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. We find that a triple dividend – improving the environment, increasing employment, and reducing poverty at the same time – remains elusive. Subsidising unskilled labour would give the most favourable result in terms of real GDP and employment, but the worst in terms of environmental effects. Transfers targeted towards poorer households have the best distributional and environmental impacts, but do not lead to increases in GDP or employment. Thus, there is scope to create additional benefits for society through the various environmental fiscal reform options studied, but there is no option which clearly outperforms the others in all respects.

Keywords: Computable General Equilibrium model; environmental fiscal reform; revenue recycling; policy instruments; Namibia

Biographical sketches

Linda Sahlén is a researcher at the Swedish National Institute for Economic Research, Environmental Economics Unit. She has a PhD from Umeå University in Sweden. She has done research on environmental and development economics and also has practical policy experience from working as environmental economist at the Swedish Environmental Protection Agency.

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1. Introduction

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

More recently, environmental fiscal reform in developing countries has become a topic of research interest (see e.g. Bosquet, 2000; OECD, 2005; O'Ryan, De Miguel, Miller & Munasinghe, 2005; Pagiola, Hurtado, Shyamsundar, Mani & Silva, 2002; Slunge & Sterner, 2009; Van Heerden, Gerlagh, Blignaut, Horridge, Hess, et al., 2006a; Van Heerden, Blignaut, Mabugu, Gerlagh, Hess, et al., 2006b). In addition to environment-related taxes on pollution, the design of an environmental fiscal reform in a developing country might also include taxes on the use of natural resources, as in forestry and fisheries, and user charges or the removal of environmentally harmful subsidies on water and electricity use, for example (Bosquet, 2000). 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 be related to employment only: poverty is often more widespread, and can largely also be related to the prices of commodities such as food, which constitute a significant part of the poor household's expenditure.

In this paper, the likely effects of an environmental fiscal reform in Namibia are examined using a Computable General Equilibrium (CGE) model. Since Namibia is a country that depends highly on its natural resource base – especially mining, fishing, agriculture and nature-based tourism – and it has one of the world's most unequal income distributions, the Namibian government has to find ways to reduce the intensity of resource use while, at the same time, reducing poverty and socio-economic 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 provide additional benefits in terms of increased GDP, increased employment, and a less skewed income distribution. The purpose of this analysis is to examine 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 in 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) subsidisation of unskilled labour, d) an increase in direct government transfers to all households (general transfers) and e) an increase in direct government 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 achieved if the environmental tax revenues from increased energy and water taxation are recycled through a reduction of taxes on food (Van Heerden et al., 2006a, 2006b). A shift of focus from employment to income distribution and poverty can also be seen in a CGE-based study of the Chilean economy, which shows that the combination of environmental and social policies (in terms of increasing government transfers to households) is critically important for the distributional consequences of a fiscal reform (O'Ryan et al., 2005).

An important contribution of this paper, which also distinguishes it from the South African studies, will be to emphasise the potential non-environmental effects of using rent taxation in the design of an environmental fiscal reform in developing countries that are rich in natural resources. Even though taxation of rents is often pointed out as an important approach to environmental fiscal reform in developing countries, there are few studies that focus on pure resource rent taxation. According to Bosquet (2000), one reason for this is that, since prices remain unchanged, rent taxation does not create any immediate incentives for resource conservation: 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. On the other hand, the prospect of replacing distortionary taxes with a non-distortionary rent tax is of obvious interest for reasons of efficiency. Another reason why rent taxation is rarely analysed is that there are usually no available estimates of the sizes of actual resource rents. 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, this analysis will focus mainly on the recycling of revenues from the perspective of alleviating poverty. As compared with the studies by Van Heerden et al. (2006a, 2006b), which include a reduction of direct and indirect taxes as recycling options, another contribution of the present paper is its analysis of additional recycling options in the form of increasing general and targeted transfers to households.

The outline of the paper is as follows: section 2 presents background information on the Namibian economy, while section 3 describes the different parts of the envisaged environmental fiscal reform. 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.

2. Namibia

(Table 1 about here)

Namibia is highly dependent on its natural resource base, namely mining, fishing, agriculture and wildlife-based tourism. These sectors, and the processing sectors associated with them, jointly account for some 30% of GDP (Table 1)[1] and almost all export earnings. With a per capita income of USD3,000 per year, Namibia is classified as an upper-middle-income country. However, Namibia's income distribution is one of the most unequal in the world. Estimates of the unemployment rate range from 35% to 50%, the Gini coefficient is estimated at 0.63, and it is estimated that 50% of the population live below the poverty line.

An explanation of the current state of the economy as well as of the main goals of Namibia's development policy can partly be found in the history of the country. In 1990, Namibia gained independence after 70 years of South African rule (and around 30 years of German rule before that). Before independence, many of Namibia's natural resources were exploited in an unsustainable way and the benefits did not always accrue to the Namibian population. The highly skewed income distribution is also largely a legacy from the South African apartheid era. Since independence, however, the Namibian government has attempted to set up policies that can contribute to the sustainable management of resources that form the basis of the country's economic activity and, at the same time, ensure that economic development will reduce inequality.

