4%	-0.4%	-0.4%	-0.4%

Source: Author Calculations

6. Conclusion and Recommendations

The popularity of CGE model indicates to a large extent their usefulness in wide ranging applications. They have featured in applications that are global, regional, national and sub-national. Their use extends beyond the social and economic realm to issues related to the environment and sustainable resource use. They have the ability to depict a considerable amount of detail with the aid of user-friendly computer applications now widely available.

The utility of a CGE model will depend on the quality of the data available; where data are lacking the scope for analysis will itself be limited. Care and attention must also be devoted to the selection of appropriate functional forms since these may have a significant effect on the outcomes. At times there may be challenges of the researcher where elasticities are not readily available but these challenges are not totally insurmountable.

The effect of fiscal policy is felt differently by different household groups. The changes in incomes resulting for a particular intervention is unlikely to be homogeneous across household groups and this is also reflected in their expenditure patterns.

The type of intervention is likely to matter in that some interventions are more successful than others. Not only are there different impacts for individual groups but also the overall output was affected in different ways.

The assumptions made with respect to model closure and the size of demand parameter are important. Changes in the assumption made regarding capital mobility produces markedly different results for the same policy intervention.

One area in which future research employing CGEs can be directed is on the environment. One such study could consider the environmental impact of macroeconomic policies. This could be done by making extensions to the SAM to include issues such as CO_2, nitrous oxide, perfluorocarbons (PFC), hydrofluorocarbons (HFC), chlorofluorocarbons (CFC), sulfur hexafluoride and methane emissions. Negative effects of rising sea levels, triggered by global warming include the reduction land space availability and even complete relocations of communities in coastal areas. Such issues must be of great concern, particularly to small island states.

It would be also be useful to estimate and make adjustments in the GDP to account for the effect of pollutants from land-based sources such as agricultural fertilizer and household detergents. These can have harmful effects on the

marine habitat and which includes the coral reefs. Extended period of degradation could ultimately result in reduced fish stocks. Since coral reefs are an attraction for the scuba-diving niche market of the tourism sector anything negatively affecting reefs will reduce their attractive appeal and may result in lower tourist revenues from the diving sub-sector.

Another area of study could be to determine the effects of macroeconomic policies on specific regions. In this regard household classifications could be done in terms of geographic location rather than income. This could help to identify areas that may require specific focus through local economic development initiatives and could also be used to evaluate the impact of government's attempt at developing specific growth poles in particular regions.

By disaggregating the enterprise sector there could be more targeted research into firms on the basis of scale of operations and in the industry in which they operate. This should also provide an excellent opportunity for future research on issues of export competitiveness and labour and import productivity.

References

Adams, Phillip B., and Peter D. Dixon. 1996. Reaching the Planners: Generating Detailed Commodity Forecast form Computable General Equilibrium Model, Preliminary Working Paper No. OP-83, Centre for Policy Studies, Monash University.

Alarcón, Jorge, Jan Van Heemst and Niek De Jong. 2000. Extending the SAM with Social and Environmental Indicators: an Application to Bolivia, *Economics Systems Research*, 12 (4): 473-479.

Aristy-Escuder, Jaime. 1999. Dominican Republic: A CGE Analysis, *North American Journal of Economics and Finance* 10: 207–233.

Bergman, Lars and Magnus Henrekson. 2003. CGE Modelling of Environmental Policy and Resource Management, Stockholm School of Economics, Department of Economics.

Bibi, Sami and Rim Chatti. 2006. Trade liberalization and the Dynamics of Poverty in Tunisia: A Layered CGE Microsimulation Analysis. MPIA Working Papers No. 2006-07.

Böhringer, Christoph, Thomas F. Rutherford and Wolfgang Wiegard. 2003. Computable General Equilibrium Analysis: Opening a Black Box. Zew Discussion Paper No. *03-56*. Centre for European Economic Research. Mannheim, Germany.

