TRACING THE SECOND DIVIDEND IN ENVIRONMENTAL POLICIES: A CGE APPLICATION TO TURKEY

A Master's Thesis

by
BENGİSU VURAL

Department of
Economics
Bilkent University
Ankara
February 2009

TRACING THE SECOND DIVIDEND IN ENVIRONMENTAL POLICIES: A CGE APPLICATION TO TURKEY

The Institute of Economics and Social Sciences
of
Bilkent University

by

BENGİSU VURAL

In Partial Fulfillment of the Requirements for the Degree of
MASTER OF ARTS

in

THE DEPARTMENT OF ECONOMICS
BİLKENT UNIVERSITY
ANKARA

February 2009

I certify that I have read this thesis and have found that it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Arts in Economics.

Asst. Prof. Selin Sayek Böke
Supervisor

I certify that I have read this thesis and have found that it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Arts in Economics.

Prof. Erinç Yeldan
Examining Committee Member

I certify that I have read this thesis and have found that it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Arts in Economics.

Asst. Prof. Ebru Voyvoda
Examining Committee Member

Approval of the Institute of Economics and Social Sciences

Prof. Erdal Erel
Director

ABSTRACT

TRACING THE SECOND DIVIDEND IN ENVIRONMENTAL POLICIES:
A CGE APPLICATION TO TURKEY

Vural, Bengisu

M.A., Department of Economics
Supervisor: Asst. Prof. Selin Sayek Böke

February 2009

As the threat of global warming is becoming more evident, the governments are called for a joint action to reduce the greenhouse gas emissions and prevent climate change, by the Intergovernmental Panel on Climate Change and its legally binding successor, the Kyoto Protocol. The inevitability of environmental policy implementation in such a context has focused the recent energy-environment-economy literature on the examination of costs related with those policy measures and the possibility of a double dividend, i.e. economic improvements along with environmental benefits. This study, by making use of a ten sector CGE model for Turkey, searches for the second dividend in the presence of environmental taxation by payroll tax reductions. The results indicate that it is possible to achieve emission reductions with no additional burden on the economy if the environmental taxes are accompanied by a reduction in payroll taxes.

Keywords: Double Dividend, Environmental Policy, CGE Modeling

ÖZET

ÇEVRE POLİTİKALARININ İKİNCİ GETİRİSİ: TÜRKİYE İÇİN BİR HGD UYGULAMASI

Vural, Bengisu

Yüksek Lisanas, Ekonomi Bölümü
Tez Yöneticisi: Doç. Dr. Selin Sayek Böke

Şubat 2009

Küresel ısınmanın son yıllarda daha da belirgin hale gelmesiyle birlikte, Hükümetlerarası İklim Değişikliği Paneli ve onun kanunen bağlayıcı takipçisi olan Kyoto Protokolü, hükümetleri, sera gazı salımlarının azaltılması ve iklim değişikliği konusunda önlem alınması amacıyla ortak hareket etmeye davet etmiştir. Bu çerçevede, çevre politikalarının uygulamaya konmasının kaçınılmaz hale gelmesiyle birlikte, son dönemdeki enerji-çevre-ekonomi modelleri bu politikaların maliyetleri ve muhtemel ikinci getirileri, yani çevresel iyileşmeyle birlikte ekonomik iyileşme olasılığı üzerine yoğunlaşmıştır. Bu çalışma, Türkiye için on sektörlü bir HGD modeli kullanarak, çevre vergisi uygulanması durumunda gelir vergisi indirimleriyle ikinci getirinin elde edilip edilemeyeceğini incelemektedir. Sonuçlar, çevre vergilerinin gelir vergilerinde indirimlerle birlikte uygulanması durumunda, ekonomiye ek bir yük getirmeden salım azaltımının mümkün olduğunu göstermektedir.

Anahtar Kelimeler: Çifte Getiri, Çevre Politikası, HGD Modellemesi

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

The rising concern of the climate change due to increasing levels of Greenhouse Gas (GHG) emissions with direct link to rapid industrialization by the enhancement of the production technologies has been a growing concern for the last three decades. It has taken the center stage in the design of policies, addressing the problem of environmental preservation and sustainable development, since the late 1980s. Although, the recognition of the possible link between carbon dioxide (CO_2) accumulation in the atmosphere and the climate change by the academia dates back as far as 1896 (Arrhenius, 1896), it took an increase in the frequency of occurrence of extreme weather conditions in the last 20-25 years, for people to conceive the severity of the problem.

The figures in the assessment reports of the Intergovernmental Panel on Climate Change (IPCC) confirmed the accelerated degradation in environmental indicators. In the IPCC 4^{th} Assessment Report (2007a) the annual average growth rate of CO_2 concentration was reported to be larger for the last decade (1995-2005) of the period for which continuous direct atmospheric measurements are available, than

the average of the whole period (1960-2005).[1] The rising global surface temperature also indicates an accelerated climate change in recent years. Eleven of the last twelve years (1995-2006) are ranked among the twelve warmest years during the period for which the global surface temperature records are kept, that is since 1850 (IPCC, 2007b). Global warming is so evident that, in order to keep up with the pace, the 100-year (1901 to 2000) warming trend of 0.6°C given in the IPCC 3rd Assessment Report, is updated to 0.74°C of 100-year (1906 to 2005) warming trend in the 4th Assessment Report. Linked to higher average surface temperatures, global sea level is also rising faster for the period 1993-2003, when compared to the average raise of the period 1961-2003. Even though it is not yet clear if these figures reflect a long term trend or a decadal variability[2], it is very likely[3] that it is not due to known natural causes alone (IPCC, 2007b). There are external factors in force and if these external factors are not brought under control, their effects will be drastic on health, industry, settlement and society[4].

In 1979, 1st World Climate Conference called for attention of governments on the issue of climate change, underlining the link between long-term dependencies on fossil fuels as an energy source and CO_2 accumulation in the atmosphere. Although there were numerous studies conducted on the causes and effects of accumulated emissions, decreasing the level of anthropogenic (derived from human activities)

[1] For the period 1995-2005, the average annual CO_2 concentration scores 1.9 parts per million (ppm) per year, whereas the figure for the period 1960-2005 (the period for which the continuous atmospheric measurement is available) is 1.4 ppm per year on average (IPCC, 2007b).
[2] For more on the uncertainties about the indicators and the effects of climate change, Wilcoxen (2002)
[3] In the UNFCCC documents the term "very likely" is used to indicate the assessed likelihood of an outcome which is greater than 90%.
[4] A study on the extensive effects of global warming is presented in the 2nd working group report of the 4th Assessment Report (IPCC, 2007c).

GHG emissions was not among the policy objectives of many of the governments until the signing of the United Nations Framework Convention on Climate Change (UNFCCC) in 1994. The only legally binding successor of the Convention, Kyoto Protocol, became effective in 2005 covering 160 countries which have agreed on taking policy measures to decrease emissions during the period 2008-2012. Now, the commitment period of the Protocol is here with an approaching deadline, yet the results are not promising[5]. Thus, the institutional design for the post-2012 period is the new agenda in the climate change debate[6].

The pressure on governments to take stringent measures at the international level has brought forth the investigation of costs related with such measures and ways to mitigate them. The literature has opposing views in this context. In the early literature the focus is mainly on the presence of excess benefit attached to taxation of externality-creating activities (Tullock, 1967; Terkla, 1984; Lee and Misiolek, 1986). In the early-90s the term "double-dividend" was introduced to the literature (Pearce, 1991) capturing the second dividend (the excess benefit) by recycling the environmental tax revenues through reduction in existing taxes (Oates, 1991; Porterba, 1993). Decomposing the effects of environmental taxation into two groups, namely tax interaction and revenue recycling effects, a line of papers (by Goulder, Parry, Bovenberg and other co-authors) have suggested that the distortion caused by the environmental taxes are large, preventing the realization of the double dividend.

[5]A note released by the UNFCCC Secretariat on the national GHG inventories of the Parties for the period 1990-2006 reveals that although a decrease of 4.7% is achieved by the Annex I Parties for the whole period, between 2000-2006 GHG emissions has increased by 2.3% for the same group. For Annex I Parties with economies in transition this figure is a 7.4 % increase.

[6] For a detailed discussion on the deficiencies in the present Kyoto system and for an offer of an alternative mechanism see McKibbin and Wilcoxen (2008).

Although there are numerous economic models investigating the presence of double dividend, the studies are scarce for the Turkish case. This study aims at filling this gap and examines not only the effects of environmental taxes but also the effects of reductions in already existing labor taxes, on the economy. Through the deployment of a CGE model which is based on the 2002 data, I try to investigate the conditions for the possibility of sustainable environment in a sustainable economy. The environmental tax is imposed on two levels (on the use of energy sources in production and on the final consumption of these energy sources) in different experiments and then the effects of different levels of labor tax reductions are compared with the results of the case of sole environmental tax. At the final stage, energy sources are taxed on both levels (use in production and final consumption) and again effects of labor tax reductions are considered.

Taxing the use of energy sources at the production stage seems to be a more effective alternative in terms of emission reductions, rather than taxing the final use of these sources. Even though this policy yields desirable results for the objective of reduced emissions, imposing energy taxes is associated with adverse effects on the overall economy (GDP losses and rising unemployment rates). It is possible to ease these adverse effects through reductions in the payroll tax rates. Each percentage point reduction in the payroll tax raises the level of economic activity, yet manages to decrease the emissions compared to the base path of the economy. The economy pursues a similar path to the case of sole energy tax levy, when a mixed tax scheme is utilized (taxing the energy use at both production and final consumption stages). Again, the adverse effects of the tax mix can be eliminated through payroll tax

deduction at the expense of a slight increase in the emission figures compared to the case of no deduction.