Government expenditure is 34% of GDP in Namibia, which is high, compared with most other developing countries. The high level of government expenditure, especially in respect of education and health, has been motivated as being aimed at increasing employment and self-employment opportunities for the poor. However, in terms of combating poverty and the highly skewed income distribution, these policies do not appear to have been successful as yet; as noted, poverty and inequality remain high.

(Table 2 about here)

Namibia's tax burden accounted for about 29% of GDP in the 2004/5 financial year, which is also high compared with other developing countries. The structure of government tax revenues can be seen in Table 2. The table further shows that the main source of revenue for the government is taxes on international trade and transactions within the Southern African Customs Union (SACU),[2] followed by taxes on profits and income, and then by the Value Added Tax.

Although the Ministry of Finance has expressed the need to introduce environmental taxes in Namibia, there are currently only a few explicitly environment-related taxes. Among them is a tourism levy included in the price of accommodation, while national park entry fees partly cover the costs of wildlife conservation. More importantly, there are various levies on mining and fishing, which explicitly target natural resource extraction. There is also a fuel levy system currently in place for petrol, diesel and paraffin, but the levy is earmarked for road infrastructure and is not motivated by environmental concerns (Humavindu & Barnes, 2006).

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 that erode the tax base. However, commercially exploited resources usually generate considerable resource rents, which are a potential source of government revenue. A further investigation of the taxation of the two main natural resource sectors in Namibia, namely mining and fishing, shows that most resource rents in the mining sector are indeed being captured; in the fishing sector, however, the government captures only about 20% of the rents (Lange, 2003).

Although, in comparison with many other African countries, Namibia's economic policy has succeeded in many respects, the pronounced government goal of ensuring sustainable and equitable development calls for the further revision and development of economic policy. One option for devising an integrated policy would be to find opportunities to implement environmental taxes that could be redistributed in such a way as to impact positively on GDP and employment, as well as lead to more equal income distribution. This paper aims at analysing the likely welfare effects of a specific environmental fiscal reform where additional tax revenues can be used to reach distributional and other objectives.

3. Possible Environmental Fiscal Reform Measures in Namibia

The three potential environmental fiscal reform measures studied in this paper are –

1. taxation of the resource rents in the fishing sector, which may reduce the long-term incentives for overfishing
2. the removal of water subsidies, which will increase the price of water used in the currently subsidised sectors (the shortage of fresh water is currently considered to be the main constraint to development in Namibia), and
3. an increase in the energy tax (based on actual carbon content), which could lead to lower CO_2 emissions.

The additional tax revenues are then recycled in different ways through a decrease in indirect value added taxes, a subsidy on unskilled labour, or increased direct government transfers to households. The various components of this fiscal reform are described in more detail below.

3.1. TAXATION OF RESOURCE RENTS IN THE FISHING SECTOR

During the period of South African occupation, Namibia's fisheries operated as an open access resource, which resulted in a depletion of the fish stocks. After independence, a new fisheries policy with two main objectives was implemented (Lange, 2003):

1. To ensure ecologically sustainable management of the fisheries, and
2. 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.

To achieve the first objective, the government sets annual fishing quotas for the total allowable catch (TAC) per species. The existing quota levies have been shown to be considerably lower than the rents actually generated by the fishing industry. The non-taxed rents appear to be higher than normal profits in the fishing sector, meaning that that there are still incentives for overfishing; as a result, the fishing sector regularly lobbies government for increased quotas.

The second objective of the fisheries policy can be seen as fitting into the broader context of the government's focus on policies to alleviate poverty. Although quotas have been allocated to new companies that were not established in the industry before independence, opening the sector to new entrants, these new entrants tend to be prosperous already. The only way for poorer Namibians to benefit from a resource that is a national/public asset is through the quota levies paid to the government and, possibly, through the creation of employment opportunities (Lange, 2003).

Even if progress has been made, both in terms of the goal to increase the Namibian population's share of benefits from fishing and in stemming the further depletion of the fish stocks, there is a growing concern that too much of the economic benefit still accrues to foreign companies, and fish stocks have not recovered to their historical levels as anticipated. Consequently, a further increase in the taxation of rents generated in this sector is motivated. Although improved government rent capture may not have much influence on the short-term incentives for overfishing, higher rent capture would have a positive effect on the sustainability of the fisheries in the long run, as it would reduce profits and, hence, also reduce the pressure to permit additional fishing. Calculations based on Namibia's national accounts show that the percentage of fishing rents collected by the government had decreased from 50% after independence to about 20% by 2000 (Lange, 2003).

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 subsidised during the period of South African occupation, especially for the commercial farming sector (Lange, 2006). Namibia's water policy changed after independence. The new Water Resources Management Act, 2004 (No. 24 of 2004) emphasises the need to recognise the economic value of water. To promote economically efficient water use, water tariffs should reflect the full opportunity cost of water, the direct cost of supply, and the cost of resulting environmental impacts.