Cardenete, Manuel Alejandro, and Ferran Sancho. 2002. An Applied General Equilibrium Model to Assess the Impact of National Tax Changes on a Regional Economy, Working Papers, E2002/13, Centro de Estudios Andaluces.

Cattaneo, Andrea. 2002. Balancing Agriculture Development and Deforestation in the Brazilian Amazon. *Research Report*, 129, IFPRI, Washington D.C.

Central Statistical Office of Trinidad and Tobago. 2007. National Income Report 2000-2006, Port of Spain.

Chitiga, Margaret, Ramos Mabugu, and Tonia Kandiero. 2007. A Computable General Equilibrium Micro-Simulation Analysis of the Impact of Trade Policies on Poverty in Zimbabwe. Working Paper 2007-15, University of Pretoria, South Africa.

Cockburn, John. 2002. Trade Liberalisation and Poverty in Nepal: A Computable General Equilibrium Micro Simulation Analysis, CREFA, Dept. d'économique, Université Laval, Québec.

Cohen, Suleiman, I. 2002. Social Accounting for Development Analysis. In *Social Accounting and Modelling for Developing Countries: analysis, policy and planning applications*, by S.I. Cohen, 1-26, Ashgate.

Decaluwé, Bernard, André Lemelin, Véronique Roubichaud and Hélène Maisonnave. 2012a. The Standard General Equilibrium Model, Single-Country, Static Version (Version 2.0) Politique économique et Pauvrete/Poverty and Economic Policy Network, Université Laval, Quebec.

_____, 2012b. PEP 1-1: AUser Guide, Politique économique et Pauvrete/Poverty and Economic Policy Network, Université Laval, Quebec.

Devarajan, Shantayanan, Jeffrey D. Lewis, and Sherman Robinson. 1990. Policy Lessons from a Trade Focused Two-Sector Model, *Journal of Policy Modeling* 12(4):625-657.

Devarajan, Shantayanan and Chalongphob Sussangkarn. 1992. Effective Rates of Protection When Domestic and Foreign Goods are Imperfect Substitutes: The Case of Thailand. *The Review of Economics and Statistics*. 74(4):701-711.

Devarajan, Shantayanan, Jeffrey D. Lewis, and Sherman Robinson. 1993. External Shocks, Purchasing Power Parity, and the Equilibrium Real Exchange Rate. *World Bank Economic Review* 7(1): 45-63.

Devarajan, Shantayanan, Delfin S. Go, Jeffrey D. Lewis, Sherman Robinson and
Pekka Sinko. 1997. Simple General Equilibrium Modelling. In *Applied Methods of Trade Policy Analysis - a Handbook*, edited by J. Francois and K. Reinert, 156-185, Cambridge University Press.

Devarajan, Shantayanan and Sherman Robinson. 2002. The Impact of Computable General Equilibrium Models on Policy, Paper presented in Conference on "Frontiers in Applied General Equilibrium Modeling", Yale University, New Haven, CT.

Devarajan, Shantayanan and Delfin S.Go. 2002. The 123 PRSP Model. In F. Bourguignon and L.A. Pereira da Silva, *The Impact of Economic Policies on Poverty and Income Distribution: Evaluation Techniques and Tools*, 277-300. Washington, DC: World Bank.

Dixon, P. B., B.R. Parmenter, J. Sutton, and D. P. Vincent. 1982. *ORANI: A Multisectoral Model of the Australian Economy*, North-Holland, Amsterdam.

Dixon, P.B., BR. Parmenter, A.A. Powell, and P. J. Wilcoxen. 1992. *Notes and Problems in Applied General Equilibrium Economics*, Elsevier Science Publishers B.V.

Dixon, Peter B. 2006. Evidenced-based Trade Policy Decision Making in Australia and the Development of Computable General Equilibrium Modelling, General Working Paper No. G-163, Centre for Policy Studies, Monash University.