Thus to restate, this thesis elaborates on the algebraic structure of the employed CGE model and reports on the results achieved under different tax schemes. The plan of the thesis is as follows: Chapter 2 gives a brief review of the literature on double dividend theory and testing it through CGE models, as well as the literature on the Turkish economy. In Chapter 3 the CGE model used in this study is detailed and the data input of the model is laid out in Chapter 4. The base-run ("business-as -usual") path of the economy and the discussion of the experiment results in relation to the base-run are presented in Chapter 5. Finally, Chapter 6 concludes.

CHAPTER 2

LITERATURE REVIEW

The use of taxes to correct the problem of externalities was first introduced by Pigou in 1920. He offered to use a tax rate which is equal to the marginal social cost of the externality (rather than taking only the private costs into account) so that the agents would internalize the costs of their actions imposed on the society as well. Later on, this tax scheme was named a Pigouvian tax scheme in his honor. Although seemed appealing, in the sense that it offers an alternative use of the taxes (apart from raising government revenue), there was much more to the subject that needed further attention.

In the case of global warming, following the recognition of Pigouvian taxes (where the optimal tax rate equals marginal environmental damage) as a means to reduce emissions, the focus of the studies have turned to the costs and benefits of employing such taxes, and alternative uses of tax revenues to reduce the costs related with the introduction of environmental taxes into the system, if there are any. Consequently, the “Double Dividend Theory” emerged.

Here, we first look at the evolution of the double dividend theory and its application through CGE models. Then, we direct our attention to the studies done so far on the Turkish economy regarding the environmental policies together with the pursuit for a double dividend.

2.1. The Evolution of the Double Dividend Theory

While the dominance of the view which underlines the excess burden that distortionary taxes impose, was slowly overthrown by the supporters of the idea that a system of taxes on certain types of activities (which create externalities) moves the economy towards a more optimal point; Tullock (1967) was the first to recognize the implication of excess benefits attached to environmental taxes. Comparing the legal restrictions on polluting activities to creating a disincentive mechanism by taxation, he argues that the latter not only yields environmental results but also the tax revenues create an excess benefit.

Supporting Tullock's idea, Terkla (1984) and Lee and Misiolek (1986) were among the first to estimate the revenues from an environmental taxation substituting the general taxation which creates excess burden. Terkla (1984), basing his study on the estimated marginal welfare costs of existing taxes (labor and corporate taxes) in the literature, calculated the efficiency values in case of labor tax and corporate tax deductions. Assuming that each dollar of environmental tax revenues will substitute a dollar of the existing labor taxes, his calculations shows that the efficiency value of

the environmental tax revenues range from 630 million to 3.05 billion US dollars. These figures rise to 1 to 4.87 billion US dollars if the revenues are substituted for corporate income taxes. Lee and Misiolek (1986), also taking the non-environmental benefits generated by the environmental taxes into consideration, investigate the importance of these benefits for the design of an efficient pollution tax. They conclude that, the efficient pollution tax may be higher or lower than the Pigouvian level (which is conceived as the optimal), as a consequence of tax substitution.

Pearce (1991) was the first to pronounce the term "double dividend" to refer to the process of governments using the pollution tax revenues to finance reductions in incentive-distorting taxes. Pearce recognized what others have overlooked until then: pollution taxes themselves may have efficiency costs that need to be opposed gains from reduced externalities. In line with his work, Oates (1991) and Porterba (1993) have emphasized the recycling pollution tax revenues through reducing the existing taxes to avoid some of the excess burden associated with these taxes.

The criticism of the double-dividend theory arrived during mid 90s. Goulder (1995) distinguishes between different forms[7] of double dividend and introduces the revenue recycling and the tax interaction effects to the double-dividend studies. Goulder, Parry and Burtraw (1996), building their argument on this work, investigate the choice between revenue-raising instruments and non-revenue-raising instruments for environmental protection in a second-best setting. Weighing the tax-interaction

[7] According to Goulder (1995), double dividend may occur in three forms: a weak form, an intermediate form and a strong form. In the weak form, there is cost saving from recycling the pollution tax revenues through reductions in the distorting taxes, instead of transferring the tax revenues in a lump-sum manner. In the intermediate form, it is possible that the excess burden attached to some existing tax is so great that, a revenue-neutral substitution of pollution tax for this tax is costless or even associated with a negative cost. And finally, the strong form states that the substitution of pollution tax for a typical distortionary tax involves zero or negative gross cost.

and revenue recycling effects of the pollution taxes, they say that the interactions of these taxes with the pre-existing taxes influence the cost of regulation. Their conclusion is that, in order for the environmental taxes to generate efficiency improvements[8] they have to exploit the revenue recycling effect, i.e. environmental tax revenue should be recycled within the economy through marginal tax cuts rather than lump-sum returns. Following this work, the distortionary effects of pollution taxes were brought to attention by Bovenberg, Goulder and Parry and other co-authors (Bovenberg and de Mooij, 1994; Bovenberg and van der Ploeg, 1994; Parry, 1995; Parry and Oates, 1998; Parry, Williams and Goulder, 1999). Making the connection between rising production costs due to pollution taxes, higher prices of consumption goods, falling real wages and decreasing labor supply, they argue that the environmental taxes compound the distortions caused by the pre-existing taxes in labor markets (tax interaction effect). They point out that, usually this negative tax interaction effect on labor supply is large enough to outweigh any positive effects that revenue recycling through cuts in labor tax might have on labor supply.

Building on these grounds there are various studies addressing the double dividend issue through various models (partial equilibrium, computable general equilibrium, macroeconomic, input-output, etc.). Bosquet (2000) surveys 139 simulations from 56 of these studies and provides the big picture in double dividend. The studies under his examination reveal that, the literature of the literally so-called second dividend makes a distinction in terms of welfare (used in the theoretical studies) and employment (used in numerical models) which is a more concrete and

[8] Efficiency improvement is measured as a positive net benefit from the introduction of environmental taxes. Net benefit is basically calculated as the difference between the gross social benefit from the reduction in pollution and the cost of pollution abatement.

measurable concept. The results under welfare and employment measures do not necessarily coincide thus, "an employment double dividend might be achieved without a welfare dividend." Bosquet (2000: 24) lists the driving factors of the results of the models as: the labor market setting, type of the model, mode of recycling and time horizon of the simulations. He identifies that models with more flexible labor markets which recycle the pollution tax revenues through reductions in labor costs and runs for a short to medium time period (up to 10 periods) tend to yield more positive results (supporting the existence of double-dividend) than the others, macroeconomic models returning more positive results than general equilibrium models, in general.[9]

A more recent study on the UK's climate change levy through a CGE model under different labor market settings is presented by Allan et al. (2007), which also surveys the studies employing CGE models in the scope of double-dividend. They also draw attention to different findings of these models. Some papers find support for a double-dividend whereas others find no evidence or a mixed response depending on the characteristics of the model economy, again, the setting of the labor market playing the leading role. Also, how the pollution taxes are devised (whether they are levied on energy use or on sectoral emissions; on which energy source or on which pollutants) differs a lot between the models, making it hard to compare the results of different studies.

[9] Bosquet (2000) also looks at the application of environmental levies in different countries and overviews the results from ex-post evaluation studies.

2.2. The Search for Double-Dividend in Turkey

Turkey's growing energy demand as a developing country puts the energy related pollution emissions in the focus of number of studies (Plinke et al., 1990; Demirbaş, 2003; Taşdemiroğlu, 2003; Kaygusuz and Kaygusuz, 2004). But the literature on the economic linkage of these energy-environment models in the Turkish context is limited. One attempt to analyze the economic impacts of taxing emissions through a general equilibrium model is presented in Arıkan and Kumbaroğlu (2001). They base their research on Turkey's NO_x and SO_2 emissions for the period 1995-2025, where the NO_x emissions remain under the EU limits but the SO_2 emissions reach four-fold of its limits. They conclude that, a tax on the SO_2 emissions is more effective than a tax on the SO_2 content of the fuels in terms of reducing emissions, through not only decreased consumption of the sulphur-rich solid fuels but also through induced abatement investments. Although laying out the consequences of the environmental policies in the Turkish framework, the model fails to recognize a sectoral decomposition, thus the inter-sectoral interaction is not captured.

The missing sectoral detail is introduced to the model in Kumbaroğlu (2003) with the recognition of four sectors (transport, manufacturing, basic industries and services). This model discusses the presence of double dividend through a welfare approach. Again, focusing on NO_x and SO_2 emissions, arrive at the conclusion that double dividend is possible even if the environmental tax revenues are not recycled, if the main emission sources are the imported fuels.

Another energy-environment-economy CGE model devised for Turkey is presented in Telli, Voyvoda and Yeldan (2008). Taking the measures set forth by the Kyoto Protocol to achieve emission reductions as the starting point, the study examines the .economic effects of emission quotas, emission taxes and abatement investments. They conclude that, even though these measures accomplish to reduce emissions, they impose a big burden on the economy in terms of GDP losses and rising unemployment rates.

In this study, I pick up from the statement:

> Results suggest that a proper mix of environmental taxation should be accompanied with reductions in labor taxes… Such a policy mix seems to be a superior policy in achieving both CO_2 abatement targets and maintaining employment rates across sectors (Telli et al., 2008: 338).

