Environmental Fiscal Reform in Namibia – a potential approach to reduce poverty?*

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Abstract

In this paper, the likely effects of an environmental fiscal reform in Namibia are examined using a Computable General Equilibrium model. Namibia is a natural resource rich country with poverty alleviation as one important target on the policy agenda. One way for the government of simultaneously ensuring both a sustainable use of the resources and a less skewed income distribution might be to introduce an environmental fiscal reform, where taxes on natural and environmental resources (fish rents, energy and water) are recycled in order to give additional benefits (in terms of GDP, employment and income distribution) to the economy. The results indicate that for some recycling options, there is scope for additional benefits. Subsidizing unskilled labour would give the most favourable result, at least in terms of real GDP and employment. However, poverty might not only be a question of employment; since food constitutes a significant part of poor households' expenditures, a decrease in taxes on food might be an interesting option if GDP, employment, income distribution and environmental impacts are considered in combination.

Keywords: computable general equilibrium model; environmental fiscal reform; revenue recycling

JEL classification: D58; H21; O13; Q25

* The author would like to thank Thomas Aronsson, Jesper Stage and Kenneth Backlund for helpful comments and suggestions. A research grant from FORMAS is gratefully acknowledged.

1. Introduction

The welfare consequences of environmental tax reforms, where higher environmental taxes partly replace other taxes, have been subject to a considerable research effort in the last few decades. So far, environmental tax reforms have mainly been implemented and studied in the US and Europe, where the main focus has been on energy taxation, and whether a second dividend (in addition to the welfare gain from a cleaner environment) in terms of GDP and/or employment can be obtained by using the environmental tax revenues to reduce other distorting taxes in the economy.[1] As the theoretical and empirical evidence for whether there exist additional benefits is mixed, the effects of an environmental tax reform need to be evaluated in each specific case.[2]

In recent years, along with an intensified debate about linkages between poverty and the environment in international development policy, environmental tax reforms have slowly started to gain interest also in the literature on developing countries. As the design of environmental policy reforms in developing countries might differ from the reforms analysed in the mainstream literature mentioned above, this is often referred to as *environmental fiscal reform* rather than *tax reform* in the literature on developing countries.[3] In addition to environmentally related taxes on pollution, the design of an environmental fiscal reform in a developing country might also include taxes on natural resource use (e.g. forestry and fisheries) and user charges or the removal of environmentally harmful subsidies (e.g. on water and electricity use).[4] Another feature distinguishing environmental fiscal reforms in developing countries from those studied in the US and Europe is that in poor countries, the poverty issue might not necessarily only be related to employment; poverty is often more widespread and can, to a greater extent, also be related to, for example, the prices of commodities that constitute a significant part of the poor households' expenditures (food).

[1] See, for example, Bovenberg and De Mooij (1994), Goulder (1995), Bovenberg and Goulder (1996), Bovenberg and Van der Ploeg (1998), Bovenberg (1999) and Bosquet (2000).
[2] A review of the results from the above mentioned studies shows that there are many different factors affecting the outcome of an environmental tax reform; for example, the type of model used (the number of sectors and production factors) and the level of complementarity between factors of production. A general result, though, is that additional benefits in terms of efficiency are improbable, unless there are initial distortions in the tax system or in the market (such as unemployment).
[3] OECD (2005). By definition, environmental fiscal reform refers to a range of taxation and pricing mechanisms aiming at providing economic incentives to correct market failures in the management of natural resources and the control of pollution.
[4] Bosquet (2000).

In this paper, the likely effects of an environmental fiscal reform in Namibia are examined using a Computable General Equilibrium model. Since Namibia is a country highly dependent on its natural resource base (especially mining, fishing, agriculture and nature-based tourism) and has one of the world's most unequal income distributions (the gini-coefficient is 0.7)[5], the Namibian government has to find ways of reducing the intensity of the resource use while, at the same time, reducing poverty and inequality. One interesting option for achieving both these targets simultaneously would be to implement an environmental fiscal reform, where taxes on natural and environmental resources are recycled in order to give additional benefits in terms of increased GDP, increased employment and a less skewed income distribution. The purpose of this analysis is to find out whether a revenue-neutral environmental fiscal reform, where revenues from taxation on resource rents in the fishing sector, the removal of environmentally harmful water subsidies and the introduction of a CO_2-tax are recycled to the economy, may give rise to benefits such as increased output, increased employment and lower income inequality. The economy-wide effects are analysed for five different revenue-neutral scenarios, which differ according to the way in which the environmental fiscal revenues are recycled; a) a general decrease in the commodity sales tax rate, b) a decrease in the commodity sales tax rate on food only, c) subsidization of unskilled labour, d) an increase in direct governmental transfers to all households (general transfers) and e) an increase in direct governmental transfers to poor households only (targeted transfers).

The reform studied in this paper is similar to that of another recent CGE-based study on South Africa, where a triple dividend, in terms of reduced emissions, increased GDP and reduced poverty is found if the environmental tax revenues from increased energy or water taxation are recycled through a reduction of taxes on food.[6] A shift of focus from employment to income distribution and poverty can also be seen in another CGE-based study of the Chilean economy, where it is shown that the combination of environmental and social policies (in terms of increasing governmental transfers to households) is of critical importance for the distributional consequences of a fiscal reform.[7] While the two above examples include environmental and/or natural resource policies, there are other examples of CGE-based studies in developing countries primarily focusing on the distributional and poverty impacts

[5] This number comes from the Namibian Household Income and Expenditure Survey (NHIES) 1993/1994.
[6] Van Heerden et al. (2006b). See also Van Heerden et al. (2006a) for a similar environmental fiscal reform, but where water taxation is not included.
[7] O'Ryan et al. (2005).

of non-environmental policies. There are several studies showing that the tax and transfer systems in developing countries can be reformed to achieve distributional benefits.[8]

An important contribution of this paper, which also distinguishes it from the South African studies by Van Heerden et al. (2006a, 2006b), will be to emphasize the potential non-environmental effects of using rent taxation in the design of an environmental fiscal reform in natural resource rich developing countries. Even though taxation of rents is often pointed out as an important approach to environmental fiscal reform in developing countries, there are few studies focusing on pure resource rent taxation. According to Bosquet (2000), one reason for this is that while prices remain unchanged, rent taxation does not create any immediate incentives for resource conservation, i.e. there is no direct quantifiable effect on environmental quality, at least not in a short-run analysis where effects on entry and exit are not considered. Another reason why rent taxation is rarely analysed is that there are usually no available estimates of the sizes of actual resource rents.[9] With respect to the latter, Namibia, with its relatively well developed system of Natural Resource Accounting, provides an interesting example for rent taxation analysis.

As the environmental effects of resource rent taxation cannot be measured in a static CGE-model, the main focus of the analysis will be given to the recycling of the revenues from the perspective of alleviating poverty. As compared to the studies by Van Heerden et al. (2006a, 2006b), which also include a reduction of direct and indirect taxes as recycling options, another contribution of the present paper is the analysis of additional recycling options of increasing general and targeted transfers to households.

The outline of the paper is as follows: In section 2 background information on the Namibian economy is presented while in section 3, the different parts of the environmental fiscal reform are described. This is followed by a discussion of the model and data in section 4. A description of the different simulation scenarios is given in section 5 and in section 6, the results of the simulations are presented. Section 7 provides the concluding remarks.

[8] See e.g. Go et al. (2005) and Chitiga (2000).
[9] Although the role of resource rent taxation in environmental fiscal reforms has previously been acknowledged, the potential effects on the economy of recycling such revenues have not been investigated. In a study of the Russian Federation by Bosquet (2002), rents for oil, gas and timber were estimated, followed by a proposal to introduce a revenue neutral fiscal reform (shifting the tax base from capital and labour to natural resources), without an explicit analysis of the likely effects on the economy of such a reform.

2. Namibia

Namibia is a country that is highly dependent on its natural resource base: mining, fishing, agriculture and wildlife based tourism. With a per capita income of USD 3 000 per year, Namibia is, by definition, a middle-income country.[10] However, these statistics hide the fact that Namibia's income distribution, measured by a gini coefficient of 0.7, makes Namibia one of the most unequal countries in the world.[11] Furthermore, the official unemployment rate is approximately 35 per cent[12] and it is estimated that 50 per cent of the population live below the poverty line.[13]

An explanation of the current state of the economy, as well as of the main goals of development policy in Namibia, can partly be found in the history of the country. On March 21, 1990, Namibia gained independence after a 70-year period of South African rule. During that period, many of Namibia's natural resources were exploited in a non-sustainable way and the benefits did not always accrue to the Namibian population. The highly skewed income distribution is, to a large extent, a heritage from the South African apartheid regime; a small white minority of the population still owns most of the land and businesses and the richest 1 per cent of the population consumes the same amount as the poorest 50 per cent.[14] Since the independence, the government has been struggling to set up policies which can contribute to a sustainable management of the resources that form the basis of the economic activity in the country and, at the same time, ensure that the economic development will reduce inequality.[15]

The ratio of government expenditures over GDP is 34 per cent in Namibia, which is a rather high number when compared to other developing countries. A high level of government expenditures, especially within education and health, has been motivated in order to increase

[10] These are countries with a per capita income between USD 906 and USD 11 115; see World Bank (2007).
[11] This official figure is based on the Namibian Household Income and Expenditure Survey (NHIES) 1993/1994 which, according to the World Bank, makes Namibia *the* most unequal country in the world. According to the preliminary NHIES 2003/2004, the gini-coefficient has fallen to 0.6. However, this would still place Namibia among the most unequal countries in the world in terms of income distribution.
[12] The estimated unemployment rate in the labour force survey 2000 was 34.5%, while it was 36.7% in 2004.
[13] This estimate comes from Van Rooy (2006) who uses the 1993/1994 NHIES, so this percentage might change according to the 2003/2004 survey.
[14] The Namibian Central Bureau of Statistics (2002).
[15] One example of such a policy is the development of the "Nature Conservation Act" in 1996, which enabled the establishment of community based conservancies through Namibia's Community Based Natural Resource Management Programme. By creating incentives for rural local communities to invest in nature based tourism activities, a sustainable management of wildlife as well as poverty reduction could be achieved simultaneously.

the chances for poor people of finding employment or becoming self-employed.[16] However, in terms of combating poverty and the highly skewed income distribution, these policies do not seem to have been very successful. Namibia's tax burden accounted for about 29 per cent of GDP in the financial year 2004/2005, which can also be considered a high figure as compared to other developing countries.[17] The structure of governmental tax revenues can be seen in table 1 below.

Table 1. Governmental Revenue Structure

Governmental Revenue structure, 2001/02	
Tax Revenue	**89.31%**
Taxes on income and profits	33.65%
- Income tax on individuals	19.43%
- Company taxes	13.28%
- Diamond Mining Companies	5.41%
- Other mining companies	0.63%
- Non-mining companies*	7.24%
Taxes on property	0.51%
Domestic taxes on goods and services (VAT)	22.22%
Taxes on International trade and transactions	30.10%
Non-Tax Revenue (for example diamond royalties)	**8.44%**
Other Revenue (for example external grants)	**2,25%**

*of which actual fish rents constitute about 50 %.

Source: Schade (2005).

As can be seen from the table, the main source of revenue for the government is taxes on international trade and transactions within the Southern African Customs Union (SACU)[18], followed by taxes on profits and income and the General Sales Tax (or VAT).

Although the Ministry of Finance has expressed the need to introduce environmental taxes in Namibia, there are currently no environment-related taxes except for a tourism levy charge[19]

[16] New classrooms and clinics have primarily been built in poor rural areas.
[17] Schade (2005).
[18] The member countries of SACU are South Africa, Namibia, Botswana, Lesotho and Swaziland. All customs duties are collected through SACU's common revenue pool in South Africa and then distributed according to a "revenue sharing formula" based on each member country's share in intra-SACU trade. For Namibia, this implies that the SACU revenues appear as a lump sum, where the amount is higher than the actual SACU tariffs collected due to the revenue sharing formula. According to a new SACU agreement in 2004, the current system for revenue sharing will be changed into a less favourable distribution for Namibia in the near future.

as well as park entry fees to partly cover the costs of wildlife conservation. Although a fuel levy system is currently in place, it is not expected to give any significant environmental effects. The levy is not motivated by environmental concerns; it is low and only levied on three fuels; petrol, diesel and paraffin.[20]

According to a study by Rakner (2002), the tax base in Namibia is not used to its full potential because of evasion and a number of tax exemptions considered to erode the tax base. Certain groups of tax payers, such as farmers, fishing companies and the mining sector, pay little tax in comparison to their contribution to GDP, which might seem surprising as commercially exploited resources usually generate considerable rents; a potential source of government revenue. A further investigation of the taxation of the two main natural resource sectors in Namibia, mining and fishing, shows that in the mining sector, a considerable part of the resource rent is actually being taxed while in the fishing sector, only about 20 per cent of the rent are captured by the government.[21]

Rakner also points out that Namibia's skewed income distribution might imply that the current tax system is effectively regressive. Although – in comparison to the situation in many other African countries – the Namibian government has been successful in many respects, the pronounced governmental goals of ensuring a sustainable and equitable development calls for further revisions and developments of the economic policy. To achieve such an integrated policy, one option would be to look for opportunities to implement environmental taxes that can be redistributed in a way that might have positive effects on GDP and employment as well as lead to a more equal income distribution. This paper aims at analysing the likely welfare effects of a specific environmental fiscal reform where the additional tax revenues can be used to reach distributional and other objectives.