Dixon, Peter B., and Maureen T. Rimmer. 2010. Johansen's contribution to CGE modeling: originator and guiding light for 50 years, Centre of Policy Studies and the Impact Project, *General Paper No G-203,* Monash University, Melbourne.

Essama-Nssah, B., Delfin S. Go, Marna Kearney, Vijdan Korman, Sherman Robinson, and Karen Thierfelder. 2007. Economy-wide and Distributional Impacts of an Oil Price Shock on the South African Economy, Policy Research Working Paper 4354, African Region, World Bank.

Floros, Christos, and Pierre Failler. 2004. Policy analysis for fisheries: A dynamic CGE approach. In *presentado en la conferencia:"Input-Output and General Equilibrium: Data, Modelling and Policy Analysis", Bruselas*.

Hallaert, Jean-Jacques. 2007. Can Regional Integration Accelerate Development in Africa?
CGE Model Simulations of the Impact of the SADC FTA on the Republic of Madagascar, *IMF Working Paper* IMF Washington D.C.

Hazel, Carlos and Patrick K. Watson, 2012. Tracing the Generation, Distribution and Use of Income in Trinidad and Tobago Using A Social Accounting Matrix. Paper presented at the SALISES Conference, August 20-25, in Kingston, Jamaica.

Ianchovichina, Elena, Alessandro Nicita, and Isidro Soloaga. 2001. Trade Reform and Household Welfare: The Case of Mexico, *Policy Research Working Paper*, Trade Development Research Group, World Bank, Washington, D.C.

King, Damien, and Sudhanshu Handa. 2003. "The Welfare Effects of Balance of Payments Reform: A Micro-Macro Simulation of the Cost of Rent-Seeking."*Journal of Development Studies* 39, no. 3: 101-128.

de Melo, Jaime and Sherman. Robinson. 1992. Productivity and Externalities: Models of Export-Led Growth. *The Journal of International Trade and Economic Development* 1(1): 41-68.

Learmonth, David, Peter G. Mc Gregor, ohn. K. Swales, Karen R. Turner and Ya Ping Yin. 2006. "The importance of the regional/local dimension of sustainable development: An illustrative Computable General Equilibrium analysis of the Jersey economy", *Economic Modelling* 24(1): 15-41.

Löfgren, Hans, and Moataz El-Said .1999. A General Equilibrium Analysis for Alternative Scenarios for Food Subsidy Reform in Egypt, *TMD Discussion Paper*, 48, IFPRI, Washington D.C.

Löfgren, Hans, Moataz El-Said and Sherman Robinson. 1999. Trade Liberalization and Complementary Domestic Policies: A Rural-Urban General Equilibrium Analysis of Morocco, *TMD Discussion Paper*, 41, IFPRI, Washington D.C.

Löfgren, Hans, Rebecca Lee Harris and Sherman Robinson. 2002. A Standard Computable General Equilibrium (CGE) Model in GAMS, Microcomputers in Policy Research Working Paper No. 5, International Food Policy Research Institute, Washington DC.

Löfgren, Hans, Sherman Robinson and Moataz El-Said. 2003. Poverty and Inequality Analysis in a General Equilibrium Framework: The Representative Household Approach. In F. Bourguignon and L.A. Pereira da Silva, *The Impact of Economic Policies on Poverty and Income Distribution: Evaluation Techniques and Tools*, 301-324. Washington, DC: World Bank.

Maisonnave, Hélène, Bernard A. Decaluwé, Véronique Roubichaud and André Lemelin, 2012. DEBUGATOR How to Debug a Computable General Equilibrium Model using GAMS, AGRODEP and Politique économique et Pauvrete/Poverty and Economic Policy Network, Uninversité Laval, Quebec.

Nganou, Jean-Pascal. 2005. Estimation of parameters of a linear expenditure system (LES) demand function for a small African economy. *MPRA Paper No. 31450.* World Bank, Washington D.C.