Then, I search for the second dividend of the environmental taxing schemes, first dividend being the decreased emissions. Double dividend is measured as the reduction in the unemployment rates, unlike Kumbaroğlu (2003), where welfare is taken to be the measure. Following chapter presents the algebraic structure of the model in detail

CHAPTER 3

THE MODEL

In order to search for the elements and characteristics of a possible “double dividend” in the Turkish economy a CGE model is used. The model employed in this study is very much in line with the environmental model used in Telli, Voyvoda and Yeldan (2008).

The model accounts for 10 aggregated sectors of the economy; Agriculture (AG), Coal Mining (CO), Paper Production (PA), Petroleum and Gas (PG), Refined Petroleum (RP), Electricity Production (EL), Iron and Steel Production (IS), Cement Production (CE), Transportation (TR), Other Economy (OE). The significance of the sector selection is such that; 4 of these sectors are recognized as the energy sectors (CO, PG, EL and RP), remaining 5 disaggregated sectors (AG, IS, CE, TR and PA) are polluting sectors and OE is the aggregation of other non-specified sectors. The mapping of the sectoral aggregation is further documented in Appendix A.

Economic agents recognized in the model are households (consumers), enterprises (producers), social security institutions and central government. Labor,

capital, energy composite (composed of coal, petroleum and gas and electricity) and the intermediate inputs from the remaining sectors are specified as the primary factors of production.

The base-run of the model is characterized by an annual GDP growth rate of 4.5-5.0 and an average unemployment rate around 10-10.5%. Dynamics of the model is given by exogenous total factor productivity and population growth.

3.1. Production Function Specification

The production activity in this model economy takes place at two stages: at the first stage of production, the energy composite for each sector is formed through a constant elasticity of substitution (CES) function where primary energy inputs (CO, PG and EL) are used[10].

$$ENG_i = AE_i \left[BCO_i ID_{CO,i}^{-\rho e_i} + BPG_i ID_{PG,i}^{-\rho e_i} + BEL_i ID_{EL,i}^{-\rho e_i} \right]^{-1/\rho e_i} \quad (1)$$

In this function AE_i denotes the technology parameter, where BCO_i, BPG_i and BEL_i represent the shares of coal, petroleum and gas and electricity respectively in the energy composite.

[10] A selection of energy-environment-economy models making use of two staged production functions (using electricity and fossil fuels to produce a energy composite at the first stage) is: Felder and Neiuwkoop, 1996; Welsch, 1996; Kemfert and Welsch, 2000; Kumbaroğlu, 2003; Telli et. al.,2008.

Each sector solves its own cost minimization problem in order to determine the demand for the primary energy inputs. Thus, the set up of the problem is:

Min

$$PEG_i ENG_i = [(1 + CO_2 tN_{CO}) PC_{CO} ID_{CO,i} + (1 + CO_2 tN_{PG}) PC_{PG} ID_{PG,i} + (1 + CO_2 tN_{EL}) PC_{EL} ID_{EL,i}] \quad (2)$$

subject to

$$ENG_i = AE_i \left[BCO_i ID_{CO,i}^{-\rho e_i} + BPG_i ID_{PG,i}^{-\rho e_i} + BEL_i ID_{EL,i}^{-\rho e_i} \right]^{-1/\rho e_i} \quad (3)$$

Then, the first order conditions revealing the sectoral demands for primary energy inputs are:

$$\frac{ID_{CO,i}}{ENG_i} = \left[\frac{BCO_i PEG_i}{AE_i^{-pe_i} (1 + CO_2 tN_{CO}) PC_{CO}} \right]^{1/(1+\rho e_i)} \quad (4)$$

$$\frac{ID_{PG,i}}{ENG_i} = \left[\frac{BPG_i PEG_i}{AE_i^{-pe_i} (1 + CO_2 tN_{PG}) PC_{PG}} \right]^{1/(1+\rho e_i)} \quad (5)$$

$$\frac{ID_{EL,i}}{ENG_i} = \left[\frac{BEL_i PEG_i}{AE_i^{-pe_i} (1 + CO_2 tN_{EL}) PC_{EL}} \right]^{1/(1+\rho e_i)} \quad (6)$$

At the second stage, gross output is produced through a Cobb-Douglas production function using labor, capital, energy composite of the primary energy sources (as defined above) and the other intermediate inputs:

$$XS_i = AX_i \left[K_i^{\lambda_{K,i}} L_i^{\lambda_{L,i}} \left(\prod_j ID_{j,i}^{\lambda_{ID,j,i}} \right) ENG_i^{\lambda_{E,i}} \right] \quad (7)$$

i = AG, CO, PG, RP, EL, CE, PA, IS, TR, OE
j = AG, RP, CE, PA, IS, TR, OE

Here, parameter AX_i governs the given state of the production technology, and parameters $\lambda_{K,i}$, $\lambda_{L,i}$, $\lambda_{IDj,i}$ and $\lambda_{E,i}$ determine the shares of capital, labor, each intermediate input other than the primary energy sources and energy composite, respectively. The sum of the shares of these factors of production is equal to unity, following the constant returns to scale (CRS) assumption:

$$\lambda_{K,i} + \lambda_{L,i} + \sum_{\mathrm{j}} \lambda_{IDj,i} + \lambda_{E,i} = 1 \tag{8}$$

At this stage of production for each sector profit maximization problem is solved and sectoral demands for production factors are determined accordingly. So maximization problem solved by the producer is:

Max

$$\pi = \left(1 - t_{Prod,i}\right) PX_i XS_i - (1 - pyrltax)\overline{w} L_i^D - \sum_j \left(1 + CO_2 tN_j\right) PC_j ID_{j,i} - r\, K_i - PEG_i ENG_i \tag{9}$$

subject to

$$XS_i = AX_i \left[K_i^{\lambda_{K,i}} L_i^{\lambda_{L,i}} \left(\prod_j ID_{j,i}^{\lambda_{ID,j,i}} \right) ENG_i^{\lambda_{E,i}} \right] \tag{10}$$

First order conditions of this profit maximization problem revealing the sectoral demands for factors of production are:

$$rK_i = \lambda_{K,i}(1 - t_{\mathrm{Prod},i}) PX_i XS_i \tag{11}$$

$$(1 + pyrltax)\overline{w} L_i^D = \lambda_{L,i}(1 - t_{\mathrm{Prod},i}) PX_i XS_i \tag{12}$$

$$(1 + CO_2 tN_j) PC_j ID_{j,i} = \lambda_{IDj,i}(1 - t_{\mathrm{Prod},i}) PX_i XS_i \tag{13}$$

$$PEG_i ENG_i = \lambda_{E,i}(1 - t_{\mathrm{Prod},i}) PX_i XS_i \tag{14}$$

3.2. Emission Specifications

The model recognizes three different sources of CO_2 emissions. One source is the emissions from energy use of the sectors. Emissions from energy usage stems not only from the use of primary energy sources (CO and PG) but also from the use of secondary energy source (RP). The emissions are calculated as a calibrated share of the intermediate use of the primary and secondary energy inputs in each sector.

$$CO_2EM_{j,i}^{PRM} = \varpi_{j,i}\ ID_{j,i} \qquad j = CO, PG \tag{15}$$

$$CO_2EM_{j,i}^{SEC} = \bar{\varepsilon}_{j,i}\ ID_{j,i} \qquad j = RP \tag{16}$$

And the total CO_2 emission due to energy usage is:

$$TOTCO_2ENG = \sum_i \left[\sum_j \left(CO_2EM_{j,i}^{PRM} + CO_2EM_{j,i}^{SEC} \right) \right] \tag{17}$$

The second source of CO_2 emission is the industrial processes. The emissions from industrial processes are assumed to depend on the level of gross output.

$$CO_2EM_i^{IND} = \bar{\delta}_i XS_i \tag{18}$$

And the total emission in the economy due to industrial process is:

$$TOTCO_2IND = \sum_i CO_2EM_i^{IND} \tag{19}$$

Third and the last source of CO_2 emission is due to energy consumption of the households and it is assumed to be proportional to private consumption demand for primary and secondary energy sources. Although one would expect the energy

use of the households to include coal, petroleum and gas and refined petroleum, the data suggests that there is zero consumption of petroleum and gas by the private agents. Thus, in this study only the consumption of coal and refined petroleum is recognized as the sources of CO_2 emissions from household activities.

$$CO_2HH_i = \overline{\psi}_i CD_i \qquad i = CO, RP \tag{20}$$

Total emission due to energy usage of households is basically:

$$TOTCO_2HH = \sum_i \overline{\psi}_i CD_i \tag{21}$$

So, the total CO_2 emission in the economy is the sum of these three distinguished sources of emissions:

$$TOTCO_2 = TOTCO_2ENG + TOTCO_2IND + TOTCO_2HH \tag{22}$$

In order to reduce CO_2 emissions environmental tax is devised as a policy tool. The environmental tax is imposed on intermediate input use by the sectors and private consumption demand, addressing directly to the sources of CO_2 emissions.

$$TOTCO_2TAX = \sum_i \sum_j \mathrm{CO_2tN_i} PC_i ID_{i,j} + \sum_i \mathrm{CO_2tC_i} PC_i CD_i \tag{23}$$

3.3. Income Generation and Demand

The income of the household is composed of net labor income and the transfers to the households by enterprises, government, social security institutions and rest of the world (as workers' remittances).