The potential benefits in terms of increased GDP, increased employment and reduced income inequality in Namibia will depend on how the production and consumption patterns are affected by the environmental tax reform. In fact, as there is a significant level of unemployment among unskilled labour in Namibia, the effects in terms of increased employment and real GDP may, to a large extent, depend on how the environmental tax

[19] A special levy included in the price for accommodation.
[20] Humavindu and Barnes (2006).
[21] Lange (2003).

reform affects demand for unskilled labour. If, for example, environmental taxes mainly affect skilled labour (which is considered to be fully employed) and other fixed factors, while the demand for unskilled labour is increased via revenue recycling, unemployment will most likely be reduced in the Namibian economy.[22] When it comes to income distribution, poverty might not only be a question of employment but also of the prices of commodities that constitute a significant part of the poor households' expenditures. Therefore, a change in prices of food might also affect the outcome in terms of poverty and income distribution in the model.

3. Environmental fiscal reform in Namibia

In situations involving externalities, economists have long favoured the use of taxes as a corrective instrument. In Namibia, important sectors like fishing, agriculture and wildlife-based tourism are highly dependent on a sustainable management of the natural resources fish, land, water and wildlife biodiversity. In this paper, fish and water are included in the environmental fiscal reform, while wildlife and land are not. This does not mean that these resources are less important – rather, as the tourism sector is the sector considered to have the largest potential to grow in the future, biodiversity conservation should be taken seriously, and considering the fact that farmers currently pay little tax in comparison to their contribution to GDP, the taxation of land rents would be interesting to take into consideration. However, due to the lack of appropriate data from the tourism sector as well as estimations of the size of actual land rents, these will not be considered for the environmental fiscal reform in this study.[23]

Namibia has made renewable resources a case of high priority and attempts to increase the share of energy sources like solar, wind, wave and biomass of the national energy production.[24] This makes it interesting to include increased taxation of CO_2-emissions in an

[22] As there is no choice-mechanism between leisure and work for the households in this model, employment of unskilled labour is determined by firm demand for unskilled labour. The assumption of involuntary unemployment is therefore important for the possibilities of increasing employment via revenue recycling in this model.

[23] Although lack of data prevents the inclusion of appropriate levels of such taxes, simulations are carried through with approximate levels of such taxes to give intuition to how the inclusion of such taxes would most likely affect the outcome of an environmental fiscal reform. See Appendix B and Appendix E, respectively, for a discussion of these simulations.

[24] In the energy chapter of the second National Development Plan, which is the most recent energy policy document, alternative energy uses, like renewable resources, are encouraged. Through "The Energy White

environmental tax reform. The three parts of the environmental tax reform studied in this paper are: taxation of the resource rents in the fishing sector which may reduce long-run incentives for overfishing, the removal of water subsidies which will increase the price of water used in the currently subsidized sectors (the shortage of fresh water is currently considered to be the main constraint to development in Namibia), and an increase in the energy tax (based on actual carbon content) that can lead to lower CO_2 emissions. The additional tax revenues are then recycled in different ways, by a decrease in indirect commodity taxes, subsidization of unskilled labour or increased direct governmental transfers to households. The different parts in the fiscal reform are described in more detail below.

3.1. Taxation of rent in the fishing sector

During the period of South African occupation, Namibia's fisheries often operated as an open access resource, which resulted in a depletion of the fish stocks. After the independence, a new fishing policy with two main objectives was implemented: i) to ensure ecologically sustainable management of the fisheries and ii) to significantly increase the share of benefits for Namibians from the fisheries sector, especially those previously excluded from the industry due to discriminating laws during the apartheid regime.[25]

To achieve the first part of the fishing policy, the government sets quotas for the total fish catches allowed every year. The existing quota levies have been shown to be considerably lower than the actual rents generated by the fishing industry. The non-taxed rents appear as higher than normal profits[26] in the fishing sector, which means that there are still incentives for overfishing and, as a result, the government is exposed to lobbying from the fishing sector for an increase in the fishing quotas.[27]

The second objective can be interpreted to fit into the broader context of the government's focus on policies of alleviating poverty. Even if quotas have been allocated to new companies that were not established in the industry before the independence, the only way for the poorest

Paper", the government has committed itself to introducing more renewable energy resources and the Ministry of Mines and Energy (see website http://www.mme.gov.na/energy/policy.htm) is working actively towards this goal.

[25] Lange (2003).

[26] Resource rent is the income to the fixed factor: in this case fish.

[27] According to Manning (2000), many of the new companies have been involved in the fishing industry by way of rent seeking, i.e. searching for opportunities to trade in fishing permits, rather than practically developing the capacity to manage their own fishing activities.

people of gaining benefits from the resource that initially belongs to the country as a whole is through the quota levies paid to the government and, possibly, through the creation of employment opportunities.[28]

Even if progress has been made both considering the goal of increasing Namibian's share of benefits and in halting further depletion of the fish stocks, there is a growing concern that too much of the economic benefit still accrues to foreign companies and it is obvious that the expected recovery of fish stocks to the high levels last observed in the 1960s has not occurred. Consequently, there are reasons to further increase the taxation of the rents generated in this sector. Although rent-capturing may not influence the short-run incentives for overfishing, at least not much, there are reasons to believe that this will have a positive effect on the sustainability of the fisheries in the long run, as it will decrease the currently high level of entry into the industry. Calculations based on Namibia's national accounts show that the percentage of the rent collected by the government has decreased from 50 per cent after the independence to about 20 per cent by the year 2000.[29]

3.2. Reducing environmentally harmful subsidies for water

Although water is an extremely scarce resource and is considered to be the main constraint to development for Namibia, the financial costs for providing water were heavily subsidized during the period of South-African occupation, especially for the commercial farming sector.[30] Since its independence, Namibia's water policy has changed and the new Water Resources Management Act[31] emphasizes the need to recognize the economic value of water. To promote an economically efficient water use, water tariffs should reflect the full opportunity cost of water, including the direct costs of providing water as well as the environmental impact. Studying the published data on costs of providing water compared to the tariffs paid by end users, it is clear that full direct cost recovery pricing had not yet been achieved by the year 2001-2002.[32] Actually, Lange (2006) found an error of underestimation in the cost of irrigation water in these figures and she concludes that especially commercial

[28] Lange (2003).
[29] Lange (2003).
[30] See Lange (2006).
[31] See Water Resources and Management Act 2004.
[32] See Technical Summary of Water Accounts – Department of Water Affairs 2006. Although the share of end-users that pay the full cost for water has increased significantly since the 1990's, some sectors continue to be heavily subsidized.

irrigated crop production continues to be heavily subsidized. Even though taxation would be the appropriate tool for capturing the full social costs of water, no estimations of the full social costs for water supply are available at present. The fact that water is a basic necessity further complicates the construction and implementation of a system of water taxes if it is not to harm the poorest households. Therefore, in this paper, the elimination of the total amount of water subsidies is implemented as a first step towards full social cost recovery of the water supply. It is important to note that the current government is actually working towards full private cost recovery and this study will highlight the possible economy-wide effects of implementing the first step of such a policy.

3.3. Energy taxation

A third option for environmental taxation in Namibia would be increased energy taxation. Namibia is not a major player when it comes to carbon emissions and as a non-Annex I country in the Kyoto protocol, Namibia has no international obligations to reduce emissions in the first commitment period 2008-2012. However, even without binding international targets for reducing carbon emissions, the use of CO_2 taxation may be an interesting option to consider. Namibia has made renewable resources a case of high priority and attempts to increase the share of sources like solar, wind, wave and biomass of the national energy production. At present, domestically produced electricity is mainly hydroelectric power, and although there exists a coal based power plant in Namibia, this is rarely used for production. As domestic electricity production does not cover domestic demand, the remaining part is imported (coal based electricity) from South Africa. Further, there is no domestic production of petroleum products in Namibia; all oil based fuels are imported.

At present, only petrol, diesel and paraffin are subject to a fuel levy, the main objective of which is to finance the maintenance of the road network system. It would be a reasonable step to replace this fairly arbitrary fuel levy system with an emission tax system including all oil-based fuels.[33]

[33] This is actually proposed by Humavindu and Barnes (2006) in a study about possible financing options for biodiversity conservation and a sustainable use of natural resources in Namibia.

This paper analyses the effects of introducing a tax on the final consumption of petroleum products.[34] This tax is based on actual carbon content in the different fuels, which implies that the fuel tax simulated in this paper is a CO_2-tax, although based on the consumption of fuel and not on the emissions themselves.[35] From a distributional point of view, as most of the poorest households do not drive their own car and mainly use the informal forest sector to collect their fire wood, these households may not be significantly affected by a higher petroleum tax, thereby suggesting that this policy could be easier to motivate from an equity perspective than a tax on water.

3.4. Options for revenue recycling

In many developing countries, there is a particular concern that any attempt at improving the environment through higher taxes will have negative effects on development in the country. Therefore, in this study, the focus is on the possibilities of recycling the tax revenues from the environmental tax reform in a way that might lead to benefits in terms of increased GDP, increased employment and alleviating poverty. The additional tax revenues will be recycled in five different ways, where the first two alternatives refer to decreased indirect taxation; first as a decrease in the general commodity sales tax rate (or VAT) and then as a decrease in the commodity sales tax on food only.[36] A comparison of these options in terms of income distribution will be of particular interest as poor households spend relatively more of their total expenditures on food than other households. The third option considers a subsidy towards employing unskilled labour. The above three recycling options are similar to the recycling options studied in two studies of South Africa by Van Heerden et al. (2006).[37] The last two ways of recycling the additional tax revenues are general and targeted governmental transfers. While general transfers might be unnecessarily costly depending on how large the

[34] Although the intention was to implement a coal based CO_2-tax also for imported electricity consumption, it was decided to exclude this from the analysis. The reason is that in this kind of model, a price increase for only imported electricity would imply substitution into more domestically produced electricity, but as only the residual demand currently is imported, such a substitution is not possible in the short run as domestic production is used to its full capacity. However, as petroleum products constitute the main source of CO_2-emissons in Namibia, the exclusion of a tax on imported coal based electricity will be of minor importance for the analysis of overall CO_2-emissions.

[35] See section 4.2.3. for further discussions of data for the energy sector.

[36] The general VAT rate in Namibia is 15%.

[37] In the two studies by Van Heerden et al. (2006), where there are pre-existing factor taxes for both capital and labour, both these taxes are decreased by means of revenue recycling. According to the authors, the reason for decreasing both factor taxes is that the South African Revenue Service would not be inclined to favour one factor of production over another in tax adjustment schemes. In Namibia, where no factor taxes are reported for capital or labour in the SAM, a subsidy of unskilled labour is used as a recycling option. This is motivated by the high rate of unemployment within this labour category.

leakages to the rich households will be, the reason for targeting transfers is to support only those in need.[38]

4. The CGE model and data

4.1. The model

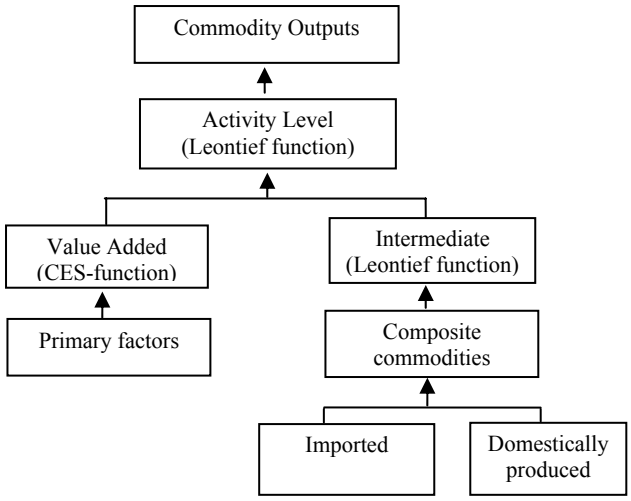
The model used for the simulations is based on a generic CGE model for developing country analysis, developed by the International Food Policy Research Institute (IFPRI). CGE models have become a standard method for economic policy analysis and have, for example, been used in the analysis of taxation, structural adjustment and trade policy. This specific model has been used in numerous studies on macro economic policies in developing countries, especially African countries[39], and it follows the standard neoclassical modelling tradition on which all original general equilibrium models are based. More specifically, the IFPRI model derives its basis from the well-known neoclassical-structuralist CGE-framework of Dervis et al. (1982), where the model agents' production and consumption decisions are driven by the maximization of profits and utility, respectively. In some respects, the model allows the user to depart from the typical neoclassical Walrasian modelling tradition, for example by allowing for structural rigidities like fixed wages and absence of factor mobility. These features of CGE-modelling have become increasingly popular, especially in the developing country literature, as they often represent a more realistic and practical way of modelling the functions of the economy in these countries.[40] The model makes use of comparative static analysis: a shock to some of the exogenous variables causes the relative prices to change and the economy adjusts to a new equilibrium. The values of the endogenous variables following from the policy-shock can then be compared to the values in the base-year equilibrium. This section provides a brief summary of the model; for a full documentation of the original model, see Löfgren et al. (2002). A formal description of the model equations is found in Appendix C.