Studying the published data on the cost of providing water compared with the tariffs paid by end users, full direct cost recovery pricing has clearly not yet been achieved – let alone pricing that recovers the full economic cost. Lange (2006) found an error of underestimation in the cost of irrigation water in the reported figures, for example, and concludes that commercially irrigated crop production, in particular, continues to be heavily subsidised.

Although taxation would be the appropriate tool for capturing the full social costs of water supply, there are currently no estimations available of these costs. 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, only the elimination of water subsidies is studied as a first step towards recovering the full social cost of supplying water.

3.3. ENERGY TAXATION

A third option for environmental taxation in Namibia would be increased energy taxation. Namibia is a minor player when it comes to carbon emissions and, as a non-Annex-I country in respect of the Kyoto Protocol, Namibia has no international obligation to reduce emissions in the first commitment period of 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 energy sources like solar, wind, wave and biomass a policy priority and is attempting to increase these sources' share of national energy use. At present, domestically produced electricity is mainly hydroelectric power, while fossil fuels only account for a small percentage of domestic production. As domestic electricity production does not cover domestic demand, however, the remaining energy requirements are imported (coal- and nuclear-based) electricity from South Africa. Furthermore, Namibia has no domestic production of petroleum products: 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 that included all oil-based fuels, as proposed by Humavindu and Barnes (2006), among others.

This paper analyses the effects of introducing a tax on the final consumption of petroleum products. The proposed tax is based on the actual carbon content in the various fuels, which implies that the fuel tax simulated in this paper is a CO_2 tax, although it is based on the consumption of fuel and not on the emissions themselves. From a distributional point of view, as most of the poorest households do not drive their own cars, these households may not be significantly affected by a CO_2 tax. Hence, a CO_2 tax 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 to improve the environment through higher taxes will have negative effects on development. Therefore, in this study, the focus is on the possibilities of recycling the tax revenues from an environmental tax reform in a way that might lead to benefits in terms of increased GDP, increased employment, and poverty alleviation. The additional tax revenues will be recycled in five different ways, the first two of which refer to decreased indirect taxation, i.e. initially as a decrease in the general VAT rate (currently 15%), and then as a decrease in the VAT on food only. A comparison of these options in terms of income distribution will be of particular interest as poor households spend relatively more of their total expenditure on food than other households do. The third option considers a subsidy targeting the employment of unskilled labour. These three recycling options are similar to those addressed in two South African studies (Van Heerden et al. 2006a, 2006b).

The last two ways of recycling the additional tax revenues studied here are through general and targeted government transfers.

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, devised by the International Food Policy Research Institute (IFPRI; see Löfgren, Harris & Robinson, 2002, for a full model description). 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 macroeconomic policies in developing countries, especially African countries (for macro-policy studies in African countries where the model is used, see e.g. Go, Kearney, Robinson & Thierfelder, 2005; Löfgren, Chulu, Sichinga, Simtowe, Tchale, et al., 2001; Thurlow, 2004; for environmental policy studies, see e.g. Bezabih, Chambwera & Stage, 2011; Reid, Sahlén, Stage & MacGregor, 2008). This section provides a brief summary of the model; for a full documentation of the original model, see Löfgren et al. (2002).

Production technology is divided into two levels: the upper level represents the substitution decision between intermediate inputs and factors of production, while the lower level represents the choice between factors of production. At the upper level, a Leontief specification is used, implying no substitutability between factors of production (value added) and intermediate inputs in production. At the lower level, a constant elasticity of substitution (CES) function is used to represent the substitutability between primary factors used in production, namely skilled labour, unskilled labour, mixed income in commercial farming, mixed income in traditional farming, capital and the fish stocks (discussed in more detail in section 4.2 below). The share of composite commodities used as intermediate inputs in production is determined by a Leontief technology. Figure 1 shows the structure of this production technology. As a result of profit maximisation, 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 about here)

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, as well as indirectly via enterprises) and transfers from other institutions. The income is then used for direct tax payments, savings, 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.[3] The consumption pattern varies across household groups due to different consumption shares for each commodity and different elasticities of market demand for each commodity between the various household groups.[4]

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 taxes, 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 the world are fixed in foreign currency. Foreign savings constitute the difference between foreign currency spending and receipts.

The model allows for an activity to produce more than one commodity, and for a commodity to be produced by more than one activity. The first step, therefore, is 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 minimising 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 maximisation, subject to a Constant Elasticity of Transformation (CET) function. The assumption is that, although the supply of exports is determined by the relative price of exports and domestic goods, the producers' maximisation 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, using 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 that 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.[5] International supplies are assumed to be infinitely elastic at given world prices.