$$YHH = YHWnet + EtrHH + GtrHH + SSItrHH + eROWtrHH \quad (24)$$

Enterprises transfer their net profit (profit net of corporate taxes, transfers abroad, and domestic and foreign debt payments) to households.

$$EtrHH = (1-t_{Corp}) \sum_{i} r K_i - EERPtrROW - NFI^G + GtrEE + r^D DomDebt^G - r^F eForDebt^E + eForBOR^E \quad (25)$$

There is also transfer from the government to the households which is calculated as a share of total government transfers:

$$GtrHH = rtGtrHH\ Gtrans \quad (26)$$

Social security institutions transfers all their revenue, from payroll taxes and social security taxes collected over labor income and the transfers it receives from the government (as a share of total government transfers), to the households.

$$revSSI = (pyrltax + sstax)\overline{w}\sum_i L_i^D \quad (27)$$

$$GtrSSI = rtGtrSSI\ Gtrans \quad (28)$$

$$SSItrHH = revSSI + GtrSSI \quad (29)$$

Out of this household income, private agents pay direct income tax. Thus, the disposable income of the household is net of income tax paid to the government.

$$YHnet = (1-t_{Inc})YHH \quad (30)$$

Households direct a portion of their income to savings and the remaining income is spent on the consumption of goods and services. In the model the total

private consumption demand of the households is disaggregated into sectors through a calibrated share.

$$CD_i = cles_i \frac{PRIVCON}{(1+CO_2tC_i)PC_i} \tag{31}$$

In a similar fashion, government consumption is distributed among sectors through a calibrated share for the public consumption.

$$GCON = gcr\ GREV \tag{32}$$

$$GD_i = gles_i \frac{GCON}{PC_i} \tag{33}$$

The government revenue is the sum of taxes collected on production, sales, foreign trade, income, capital profits, CO_2 emissions and public sector factor income.

$$GREV = \sum_i t_{\mathrm{Prod},i} PX_i XS_i + \sum_i t_{Sal,i} PC_i CC_i + \sum_i tm_i ePW_i^m M_i + \sum_i te_i ePW_i^e E_i$$

$$+ t_{Inc} YHH + t_{Corp} \sum_i rK_i + \sum_i NFI^G + \mathrm{TOTCO}_2\mathrm{TAX} \tag{34}$$

3.4. General Equilibrium

In the commodity markets the equilibrium is sustained through the adjustment of the product prices. In the labor markets, since the nominal wages are fixed in each period, the employment figures adjust.

$$w = \overline{w} \Rightarrow \overline{L}^S - \sum_i L_i^D = UNEMP \tag{35}$$

The market clearing condition for the composite commodity produced by sector *i* is: the production should be equal to the use of the commodity as public and private consumption, public and private investment and intermediate input in the production of other commodities.

$$CC_i = INT_i + CD_i + GD_i + IDP_i + IDG_i \quad (36)$$

Sectoral public and private investment demands are again calculated as (calibrated) shares of total public and private total investment demand.

$$IDP_i = iples_i \frac{PINV}{PC_i} \quad (37)$$

$$IDG_i = igles_i \frac{GINV}{PC_i} \quad (38)$$

The full algebraic structure of the model is further tabulated in Appendix A.

3.5. Dynamics

In order to draw the base-path of the economy for 10 periods, the static model is updated through recursive dynamics. Capital stock is updated with public and private investment expenditures. The depreciation rate for the capital is taken as 10% and a gestation lag of 70% (70% of the investment expenditures reflect in the next period's capital stock) is assumed in order for the first run to match the initial data. Population is updated exogenously which in turn determines the labor supply. Total factor productivity rates are also updated to govern the growth of the economy.

These updating parameters are selected such that the economy displays an annual GDP growth rate around 4.5% - 5.0% and the unemployment rate fluctuates around 10% as it is revealed in the initial data.

CHAPTER 4

THE DATA

CGE models are highly data-intensive tools, making use of various data sources such as the input-output tables, national accounts and household labor force surveys. In this chapter we introduce the Social Accounting Matrix (SAM) and the environmental data utilized in the model.

4.1. Constructing the SAM

The main data source of the model is the Social Accounting Matrix (SAM) which is constructed based on the official 2002 Input-Output (IO) table. This IO table is published by TURKSTAT in March, 2008 and it is the latest available data characterizing the input and output flows of the Turkish economy. Until its publication, the studies were making use of earlier IO tables, the latest of which dates back to 1998. Since the economy had gone through a major economic crisis in year 2001, the structure of the economy and the inter-industrial relationships are expected to be altered. Although, the studies make use of scientific methods, such as RAS, to

move the constructed SAM data to more recent past, none of the techniques would give a more accurate data than the actual data. That is why this study is based on the 2002 IO table and for any other data requirement of the model is met through the 2002 data.

The 2002 IO originally consists of 59 sectors but for the purpose of this paper these sectors are aggregated into 10 sectors. The description of the SAM data is given in Appendix B (Table B.2) and a summary of the 2002 SAM (with no sectoral detail) employed in the model is presented in Table 1. Basically the flows from columns to the rows denote the payments of the columns to the rows. So the column totals equal to the total expenditure of the column, whereas the row totals give the total receipt of the rows. The detailed SAM can also be viewed in Appendix B (Table B.1).

Table 1: 2002 Macro SAM

				Factors						Capital Account			
(2002, billion TL)		Activities	Commodities	*Labor*	*Capital*	Households	Enterprises	Social Sec. Inst.	Government	*Private Investment*	*Public Investment*	ROW	Total Receipts
Activities			503,933,544									79,463,787	583,397,331
Commodities		329,918,519				187,298,916			34,826,624	41,343,416	17,221,307		610,608,782
Factors	*Labor*	99,748,358											99,748,358
	Capital	122,989,992											122,989,992
Households				93,911,422			144,850,910	25,395,730	12,686,902			3,042,297	279,887,261
Enterprises					122,989,992				49,615,228			4,685,324	177,290,544
Social Sec. Inst.		10,721,893		5,836,935					8,836,902				25,395,730
Government		20,018,570	22,524,176			24,217,245	27,954,428						94,714,419
Capital Account	*Private Investment*					41,343,416							41,343,416
	Public Investment					27,027,684			-17,033,473			7,227,096	17,221,307
Rest of the World			84,151,063				4,485,205		5,782,235				94,418,503
Total Expenditures		583,397,331	610,608,783	99,748,358	122,989,992	279,887,261	177,290,544	25,395,730	94,714,418	41,343,416	17,221,307	94,418,504	

4.2. The Environmental Data

In this study CO_2 emissions are taken as an approximation of the total GHG emissions in the economy. The rationale behind this assumption is that the CO_2 emissions make up a big portion of the total GHG emissions. There exist six GHGs that are determined to be the causes of global warming listed in Annex I of Kyoto Protocol: carbon dioxide (CO_2), methane (CH_4), nitrogen oxide (N_2O) and F-Gases (hydrofluorocarbons (HFCs), perflorocarbons (PFCs) and sulphurhexafluoride (SF_6)). According to the GHG emission figures of TURKSTAT, CO_2 emissions constitute 80% of the total emissions on average between years 1990 and 2006 (Table 2). Taking CO_2 emissions as an indicator of the total GHG emissions is, then, a valid assumption.

Table 2: Emission values of GHGs for Turkey, for selected years

	GHG emissions (million tones CO_2 eq.)				**shares in total GHG emissions**			
	1990	**1995**	**2000**	**2002**	**1990**	**1995**	**2000**	**2002**
CO_2	139.59	171.85	223.81	216.43	0.821	0.779	0.799	0.800
CH_4	29.21	42.54	49.27	46.87	0.172	0.193	0.176	0.173
N_20	1.26	6.33	5.74	5.41	0.007	0.029	0.021	0.020
F Gases	0.00	0.00	1.14	1.90	0.000	0.000	0.004	0.007
Total	**170.06**	**220.7**	**280.0**	**270.6**	**1.00**	**1.00**	**1.00**	**1.00**

Source: TURKSTAT.

The sectoral distribution of the 216.43 million tones of CO_2 emissions in 2002 is given in Table 3. As displayed in the table, the major part (91%) of this CO_2 emission is related with energy-fuel combustion, including energy used in electricity production, industry, transportation and other activities, and the remaining portion of the CO_2 emission is through industrial processes.

Table 3: Sectoral distribution of 2002 CO_2 emissions (million tons)

Energy-fuel combustion	197,326
Electricity Production	65,451
Industry	72,017
Transportation	34,418
Other	25,440
Industrial processes	19,107
TOTAL	216,433

Source: TURKSTAT.

Taking above statistics as a starting point, the CO_2 emissions are divided among 10 identified sectors of the Turkish economy. Since the model recognizes three sources of CO_2 emissions (energy combustion, industrial processes and household energy use), the emissions are disaggregated to three levels. First of all, the total CO_2 emitted from energy-fuel combustion is distributed among the 10 sectors of the model such that:

- Figures for emissions from electricity production and transportation are taken directly from Table 4. Emissions identified as "Other" is also taken as the emissions from the energy-fuel use of the rest of the economy (OE).
- For the remaining sectors, the shares in Telli, Voyvoda and Yeldan (2008) are used. Those shares were calculated as shares of the sectors in the total energy demand (for those having the energy demand figures) and the rest is calculated as the shares of the sectors in the total value added.