[38] See section 4.2.4. for an explanation of how the (imperfect) targeted transfers are carried out in this study.
[39] Examples of macro-policy studies in African countries where the generic IFPRI CGE-model is used; Malawi: Löfgren et al. (2001), South Africa: Thurlow (2002) and Go et al. (2005) and Tanzania: Eskola (2005).
[40] See, for example, Van Heerden et al. (2006) where a similar CGE-model for South Africa is used and the high unemployment rate among low skilled workers is explicitly modelled by a fixed wage for this particular labour category. This wage rigidity is an important driving force for the results of the policy analysis.

4.1.1. Production

Each producer is assumed to maximize its profits subject to the production technology in a perfect competition setting: the firm takes prices of output, production factors and other inputs as given. Production technology is divided into two levels; the top level, representing the substitution decision between intermediate inputs and factors of production and the second level, representing the choice between factors of production. At the top level, a Leontief specification is used, implying no substitutability between factors of production (value added) and intermediate inputs in production. At the second level, a CES function is used to represent the substitutability between primary factors used in the production. The share of composite commodities used as intermediate inputs in the production is determined by a Leontief technology. The structure of the production technology is shown in figure 1 below.[41] As a result of profit-maximization, each producer uses a set of factors up to the point where the marginal revenue product of each factor is equal to its factor price.

Figure 1. Production Technology



Source: Löfgren et al. (2002).

[41] As a Leontief production structure is used for intermediate inputs, the model does not allow for substitution in production between, for example, energy or water and other intermediate inputs. (For *factors* of production, though, a CES function is used, allowing for substitution in the production between capital and labour, for example.) This structure of limited substitution for intermediate inputs on the production side is standard in most CGE-models and is also used in the model by Van Heerden et al. (2006) where it is motivated by a short-run time horizon for the simulations.

4.1.2. Institutions

The institutions in the model include households, enterprises (firms), the government and the rest of the world. Households receive income from the factors of production (directly from labour and indirectly via enterprises from capital) and transfers from other institutions. The income is then used for direct tax payments, saving, consumption and transfers to other institutions. Household consumption is allocated across different commodities according to a linear expenditure system (LES), implying that the consumption spending for a specific commodity is a linear function of total consumption expenditure.[42] The consumption pattern differs across household groups due to different consumption shares of each commodity and different elasticities of market demand for each commodity between the different household groups.[43] Enterprises receive factor income from capital and transfers from other institutions. This income is then allocated to direct taxes, savings and transfers to other institutions. The government collects taxes from sales, households and enterprises, import and export and value added and receives transfers from other institutions. All taxes are treated as fixed ad valorem taxes. This income is used for consumption and transfers to institutions. All transfers to or from the rest of world are fixed in foreign currency. Foreign savings constitute the difference between foreign currency spending and receipts.

4.1.3. Commodity Markets

The model allows for one single activity to produce more than one commodity and for one commodity to be produced by more than one activity. The first step is therefore to generate aggregated domestic output from the output generated by different activities for a given commodity, using a CES aggregation function. Demand for the output of each activity is based on minimizing the cost for supplying a given quantity of aggregated output. For each disaggregated commodity, activity-specific commodity prices ensure that the market will clear.

Aggregate output is allocated between exports and domestic sales based on suppliers' revenue maximization, subject to a Constant Elasticity of Transformation (CET) function, which

[42] The linear expenditure system contains the first-order conditions resulting from the maximization of a Stone-Geary utility function, i.e. it is assumed that for each household, a minimum level of some good must be consumed, irrespective of its price or consumer income. After subsistence has been achieved, the relative contribution of each commodity to utility can be considered.

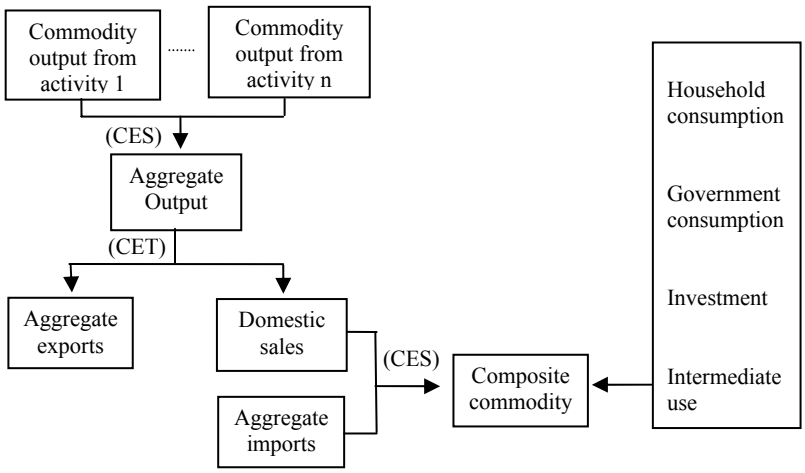
[43] The consumption shares are taken from the SAM, while the elasticities differ slightly between rich and poor household groups (using the same pattern of elasticity values as in the CGE study of South Africa, from which the elasticities are mainly taken). See section 4.2.5. for the elasticities data.

implies that although the supply of exports is determined by the relative price of exports and domestic goods, the producers' maximization of sales is subject to imperfect substitutability between export and domestic sales. Export demands are assumed to be infinitely elastic at given world prices, and export prices are expressed in domestic currency by adjusting the world price with the exchange rate and potential export taxes.

Domestic demand consists of household and government consumption, investment and intermediate inputs. If a commodity is imported, domestic demand is measured for a composite commodity which comprises imports and domestic output. The consumers' choice between domestically produced and imported variants of the same commodity is subject to imperfect substitutability between imports and domestic commodities represented by a CES aggregation function.[44] International supplies are assumed to be infinitely elastic at given world prices.

The assumptions of imperfect transformability between exports and domestic output, and imperfect substitutability between imports and domestic output are made to better reflect the empirical realities of most countries and this is a standard assumption in CGE-modelling. Figure 2 below presents an overview of the flow of marketed commodities in the model.

Figure 2. Market flow of commodities



Source: Löfgren et al. (2002).

[44] This CES-function is called the Armington function and is used to prevent unrealistic import and export responses to policy changes as it allows for some independence of the domestic price system as compared to the international one.

4.1.4. System constraints

In addition to the behavioural assumptions for the agents described above, the model equations also include a set of constraints that must be satisfied for the system as a whole, which is not necessarily considered by any individual agent. These include constraints for factor- and commodity markets and macroeconomic aggregates.[45] With regard to the factor markets, this paper follows Van Heerden et al. (2006) by assuming the capital stock in each sector to be fixed, while the rate of return is allowed to vary. The same assumption holds for the fish factor as well as the mixed factor used in agricultural production.[46] This is the standard way in which capital and land are modelled in static CGE-models in developing countries and it is motivated by the relatively short time horizon. The labour market in Namibia is divided between skilled and unskilled labour, where skilled labour is characterized by full employment while there is significant unemployment among unskilled workers. To reflect this division, the two different labour categories are treated differently in our model. Skilled labour is assumed to be fully employed and mobile between sectors. In terms of model specification, this implies that supply is fixed while an economy-wide wage rate can be freely adjusted to ensure that demand equals supply. On the other hand, the real wage rate for unskilled labour is fixed to allow for unemployment among unskilled workers.[47]

Concerning the macroeconomic aggregates, an important assumption is that all tax rates, except those collected via the fiscal reform, are fixed. Foreign savings are also assumed to be fixed in the model, which prevents any misleading short-run effects on household welfare in a single-period-model.[48] The level of real government consumption and real investment is exogenous and thus not assumed to be affected by the policies in question and the model numeraire in all simulations is the Domestic Producer Price Index (DPI).[49] A full description of the macroeconomic model constraints is found in Appendix D.

[45] These constraints are satisfied by different model closure rules. By choosing closure rules, the user determines which variables should be exogenous and which should be endogenous; see Appendix D for a specification of the alternative closure rules available.
[46] See section 4.2. for a clarification of this mixed factor.
[47] It is the real wage rate (after factor tax) for unskilled labour that is fixed, i.e. the after tax nominal wage rate deflated by the consumer price index. This allows for variation in the firm's labour costs if the factor tax and/or the general price level changes. These factor closure rules coincide with the factor market closure rules used in similar studies dealing with environmental tax reforms in South Africa; see Van Heerden et al. (2006).
[48] An increase (decrease) in foreign savings will cause a rise (fall) in household welfare. These results might be misleading in a single-period model as the analysis does not capture welfare losses (benefits) in later periods that arise from a smaller (greater) foreign debt. See Appendix D for a further discussion of this closure rule.
[49] As the model is a real model, only relative prices are of importance and a numeraire must be chosen. All simulated price and income changes are interpreted as changes in comparison to the numeraire price index.

4.2. Data

The primary database on which the CGE model is built is the preliminary Social Accounting Matrix (SAM) for Namibia from 2002 (full documentation is given in Lange et al. 2004).[50] The SAM divides the economy into 26 sectors of production, five factors of production and six household groups according to their main source of income. To make the model easier to solve numerically, a number of the smaller manufacturing and service sectors as well as the different commercial agricultural sectors have been aggregated when fed into the CGE-model.

The factors of production included in the original SAM are unskilled labour, skilled labour, capital, a mixed factor in the commercial agricultural sectors (representing a mix of farm owners' labour, capital and a land component) and a mixed factor in the traditional agricultural sector (analogous to that in the commercial sectors, but with a negligible capital component). The reason for using the mixed factors in the database is that it is difficult to distinguish between different types of earnings of self-employed farmers; the surplus of sales revenue over input costs includes a payment for own labour, own capital input as well as land input. Therefore, in the national accounts, this surplus is left as "mixed income".

Some small adjustments in the SAM (concerning the traditional agricultural sector and tourist data) were necessary for the data to fit the standard model set-up and purpose of analysis. These small adjustments are described in Appendix B, while the data adjustments as well as the complementary data for the more important sectors are described in this section.

4.2.1. Fish-sector data

To study the effects of a larger share of the resource rents captured by the government within the fishing sector, fish needs to be included in the current SAM as a factor of production in the fish and fish processing sectors. This is done by making use of the resource rent (as factor income distributed to different households etc.) estimated through the Natural Resource Accounts (NRA) methods for fish.[51] In the original SAM, the factor income for capital in the

[50] A SAM is an economy-wide data framework representing the economic structure of a country for one year. Technically, it is a square matrix where each account is represented by a row and a column where the incomes of an account appear along its row and its expenditures along its column. The economy is disaggregated into factors, activities (production), commodities and institutions. The sum of each row (total revenue) must equal the sum of each column (total expenditure) in the SAM.

[51] The Namibian fisheries accounts are based on the UN System of Integrated Environmental and Economic Accounts (SEEA). See Lange (2005) for a detailed description of the methodology for fish-rent calculations.

fishing sector contains a capital rent component and a fish rent component. To identify the latter, which is the factor income attributable to the production factor fish, the total amount of fish rent is redistributed from the total capital rents in the fish sectors into actual fish rents instead. According to these resource rent data, in the year 2001 (which is the latest year for which the resource rent is calculated) 20 per cent of the total rents were actually captured by the government. These captured rents appear in the original SAM as a part of the business tax in the fishing sectors. For the purposes of this study, the amount of taxed fish rents is transferred from the business tax account to a direct tax on fish rents, which also constitutes a more correct specification than the former way of presenting rent taxes in the SAM. The rest of the total fish rent is distributed as factor incomes to enterprises and foreign factor owners according to the same distributional shares by which capital rents are distributed. This adjustment opens up the possibility of studying the effects of an increased share of the fish rent captured by government – through an increase in the direct tax on fish rents.