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

(Figure 2 about here)

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.[6] With regard to the factor markets, this paper follows Van Heerden et al. (2006a, 2006b) 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 stocks factor as well as for the mixed factors used in agricultural production. This is the standard way in which capital and natural resources 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 characterised by full employment. 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.[7]

The main adjustments made to the generic IFPRI model in this study are that the country's fish stocks are incorporated as a separate factor of production (discussed in more detail below), and that the real after-tax wage rate for unskilled labour is assumed to be fixed in Consumer Price Index terms in order to allow for unemployment. Labour is assumed to be mobile between sectors, while other factors of production (capital, land and fish) are assumed to be fixed. Concerning the macroeconomic aggregates, an important assumption in this study is that all tax rates, except those directly affected by the fiscal reform, are fixed, and that the overall government deficit is held constant. Foreign savings are also assumed to be fixed in the model. The level of real government consumption and real investment is exogenous and, thus, not assumed to be affected by the policies in question.

4.2. DATA

The primary database on which the CGE model is built is the Social Accounting Matrix (SAM) for Namibia from 2004 (for full documentation of the work to develop a Namibian SAM, see Lange, Schade, Ashipala & Haimbodi, 2004; Lange & Schade, 2008). Full lists of the sectors in the original and in our adapted SAM are provided in Table 3.

(Table 3 about here)

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 allocating farm income to these mixed factors in the SAM is that it is difficult to distinguish between the different types of earnings derived by self-employed farmers: the surplus of sales revenue over input costs includes a payment for own labour, own capital input, and land input. Therefore, in the national accounts as well as in the SAM, this surplus is reported as *mixed income*.[8]

4.2.1. Agricultural Sector Data

Minor adjustments in the SAM have been made for the traditional agricultural sector. In the original SAM, this sector produces an 'own' commodity, termed the *traditional agricultural 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 can be substituted for food purchased from elsewhere. Therefore, *traditional agricultural 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 this sector, the *Mixed income* category includes land rents and income generated by labour supplied by people informally employed in the sector. By using the approximate number of informal workers in the subsistence agricultural sector (Angula & Sherbourne, 2003), together with an estimate of the mean rural informal wage (Humavindu, Forthcoming), 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 the total income in the economy, this small adjustment represents a better means of modelling factor income distribution in the traditional agricultural sector.

4.2.2. Tourism Data

Tourism is included as a dummy sector in the Namibian SAM as a way of indicating the importance of this activity, despite the fact that it does not correspond to an actual economic industry. This dummy sector corresponds to the total value of *Purchases of products in the Namibian economy by non-residents*, which is reported as a separate export category in the national accounts. 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 merging the tourism dummy sector with other exports. Due to the lack of specific data for the tourism sector, a reasonable analysis of raising taxes within this industry is not feasible. In addition, in contrast to the fishing sector data described above, there are no available estimates in the Natural Resource Accounts (NRAs) for ‘rents’ on wildlife. The tourism sector is, therefore, not included in the environmental fiscal reform studied in this paper.[9]

4.2.3. Fishing Sector Data

To study the effects of a larger share of the resource rents captured by the government within the fishing sector, the fish stocks are included as a factor of production in the fishing and fish processing sectors. This is done by making use of the resource rent estimated through the NRA for fishing.[10] In the original SAM, the factor income for capital reported in the fishing sector effectively contained both a normal capital rent component and a component more appropriately attributable to the fish resource rent. To identify the latter, therefore, we subdivide the reported capital income into capital rents and fish resource rents. In 2001, the most recent year for which the resource rent is calculated, only 20% of the total fish resource 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 sector. For the purposes of this study, the amount of taxed fish resource rents is reclassified from the business tax account to a direct tax on fish resource rents. The rest of the total fish resource 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 resource rent captured by government, through an increase in the direct tax on such rents.

4.2.4. Water Data

There is no information on water subsidies in the SAM. The sectors supported through water subsidies are mainly the agricultural sectors (commercial crop and livestock production) and private services.[11] In the SAM, water is considered to be an intermediate input in production and not a factor of production. The removal of water subsidies will reduce the current incentives for overuse in the subsidised sectors. In total, the water subsidies only constitute a small fraction (about 4%) of the total environmental tax revenues.[12]

4.2.5. Energy Data

To calculate the environmental tax to be levied on fuels, an official energy balance for Namibia from the year 1999 has been used. This is the latest energy balance compiled for the economy. Since energy production and consumption between 1999 and 2004 have probably not changed to any considerable extent, the fact that the years for the energy balance and the SAM differ should not constitute a major problem.

In the energy balance, information is given on the fuel types included in the aggregated petroleum commodity account in the SAM. However, although overall import statistics for different fuels is fairly reliable, sectoral disaggregation of energy use is problematic in Namibia[13] and the SAM relies partly on share estimates based on South African data. The implemented tax is based on the final actual consumption of petroleum products (according to the carbon content) and not actual emissions by production sector.[14] This can be seen as a fuel tax, where the tax rate for the commodity *Petroleum products* is calculated as the CO_2 tax, multiplied by the carbon content of petrol, diesel and all other products included in the petroleum product account found in the Namibian SAM for 2004. The level of CO_2 tax used here is N$35[15] per tonne of CO_2, following Van Heerden et al. (2006b). The carbon content in the total consumption of petroleum products is calculated by using the Intergovernmental Panel on Climate Change (IPCC) default conversion factors.