Nijkamp, Peter, Shunli Wang, and Hans Kremers. 2005. Modelling the impact of International Climate Change Policy in a CGE context: the use of the GTAP-E model. *Economic Modelling* 22: 955-974

Paltsev, Sergey and John Reilly, 2006. Incorporating Climate Change Feedbacks into a General Economic Equilibrium Model, Joint Program on the Science and Policy of Global Change. Massachusetts Institute of Technology, Cambridge.

Piermartini, Roberta and Robert Teh. 2005. Demystifying Modelling Methods for Trade Policy. *Discussion Paper* No.10, WTO, Switzerland.

Robinson, Sherman, Antonio Yúnez-Nunde, Raúl Hinojosa-Ojeda, Jeffrey D. Lewis, Shantayanan Devarajan. 1999. From Stylized to applied models: Building Multisector CGE models for Policy analysis. *North American Journal of Economics and Finance* 10: 5-58.

Sadoulet, Elisabeth, and Alain de Janvry. 1995. Computable General Equilibrium Models. In *Quantitative Development Policy Analysis* by E. Sadoulet and A. de Janvry, 341-371, John Hopkins.

Sapkota, Prakash R. and Ram K. Sharma. 1998. A Computable general Equilibrium Model of the Nepalese Economy, Paper presented at the Micro Impact of Macroeconomic and Adjustment Policies, Third Annual Meeting, Kathmandu, Nepal.

Sue Wing, Ian 2004. Computable General Equilibrium Models and Their Use in Economy-Wide Policy Analysis. Technical Note 6. Center for Global Change Science, MIT.

Sun, Chin-Hwa, Fu-Sung Chiang, and Cheng-Hong Lin. 2002. Impact Evaluation of the Tariff Reduction on the Fisheries Sector in Taiwan: A Comparison of Multi-Sector CGE Model and Single-Sector Multi-Activity Sector Model, Paper presented at the 5th Annual Conference on Global Economic Analysis, Taipei, Taiwan.

Tafere, Kibrom, Alemayehu S. Taffesse, Seneshaw Tamru, Nigissie Tefera and Zelekawork Paulos. 2010. Food Demand Elasticities in Ethiopia: Estimates Using Household income Consumption Expenditure (HICE) Survey Data, ESSP II Working Paper 11, IFPRI, Washington D.C.

Warr, Peter. 2006. The Gregory Thesis Visits the Tropics, Australian National University.

Xie, Jian, and Sidney Saltzman. 2000. Environmental Policy Analysis: An Environmental Computable General-Equilibrium Approach for Developing Countries. *Journal of Policy Modeling* 22(4): 453–489.

Yúnez-Naude, Antonio, and Fernando Barceinas Paredes. 1999. Guatemala Application of a CGE Model, *North American Journal of Economics and Finance* 10: 115–147.

Yusuf, Arief A. 2006. Constructing Indonesian Social Accounting Matrix for Distributional Analysis in the CGE Modelling Framework, Working Paper No. 200604 in Economic Development Studies, Department of Economics, Padjadjaran University.

Appendices

Appendix I : Changes in Household Income in Response to Fiscal Measure Adopted (Mobile Capital Assumption)