Table 4: Distribution of energy-fuel combustion related CO_2 emissions to the sectors of the model (2002, million tons)

AG	Agricultural production	4,641
CO	Coal mining	2,575
PG	Petroleum and Gas	1,759
RP	Refined Petroleum	31,727
EL	Electricity production	65,451
CE	Cement Production	6,660
PA	Paper Production	6,022
IS	Iron and Steel Production	18,634
TR	Transportation	34,418
OE	Other Economy	25,440
	TOTAL	197,326

Emission from household energy use is assumed to be equally shared by the use of coal and refined petroleum (10,000 million tones, each). As mentioned before, the 2002 IO table reveals zero consumption of petroleum and gas by the private households. Emissions related with household energy use are included in the "Other Economy" emission figures. So, while constructing the model household emissions are subtracted from OE emissions.

Finally, the distribution of the emissions due to industrial processes is done by weighing the total industrial emissions with the shares of each sector in the total output.

Table 5: Distribution of industrial process related CO_2 emissions to the sectors of the model (2002, million tons)

AG	Agricultural production	1,425
CO	Coal mining	59
PG	Petroleum and Gas	23
RP	Refined Petroleum	165
EL	Electricity production	250
CE	Cement Production	317
PA	Paper Production	461
IS	Iron and Steel Production	573
TR	Transportation	2,090
OE	Other Economy	13,742
	TOTAL	19,107

Table 6: Input-Output flows of the economy (billion TL, 2002 prices)

	Agriculture	Coal	Petroleum and Gas	Paper Products	Refined Petroleum	Cement	Iron and Steel	Electricity Production	Transportation	Other Economy
Agriculture	7,296,542	24	249	13,945	12,494	1,078	861	5,796	24,005	21,628,643
Coal	12,746	23,451	0	1,621	477	146,904	43,953	508,961	2,475	840,003
Petroleum and Gas	109	0	12,715	59,162	4,337,642	99,330	43,915	2,744,661	0	1,124,445
Paper Products	14,125	2,648	280	1,396,601	3,491	228,285	27,372	6,932	49,218	4,643,004
Refined Petroleum	824,700	54,962	2,829	71,610	599,450	297,753	97,101	68,387	3,197,351	3,979,363
Cement	40,974	4,445	1,116	16,935	36,049	1,434,515	455,418	3,205	2,743	7,074,453
Iron and Steel	1,807	41,983	15,996	14,503	51,436	65,773	6,008,158	91,638	323,732	13,180,740
Electricity Production	233,149	70,319	27,476	241,902	64,495	312,640	723,203	7,687,350	81,512	5,612,627
Transportation	763,485	41,785	9,996	258,990	559,363	535,381	763,295	375,095	13,994,613	18,915,515
Other Economy	7,632,200	372,722	119,377	1,762,735	896,466	3,295,675	2,838,468	1,296,541	13,548,493	163,466,362

Source: Compiled from 2002 IO Table.

Looking at the input-output flows of the sectors presented in Table 6 we can arrive at primitive conclusions about the energy-emission linkages of the economy. Electricity production sector constitutes the highest share for the consumption of both primary energy sources (CO and PG). Following electricity production sector, uses of coal by cement and iron and steel sectors are among the highest uses. For the uses of petroleum and gas, refined petroleum and cement sectors follow electricity production sector. When it comes to the use of secondary energy sources (RP), transportation and agriculture sectors constitute the highest demands for refined petroleum.

CHAPTER 5

BUSINESS-AS-USUAL SCENARIO
AND
INVESTIGATION OF ALTERNATIVE POLICY PATHS

As explained in section 3.5., the static model is updated recursively, to characterize a base-run of the economy for 10 periods. For purposes of added realism and comparability each “period” has been taken as “one calendar year” in the model simulations. The dynamics is given to the model by the evolution of the capital stock (with new investment expenditures net of depreciation), by the imposed annual labor supply growth rate (adopted from 2002 household labor force survey, TURKSTAT) and by the total factor productivity growth rate (of around 1% on average) and wage rate (updated by inflation).

The base-run scenario should not be read as the characterization of the Turkish economy for 10 years following 2002 (the base year of the model for which the model parameters are calibrated). Rather the interpretation here should be as that of an economy which displays an annual real GDP growth rate of around 4.5% - 5.0% and an annual unemployment rate of 10% on average.

CO_2 taxes (on intermediate use and final consumption energy sources) are not included in the base-run scenario; they are introduced into the economy during the experiments. The implications of the policy measures taken for the purpose of reducing CO_2 emissions and complementary decrease in already existing tax items (payroll and corporate taxes) are tested against the base-run values.

5.1. Business-as-Usual Scenario

In Figure 1 the base-path of the real GDP is presented. With an average annual growth rate of 4.7% the real GDP figure displays a growth rate of around 60% compared to the base year and reaches to 444,635 billion TL by the end of the period. CO_2 emissions also follow a similar pattern (Figure 2). During the same time period CO_2 emissions grow by 62% compared to the base year (2002), with an annual growth rate of 4.9% on average.

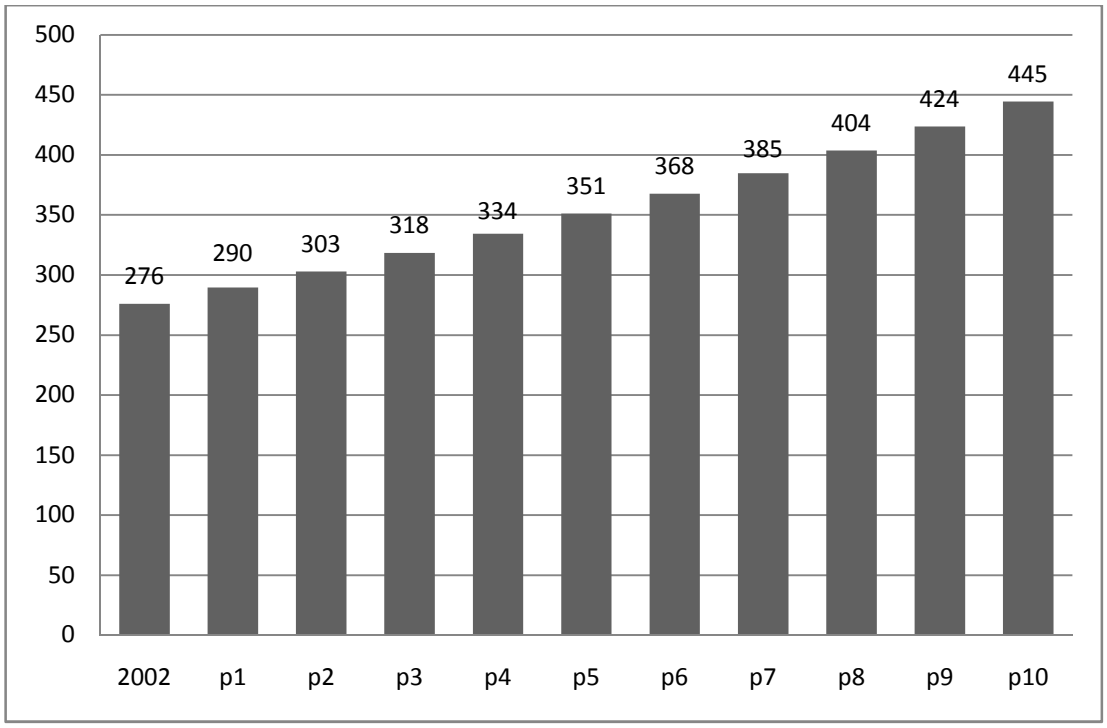

Figure 1: GDP in the base-run (2002 prices, billion TL)

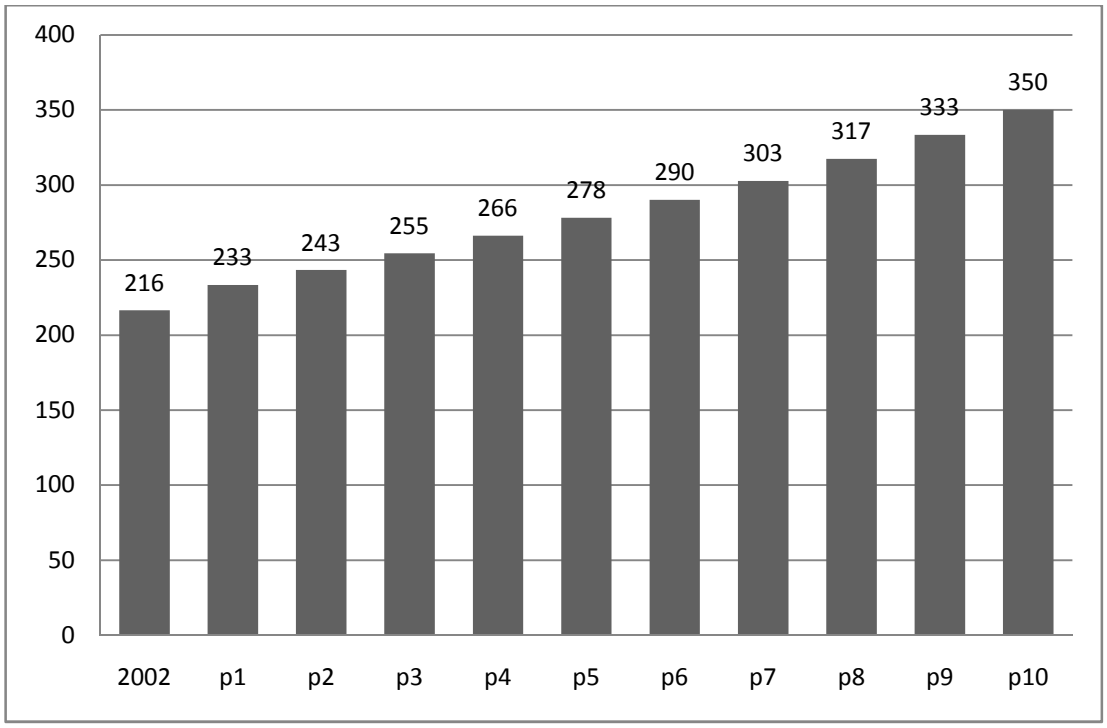

Figure 2: CO_2 emission in the base-run (million tons)

Table 7 presents the sectoral composition of the total CO_2 emissions in the economy from energy use, industrial processes and household energy use. It also

gives the changes in the sectoral CO_2 emissions throughout the base-run. According to these values, CO_2 emission due to paper production (PA) has grown the most (94%) in 10 years, compared to base year, among all other sectors. Rest of the sectors have also shown growth rates well above 47%, cement, electricity production, iron and steel and refined petroleum following the paper production sector regarding the growth potential in sectoral emissions.