4.2.2. Water data

There is no information about water subsidies in the SAM from 2002. The sectors subjected to significant water subsidies by the year 2001-2002, corresponding to actual sectors in the SAM, are mainly the agricultural sectors (commercial crop and livestock production) and private services.[52] In the SAM, water is considered to be an intermediate input in production and not a factor of production. As only a few sectors actually pay the lower price for water, the SAM needed to be extended to include a second water commodity, which represents the water bought by the subsidized sectors only. The removal of the water subsidies will reduce the current incentives of over-use in these water-intensive sectors. In total, the amount of water subsidies is only about N$ 15 million, only constituting a small part (about 4 per cent) of the total environmental tax revenues.[53]

4.2.3. Energy data

To calculate the environmental tax to be levied on fuels, an official energy balance for Namibia from the year 1999 is used. This is the latest energy balance compiled for the

[52] See Lange (2006). While urban households in general pay more than the actual private cost of providing water, poor rural households are subsidized. However, as the current water accounts do not distinguish between different categories of households, only the production sectors subjected to water subsidies can be included in the analysis.

[53] As the subsidies are not included in the original data – and a chain of different assumptions would have to be made in order to include them in the SAM – this environmental policy is actually modelled as an increased tax on the sector-specific water in the model simulations. This will be of minor importance as the direct effects of a removal of subsidies or an introduction of a tax on the currently subsidized sectors will be the same.

economy and as energy production and consumption between the years 1999 and 2002 have most likely not changed to any considerable extent, the different years for the energy balance and the SAM should not constitute any major problem. In the energy balance, there is information about which fuel types are actually included in the aggregated petroleum commodity account in the SAM. The implemented tax is based on the actual final consumption of petroleum products (according to the carbon content) and not actual emissions by production sector.[54] This can be seen as a fuel tax, where the tax rate for the commodity "petroleum products" is calculated as the CO_2-tax[55] multiplied by the carbon content of petrol, diesel and all other products included in the petroleum product account found in the Namibian national accounts for 2002. The carbon content in the total consumption of petroleum products is calculated by using the Intergovernmental Panel on Climate Change (IPCC) default conversion factors.

4.2.4. Household data and the Representative Household approach

The household groups in the SAM are divided into six different subgroups according to their main source of income. These groups are 1) urban households who receive their income from wages and salaries, 2) urban households involved in business activities including farming, 3) urban households who depend on pensions, cash remittances and other sources of income, 4) rural households who receive their income from wage and salary, 5) rural households within business activities and commercial farming and 6) rural households depending on subsistence farming, pensions, cash remittances[56] and other sources of income. Although the household-data is poor in the sense that the households are not divided by income deciles in the SAM, the division into separate socio-economic income groups makes it possible to identify the households in terms of location and income source, which is often decisive for the general living conditions. This approach to studying poverty and income distribution effects is called the Representative Household (RH) approach which represents the most common approach used among the vast literature of dealing with the links between different macro-reforms and

[54] The tax is levied on industrial use as well as household consumption of petroleum products. As Namibia does not produce any petroleum products domestically, there is no problem of energy losses from converting coal to petroleum, which is otherwise the main reason why emissions should be taxed at the point of combustion rather than consumption.

[55] The level of CO_2-tax used here is 35 Rand per tonne CO_2 (≈ 35 N$), following van Heerden et al. (2006). This rate is based on estimations of the global climate change damage costs by Sandor (2001) which, according to van Heerden et al. (2006), correspond well with the median of marginal climate change damages reported in the literature.

[56] These are private intra-household transfers of income, for example regular transfers from a family member working away from home or occasional gifts. These transfers often play a significant role for poor households in developing countries.

changes in poverty and income distribution through CGE-models.[57] This approach implies that changes in income in the subgroups are interpreted as changes for all households within the group. The main drawback is that the within-group income distribution is not taken into account, but the reason why this approach is the most popular is the lack of more detailed data in developing countries.

When it comes to assigning which household groups are the poorest – and thereby should be subject to targeted transfers – it would be interesting to know more about the household groups than the total income given in the SAM. Average income per household within each household group was calculated using available data on the total income of each household group (provided in the SAM) together with data on the actual number of households in each household group (provided in the preliminary report of the Namibian HIES 2003/2004).[58] The average income is lowest for urban households including pensions, cash remittances and other sources of income, rural households that get their income from wages and salaries and other rural households mainly including subsistence (self-sufficient) agriculture. In this paper, the effects on income distribution are studied in terms of changes in real income for the three poorest household groups in comparison to the corresponding changes for richer household groups.[59] The three groups with the lowest average income can be identified and these three groups are then subject to the targeted transfers in order to minimize the leakages to rich households. Having decided which households should be subject to targeted transfers, the total amount of transfers can be distributed among the low-average-income groups according to the number of households in each of the poor household groups, thereby ensuring that each household obtains an equal amount of transfer.[60] In this respect, my way of distributing the transfers to each chosen representative household group differs from a study of targeted

[57] While general equilibrium modellers generally have shown little interest in distributive impacts of policies, the standard CGE model developed by Löfgren et al. introduces the representative household approach, which has become the traditional way of involving distributive impacts in CGE-analysis. Other more recent approaches are, for example, the CGE-integrated multi-household approach and a micro-simulation sequential approach. However, these methods require more specific household data than what is currently available in the case of Namibia; see Boccanfuso (2007).

[58] The preliminary report of the Namibian HIES 2003/2004 only presents the main findings at an aggregated level. As the final report of the Namibian HIES 2003/2004 has not yet been published, there is unfortunately no updated household income and expenditure data available that can be added to this analysis.

[59] Naturally, the current division of household groups conceals some of the variations in income within rural sectors, but as about 70% of the poor live in rural areas and the remaining poor are to a large extent unemployed urban households (The World Bank Group: Poverty Monitoring Database), at least the majority within the three chosen household groups can be considered to be really poor.

[60] The general transfers are also distributed to all households according to the number of households in each household group. This is motivated by the fact that this is how real pensions or other transfer systems usually work: a fixed amount given to all households.

versus unilateral transfers in the Zimbabwean economy by Chitiga (2000). The latter study also uses the representative household approach, but the transfers are only distributed according to the total original income of each group and not according to the number of households within each group.

4.2.5. Elasticities

Apart from the SAM, some additional data is needed to calibrate the model, mainly elasticities, depending on the chosen shape of the model equations of the production and consumption structure, which are further described in Appendix C. The elasticities of interest are trade elasticities, substitution elasticities between the factors of production and expenditure elasticities of market demand by households. Trade elasticities include the elasticity of substitution between imports and domestic output in domestic demand (the so-called Armington-function) as well as the elasticity of transformation between exports and domestic demands for domestic marketed output (CET-function).[61] The substitution elasticities between factors of production are represented by a CES-function[62] and the expenditure elasticities by a linear expenditure system.[63] Concerning the expenditure elasticities for household energy demand (more specifically petroleum and electricity), these values are taken from an empirical study of Namibian energy demand by De Vita et al. (2006).[64] Since, to my knowledge, there are no other available empirical estimates of the required elasticities in Namibia, all other elasticity values are taken from a CGE model of the South African economy by Thurlow (2004).[65] This is motivated by the fact that the structure of the Namibian economy is similar to that of the South African economy.

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[61] See equations (22) and (23) in Appendix C for the functional relationship (represented by a CES-function) between imports and domestic output and equations (19) and (20) for the functional relationship (represented by a CET-function) between exports and domestic sales. Parameters ρ_c^t and ρ_c^q can be calibrated by including trade elasticities.

[62] In Appendix C, the equation affected by the elasticity of factor substitution is equation (11), where ρ_a^{va} is calibrated.

[63] See equation (32) for the household demand function, where parameters γ_{ch} (subsistence quantity) and β_{ch} (the relative contribution of each commodity to utility after subsistence has been achieved) are calibrated using expenditure elasticities and a Frisch parameter.

[64] De Vita et al. estimate income- and price-elasticities of the Namibian energy demand by end users, both at the aggregated level and by type of energy (electricity, petrol and diesel), for the period 1980 to 2002. Unfortunately, this analysis does not include a sectoral analysis; i.e. it does not take into account that energy demand by different types of consumers might differ.

[65] These elasticities, in turn, are mainly based on empirical estimates for the South African economy. See Thurlow (2004) for a further discussion about elasticities.

5. Simulation scenarios

The additional tax revenues raised via carbon taxation, lower water subsidies and rent taxation are combined with the different ways of recycling the tax revenues described above, thus resulting in five different scenarios. The environmental part of the fiscal reform includes an increase in the petroleum tax by about 30 per cent (following from the calculations of carbon contents described in section 4.2.3.), the introduction of a tax on the water use for the commercial agricultural sector and the private service sector of about 9 per cent (corresponding to the total amount of N$ 15 million which is the recorded amount of the current water subsidies among these sectors) and an increase in the direct tax on the fish factor of production from the current level of about 20 per cent to a case of total governmental capture of fish rent, i.e. the tax being 100 per cent of total fish rents. As this is a pure rent tax in the model, it will have no significant effect on the level of fish production, only on the distribution of fish factor income. As the main problem in Namibian fisheries currently seems to be a high pressure of new entries into the industry, the purpose of this policy would be to prevent new entries as well as force inefficient companies to exit by reducing the profits made within the industry. This will help secure a sustainable long-run fish stock. However, given the static model to which I have access, it is not possible to capture possible effects on entry.

Concerning the choice of total governmental rent capture, it can be argued that, since the actual size of this rent is generally associated with a high degree of uncertainty, total rent capture is too risky a policy objective. The Namibian fisheries accounts are based on the UN System of Integrated Environmental and Economic Accounts (SEEA), which has also been used to construct fish accounts in a number of other countries including, for example, Norway, Iceland and the Philippines. In the calculations of rent, the only figure required (that is not provided by the national accounts) is the opportunity cost (rate of return) of fixed capital. In Namibia, a 20 per cent return is used in order to reflect the high risk associated with fishing activities.[66] This rather high rate of return, together with the fact that rent calculations are based on realised and not potential rents that could have been realised without inefficiencies like over-capacity, should reduce the risk of an over-estimation of the fish rents. However, as the model does not capture any possible effects on entry and exit, it might still be

[66] This rate is higher than the return used in other countries (Norway 7% and the Philippines 10-15%) and also higher than the 10% rate used for calculating the value of minerals in Namibia.

argued that the tax revenues from a 100 per cent profit tax may be overestimated and therefore, a sensitivity analysis has been conducted for the case of 50 per cent rent capturing. The results of this sensitivity analysis are presented in Appendix E.

In total, the environmental fiscal revenues amount to about 1-2 per cent of total GDP, suggesting that the environmental fiscal reform will only create minor changes in the structure of the economy. The contents of the five different scenarios are shown in table 2 below.

Table 2. Simulation Scenarios

	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Environmental taxes (fish, energy and water)	x	x	x	x	x
Recycling alternatives:					
- Decreasing the commodity sales tax rate	x				
- Decreasing the commodity sales tax rate on food		x			
- Subsidizing unskilled labour			x		
- Increasing (general) transfers to all households				x	
- Increasing (targeted) transfers to poor households					x

In scenario 1, the tax revenues are recycled through cuts in the commodity tax rate while in scenario 2, only the commodity taxes on food are decreased. In scenario, 3 the environmental tax revenues are used to introduce a subsidy of unskilled labour. In scenarios 4 and 5, direct governmental transfers to households are introduced, first through an increase in the transfers to all households, i.e. general transfers, and then by targeted transfers to the poorest household groups only.

6. Simulation results

6.1. Environmental effects

Although the environmental benefits of fish rent taxation, which constitutes the main part of the environmental fiscal reform in this paper, are not measurable in the context of the model, it is interesting to note that in terms of total CO_2 emissions and water use, all scenarios will lead to decreased CO_2-emissions, while the water use will slightly increase in all scenarios except the transfer scenarios. The total change in the consumption of petroleum products and water is shown in table 3 below.

Table 3. Consumption of petroleum products and water

Percentage change as compared to base case (household and intermediate demand)	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Total consumption of petroleum products	-0.73	-1.05	-0.01	-1.22	-1.61
Total consumption of water	0.23	0.13	0.75	-0.15	-0.31

The decrease in total CO_2-emissions is mainly a result of decreased household demand for petroleum products in the economy. From table 3, it is clear that the scenarios where the tax revenues are recycled through direct transfers to households, followed by the scenario where taxes on food are reduced, are the most efficient in terms of reducing CO_2-emissions. It is interesting to note that in scenario 3, there is only a minor decrease in the consumption of petroleum products. The main reason is the relatively high increase in total production in this scenario as compared to the others. However, despite the correlation between the change in petroleum product consumption and the change in the overall production level in the economy[67], this does not fully explain the differences between scenarios; while for example scenarios 1 and 2 achieve almost the same positive effect on overall GDP[68], scenario 2 (food tax reduction) reduces petroleum consumption, and thereby CO_2-emissions, more than scenario 1 (overall commodity tax cuts).