4.2.6. 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 as follows:

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 wages and salaries
5. Rural households who receive their income from business activities and commercial farming, and
6. Rural households that depend on subsistence farming, pensions, cash remittances and other sources of income.

Although the SAM for 2004 used in this study draws on some recent economic data, in some cases it also relies on data from the *Namibia Household Income and Expenditure Survey 1993/1994* (GRN, 1996) and on data from South Africa. Although the household data is poor in the sense that, for example, the households are not divided by income deciles in the SAM, the division into separate socio-economic income groups allows one to identify households in terms of their location and source of income, which is often decisive in respect of general living conditions. This approach to studying poverty and income distribution effects is called the *Representative Household* (RH) approach. The approach is the most common in the vast literature that deals with the links between different macro reforms and changes in poverty and income distribution through CGE models. The RH approach also implies that changes in income in the subgroups are interpreted as changes for all households within the group.

When it comes to determining which household groups are the poorest – and, therefore, which should be subject to targeted transfers – it would be interesting to know more about the household groups apart from their total income, as given in the SAM. Ideally, one should have households subdivided by actual income distribution, rather than merely by source of income; however, household income and expenditure data were not available at this level of detail when the SAM was constructed (Lange & Schade, 2008). Therefore, we were unable to use data on the actual income distribution. Instead, as a proxy, we calculated an average income per household within each household group, 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 *Namibia Household Income and Expenditure Survey 2003/2004* [GRN, 2006]). The average income is lowest for urban households with pensions and cash remittances as their main sources of income; rural households that get their income from wages and salaries; and rural households with their main income from subsistence agriculture, remittances and pensions.

In this paper, the effects on income distribution are studied in terms of changes in real income for these three poorest household groups in comparison with the corresponding changes for richer household groups. This division of household groups conceals some of the variations in income within rural sectors; however, since about 70% of the poor live in rural areas and the remaining poor largely constitute unemployed urban households, at least the majority within the three chosen household groups can be considered to be poor. Thus, three groups with the lowest average income can be identified, and they would then be subject to the targeted transfers in order to minimise leakages to rich households.

Once the households subject to targeted transfers have been identified, the transfers are distributed proportionally among the low-average-income groups according to the number of households in each of the poor household groups, thereby ensuring that each household in these three groups obtains an equal transfer. In this respect, our way of distributing the transfers to each chosen representative household group differs from a study of targeted versus unilateral transfers in the Zimbabwean economy by Chitiga (2000). The latter study also uses the RH 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.

4.2.7. Elasticities

Expenditure elasticities for household energy demand – more specifically petroleum and electricity – are taken from an empirical study of Namibian energy demand by De Vita, Endresen and Hunt (2006). All other elasticity values are taken from a CGE model of the South African economy by Thurlow (2004). The latter decision is motivated by the fact that the structure of the Namibian economy is similar to that of the South African economy.

5. Simulation Scenarios

The additional tax revenues raised via carbon taxation, lower water subsidies and increased resource 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 of about 30% in the petroleum tax (based on the calculations of carbon contents described earlier in section 4.2.5)
- the introduction of a tax on water use by the commercial agricultural sector and the private service sectors, corresponding to the size of the current water subsidies to these sectors, and
- an increase in the direct tax on fish resource rents from the current level of about 20% to 100% of the total of such rents.[16]

Provided that the tax on fish resource rents is designed so as to capture only the rents without affecting input or output prices (e.g. through a quota auctioning system), it will have no significant effect on the level of fish production – only on the distribution of factor income from fishing. The purpose of this policy would be to discourage new entrants, reduce the political pressure on government to permit additional fishing, and force inefficient companies to exit by reducing profits made within the industry. This will help secure sustainable long-term fish stocks.

In total, the environmental fiscal revenues envisaged above only amount to about 1.5% of total GDP, suggesting that the proposed 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 4.

(Table 4 about here)

In Scenario 1, the tax revenues are recycled through a general reduction in the VAT rate, while in Scenario 2, only VAT on food is decreased. In Scenario 3, the environmental tax revenues are used to finance a subsidy of unskilled labour. In Scenarios 4 and 5, direct government transfers to households are introduced, respectively, by way of transfers to all households, and through targeted transfers to the poorest household groups only.

6. Simulation Results

(Table 5 about here)

The effects of the proposed environmental fiscal reform scenarios on the environmental, economic and social target variables are shown in Table 5. Since the overall turnover of the modelled reform only amounts to some 1.5% of GDP, many effects are quite small; nonetheless, some of the effects are large compared with the size of the reform.

Real GDP increases in scenarios where VAT or labour costs are reduced, but not in the transfer scenarios. The impact on GDP is greatest in the labour subsidy scenario. The environmental benefits of fish resource rent taxation are not measurable in the context of the model. For the other two targeted environmental issues, CO_2 emissions and water use, all scenarios except the labour subsidy scenario lead to decreased CO_2 emissions. Water use declines in the targeted transfer scenario, is unchanged in the general transfer scenario, and increases in the other scenarios.