Table 7: Sectoral CO_2 emissions in the base-run for selected years (million tons)

	2002	p1	p5	p10
Agriculture	6	6	7	9
Coal	13	13	15	19
Petroleum and Gas	2	2	2	3
Refined Petroleum	42	46	55	69
Electricity Production	66	71	85	108
Cement	7	8	9	12
Paper Products	6	8	10	13
Iron And Steel	19	21	25	31
Transportation	37	39	45	56
Other Economy	19	20	25	31

5.2. Where Does Turkey Stand In The Environmental Issues?

Before turning to the experiment results, I first lay out the Turkey's current stance in the environmental issues both at the international and the national level. Turkey, with its increasing energy demand due to its pace of industrialization as a developing country, has not been able to stabilize its emission levels yet. Some of the problems faced in the course of reducing emissions are: intensive use of low quality, domestic lignite sources; increasing emissions from vehicles; intensive overall

energy use due to low energy efficiency in the industry; inadequate emission measures taken by the power plants (Turkey's National Environmental Action Plan, 1999). Although there does not exist any policy aiming directly at decreasing or controlling emissions in Turkey, there are many legal arrangements which contributes to the GHG emission reduction efforts indirectly. Appendix E gives an extensive list of these regulations, legislations and by-laws.

In the course of the international attempts to reduce emissions, as an OECD member, Turkey joined the UNFCCC but being included in both annexes[11] of the Convention became a matter of controversy. Turkey refused to be listed as an Annex II country, which agrees on the provision of aid to the developing countries in their actions to reduce emission. Upon Turkey's request she was removed from the Annex II list in the 7th Conference of the Parties (COP 7) in 2001, with the recognition of her special circumstances[12] in Annex I (list of countries that are primarily responsible for the reduction of their emissions). Since, Turkey did not ratify the Convention at the beginning, the Kyoto Protocol which quantifies the reduction levels, has never set limits for Turkey's emissions. Even though the emission limits are not set and Turkey is not a part of the Protocol yet, the prospective EU membership of Turkey requires the harmonization of the legal actions taken for the prevention of global warming with the EU legislation, as it does in any other area. Under the Convention, Turkey is obliged to control its GHG

[11] The Convention recognizes the Annex I countries as Parties of the Convention who are has "common but differentiated" responsibilities in reducing the anthropogenic GHG emissions to 1990-levels and preventing global warming, leaving the responsibility of providing developing countries the financial and technical support to the Annex II countries.

[12] Turkey is agreed to benefit from the distinguished rights granted to the transition economies, in the scope of the Convention.

emissions, protect and enhance its carbon sinks, introduce national policies and proper measures for this purpose and report regularly to the UNFCCC Secretariat (Turkey's 9th National Development Plan). In this context, Turkey has submitted its first National Inventory Report in 2006 and first National Communication on Climate Change in 2007.

5.3. What Does The Experiment Results Reveal?

As can be understood from the course of the environmental events laid above, Turkey is soon to introduce environmental policies directly addressing to the emission levels. The questions I am trying to answer in this section are; what would be the costs of employing such environmental policies and if it is possible to overcome these costs, or even create external benefits, through undertaking alternative measures. For this purpose, I first examine the effects of alternative CO_2 taxes (imposed on intermediate use and final consumption of primary energy sources; coal, petroleum and gas and electricity). During this examination, the attention is drawn not only on the changing CO_2 emission levels but also on the changes in GDP level, unemployment rate and the burden of taxation on the overall economy. Introducing energy and consumption taxes on the primary energy goods displays improvements in the emission figures at different levels but they also imply an excess burden on the economy (especially on the labor market, which is under question) with deteriorating indicators (such as falling GDP growth rate and increasing unemployment rate). Thus, further inference is needed to correct for these adverse effects. Therefore, following the exercises of applying energy and

consumption taxes, the already existing taxes on labor (payroll tax) is decreased to see if an ultimate goal of “sustainable environment in a sustainable economy” could be achieved. The devised exercises are summarized below:

I. Experiment 1: Taxing the intermediate use of energy sources in production
    a. Applying 10% and 20% energy tax
    b. Introducing payroll tax deductions
II. Experiment 2: Taxing the final consumption of energy sources
    a. Applying consumption tax
    b. Introducing payroll tax deductions
III. Experiment 3: Taxing both the intermediate use and the final use of the energy sources
    a. Applying the tax mix
    b. Introducing payroll tax deductions

5.3.1. Experiment 1: Energy Tax

First, we levy a tax on the intermediate uses of energy sources on two levels, 10% and 20%. The tax revenues are transferred to the government budget and treated just like any other revenue item; no specific utilization of energy tax revenue is envisaged.

As anticipated, energy taxation is a practical tool in decreasing the emissions in the economy. They inhibit the use of primary energy sources in the production

processes through increased input prices. An energy tax at a rate of 10% is associated with an 11% decrease in CO_2 emissions by the end of the period, compared to the base run, whereas a 20% energy tax manages to decrease emissions by 16% (Figure 3).

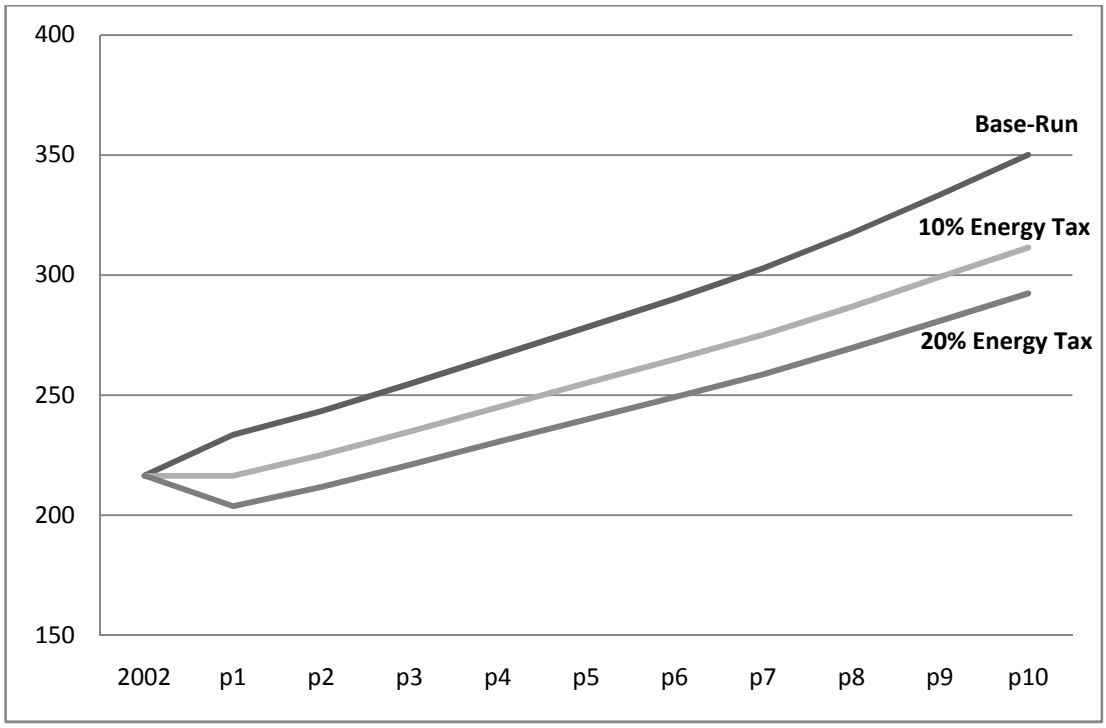

Figure 3: Total CO_2 emissions under alternative energy tax rates (million tons)

If we turn to the sectoral distribution of the emissions and to the rates of contribution of sectors to the emission reductions we see that, petroleum and gas, electricity production and iron and steel industries are among the leading sectors, with an average decrease of 19% and 29% in 10 periods, under a 10% and a 20% energy tax scenarios respectively (Table 8). The decrease in the emissions of petroleum and gas sector stems from the fall in its output due to decreasing demand (caused by the increased prices). The fall in the electricity sector's emissions has two

folds. First, the similar mechanism in the case of petroleum and gas sector is put into effect for the electricity production sector as well; demand for electricity production decreases due to increased prices and in turn the output level decreases. The second fold is that, electricity production constitutes the higher demand for petroleum and gas. With the increasing input prices due to energy taxation, cost of production also increases for electricity sector, leading to a decrease in the output level. Under these two effects, the fall in the output level of electricity sector, with a 28% decrease at the end of 10 periods, is the highest among 10 sectors (Table 9).