The reason why total water use increases is partly because the removal of water subsidies only constitutes a small share of the fiscal reform and partly because the model does not allow for a high rate of substitution between intermediates, thus implying that water use will closely follow the change in total production.

6.2. Effects on production, employment and income inequality

In this section, results concerning the potential non-environmental additional benefits from the environmental fiscal reform are presented. As unemployment together with the skewed income distribution are two important characteristics of the Namibian economy, it is interesting to evaluate the policies in terms of changes in these measures. In addition, the

[67] See section 6.2.1. and table 4 below for the effects on the real GDP-level in each scenario. The transfer scenarios give significant environmental benefits, but this comes at the cost of reduced real GDP. The environmental benefit in the scenario where unskilled labour is subsidized is less significant, but one reason for this is that the economy grows the most in this scenario.
[68] See table 4 below for the effects on the real GDP-level.

overall effect on GDP is also of interest. Therefore, the variables considered in this section are the real GDP, the employment of unskilled labour and the real consumption by the poorest household groups in relation to the real consumption by richer households. The effects on these variables are summarized for all scenarios in table 4 below. The results for other key variables are shown in Appendix E.

Table 4. Effects on target variables

Percentage change as compared to base case	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Effect on real GDP	0.19	0.17	0.49	-0.03	-0.04
Effect on employment for unskilled labour	0.53	0.42	1.47	-0.10	-0.16
Change in real consumption:					
- among the poorest households	0.53	1.03	1.23	0.74	1.96
- among the richer households	0.27	-0.20	0.88	-0.88	-2.07

6.2.1. Real GDP and employment

Scenario 3 leads to the largest increases in real GDP and employment among unskilled labour. While increased environmental taxes raise the production costs and, in turn, reduce the demand for unskilled labour[69], the subsidization of unskilled labour decreases the production costs and thereby increases the demand for unskilled labour. As the positive recycling effect more than offsets the first negative effect on overall production levels, the result of this scenario is a significant increase in employment of unskilled labour as well as real GDP. This result is intuitive as the subsidy is directed towards unskilled labour only (which is the factor that is unemployed), while the environmental tax to a large extent falls on one of the fixed factors, fish, without any significant negative effect on production in the model.

A positive effect on real GDP and employment can also be achieved by reducing commodity taxes, as in scenarios 1 and 2. The main reason is that overall commodity prices fall, leading to a fall also in the cost of employing unskilled labour (as the unskilled labour wage – paid by firms – is tied to the CPI) and thereby an increase in employment of unskilled labour, which

[69] As the model does not allow for substitution between different intermediate inputs, the production costs increase along with the increasing costs of petroleum and water inputs. The production levels are reduced and there is a decrease in the demand for factors of production.

is seen in table 3 above.[70] The positive effect on GDP is larger when the tax revenues are recycled through cuts in all commodity taxes than when only food taxes are cut, although the difference is relatively small.[71]

The effect on real GDP in scenarios 4 and 5 is negative; in fact, the increase in direct governmental transfers to households does not have the positive effect on real GDP and employment as do indirect and direct tax cuts/subsidies. The main reason is that there is no direct effect on costs of production and also, more importantly, no direct effect on the unskilled labour wage from increasing governmental transfers. Therefore, the negative effect on GDP and employment resulting from increased environmental taxes is not offset by this recycling option. Using the tax revenues to increase governmental transfers, the structure of economic activity is only affected through the changes in demand patterns among household groups. The more the transfers are directed to rural households, the larger is the negative effect on employment and GDP. The reason is that when increasing the income of poor – mainly rural, agricultural households – relatively more agricultural products and food are demanded in the economy. The prices of these products increase, mobile factors like labour move to these more profitable sectors, and the prices of fixed factors within these sectors increase. At the same time, in the service sectors, there is a decrease in production along with the price of sector-specific factors, thus explaining the decreased factor income for households relying on these factors (especially richer household groups) and this is the reason why the total effect on demand is negative. In this specific case, as agricultural production is less labour intensive than the service sectors, the result of this redistribution of production is increased unemployment in the economy. The reason why this result holds also in the case of general transfers to all households is that the transfers are distributed according to the number

[70] The fall in overall commodity prices also affects the cost of intermediate inputs, so that the overall costs of production decrease, but the decrease in the unskilled labour wage is the main driving force behind the increased employment and production levels throughout the economy.

[71] These results can be compared to the results of the South African studies by Van Heerden et. al. (2006). In the South African studies, where environmental tax revenues were recycled through a food tax break, a general tax break on all commodities or a decrease in the factor taxes on capital and labour, the food tax break was shown to be the only recycling option resulting in a positive effect on GDP. One explanation as to why there seems to be more scope for positive GDP-effects in this study is that the tax on fish rents is non-distortionary. The reason why the subsidy of unskilled labour performs so well in terms of employment and GDP-effects is that the whole subsidy is directly directed towards the unemployed factor; in the South African study, factor taxes were equally reduced on capital, skilled and unskilled labour (unskilled labour only contributes about 14% to total factor income). The reason why a reduction of the taxes on all commodities increases GDP and employment more than a reduction of food taxes only, which is contrary to the case in the South African model, is that, in Namibia, food production is less labour intensive than, for example, the service sector. However, this might be due to the problem of distinguishing factor income within the agricultural sectors; see section 4.2. concerning the "mixed factor" in the agricultural sectors.

of households in each group. While there is a greater number of poor households, these as a group will receive a greater amount of total transfers than richer households also in a situation with general transfers.[72]

6.2.2. Distribution of real consumption changes among rich and poor households

When it comes to real consumption[73] by all households, the total effect is positive for scenarios 1, 2 and 3, where the increase is largest in scenario 3. However, for scenarios 4 and 5, there is a slight decrease in total real consumption of all households. Turning to the change in real consumption among the three poorest household groups only, it is clear that the effect is positive for all scenarios. If only looking at the total increase in real consumption by the poorest households, scenario 5 is subject to the largest increase, followed by scenarios 3, 2, 4 and 1.

However, in terms of income distribution, it might be more interesting to study how consumption by the three poorest household groups is changed as compared to that of richer households. If the richer household groups benefit as much – or relatively more – than the poorest groups, the current gap between the rich and the poor in Namibia would remain or even increase. According to the model results, it is clear that all five scenarios will actually decrease the current gap between rich and poor households.[74] In scenarios 4 and 5, where governmental direct transfers to households are increased, the differences between real consumption changes for rich and poor households are most significant. In scenario 5, where the transfers are concentrated to the three poorest household groups only, the real consumption of these three household groups increases significantly while it decreases for all other groups. This scenario gives the most significant effect on income distribution in terms of decreasing the gap between rich and poor households, followed by the scenario with general transfers to all households. The reason why poor households benefit more than rich households in the transfer scenarios is that poor households constitute a significant share of the total number of households. As a group, poorer households will receive a greater amount of total transfers than richer households. The direct effect is that the poor households will use

[72] Interesting to note is that if the transfers were designed to only target rich urban households instead of all or only poor (rural) households, demand for services would increase in relation to agricultural and food products, resulting in the reverse impacts and a small positive GDP- and employment effect in the economy.
[73] Real consumption is equal to real disposable income.
[74] It is interesting to note that increased environmental taxes on fish rents, energy and water will mainly affect the richer household groups, thus implying that even without recycling the environmental tax revenues, a redistribution effect can be achieved. However, recycling of the revenues reinforces the redistribution of income (in terms of reducing the gap between rich and poor households).

their transfer incomes to increase their consumption, especially of agricultural products, which leads to an increase in production in these sectors which, in turn, also indirectly affects the income of poor rural households as they are mainly employed within the agricultural sectors. At the same time, production decreases within service sectors and households depending on factor income from the sector-specific factors within these sectors (mainly richer households) will be subject to a loss of factor income as the prices of these factors decrease. This, together with a slightly increased price level throughout the economy, actually results in a negative effect on total real household consumption. This implies that while unilateral as well as targeted transfers seem to ensure that the poorest household groups will be better off, these benefits come at the cost of making richer households significantly less well off as compared to the base situation.

Comparing scenarios 1 and 2, where commodity taxes are cut, the difference between the consumption changes of poor and rich households is greater in scenario 2, thus implying that by reducing the commodity sales taxes on food only, it is possible to achieve a more equal income distribution than in the case of general commodity sales tax cuts. In fact, scenario 2 is the second most redistributive scenario (after scenario 5) considering the targeting of poor households. However, this also comes at the cost of decreased real income for richer households, although not as significant as in the transfer scenarios. The mechanisms behind these results are a general decrease in the price level followed by increased demand and production levels in the economy. When only food taxes are cut, poor households benefit relatively more as they spend a greater share of their income on these products. This also has the effect of slightly redistributing the production structure in favour of agricultural products in relation to the service sectors. This is the reason why richer households as a group become worse off in scenario 2, as compared to scenario 1.

Regarding scenario 3, which gives the most significant effect on total real household consumption, the redistribution profile is less significant in comparison with scenarios 2, 4 and 5. The reasons why scenarios 3 and 1 do not have a strong redistribution effect are that especially the household group “urban wage and salary”, which is the largest of the three richer household groups, benefit relatively more in scenarios 1 and 3 than in other scenarios. This is due to the fact that urban households demand relatively more of other commodities than food, thus explaining the positive effect on urban households in scenario 1 and this

household group also owns a great deal of unskilled labour, which means that it will benefit significantly from increased employment of unskilled labour following from scenario 3.

7. Conclusions

The purpose of this paper was to find out whether different forms of recycling of revenues from environmental taxation of fish rents, energy and water could give rise to additional benefits in terms of GDP, employment and income distribution to the Namibian economy. Concerning the environmental effects, the results show that while water consumption, to a large extent, seems to follow the economy-wide changes in production, the consumption of petroleum products, and thereby CO_2-emissions, decreases for all scenarios irrespective of the direction of the overall production level (although the decrease in CO_2-emissions is low in the scenario where unskilled labour is subsidized). The results also show that for some of the recycling options, there is some scope for additional, non-environmental benefits. Therefore, an environmental fiscal reform should be considered as an interesting option for policymakers in Namibia when deciding how to ensure a more sustainable and equitable future for the country. However, the way in which the tax revenues should be redistributed needs to be carefully examined as the economy-wide effects of each recycling option will most likely differ.

It is interesting to note that according to the results, environmental taxes might not necessarily be regressive in nature; the increased taxes on fish rents and energy together with decreased subsidies of water will mainly affect richer households. Although all recycling options considered in this analysis reinforce the redistribution of income in terms of reducing the gap between rich and poor households, the degree of this redistribution differs across recycling options. It is clear that while using the additional revenues to subsidize unskilled labour gives the largest effects on real GDP and total change in real consumption by all households, this might not necessarily be the first choice for reducing CO_2-emissions as well as reducing the gap between rich and poor households. Another interesting option for using the additional revenues to achieve both an increase in GDP and a more equal income distribution would be to decrease the taxes on food. The reason why this scenario performs better from the point of view of reducing the income gap between rich and poor households is that food constitutes a significant share of poor households' total expenditures. These results provide further

evidence of the idea that in developing countries, poverty is not only a question of employment: although the employment effect is roughly the same when reducing general commodity taxes and taxes on food only, the latter performs significantly better in targeting poor households. However, it is important to consider the risk of making the richer households significantly worse off. Furthermore, as household data in the current SAM is based on the income and expenditure survey from 1993/94, which is quite old and does not allow for a high level of disaggregation between different household groups, a more detailed data-set for the households would be necessary to make a more rigorous analysis of the poverty implications of potential environmental fiscal reforms in Namibia. Although the inclusion of rent taxation (which was feasible through a relatively well-developed system of Natural Resource Accounting in Namibia) is an important contribution of this study, further research should focus on the environmental effects of this kind of environmental fiscal reform.