Households (Average Monthly Income)	20 % Increase in Indirect Taxation	50 % Decrease in Indirect Taxation	20 % Increase in Government Spending	20 % Decrease in Average Taxes and Duties on Imports	20 % Increase in Taxes and Duties on Imports of Alcohol and Tobacco Products	30 % Increase in Tax on Commodities of Oil and Gas Refineries	20 % Decrease in Production Tax on Other Manufacturing	20 % Increase in Marginal Direct Tax on Firms
HH1	0.44%	1.12%	5.40%	17.77%	0.67%	0.47%	0.64%	0.82%
HH2	0.14%	0.58%	3.98%	14.25%	0.31%	0.03%	0.27%	0.15%
HH3	0.01%	0.38%	3.41%	12.94%	0.16%	-0.15%	0.11%	-0.01%
HH4	-0.08%	0.56%	3.03%	13.78%	0.15%	-0.22%	0.10%	-0.10%
HH5	-0.09%	0.70%	3.05%	14.64%	0.18%	-0.21%	0.13%	-0.07%
HH6	-0.12%	0.83%	2.93%	15.27%	0.19%	-0.22%	0.15%	-0.25%
HH7	-0.23%	0.91%	2.53%	15.68%	0.13%	-0.32%	0.10%	-0.46%
HH8	-0.20%	0.93%	2.77%	16.02%	0.16%	-0.27%	0.12%	-0.37%
HH9	-0.25%	0.99%	2.60%	16.32%	0.14%	-0.32%	0.10%	-0.57%
HH10	-0.31%	0.95%	2.33%	16.05%	0.08%	-0.40%	0.04%	-0.93%
HH11	-0.34%	0.98%	2.22%	16.21%	0.07%	-0.42%	0.03%	-1.08%
HH12	-0.39%	0.99%	1.94%	16.08%	0.04%	-0.48%	0.00%	-1.41%
HH13	-0.40%	1.00%	1.93%	16.14%	0.03%	-0.49%	0.00%	-1.50%
HH14	-0.45%	1.08%	1.46%	16.15%	0.02%	-0.56%	-0.02%	-1.35%

Appendix II: Changes in Household Income in Response to Fiscal Measure Adopted (Sector-specific Capital Assumption)

Households (Average Monthly Income)	20 % Increase in Indirect Taxation	50 % Decrease in Indirect Taxation	20 % Increase in Government Spending	20 % Decrease in Average Taxes and Duties on Imports	20 % Increase in Taxes and Duties on Imports of Alcohol and Tobacco Products	30 % Increase in Tax on Commodities of Oil and Gas Refineries	20 % Decrease in Production Tax on Other Manufacturing	20 % Increase in Marginal Direct Tax on Firms
HH1	1.07%	1.61%	6.72%	18.69%	1.27%	1.18%	1.22%	1.43%
HH2	0.73%	1.07%	5.24%	15.34%	0.88%	0.69%	0.83%	0.72%
HH3	0.57%	0.86%	4.62%	13.97%	0.71%	0.49%	0.65%	0.52%
HH4	0.42%	1.03%	4.15%	14.79%	0.64%	0.35%	0.59%	0.39%
HH5	0.37%	1.16%	4.11%	15.68%	0.64%	0.32%	0.59%	0.38%
HH6	0.31%	1.28%	3.94%	16.29%	0.63%	0.27%	0.59%	0.19%
HH7	0.14%	1.35%	3.44%	16.75%	0.53%	0.10%	0.48%	-0.09%
HH8	0.15%	1.36%	3.67%	17.14%	0.54%	0.13%	0.49%	-0.01%
HH9	0.06%	1.41%	3.45%	17.52%	0.49%	0.04%	0.44%	-0.24%
HH10	-0.03%	1.37%	3.13%	17.30%	0.41%	-0.07%	0.37%	-0.62%
HH11	-0.08%	1.40%	2.99%	17.48%	0.38%	-0.12%	0.34%	-0.79%
HH12	-0.13%	1.41%	2.70%	17.28%	0.35%	-0.18%	0.31%	-1.12%
HH13	-0.15%	1.42%	2.68%	17.37%	0.34%	-0.20%	0.29%	-1.23%
HH14	-0.19%	1.52%	2.21%	17.23%	0.33%	-0.26%	0.29%	-1.07%

Appendix III: Income Difference between Assumptions in Response to Fiscal Measure Adopted