Table 8: Changes in the sectoral emission levels under alternative energy tax rates (million tons)

		BASE SCENARIO			10% ENERGY TAX			20% ENERGY TAX		
	2002	p1	p5	p10	p1	p5	p10	p1	p5	p10
AGRICULTURE	6.07	6.22	7.34	9.08	6.15	7.18	8.63	6.09	7.11	8.53
COAL	12.64	13.06	15.08	18.53	12.69	14.48	17.31	12.40	14.12	16.82
PETROLEUM AND GAS	1.78	1.85	2.25	2.86	1.55	1.86	2.31	1.33	1.61	2.00
REFINED PETROLEUM	41.89	45.66	54.58	68.53	43.59	51.51	62.73	41.89	49.47	60.12
ELECTRICITY PRODUCTION	65.71	71.35	85.20	108.25	63.86	75.45	93.16	58.25	68.82	84.85
CEMENT	6.98	7.63	9.21	11.67	7.21	8.61	10.57	6.72	7.94	9.77
PAPER PRODUCTS	6.48	8.02	9.71	12.59	7.28	8.65	10.75	6.87	8.20	10.06
IRON AND STEEL	19.21	20.78	24.80	31.26	16.68	19.68	24.09	13.92	16.40	20.04
TRANSPORTATION	36.51	38.59	45.43	56.22	37.41	43.52	52.26	36.48	42.37	50.73
OTHER ECONOMY	19.18	20.25	24.58	31.08	19.99	24.07	29.64	19.80	23.89	29.49

Table 9: Changes in the sectoral output levels under alternative energy tax rates (billion TL, 2002 prices)

		BASE SCENARIO			10% ENERGY TAX			20% ENERGY TAX		
	2002	p1	p5	p10	p1	p5	p10	p1	p5	p10
AGRICULTURE	43.51	43.95	51.71	63.52	43.80	50.99	60.89	43.75	50.90	60.67
COAL	1.81	1.95	2.17	2.51	1.83	1.99	2.21	1.73	1.87	2.06
PETROLEUM AND GAS	0.70	0.70	0.85	1.07	0.59	0.72	0.89	0.52	0.63	0.78
REFINED PETROLEUM	5.05	5.55	6.79	8.75	5.39	6.53	8.18	5.26	6.38	7.99
ELECTRICITY PRODUCTION	7.64	8.44	10.33	13.51	7.40	8.97	11.41	6.61	8.02	10.20
CEMENT	9.68	10.52	12.97	16.79	10.20	12.46	15.69	9.95	12.17	15.34
PAPER PRODUCTS	14.09	17.78	21.91	29.12	16.29	19.74	25.18	15.18	18.32	23.15
IRON AND STEEL	17.51	19.19	23.31	30.04	14.38	17.28	21.66	11.28	13.56	16.98
TRANSPORTATION	63.83	66.83	79.38	98.88	66.32	77.95	94.38	66.04	77.58	93.79
OTHER ECONOMY	419.57	440.36	538.21	685.02	438.64	532.15	660.17	437.81	532.71	662.84

Although energy taxation seems like a convenient policy tool for achieving emission reductions, it has severe adverse effects on GDP level and unemployment rate. A 10% energy tax decreases GDP level by 3.7%, by the end of the 10 periods. The decrease in GDP level with the imposition of a 20% energy tax also displays a very similar rate; 3.8% of the base-run value (Figure 4).

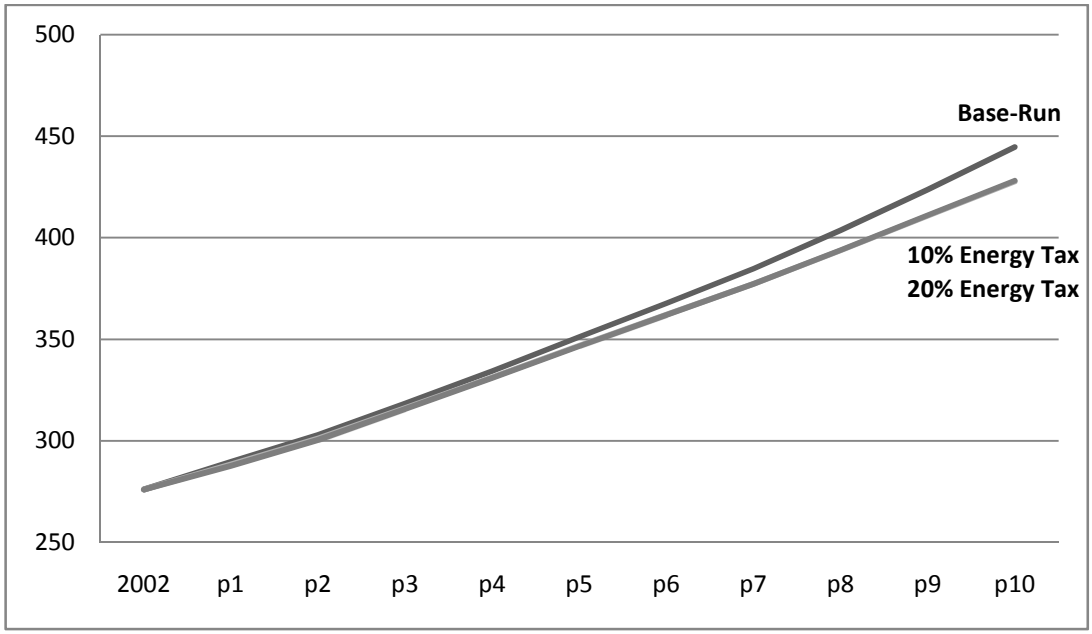

Figure 4: GDP under alternative energy tax rates (2002 prices, billions TL)

In the case of unemployment, 10% energy tax increases the unemployment rate by almost 5 points by the end of the period, whereas under a 20% energy tax, unemployment rate increases by 8 points, compared to the base-run (Figure 5). So the unemployment rate becomes 15% with a 10% energy tax and 18% with a 20% energy tax, which is twice the base-run unemployment rate.

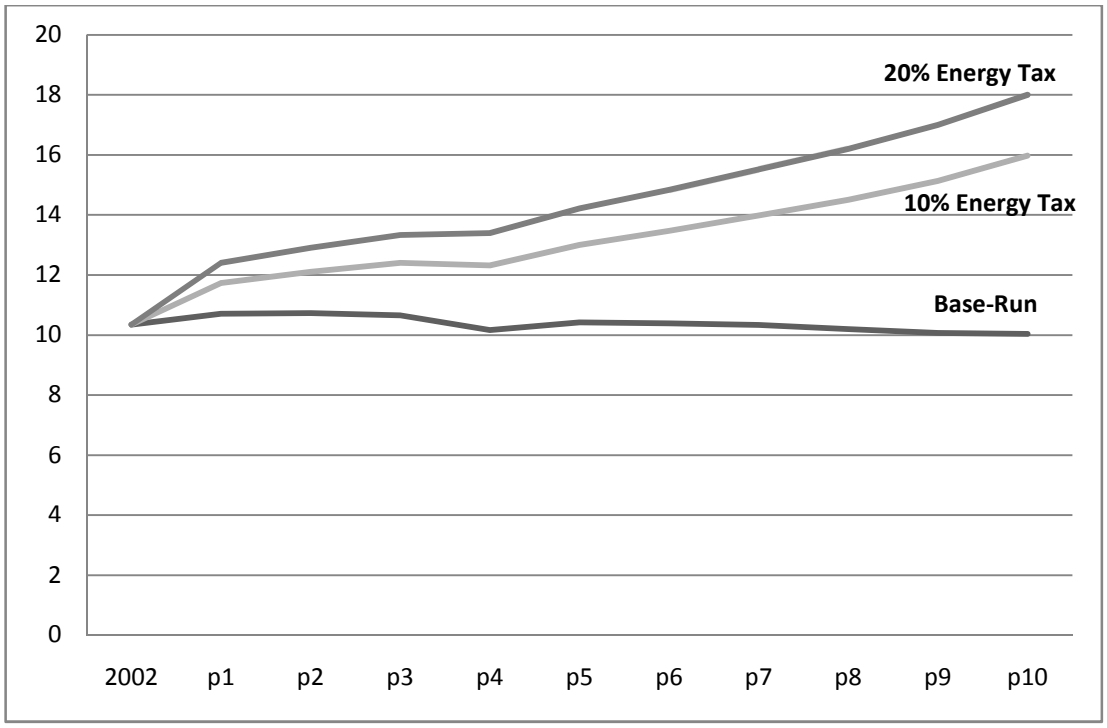

Figure 5: Unemployment rate under alternative energy tax rates (%)

With the imposition of a 10% energy tax, the ratio of government revenues (sum of all taxes except for the payroll taxes on wages and the social security payments) to GDP rises from 33.8% to %34.5 and it is 35.0% in case of a 20% energy tax. But, since the aim of this study is to investigate the effects of decreased payroll and corporate taxes simultaneously with the imposition of CO_2 taxes, the ratio of the total tax revenues (including the payroll taxes and social security payments) to GDP is an appropriate measure to calculate the burden of taxation on the economy. According to this figure, the tax burden increases from 39.8% to 40.4% with a 10% energy tax. A 20% energy tax imposes a 40.8% burden on the economy.