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Appendix A – Namibian Social Accounting Matrix 2002 (million N$ in current prices)

		P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30	Subtotal
P1	ComCereal																															0
P2	ComOtherCrops																															0
P3	ComAnimalProd																															0
P4	FoodforOwnCons																															0
P5	Fishing																															0
P6	Mining																															0
P7	Meat processing																															0
P8	Fish processing																															0
P9	grain milling																															0
P10	Bev and other food prod																															0
P11	Textiles																															0
P12	Light Manufacturing																															0
P13	Petroleum Products																															0
P14	Heavy Manufacturing																															0
P15	Electricity																															0
P16	Water																															0
P17	Construction																															0
P18	Trade. Repairs																															0
P19	Hotels and Restaurants																															0
P20	Transport																															0
P21	Communication																															0
P22	Finance and Insurance																															0
P23	Real Estate, own																															0
P24	Mkt Real Est/bus service																															0
P25	Other private services																															0
P26	Government services																															0
P27	direct purch.abroad by res																															0
P28	Dom purch. by non res																															0
P29	TradeandTransport-margin	77	34	7	0	0	0	110	17	163	405	371	814	1226	1270	0	0	0	-4493	0	0	0	0	0	0	0	0	0	0	0	0	1
P30	CIF/FOB adjustment																				-1114		-125								1238	-1
	Subtotal	77	34	7	0	0	0	110	17	163	405	371	814	1226	1270	0	0	0	-4493	0	-1114	0	-125	0	0	0	0	0	0	0	1238	0
A1	ComCereal	63																														63
A2	ComOtherCrops		303																													303
A3	Commercial Livestock			1396	153																											1549
A4	Traditional Agriculture				398																											398
A5	Fishing					696			1938																							2634
A6	Mining						7322																									7322
A7	Meat processing							1070																								1070
A8	Fish processing								1265																							1265
A9	grain milling									755																						755
A10	Bev and other food prod										2657																					2657
A11	Textiles											143																				143
A12	Light Manufacturing												929																			929
A13	Heavy Manufacturing														1038																	1038
A14	Electricity															747																747
A15	Water																557															557
A16	Construction																	2681														2681
A17	Trade/Repairs																		5150													5150
A18	Hotels and Restaurants																			1440												1440
A19	Transport																				2939											2939
A20	Communication																					1197										1197
A21	Finance and insurance																						1890									1890
A22	Real Estate, own																							1470								1470
A23	Mkt Real Est/business																								2374							2374
A24	Other private services																									1520						1520
A25	Government services																										8468					8468
A26	Tourism-nonresidents																												2377			2377
	Subtotal	63	303	1396	551	696	7322	1070	3203	755	2657	143	929	0	1038	747	557	2681	5150	1440	2939	1197	1890	1470	2374	1520	8468	0	2377	0	0	52936
F1	Skilled Labour																															0
F2	Unskilled Labour																															0
F3	Mixed Income, Com Agr																															0
F4	Mixed Income, Trad Agr																															0
F5	NOS																															0
	Subtotal																															0
I1	Urban - Wage/Salery																															0
I2	Urban - Farm/business																															0
I3	Urban - other																															0
I4	Rural - Wage/Salery																															0
I5	Rural - ComAgr/Business																															0
I6	Rural - subsistence/other																															0
I7	NPISH																															0
I8	Enterprises																															0
I9	Government	2	10	9	0	0	358	96	15	117	647	224	336	268	475	0	0	0	11	187	0	0	0	0	57	4	0	0	0	0	0	2816
	Subtotal	2	10	9	0	0	358	96	15	117	647	224	336	268	475	0	0	0	11	187	0	0	0	0	57	4	0	0	0	0	0	2816
K1	Saving																															0
R1	Imports	290	140	31	0	5	402	166	0	287	867	823	3281	1515	6148	34	0	193	0	0	972	2	138	0	576	0	0	684	0	0	-1238	15316
	TOTAL	432	487	1443	551	701	8082	1442	3235	1322	4576	1561	5360	3009	8931	781	557	2874	668	1627	2797	1199	1903	1470	3007	1524	8468	684	2377	0	0	71068

		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	A19	A20	A21	A22	A23	A24	A25	A26	Subtotal
P1	ComCereal	3	2		1					344	83																	433
P2	ComOtherCrops	0	11	5	0	0	0	0	0	0	44	3	16	1	0	0	0	0	23	0	0	0	0	1	6	3	24	137
P3	ComAnimalProd	0	0	14	10	0	0	725	0	0	64	0	0	0	0	0	0	0	58	0	0	0	0	0	3	8		882
P4	FoodforOwnCons																											0
P5	Fishing								452																			452
P6	Mining						881						16	211				89			7			1	3	9		1217
P7	Meat processing				1			82			13								102	1				2	5	7	48	261
P8	Fish processing								12										8							1	24	45
P9	grain milling				1			7	1		73								43	1				2	4	27		159
P10	Bev and other food prod			113	1			12	4		584							11	261	23				3	17	61	95	1185
P11	Textiles		2				2	1			2	47	21	1				34	9	3	15	9			2	9	11	24	192
P12	Light Manufacturing	7	22	41	2	175	166	17	13	6	246	11	358	46	10	20	326	420	40	243	34	255	0	138	216	195	71	3078
P13	Petroleum Products	4	2	43	4	296	332	3	6	5	22	0	7	15	4	7	116	61	10	568	22	15	0	30	26	59	119	1776
P14	Heavy Manufacturing	2	4	32	26	349	672	4	17	2	202	4	32	135	94	18	1165	67	25	284	88	19	0	65	93	391	0	3790
P15	Electricity	0	5	21	0	0	100	4	3	5	14	1	7	38	40	13	8	30	32	49	11	15	0	8	16	190	12	622
P16	Water	1	1	2	4	0	6	1	1	0	10	0	1	1	0	161	5	8	14	16	2	6	0	10	8	224	12	494
P17	Construction														1			66	4	37	0	9	0	48	11	42	0	218
P18	Trade. Repairs						37	6	14	9	21	2	8	6	0	0	9	163	1	100	40	16	0	43	25	46	0	546
P19	Hotels and Restaurants						9			2								28	1	61	0	5	0	20	24	163	951	1264
P20	Transport	0	34	16	1	0	92	52	27	29	296	10	89	51	2	7	61	283	9	106	46	73	0	93	55	588	713	2733
P21	Communication	0	1	13	0	10	4	3	3	2	14	2	13	7	4	2	45	320	10	88	188	58	0	95	61	52	71	1066
P22	Finance and Insurance	1	3	49	0	49	30	8	9	1	57	3	19	18	3	10	68	271	12	241	6	72	0	166	36	67	24	1223
P23	Real Estate, own																											0
P24	Mkt Real Est/bus service	0	2	20	0	139	418	7	2	20	20	1	11	19	21	18	87	284	25	98	13	198	0	104	86	115	71	1779
P25	Other private services							4	2	14	21	2	12	7	0	0	6	4	1	12	1	6	0	6	4	71	119	292
P26	Government services						32	1	1	2	9	0	3	2	0	0	11	32	0	11	1	19	0	7	16	70	0	217
P27	direct purch.abroad by res					18	58	2	1	4	8	1	0	2	0	0	21	0	14	19	2	35	0	14	0	45	0	244
P28	Dom purch. by non res																											0
P29	TradeandTransport-margin																											0
P30	CIF/FOB adjustment																											0
	Subtotal	18	89	369	51	1036	2839	939	568	445	1803	87	613	560	179	256	2051	2057	696	1980	463	801	0	858	724	2445	2378	24305
A1	ComCereal																											0
A2	ComOtherCrops																											0
A3	Commercial Livestock																											0
A4	Traditional Agriculture																											0
A5	Fishing																											0
A6	Mining																											0
A7	Meat processing																											0
A8	Fish processing																											0
A9	grain milling																											0
A10	Bev and other food prod																											0
A11	Textiles																											0
A12	Light Manufacturing																											0
A13	Heavy Manufacturing																											0
A14	Electricity																											0
A15	Water																											0
A16	Construction																											0
A17	Trade/Repairs																											0
A18	Hotels and Restaurants																											0
A19	Transport																											0
A20	Communication																											0
A21	Finance and insurance																											0
A22	Real Estate, own																											0
A23	Mkt Real Est/business																											0
A24	Other private services																											0
A25	Government services																											0
A26	Tourism-nonresidents																											0
	Subtotal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
F1	Skilled Labour	1	7	25	0	352	433	22	81	21	78	11	61	80	80	57	159	521	66	223	175	94	0	132	517	1512		4708
F2	Unskilled Labour	3	36	129	6	371	457	27	99	26	96	15	75	58	99	70	58	549	166	462	123	70	0	87	203	3499		6784
F3	Mixed Income, Com Agr	31	127	771																								929
F4	Mixed Income, Trad Agr				340																							340
F5	NOS					655	2907	73	447	229	560	27	164	296	196	88	202	1792	457	16	27	751	1405	1042	106	0		11440
	Subtotal	35	170	925	346	1378	3797	122	627	276	734	53	300	434	375	215	419	2862	689	701	325	915	1405	1261	826	5011	0	24201
I1	Urban - Wage/Salery																											0
I2	Urban - Farm/business																											0
I3	Urban - other																											0
I4	Rural - Wage/Salery																											0
I5	Rural - ComAgr/Business																											0
I6	Rural - subsistence/other																											0
I7	NPISH																											0
I8	Enterprises																											0
I9	Government	0	0	4	0	152	12	1	3	0	5	0	-11	0	0	0	7	33	7	7	0	36	66	65	-56	0		331
	Subtotal	0	0	4	0	152	12	1	3	0	5	0	-11	0	0	0	7	33	7	7	0	36	66	65	-56	0	0	331
K1	Saving	9	43	251	0	68	675	11	69	35	116	4	25	45	192	86	202	195	50	250	410	138	0	191	27	1012		4104
R1	Imports																											0
	TOTAL	62	302	1549	397	2634	7323	1073	1267	756	2658	144	927	1039	746	557	2679	5147	1442	2938	1198	1890	1471	2375	1521	8468	2378	52941

		F1	F2	F3	F4	F5	subtotal	I1	I2	I3	I4	I5	I6	I7	I8	I9	Subtotal	K1	R1	TOTAL
P1	ComCereal																0			432
P2	ComOtherCrops							33	7	5	11	3	41	0		0	100		251	487
P3	ComAnimalProd							37	5	6	22	31	23	0			124	-195	632	1443
P4	FoodforOwnCons							0	0	0	55	0	496				551	0	0	551
P5	Fishing																0	0	250	702
P6	Mining																0	-163	7026	8082
P7	Meat processing							244	37	35	107	27	203				653	0	530	1443
P8	Fish processing							21	4	5	9	4	39				82		3108	3235
P9	grain milling							100	15	25	147	59	759				1105		60	1323
P10	Bev and other food prod							645	110	89	443	115	1124				2526		863	4575
P11	Textiles							508	95	28	196	50	421				1298		71	1561
P12	Light Manufacturing							997	168	177	236	94	333				2005	22	254	5360
P13	Petroleum Products							594	86	36	156	189	171				1232		0	3008
P14	Heavy Manufacturing							558	136	56	414	70	521	0			1755	2850	536	8931
P15	Electricity							91	21	10	13	0	19	0			154		5	781
P16	Water							43	9	5	1	0	2				60			557
P17	Construction							74	9	2	11	5	21				122	2640	16	2875
P18	Trade. Repairs							181	80	8	47	3	44	0			363			668
P19	Hotels and Restaurants							30	5	2	9	1	17	0			64			1627
P20	Transport							52	16	6	9	6	1				90			2797
P21	Communication							537	20	21	71	7	8	0			664		42	1199
P22	Finance and Insurance							878	183	107	93	41	168				1470		16	1903
P23	Real Estate, own							253	26	174	100	56	18	0			627		0	1470
P24	Mkt Real Est/bus service							125	29	16	24	41	40	958			1233	558	44	3007
P25	Other private services							108	19	6	30	18	23	0			204			1524
P26	Government services							339	59	0	34	10	0	0		8045	8487			8468
P27	direct purch.abroad by res																0	2		684
P28	Dom purch. by non res																0		2377	2377
P29	TradeandTransport-margin																0			0
P30	CIF/FOB adjustment																0			0
	Subtotal	0	0	0	0	0	0	6448	1139	819	2238	830	4492	958	0	8045	24969	5714	16081	71070
A1	ComCereal																			63
A2	ComOtherCrops																			0
A3	Commercial Livestock																			1549
A4	Traditional Agriculture																			398
A5	Fishing																			2634
A6	Mining																			7322
A7	Meat processing																			1070
A8	Fish processing																			1265
A9	grain milling																			755
A10	Bev and other food prod																			2657
A11	Textiles																			143
A12	Light Manufacturing																			929
A13	Heavy Manufacturing																			1038
A14	Electricity																			747
A15	Water																			557
A16	Construction																			2681
A17	Trade/Repairs																			5150
A18	Hotels and Restaurants																			1440
A19	Transport																			2939
A20	Communication																			1197
A21	Finance and insurance																			1890
A22	Real Estate, own																			1470
A23	Mkt Real Est/business																			2374
A24	Other private services																			1520
A25	Government services																			8468
A26	Tourism-nonresidents																			2377
	Subtotal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	52939
F1	Skilled Labour																			4751
F2	Unskilled Labour																			6783
F3	Mixed Income, Com Agr																			930
F4	Mixed Income, Trad Agr																			340
F5	NOS																			13200
	Subtotal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	26003
I1	Urban - Wage/Salery	3759	3383				7142								2000		2000			9142
I2	Urban - Farm/business	39		154			193								1500		1500			1693
I3	Urban - other		524				524	7	2		3	3			250	73	338			862
I4	Rural - Wage/Salery	824	824				1648								1200		1200			2848
I5	Rural - ComAgr/Business	58	0	775			833								500		500			1333
I6	Rural - subsistence/other		2052		340		2392	95	25	0	45	40			950	984	2139			4531
I7	NPISH					73	73	11	3	1	5	5	15		417	428	885			958
I8	Enterprises					11689	11689									831	831			12520
I9	Government						0	1618	17	40	369	26	23		1931		4024		3072	10245
	Subtotal	4680	6783	929	340	11762	24494	1731	47	41	423	73	38	0	8748	2316	13417	0	3072	44132
K1	Saving							961	510	2	187	430	2	0	3771	-560	5303		-3693	5715
R1	Imports	72				1438	1510									444	444			17268
	TOTAL	4752	6783	929	340	13200	26004	9142	1693	862	2848	1333	4531	958	12520	10245	44132	5714	17268	

Appendix B – Adjustments of the SAM-data

Agricultural sector data

Some necessary small adjustments in the SAM have been made for the traditional agricultural sector. In the original SAM, the traditional agricultural sector produces an "own" commodity called "traditional commodity", which can be described as "food for own consumption"; this is largely cereal crop production. However, for modelling purposes, it is important that food produced in the traditional agricultural sector could be substituted for food purchased from elsewhere. Therefore, the "traditional commodity" has been redefined; it is assumed that the traditional sector produces crops (mainly cereals) that are replaceable either by crops produced elsewhere in the country or by imported crops. Some adjustments have also been made with regard to the distribution of factor income in the traditional agricultural sector in the SAM. In the traditional agricultural sector, the mixed factor category includes land rents and income generated by labour supplied by people informally employed in the sector. By recognizing the approximate number of informal workers in the subsistence agricultural sector (see Angula and Sherbourne 2003) together with an estimate of the mean rural informal wage (see Humavindu 2007), part of the total mixed income in the traditional sector can be transformed into factor income for unskilled workers. For the purposes of this study (where any effects on the demand for unskilled labour will be important for the distribution of income as well as total income in the economy), this small adjustment represents a better way of modelling the factor income distribution in the traditional agricultural sector.