Households (Average Monthly Income)	20 % Increase in Indirect Taxation	50 % Decrease in Indirect Taxation	20 % Increase in Government Spending	20 % Decrease in Average Taxes and Duties on Imports	20 % Increase in Taxes and Duties on Imports of Alcohol and Tobacco Products	30 % Increase in Tax on Commodities of Oil and Gas Refineries	20 % Decrease in Production Tax on Other Manufacturing	20 % Increase in Marginal Direct Tax on Firms
HH1	0.63%	0.49%	1.32%	0.91%	0.60%	0.70%	0.59%	0.61%
HH2	0.59%	0.49%	1.25%	1.09%	0.57%	0.66%	0.56%	0.56%
HH3	0.56%	0.48%	1.21%	1.02%	0.55%	0.64%	0.54%	0.54%
HH4	0.50%	0.47%	1.11%	1.01%	0.50%	0.57%	0.49%	0.49%
HH5	0.46%	0.46%	1.06%	1.04%	0.47%	0.52%	0.46%	0.46%
HH6	0.43%	0.46%	1.01%	1.02%	0.45%	0.49%	0.44%	0.43%
HH7	0.37%	0.44%	0.91%	1.07%	0.39%	0.41%	0.39%	0.38%
HH8	0.35%	0.43%	0.90%	1.13%	0.38%	0.40%	0.37%	0.36%
HH9	0.31%	0.43%	0.84%	1.20%	0.35%	0.36%	0.34%	0.33%
HH10	0.29%	0.42%	0.80%	1.24%	0.33%	0.33%	0.32%	0.31%
HH11	0.26%	0.42%	0.77%	1.27%	0.31%	0.30%	0.30%	0.29%
HH12	0.26%	0.42%	0.76%	1.20%	0.31%	0.30%	0.30%	0.29%
HH13	0.25%	0.42%	0.74%	1.23%	0.30%	0.28%	0.30%	0.28%
HH14	0.26%	0.44%	0.74%	1.09%	0.32%	0.29%	0.31%	0.28%
GDP at market prices	0.5%	0.7%	1.2%	0.1%	0.6%	0.7%	0.7%	0.5%

Appendix IV: Change in Expenditure on Health Services resulting from a 20% Increase in Indirect Taxes

Household	Mobile Capital Assumption	Sector Specific Capital Assumption
HH1	7.9%	6.5%
HH2	7.0%	5.7%
HH3	6.6%	5.3%
HH4	6.9%	5.5%
HH5	7.0%	5.6%
HH6	6.2%	4.9%
HH7	5.8%	4.5%
HH8	5.7%	4.5%
HH9	5.7%	4.4%
HH10	5.6%	4.3%
HH11	5.8%	4.5%
HH12	5.6%	4.3%
HH13	5.6%	4.3%
HH14	5.5%	4.3%

Appendix V: Change in Expenditure on Confectionary and other foods resulting from a 20% Increase in Indirect Taxes

Household	Mobile Capital Assumption	Sector Specific Capital Assumption
HH1	0.11%	0.21%
HH2	-0.09%	-0.01%
HH3	-0.10%	-0.03%
HH4	-0.18%	-0.13%
HH5	-0.14%	-0.10%
HH6	-0.13%	-0.11%
HH7	-0.21%	-0.22%
HH8	-0.19%	-0.20%
HH9	-0.15%	-0.18%
HH10	-0.11%	-0.15%
HH11	-0.01%	-0.06%
HH12	-0.02%	-0.08%
6HH13	0.00%	-0.05%
HH14	-0.09%	-0.14%

Appendix VI: Change in Expenditure on Communication Services resulting from a 50% Decrease in Indirect Taxes

Household	Mobile Capital Assumption	Sector Specific Capital Assumption
HH1	3.5%	3.3%
HH2	3.4%	3.3%
HH3	2.4%	2.2%
HH4	3.1%	2.9%
HH5	2.8%	2.6%
HH6	3.1%	2.9%
HH7	3.7%	3.4%
HH8	3.7%	3.4%
HH9	3.5%	3.1%
HH10	3.0%	2.7%
HH11	3.2%	2.9%
HH12	3.1%	2.7%
HH13	2.7%	2.3%
HH14	3.4%	3.1%

Appendix VII: Change in Expenditure on Sugar, Molasses and Honey resulting from a 50% Decrease in Indirect Taxes