Scenario 3 – where revenue from the fiscal reform is used to subsidise employment of unskilled labour – leads to the largest increases in real GDP and employment among unskilled labour. While the increased environmental taxes raise production costs and thereby reduce the demand for factors including unskilled labour, the subsidy decreases labour costs and, therefore, increases the demand for unskilled labour. As the positive recycling effect more than offsets the initial negative effect on overall production levels, the result of this scenario is significant increases both in the employment of unskilled labour and in 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 falls largely on one of the fixed factors – the fish stocks – without any significant negative effect on production in the model. However, the flip side of the increase in production is that the use of petroleum products and the use of water both increase, despite their higher prices. We should also note that, although all household groups experience increased income in this scenario, the three richer household groups gain relatively more than the poorer household groups do.

A positive effect on real GDP and employment can also be achieved by reducing value added taxes, as in Scenarios 1 and 2. Commodity taxes are reduced overall, but the price of petroleum products and of some sectors' water use increases. This causes a shift in consumption from (imported) petroleum products to other products, some of which are produced domestically. The overall effect of this shift is an increase in GDP, increased employment of unskilled labour, and slight increases in consumption for most household groups. The positive effects on GDP and employment are larger when the tax revenues are recycled through cuts in all value added taxes in comparison to when only food taxes are cut, although the difference is relatively small. The reason why a reduction of the taxes on all commodities increases GDP and employment more than a reduction of food taxes only does – 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 sectors. Because of the greater impact on employment of the overall tax cut envisaged in Scenario 1, the effects on income are also somewhat greater in this scenario than in Scenario 2. In Scenario 1, all household groups' income increases, although the richer households gain relatively more than their poorer counterparts. In Scenario 2, most groups see smaller income increases, while some groups even experience reduced income.

These results can be compared with those of the South African studies by Van Heerden et al. (2006a, 2006b). In the latter, where environmental tax revenues were recycled either 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 that resulted in a positive effect on GDP. One explanation as to why there is more scope for positive GDP effects in our study is that the tax on fish resource rents is non-distortionary: increasing this tax and reducing others improves overall efficiency, therefore. 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 aimed at the unemployed factor; in the South African study, factor taxes were reduced equally on capital, skilled and unskilled labour (unskilled labour only contributes about 14% to total factor income).

In Scenarios 4 and 5, where the revenue from the proposed fiscal reform is used to finance transfers either to all households or to selected poorer households, environmental impacts are beneficial or negligible (the higher taxes on petroleum products lead to a shift in consumption from those products to others), while impacts on GDP and employment are small but negative. These two scenarios perform best in terms of income distribution. In the targeted transfer scenario, all three poorer household groups experience rising income, while all three richer household groups experience reductions in income.

The reason why poorer households benefit more than their richer counterparts in the transfer scenarios, even when the transfer is general, is that they are less affected by the increases in fuel costs. The direct effect is that the poorer households will use their transfer incomes to increase their consumption, especially of agricultural products, which leads to an increase in production in these sectors. This, in turn, affects the income of poorer rural households as they are mainly employed within the agricultural sectors. At the same time, when richer households reduce consumption, production decreases within the labour-intensive service sectors. This implies that, although general and targeted transfers both ensure that the poorest household groups will be better off, these benefits come at the cost of making richer households less well-off than in the baseline situation, and at the cost of reducing overall employment for unskilled labour.

According to the model results, none of the five scenarios leads to a ‘triple dividend’, where environmental impacts are reduced, GDP increases, and poverty is reduced, all at the same time. The transfer scenarios – where GDP impacts are very small and the other impacts are all in the desired direction – come closest to a triple dividend outcome. Using environmental fiscal reform to reduce distortions in goods markets (through reduced VAT rates) or in labour markets (by subsidising unskilled labour) has a better impact on GDP, but, ironically, its impact is worse in terms of the environment and income distribution.

7. Conclusions

The purpose of this paper was to examine whether different ways to recycle revenue from the environmental taxation of fish resource rents, energy and water could give rise to additional benefits for the Namibian economy in terms of GDP, employment and income distribution. We find no 'triple dividend' outcome – where environmental impacts and poverty are reduced and GDP simultaneously grows.

With respect to the environmental effects of environmental tax reform, Scenario 3 has the best impact on GDP and employment, but has the worst environmental effects: water use increases, as does the consumption of petroleum products and, therefore, emissions of CO_2. Using the increased revenue to finance household transfers (Scenarios 4 and 5) has the best distributional effects and leads to lower CO_2 emissions, but also at the cost of reducing overall GDP (slightly) as well as employment for unskilled labour. Using the revenue to finance reduced VAT rates (Scenarios 1 and 2) leads to reduced CO_2 emissions, higher GDP, higher employment, and higher income for most groups, but the distributional profile is worse than with household transfers.