Tourism data

Due to lack of data, a full representation of tourism was not possible at the time of development of the SAM. Therefore, tourism is treated as a "dummy sector" in the current SAM, which is a way of pointing out the importance of an activity which does not correspond to an actual industry. This dummy sector corresponds to the total value of "the purchase of products in the Namibian economy by non-residents", which was found in the national accounts.[75] However, in the CGE-model, activities without factor inputs are not allowed, so this dummy sector had to be eliminated from the original SAM for the data to fit the model. This was simply done by directly treating the values of purchases by foreign tourists for each commodity as "exports". Due to the lack of specific data for the tourism sector, a reasonable

[75] Lange et al. (2004).

analysis of raising taxes within this industry is not feasible. In addition, in contrast to the fish sector data described above, there are no available estimations in the natural resource accounts for "rents" on wildlife. Therefore, the tourism sector is not included in the environmental tax reform studied in this paper.[76]

Appendix C – Mathematical statement of the model

Equations of the model

Price Block

Import price:

$$PM_c = pwm_c \cdot (1 + tm_c) \cdot EXR + \sum_{c' \in CT} PQ_{c'} \cdot icm_{c'c} \quad (1)$$

Export price:

$$PE_c = pwe_c \cdot (1 - te_c) \cdot EXR - \sum_{c' \in CT} PQ_{c'} \cdot ice_{c'c} \quad (2)$$

Demand price of domestic nontraded goods:

$$PDD_c = PDS_c + \sum_{c' \in CT} PQ_{c'} \cdot icd_{c'c} \quad (3)$$

Absorption:

$$PQ_c \cdot (1 - tq_c) \cdot QQ_c = (PDD_c \cdot QD_c + PM_c \cdot QM_c) \quad (4)$$

Marketed output value:

$$PX_c \cdot QX_c = PDS_c \cdot QD_c + PE_c \cdot QE_c \quad (5)$$

Activity price:

$$PA_a = \sum_{c \in C} PXAC_{ac} \cdot \theta_{ac} \quad (6)$$

Aggregate intermediate input price:

$$PINTA_a = \sum_{c \in C} PQ_c \cdot ica_{ca} \quad (7)$$

Activity revenue and costs:

[76] Since the tourism sector represents a significant part of the Namibian economy and since it is highly dependent on the quality and sustainability of wildlife, this industry is an interesting target for future environmental taxation. Therefore, I have simulated a variant of the model, where an approximate tax level in the "hotel and restaurant sector" (one important tourism sector) is introduced. However, as this extension did not affect the directions of any results, I decided not to include the simulation of this extended model in the paper, since the tourism data is not reliable.

$$PA_a \cdot (1 - ta_a) \cdot QA_a = PVA_a \cdot QVA_a + PINTA_a \cdot QINTA_a \tag{8}$$

Consumer price index:

$$CPI = \sum_{c \in C} PQ_c \cdot cwts_c \tag{9}$$

Producer price index for nontraded market output:

$$DPI = \sum_{c \in C} PDS_c \cdot dwts_c \tag{10}$$

Production and Trade block

Value-added production function:

$$QVA_a = \alpha_a^{va} \left(\sum_{f \in F} \delta_{fa}^{va} \cdot \left(\alpha_{fa}^{vaf} \cdot QF_{fa} \right)^{-\rho_a^{va}} \right)^{-\frac{1}{\rho_a^{va}}} \tag{11}$$

Leontief technology: demand for aggregate value added:

$$QVA_a = iva_a \cdot QA_a \tag{12}$$

Leontief technology: demand for aggregate intermediate input:

$$QINTA_a = \text{int}\, a_a \cdot QA_a \tag{13}$$

Factor demand:

$$\begin{aligned} &WF_f \cdot WFDIST_{fa} = PVA_a \cdot (1 - tva_a) \cdot QVA_a \\ &\cdot \left(\sum_{f \in F} \delta_{fa}^{a} \cdot \left(\alpha_{fa}^{vaf} \cdot QF_{fa} \right)^{-\rho_a^{va}} \right)^{-1} \cdot \delta_{fa}^{va} \cdot \left(\alpha_{fa}^{vaf} \cdot QF_{fa} \right)^{-\rho_a^{va} - 1} \end{aligned} \tag{14}$$

Disaggregated intermediate input demand:

$$QINT_{ca} = ica_{ca} \cdot QINTA_a \tag{15}$$

Commodity production and allocation:

$$QXAC_{ac} = \theta_{ac} \cdot QA_a \tag{16}$$

Output aggregation function:

$$QX_c = \alpha_c^{ac} \cdot \left(\sum_{a \in A} \delta_{ac}^{ac} \cdot QXAC_{ac}^{-\rho_c^{ac}} \right)^{-\frac{1}{\rho_c^{ac} - 1}} \tag{17}$$

First-order condition for output aggregation function:

$$PXAC_{ac} = PX_c \cdot QX_c \cdot \left(\sum_{a \in A} \delta_{ac}^{ac} \cdot QXAC_{ac}^{-\rho_c^{ac}} \right)^{-1} \cdot \delta_{ac}^{ac} \cdot QXAC_{ac}^{-\rho_c^{ac} - 1} \tag{18}$$

Output transformation (CET) function:

$$QX_c = \alpha_c^t \cdot \left(\delta_c^t \cdot QE_c^{p_c^t} + \left(1-\delta_c^t\right) \cdot QD_c^{p_c^t}\right)^{\frac{1}{\rho_c^t}} \tag{19}$$

Export-domestic supply ratio:

$$\frac{QE_c}{QD_c} = \left(\frac{PE_c}{PDS_c} \cdot \frac{1-\delta_c^t}{\delta_c^t}\right)^{\frac{1}{\rho_c^t - 1}} \tag{20}$$

Output transformation for non-exported commodities:

$$QX_c = QD_c + QE_c \tag{21}$$

Composite supply (Armington) function:

$$QQ_c = \alpha_c^q \left(\delta_c^q \cdot QM_c^{-\rho_c^q} + \left(1-\delta_c^q\right) \cdot QD_c^{-\rho_c^q}\right)^{-\frac{1}{\rho_c^q}} \tag{22}$$

Import-domestic demand ratio:

$$\frac{QM_c}{QD_c} = \left(\frac{PDD_c}{PM_c} \cdot \frac{\delta_c^q}{1-\delta_c^q}\right)^{\frac{1}{1+\rho_c^q}} \tag{23}$$

Composite supply for non-imported outputs and non-produced imports:

$$QQ_c = QD_c + QM_c \tag{24}$$

Demand for transactions services:

$$QT_c = \sum_{c' \in C'} \left(icm_{cc'} \cdot QM_{c'} + ice_{cc'} \cdot QE_{c'} + icd_{cc'} \cdot QD_{c'}\right) \tag{25}$$

Institution Block

Factor income:

$$YF_{if} = \sum_{a \in A} WF_f \cdot WFDIST_{fa} \cdot QF_{fa} \tag{26}$$

After tax real wage rate (*WFAT* is held fixed for the factor unskilled labour):

$$WFAT_f = WF_f \cdot (1-tf_f) / CPI \tag{27}$$

Institutional factor incomes:

$$YIF_{if} = shif_{if} \cdot \left[\left(1-tf_f\right) \cdot YF_{if} - trnsfr_{rowf} \cdot EXR\right] \tag{28}$$

Income of domestic nongovernment institutions:

$$YI_i = \sum_{f \in F} YIF_{if} + \sum_{i' \in INSDNG'} TRII_{ii'} + trnsfr_{igov} \cdot CPI + trnsfr_{irow} \cdot EXR \tag{29}$$

Intra-institutional transfers:

$$TRII_{ii'} = shii_{ii'} \cdot (1 - MPS_{i'}) \cdot (1 - tins_{i'}) \cdot YI_{i'} \tag{30}$$

Household consumption expenditure:

$$EH_h = \left(1 - \sum_{i \in INSDNG} shii_{ih}\right) \cdot (1 - MPS_h) \cdot (1 - tins_h) \cdot YI_h \tag{31}$$

Household consumption demand for commodities:

$$PQ_c \cdot QH_{ch} = PQ_c \cdot \gamma_{ch} + \beta_{ch} \cdot \left(EH_h - \sum_{\in} PQ_{c'} \gamma_{c'h}\right) \tag{32}$$

Investment demand:

$$QINV_c = IADJ \cdot qinv_c \tag{33}$$

Government consumption demand:

$$QG_c = qg_c \cdot GADJ \tag{34}$$

Government revenue:

$$\begin{aligned} YG = & \sum_{i \in INSDNG} tins_i \cdot YI_i + \sum_{f \in F} tf_f \cdot YF_f + \sum_{a \in A} tva_a \cdot PVA_a \cdot QVA_a \\ & + \sum_{a \in A} ta_a \cdot PA_a \cdot QA_a + \sum_{a \in A} tq_a \cdot PQ_a \cdot QQ_a + \sum_{c \in C} tm_c \cdot pwm_c \cdot QM_c \cdot EXR \\ & + \sum_{a \in A} te_a \cdot pwe_a \cdot QE_a \cdot EXR + \sum_{f \in F} YF_{gov\,f} + trnsf_{gov\,row} \cdot EXR \end{aligned} \tag{35}$$

Government expenditures:

$$EG = \sum_{c \in C} PQ_c \cdot QG_c + \sum_{1 \in INSDNG} trnsfr_{i\,gov} \cdot CPI \tag{36}$$

System constraint block

Factor market (factor supply and demand can be fixed/flexible depending on the factor closure rules chosen):

$$\sum_{a \in A} QF_{fa} = QFS_f \tag{37}$$

Composite commodity markets:

$$QQ_c = \sum_{a \in A} QINT_{ca} + \sum_{h \in H} QH_{ch} + QG_c + QINV_c + qdst_c + QT_c \tag{38}$$

Current account balance for rest of the world:

$$\sum_{c \in C} pwm_c \cdot QM_c + \sum_{f \in F} trnsfr_{rowf} = \sum_{c \in CE} pwe_c \cdot QE_c + \sum_{i \in INSD} trnsfr_{i\,row} + \overline{FSAV} \tag{39}$$

Government balance:

$$YG = EG + GSAV \tag{40}$$

Institutional savings rate:

$$MPS_i = mps_i \cdot (1 + MPSADJ \cdot mps01_i) + DMPS \cdot mps01_i \tag{41}$$

Savings-Investment balance:

$$\sum_{i \in INSDNG} MPS_i \cdot (1 - tins_i) \cdot YI_i + GSAV + EXR \cdot FSAV = \sum_{c \in C} PQ_c + QINV_c + \sum_{c \in C} PQ_c \cdot qdst_c \tag{42}$$

Definitions

Symbol	Explanation	Symbol	Explanation
Latin symbols			
$cwts_c$	weight of commodity c in the CPI	pwm_c	import price (foreign currency)
$dwts_c$	weight of commodity c in the producer price index	qg_c	base year quantity of government demand
ica_{ca}	quantity of c as intermediate input per unit of activity a	$qinv_c$	quantity of private investment demand
$icd_{cc'}$	quantity of commodity c as trade input per unit of c' produced and sold domestically	$shif_{if}$	share for domestic institution i in income of factor f
$ice_{cc'}$	quantity of commodity c as trade input per exported unit of c'	$shii_{ii'}$	share of net income of i' to i
$icm_{cc'}$	quantity of commodity c as trade input per exported unit of c'	$t\alpha_a$	tax rate of activity a
int a_a	quantity of aggregate intermediate input per activity unit	te_c	export tax rate
iva_a	quantity of value added per activity unit	tf_f	direct tax rate for factor f
mps_i	base savings rate for domestic institutions	$tins_i$	exogenous direct tax rate for domestic institution i
$mps01_i$	0-1 parameter with 1 for institutions with potentially flexed direct tax rates	$tins01_i$	0-1 parameter with 1 for institutions with potentially flexed tax rate
pwe_c	export price (foreign currency)	tm_c	Import tariff rate
tva_a	rate of value added tax for activity a		

Source: Löfgren et al. (2002).