Household	Mobile Capital Assumption	Sector Specific Capital Assumption
HH1	0.63%	0.69%
HH2	0.62%	0.68%
HH3	0.41%	0.45%
HH4	0.55%	0.60%
HH5	0.49%	0.53%
HH6	0.57%	0.60%
HH7	0.68%	0.70%
HH8	0.68%	0.70%
HH9	0.64%	0.65%
HH10	0.54%	0.55%
HH11	0.59%	0.60%
HH12	0.56%	0.56%
HH13	0.49%	0.48%
HH14	0.63%	0.64%

Appendix IV: Change in Expenditure on Educational Services resulting from a 20% Increase in Government Spending

Household	Mobile Capital Assumption	Sector Specific Capital Assumption
HH1	2.08%	1.95%
HH2	0.94%	0.78%
HH3	0.49%	0.31%
HH4	0.23%	-0.02%
HH5	0.25%	-0.04%
HH6	0.17%	-0.13%
HH7	-0.12%	-0.47%
HH8	0.06%	-0.31%
HH9	-0.01%	-0.43%
HH10	-0.15%	-0.58%
HH11	-0.03%	-0.49%
HH12	-0.20%	-0.67%
HH13	-0.20%	-0.68%
HH14	-0.52%	-0.97%

Appendix VX: Change in Expenditure on Electricity resulting from a 20% Increase in Government Spending

Household	Mobile Capital Assumption	Sector Specific Capital Assumption
HH1	3.17%	3.53%
HH2	1.58%	1.86%
HH3	0.94%	1.16%
HH4	0.60%	0.76%
HH5	0.62%	0.73%
HH6	0.49%	0.52%
HH7	0.09%	0.02%
HH8	0.32%	0.24%
HH9	0.21%	0.05%
HH10	0.02%	-0.18%
HH11	0.18%	-0.07%
HH12	-0.06%	-0.33%
HH13	-0.06%	-0.35%
HH14	-0.49%	-0.74%

Appendix X: Change in Expenditure on Construction Services resulting from a 20% Decrease in Taxes and Duties on Imports

Household	Mobile Capital Assumption	Sector Specific Capital Assumption
HH1	31.1%	26.5%
HH2	25.6%	21.5%
HH3	22.4%	18.5%
HH4	27.0%	22.6%
HH5	28.1%	23.8%
HH6	23.8%	19.9%
HH7	23.6%	19.8%
HH8	23.4%	19.7%
HH9	23.3%	19.6%
HH10	22.2%	18.7%
HH11	22.3%	18.7%
HH12	21.5%	17.9%
HH13	21.3%	17.7%
HH14	22.3%	18.7%

Appendix XI: Change in Expenditure on Household Appliances resulting from a 20% Decrease in Taxes and Duties on Imports

Household	Mobile Capital Assumption	Sector Specific Capital Assumption
HH1	24.8%	26.0%
HH2	19.6%	20.9%
HH3	16.7%	17.8%
HH4	20.8%	22.0%
HH5	22.0%	23.2%
HH6	18.4%	19.4%
HH7	18.3%	19.2%
HH8	18.3%	19.2%
HH9	18.2%	19.1%
HH10	17.3%	18.2%
HH11	17.5%	18.3%
HH12	16.8%	17.4%
HH13	16.6%	17.2%
HH14	17.5%	18.2%

Appendix XII: Change in Expenditure on Alcohol and Tobacco Products resulting from a 20% Increase in Taxes and Duties on Imports of Alcohol and Tobacco Products

Household	Mobile Capital Assumption	Sector Specific Capital Assumption
HH1	-0.10%	-0.06%
HH2	-0.26%	-0.24%
HH3	-0.30%	-0.29%
HH4	-0.35%	-0.35%
HH5	-0.32%	-0.34%
HH6	-0.26%	-0.29%
HH7	-0.29%	-0.34%
HH8	-0.26%	-0.32%
HH9	-0.23%	-0.30%
HH10	-0.22%	-0.30%
HH11	-0.11%	-0.20%
HH12	-0.13%	-0.21%
HH13	-0.12%	-0.21%
HH14	-0.17%	-0.25%