It is interesting to note that, according to the results, environmental taxes might not necessarily be regressive in nature: the increased taxes on fish resource rents and energy, together with decreased subsidies of water, will mainly affect richer households. Although none of the studied scenarios have unequivocally beneficial effects, in terms of achieving all three 'dividends' simultaneously, increasing non-distortionary taxes such as rent taxes remains an attractive option for increasing government revenue and it might be possible to tailor mixed scenarios that achieve all three dividends at the same time. Thus, more policy interest in environmental taxes and in environmental fiscal reform seems in order – albeit with a few caveats.

Some of the household data in the SAM draws on estimates based on relatively old sources or on foreign data. Similarly, although the overall energy consumption data are relatively reliable, the distribution of the use of different fuels among different sectors is uncertain. Given that different sectors have very different profiles in terms of employment and income distribution, care needs to be taken when implementing reforms based on such uncertain data. Improved collection of data that can feed into the scenario analysis should, thus, be a forerunner to any actual policy implementation. Nonetheless, our results suggest that environmental fiscal reform might indeed be worth pursuing in Namibia, and that the impacts on both environment and income distribution could be quite beneficial.

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Table 1. Different sectors' shares of GDP, 2004

Sector	**Share of GDP**
Agriculture	5,8%
Fishing	4,0%
Mining	10,6%
Food processing	7,7%
Other manufacturing	5,9%
Electricity and water	2,3%
Construction	2,9%
Wholesale and retail trade	11,9%
Hotels and restaurants	2,0%
Transportation and communication	6,1%
Other private services	14,1%
Government and non-profit services	26,8%

Source: Central Bureau of Statistics (2010)

Table 2. Government revenue structure, 2001/2

Tax revenue other than Southern African Customs Union (SACU)	**59,21%**
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%
Other companies	7,24%
(of which approx. half is fishing)	
Property taxes	0,51%
Value added tax	22,22%
SACU revenue	**30,10%**
Non-tax revenue	**8,44%**
(e.g. diamond royalties)	
Other revenue	**2,25%**
(e.g. external grants)	

Source: Schade (2005)

Table 3. Sectors in the original and adapted Social Accounting Matrices (SAMs)

Commodities	**Activities**
Commercial cereal crops	Commercial cereal crops
Other commercial crops	Other commercial crops
Commercial animal products	Commercial animal products
Traditional agriculture (only in original SAM)	Traditional agriculture
Fishing	Fishing
Mining	Mining
Meat processing	Meat processing
Fish processing	Fish processing
Grain milling	Grain milling
Beverages and other food processing	Beverages and other food processing
Textiles	Textiles
Wood and furniture	Wood and furniture
Paper, printing	Paper, printing
Petroleum products	Chemicals and rubber
Chemicals and rubber	Non-metallic mineral products
Non-metallic mineral products	Basic metals
Basic metals	Fabricated metals, machinery
Fabricated metals, machinery	Electricity
Electricity	Water
Water	Construction
Construction	Trade; repairs
Trade; repairs	Hotels and restaurants
Hotels and restaurants	Transport
Transport	Communication
Communication	Finance and insurance
Finance and insurance	Real estate, own

Real estate, own

Market real estate and business services

Other private services

Government services

Direct purchases abroad by residents

Purchases by non-resident tourists (only in original SAM)

Trade margin

Factors of production

Skilled labour

Unskilled labour

Mixed income, commercial farming

Mixed income, traditional agriculture

Capital

Fish stocks (only in adapted SAM)

Savings and investment account

Rest of world

Market real estate and business services

Other private services

Government services

Foreign tourism (only in original SAM)

Institutions

Urban households deriving most of their income from

- wages and salaries
- business activities
- other sources of income (e.g. pensions, remittances)

Rural households deriving most of their income from

- wages and salaries
- agriculture and other business activities
- other sources of income (e.g. pensions, remittances)

Non-profit institutions serving households (only in original S

Enterprises

Government

Table 4. Simulation scenarios

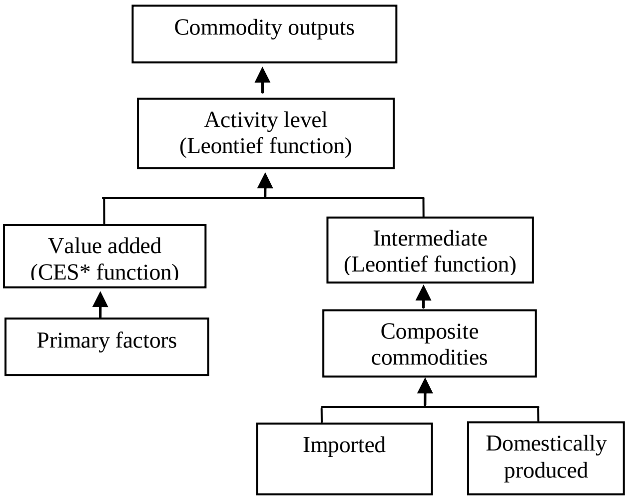
	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Environmental taxes (fish, energy and water)	x	x	x	x	x
Recycling alternatives:					
- Decreasing the value added tax (VAT) rate	x				
- Decreasing the VAT rate on food only		x			
- Subsidising unskilled labour			x		
- Increasing (general) transfers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