Symbol	Explanation	Symbol	Explanation
Greek symbols			
α_a^a	Efficiency parameter in the CES activity function	δ_c^q	Armington function share parameter
α_a^{va}	Efficiency parameter in the CES value added function	δ_{fa}^{va}	CES value-added function share parameter
α_c^{ac}	Shift parameter for domestic commodity aggregation function	δ_c^t	CET function share parameter activity function
α_c^q	Armington function shift parameter	γ_{ch}	Subsistence consumption of marketed commodity c for household h
α_c^t	CET function shift parameter	θ_{ac}	Yield of output of c per unit of activity a
β_{ch}	Marginal share of consumption spending on marketed commodity c for household h	ρ_a^a	CES production function exponent
δ_a^a	CES activity function share parameter	ρ_a^{va}	CES value added function exponent
δ_{ac}^{ac}	Share parameter for domestic commodity aggregation function	ρ_c^{ac}	Domestic commodity aggregation function exponent
ρ_c^q	Armington function exponent	ρ_c^t	CET function exponent

Source: Löfgren et al. (2002).

Symbol	Explanation	Symbol	Explanation
Endogenous variables			
$DMPS$	Change in domestic institution savings	PDD_c	Demand price for commodity produced and sold domestically
DPI	Producer price index for domestically marketed output	PDS_c	Supply price of commodity produced and sold domestically
EG	Government expenditures	PE_c	Export price (domestic currency)
EH_h	Consumption spending for household h	$PINTA_a$	Aggregate intermediate input price for activity a
EXR	Exchange rate (LCU per unit of FCU)	PA_a	Activity price
$GADJ$	Government consumption adjustment factor	PM_c	Import price (domestic currency)
$GOVSHR$	Government share in nominal absorption	$PQ_{c'}$	Composite commodity price
$INVSHR$	Investment share in nominal absorption	PVA_a	Value-added price (factor income per unit of activity)
QF_{fa}	Quantity demanded of factor f from activity a	PX_c	Aggregate producer price for commodity c
QG_c	Government consumption demand for commodity c	$PXAC_{ac}$	Producer price of commodity c for activity a
QH_{ch}	Quantity consumed of commodity c by household h	QA_a	Quantity level of activity

$QINTA_a$	Quantity of aggregate intermediate input	QD_c	Quantity sold domestically of domestic output
$QINT_{ca}$	Quantity of commodity c as intermediate input to activity a	QE_c	Quantity of exports
$QINV_c$	Quantity of investment demand for commodity c	QQ_c	Quantity of goods supplied to domestic market (composite supply)
QM_c	Quantity of imports of commodity c	QT_c	Quantity of commodity c demanded as trade input
$MPS_{i'}$	Marginal propensity to consume by household h	QX_c	Quantity of domestic output of commodity c
$QXAC$	Quantity of output of commodity c from activity a	YF_f	Income of factor f
QVA_a	Quantity of (aggregate) value added	YG	Government revenue
$TABS$	Total nominal absorption	YI_i	Income of (INSDNG) institution i
$TINS_i$	Direct tax for domestic non-governmental institution i (INSDNG)	$YIF_{i\,f}$	Income to domestic institution i from factor f
$TRII_{ii'}$	Transfers from institution i' to institution i' (both in set INSDNG)	WF_f	Average price of factor f

Source: Löfgren et al. (2002).

Symbol	**Explanation**	**Symbol**	**Explanation**
Exogenous variables			
CPI	Consumer price index	QFS_f	Quantity of supplied factor
$FSAV$	Foreign savings (FCU)	$MPSADJ$	Savings rate scaling factor
$DTINS$	Change in domestic institution tax share	$WFDIST_{fa}$	Wage distortion factor for factor f in activity a
$IADJ$	Investment adjustment factor	$GADJ$	government consumption adjustment factor
$TINSADJ$	direct scaling factor	$WFAT_f$	After tax price of unskilled labour

Source: Löfgren et al. (2002).

Appendix D: Micro and Macroeconomic Model Constraints

Available closures in the standard CGE-model

Factor Market	Government	Rest of World	Savings-Investment
FAC-1 Fixed factor supply; flexible wages; mobile factors	**GOV-1** Flexible government savings; fixed direct tax rates	**ROW-1** Fixed foreign savings; flexible real exchange rate	**SI-1** Fixed capital formation; uniform MPS point change for selected institutions
FAC-2* Flexible factor supply; fixed wages; mobile factors	**GOV-2** Fixed government savings; uniform direct tax rate, point change for selected institutions	**ROW-2** Flexible foreign savings; fixed real exchange rate	**SI-2** Fixed capital formation; scaled MPS for selected institutions
FAC-3 Fixed factor supply; fixed wages; immobile factors (activity specific)	**GOV-3** Fixed government savings; scaled direct tax rates for selected institutions		**SI-3** Flexible capital formation; fixed MPS for all non-gov. institutions
			SI-4 Fixed investment and gov. consumption absorption shares (flexible quantities); uniform MPS point change for selected institutions
			SI-5 Fixed investment and gov. consumption absorption shares (flexible quantities); scaled MPS for selected institutions

***** For the purpose of my model, this model has been extended from the pre-programmed case by fixing the *post-tax-real wage* instead of the *pre-tax real wage*.

Macroeconomic balances

The macroeconomic balances include balances for savings-investment, the government and the external balance.

Concerning the government balance[77], there are basically two options for closures. The first possible closure option for the government balance uses flexible direct tax rates and fixed

[77] which relates to equation (40) in Appendix C: $YG = EG + GSAV$, where YG are governmental revenues, EG are governmental expenditures and $GSAV$ are governmental savings.

governmental savings. The second option, which is used in this study, is one where all tax rates, except those changed in the fiscal reform, are fixed. In a study of tax reforms, fixed direct tax rates are a necessary condition as it ensures that the changes in tax levels imposed through the specific tax reform are the only tax changes taking place. A revenue-neutral fiscal reform can then be ensured by recycling exactly the amount raised from the environmentally motivated taxes. The level of real government consumption is exogenous.

When it comes to the external balance,[78] foreign savings constitute the difference between all receipts and expenditures of foreign exchange. As transfers between the rest of the world and domestic institutions and factors are fixed, either the real exchange rate or the current account deficit must be adjusted to maintain the external balance. In this model, foreign savings are assumed to be fixed, implying that the exchange rate is instead free to vary. This is the most common approach used for static CGE-models, motivated by the fact that it prevents misleading short-run welfare effects from a change in foreign savings in a single-period-model.[79]

Finally, a closure rule must be specified for the savings-investment balance.[80] There are various options for closure rules for the savings-investment balance in the IFPRI model. The main difference between the various options available is related to whether savings or investments should be endogenous. If savings are chosen to be endogenous, the savings rates of non-government institutions are adjusted to maintain the fixed level of real investment. If, on the other hand, investment is assumed to be endogenous, the savings-rates for all non-government institutions are held fixed while the quantity of investment is adjusted to equal the level of savings. In this study, the first closure rule is used, i.e. the level of real investment is fixed. However, this is of minor importance for the policy reform studied in this paper: as the foreign savings are chosen to be fixed and a revenue-neutral fiscal reform also ensures

[78] which relates to equation (39) in Appendix C: $M + Net\ Transfers - X = FSAV$, where M are imports, X are exports and $FSAV$ are foreign savings.
[79] In this model, the export volumes might be affected by the choice of the domestic price index (DPI) as the numerarie. Export volumes are determined by the relative price of exports and domestic goods, and while the DPI is held fixed, a decrease in the domestic price of some goods will imply an increase in the domestic prices of other goods. As this constraint might affect the generation of exports volumes, an explicit analysis of the effects on export/import ratios is avoided by choosing fixed foreign savings. Therefore, although the Namibian exchange rate is tied to the South African rand, and South Africa is the main trading partner, fixed foreign savings (and a flexible exchange rate) are chosen here.
[80] This is related to equation (42) in Appendix C and can be written: $PSAV + GSAV + FSAV = INV$, where $PSAV$ are private savings, $GSAV$ are governmental savings, $FSAV$ are foreign savings and INV is investment.

governmental savings to be fixed, there is no need for private savings to be adjusted in order to maintain the fixed level of investment.

Appendix E – Sensitivity analysis of fish rent taxation and the inclusion of an approximate land rent tax, and results of other key variables

Due to the uncertainty associated with the calculation of actual fish rents, there is a possibility that the taxable fish rent might be over-estimated. Therefore, a sensitivity analysis has been conducted concerning the size of fish rent taxation for the results of the environmental fiscal reform. The results from the sensitivity analysis, where the fish rent taxation is decreased to 50 per cent, are shown in table 5 below.

Table 5: Effects on target variables for the case of fish rent taxation being 50%

Percentage change as compared to base case	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Effect on real GDP	0.07	0.06	0.19	-0.03	-0.04
Effect on employment for unskilled labour	0.2	0.16	0.59	-0.09	-0.12
Change in real consumption:					
- among the poorest households	0.24	0.45	0.51	0.39	0.89
- among the richer households	0.08	-0.19	0.29	-0.48	-0.96

It is clear that while higher fish rent taxation allows for higher tax revenues, which increase the possibility of achieving additional benefits through different forms of recycling, the directions of the results do not change depending on the level of fish rent capturing. In fact, all qualitative results presented for total rent capture still hold also in a case of 50 per cent rent capturing. These results are intuitive; as the model does not take entry effects into account, the taxation of rents, unlike the other taxes in the model, is non-distortionary.

Although the lack of reliable estimates of actual land rents prevented a formal analysis of land rent taxation in this paper, it is interesting to point out what the likely effects of such a policy would be. A variant of the model is simulated where an approximate land rent tax of about 50 per cent of the total mixed factor in the commercial agricultural sector (assuming that land constitutes half of the mixed factor) is included. The results indicate that the GDP and

employment effects will not change as long as *the sum* of fish rent and land rent taxes is equal to the case of 100 per cent fish rent taxation. Concerning the distributional impacts, taxation of land rents in the commercial agricultural sector will have a greater impact on income distribution than the fish rent tax; rich households in the farming business will be considerably less well off as their factor income will decrease significantly when land rents are taxed.

Table 6: Results of other key variables (rent taxation 100%)

Percentage change as compared to base case	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Consumer Price Index	-0.8	-1.0	1.4	0.2	0.3
Change in production of:					
- Commercial Agriculture	0.1	0.2	0.3	0.0	0.0
- Traditional Agriculture	0.8	1.0	2.3	0.1	0.2
- Fish	0.1	0.1	0.3	0.0	0.0
- Fish processing	0.0	0.1	0.2	0.0	0.0
- Mining	0.3	0.2	0.4	0.0	0.0
- Meat production	0.3	0.7	0.3	0.0	0.0
- Grain Milling	0.1	0.1	0.1	0.0	0.0
- Beverages production	0.3	0.7	0.3	0.0	0.0
- Industry	0.4	0.2	0.5	0.0	0.0
- Construction	0.1	0.0	0.1	0.0	0.0
- Water	0.2	0.3	0.7	-0.1	-0.2
- Electricity	0.2	0.1	0.5	0.0	-0.1
- Services	0.1	0.1	0.4	0.0	-0.1
- Hotels and Restaurants	0.5	0.2	0.8	-0.3	-0.5
- Transport	0.4	0.1	1.3	-0.2	-0.4
- Government services	0.0	0.0	0.1	0.0	0.0
Change in real factor income (to households):					
- Mixed factor commercial agriculture	1.8	2.8	0.6	0.2	0.4
- Mixed factor traditional agriculture	2.3	3.8	4.2	0.0	0.1
- Skilled Labour	1.5	1.1	-0.9	-0.2	-0.4
- Unskilled Labour	0.5	0.4	1.1	-0.1	-0.2