Appendix VI: Change in Expenditure on Health resulting from a 20% Increase in Taxes and Duties on Imports of Alcohol and Tobacco Products

Household	Mobile Capital Assumption	Sector Specific Capital Assumption
HH1	8.05%	6.71%

HH2	7.30%	6.00%
HH3	6.77%	5.53%
HH4	7.22%	5.86%
HH5	7.24%	5.86%
HH6	6.52%	5.26%
HH7	6.22%	4.96%
HH8	6.14%	4.89%
HH9	6.01%	4.76%
HH10	5.91%	4.67%
HH11	6.03%	4.77%
HH12	5.83%	4.61%
HH13	5.81%	4.58%
HH14	5.88%	4.65%

Appendix VII: Change in Expenditure on Business Services resulting from a 30% Increase in Taxes Oil and Gas Refining

Household	Mobile Capital Assumption	Sector Specific Capital Assumption
HH1	0.98%	0.98%
HH2	0.04%	0.04%
HH3	-0.36%	-0.36%

HH4	-0.71%	-0.71%
HH5	-0.76%	-0.76%
HH6	-0.64%	-0.64%
HH7	-0.95%	-0.95%
HH8	-0.85%	-0.85%
HH9	-0.87%	-0.87%
HH10	-0.95%	-0.95%
HH11	-0.57%	-0.57%
HH12	-0.69%	-0.69%
HH13	-0.73%	-0.73%
HH14	-0.93%	-0.93%

Appendix VIII: Change in Expenditure on Business Services resulting from a 20% Decrease in Taxes on Other Manufacturing

Household	Mobile Capital Assumption	Sector Specific Capital Assumption
HH1	1.10%	1.10%
HH2	0.32%	0.32%

HH3	-0.05%	-0.05%
HH4	-0.22%	-0.22%
HH5	-0.21%	-0.21%
HH6	-0.09%	-0.09%
HH7	-0.30%	-0.30%
HH8	-0.24%	-0.24%
HH9	-0.22%	-0.22%
HH10	-0.26%	-0.26%
HH11	0.14%	0.14%
HH12	0.05%	0.05%
HH13	0.02%	0.02%
HH14	-0.07%	-0.07%

Appendix XVI: Change in Expenditure on Personal Services resulting from a 20% Increase in Marginal Direct Taxes Firms

Household	Mobile Capital Assumption	Sector Specific Capital Assumption
HH1	1.24%	1.37%
HH2	0.36%	0.43%
HH3	0.13%	0.17%
HH4	-0.01%	-0.02%
HH5	0.02%	-0.03%
HH6	-0.09%	-0.17%

HH7	-0.34%	-0.49%
HH8	-0.20%	-0.37%
HH9	-0.33%	-0.54%
HH10	-0.63%	-0.86%
HH11	-0.46%	-0.73%
HH12	-0.79%	-1.06%
HH13	-0.87%	-1.15%
HH14	-0.83%	-1.09%

Appendix XVII: Change in Expenditure on Printing Services resulting from a 20% Increase in Marginal Direct Taxes Firms

Household	Mobile Capital Assumption	Sector Specific Capital Assumption
HH1	0.96%	1.23%
HH2	0.35%	0.57%
HH3	0.18%	0.36%
HH4	0.09%	0.25%
HH5	0.11%	0.25%

HH6	0.03%	0.12%
HH7	-0.15%	-0.11%
HH8	-0.06%	-0.03%
HH9	-0.15%	-0.16%
HH10	-0.36%	-0.38%
HH11	-0.24%	-0.29%
HH12	-0.47%	-0.53%
HH13	-0.53%	-0.60%
HH14	-0.50%	-0.55%