Table 5. Simulation results

Percentage change, compared with base case	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Environmental effects					
Consumption of petroleum products	-0,98	-1,05	1,23	-0,85	-1,06
Consumption of water	0,11	0,09	1,61	0,00	-0,1
Effects on gross domestic product (GDP), employment and income					
Real GDP	0,19	0,14	1,38	-0,03	-0,04
Employment of unskilled labour	0,46	0,32	3,91	-0,08	-0,10
Change in real income					
Higher-income households	0,61	0,35	1,92	0,06	-0,57
Urban wage and salary earners	0,65	0,38	2,07	0,23	-0,39
Urban business income	0,22	-0,05	1,16	-1,06	-1,82
Rural agriculture and business income	0,69	0,59	1,31	-0,31	-0,97
Lower-income households	0,36	0,23	1,43	2,24	3,94
Urban – Other income	0,06	-0,12	0,98	0,21	0,91
Rural wage and salary earners	0,49	0,22	1,89	0,53	1,22
Rural – Other income	0,31	0,36	1,04	4,82	8,00

In comparison, the turnover of the reform amounts to some 1.5% of GDP.

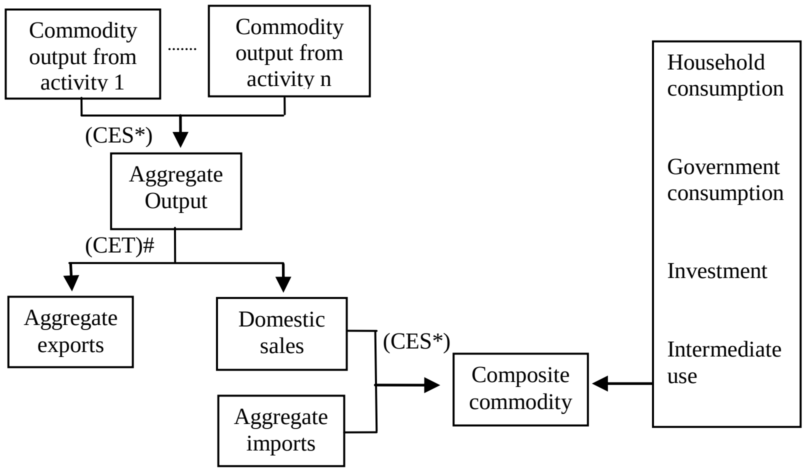
Figure 1. Production technology



Source: Löfgren et al. (2002)

* Constant elasticity of substitution

Figure 2. Market flow of commodities



Source: Löfgren et al. (2002)

* Constant elasticity of substitution

Constant elasticity of transformation

[1] *Tourism* is not a separate category in the national accounts, so the exact share of the natural-resource-based sectors is impossible to determine. However, as can be seen in Table 1, agriculture, fishing, food processing, mining, and hotels and restaurants (most of which are dependent on tourism) account for some 30% altogether; some of the other service activities also depend on tourism for at least a portion of their revenue.

[2] SACU member countries are Botswana, Lesotho, Namibia, South Africa 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 the smaller countries, such as Namibia, there is no direct link between overall imports and SACU revenue; the SACU revenue acts as a lump sum transfer from South Africa. This sum is substantially higher than the actual SACU tariffs collected on Namibian imports. According to a 2004 SACU agreement, the current system for revenue-sharing will be changed into a less favourable distribution for Namibia in the near future.

[3] The linear expenditure system contains the first-order conditions resulting from the maximisation 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.

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

[5] This CES function – or *Armington function* – is used to prevent unrealistic import and export responses to policy changes as it allows for some independence of the domestic price system in comparison with the international one.

[6] 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.

[7] 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. (2006a, 2006b).

[8] In many countries, the same problem would apply to the income of self-employed fishermen; however, the Namibian fishing sector almost exclusively consists of large-scale fishing firms, so the problem does not arise here.

[9] 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, we have simulated a variant of the model where a guesstimated tax level in the *Hotel and restaurant sector* (an important tourism sector) is introduced. However, this extension did not affect the results qualitatively and is not reported here.

[10] The Namibian fisheries accounts are based on the United Nations System of Integrated Environmental and Economic Accounts (SEEA). See Lange (2003, 2004) for a detailed description of the methodology for fish resource rent calculations.

[11] See Lange (2006). While urban households in general pay more than the actual private cost of providing water, poor rural households are subsidised. 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.

[12] 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 is of minor importance, as the effects of a removal of subsidies or an introduction of a tax of equal size would be the same.

[13] See e.g. Stage & Fleermuys (2001) for a discussion of Namibian energy statistics.

[14] The tax is levied on industrial use as well as household consumption of petroleum products. As Namibia does not produce any petroleum products domestically, the problem of energy losses from converting coal to petroleum does not arise. This problem is the main reason why emissions should be taxed at the point of combustion rather than consumption.

[15] N$1 = US$0.1525 on average during 2004.

[16] We also simulated lower taxes capturing 30% and 50% of total rents, respectively. This affected the overall size of the impacts but did not affect the results qualitatively, and the results are not reported here.