Looking at the changes in the shares of tax revenue items in the aggregate government revenue we see that the payroll tax revenue is decreasing both in

absolute terms and as a share of the government revenue with higher rates of energy tax, compared to the base-run (Table 9). Since the payroll tax rate is not subject to a change (the calibrated rate is 36%), the difference in the payroll tax revenues stems from the deteriorating tax base, i.e. increasing unemployment rate. The setting of the energy tax is such that, the intermediate use of coal, petroleum and gas and electricity is taxed. In this case, although the growth of intermediate demand for these goods slows down with higher rates of energy taxes, the demand still increases in each period in absolute terms. So, the tax base does not erode, resulting in higher energy tax revenues with higher tax rates.

Table 10: Total payroll and energy tax revenues (billion TL, 2002 prices) and their shares in the total tax revenue under alternative energy tax rates

(as of period 10)	**Base Scenario**	**10% Energy Tax**	**20% Energy Tax**
Payroll Tax Revenues	17.14	16.24	16.07
Share of Payroll Tax	9.69%	9.39%	9.19%
Energy Tax Revenues	-	3.31	5.66
Share of Energy Tax	-	1.91%	3.24%

According to the findings summarized above, although a 10% energy tax decreases the CO_2 emissions by 11% by the end of the period, it is also associated with a 3.7% decrease in GDP level and a 15% unemployment rate. And the total taxes revenues in the economy as a share of GDP rises to 40.4% as well. In order to ease these adverse effects while maintaining the decreased CO_2 margins as much as possible, a reduction in payroll tax with alternative levels is introduced in this section.

i. Effects of Reduced Payroll Tax when a 10% Energy Tax is Present

The reduction rates considered here are 1, 2, 3, 5 and 6 percentage point reductions which are employed on top of a 10% energy tax. For each point reduction in payroll tax, its effect on unemployment rates, GDP level, CO_2 emissions and tax burden is examined.

- **Effects on unemployment**

Payroll tax enters into the firm's profit equation (Eq. 9) as a factor increasing the labor cost. This cost, in turn, affects the labor demand conditions of the firms (Eq. 12) which operate on the objective of profit maximization. So, as a result of this causality, with each incremental point reduction in the payroll tax, the unemployment rate displays a decreasing trend in this experiment. A 3 percentage point decrease in the payroll tax reveals an unemployment rate which is closest to the base-run rate, among all percent point reductions in payroll tax considered here. A 6 percentage point reduction in the payroll tax decreases the unemployment rate considerably and eventually the unemployment rate converges to 3%, which would be indicated as the non-accelerating inflation rate unemployment (NAIRU) for Turkey[13], by the end of the period (Figure 6).

[13] Yavan (1999) estimates NAIRU for Turkey for the period 1970-1995 and documents a fluctuating series for the stated period. It scores 1.5-3% for the pre-1980 period, then declines to 2% between years 1980 and 1988, and rises again to 4% in 1990s. Küçükkale (2002) also supports these findings.

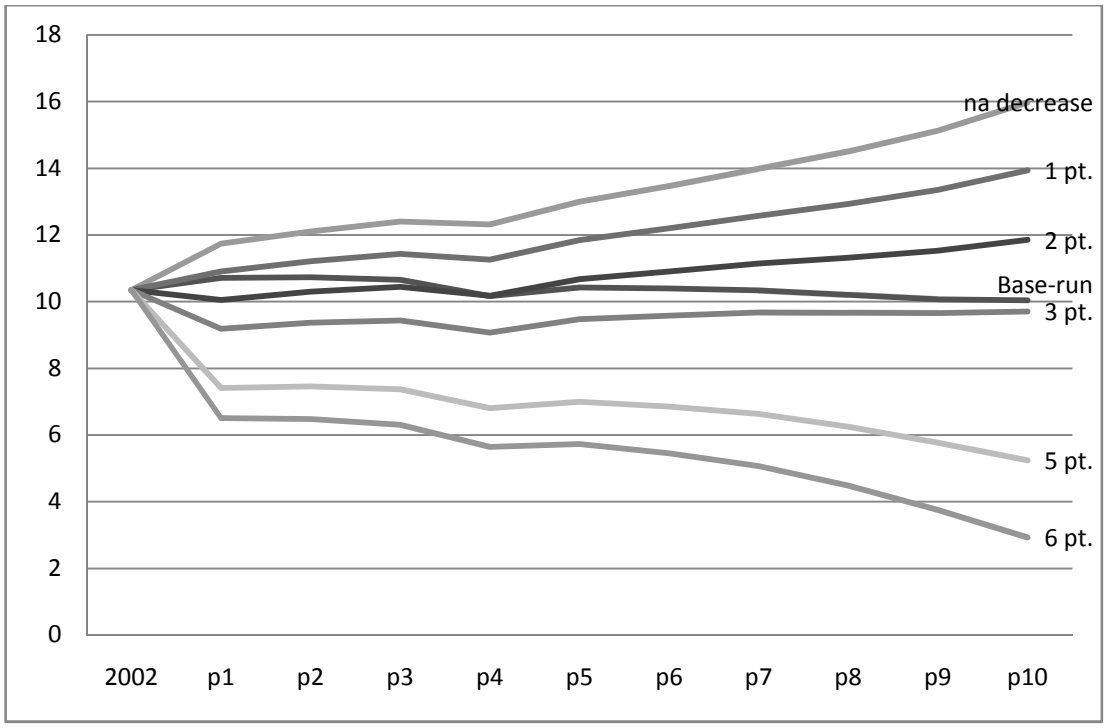

Figure 6: Unemployment rate under a 10% energy tax and alternative payroll tax reductions (%)

- **Effects on GDP**

The increase in labor demand as a factor of production, as a result of decreased payroll tax, increases the gross output level. Thus, a 10% energy tax without any further reduction in the payroll tax giving the lowest GDP level, each incremental point decrease in the payroll tax is associated with higher GDP levels (Figure 7). A 2 percentage point decrease in the payroll tax displays a GDP level which is closest to the base-run level, whereas 6 percentage point decrease gives the highest GDP level (5.9% above the base-run GDP level at the end of the period).

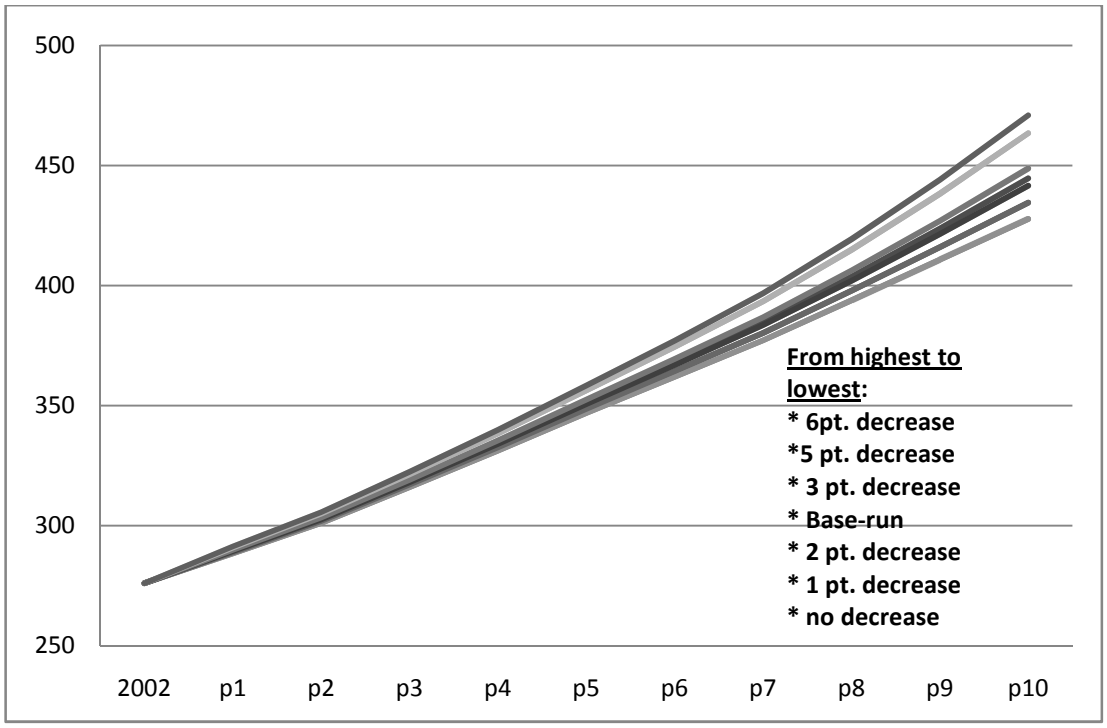

Figure 7: GDP under a 10% energy tax and alternative payroll tax reductions (2002 prices, billion TL)

- **Effects on CO_2 emissions**

Similar to GDP figures, a 10% energy tax in the absence of any further decrease in payroll tax, gives the lowest level of CO_2 emissions. Although, under all alternative levels of payroll tax and in all periods, the CO_2 emissions are lower than the base-run level, each percentage point decrease in the payroll tax increases the emissions (Figure 8). The trend in emissions is in line with GDP trend, which reflect the dependency of emissions on the aggregate economic activity. A 2 point decrease in the payroll tax, which seems to yield results closer to the base-run values concerning other indicators, still manages to decrease the emissions by 7.8% of the base-run level by the end of the period (the reduction ratio falls by 2.2 points, compared to the 11% decrease with only 10% energy tax).

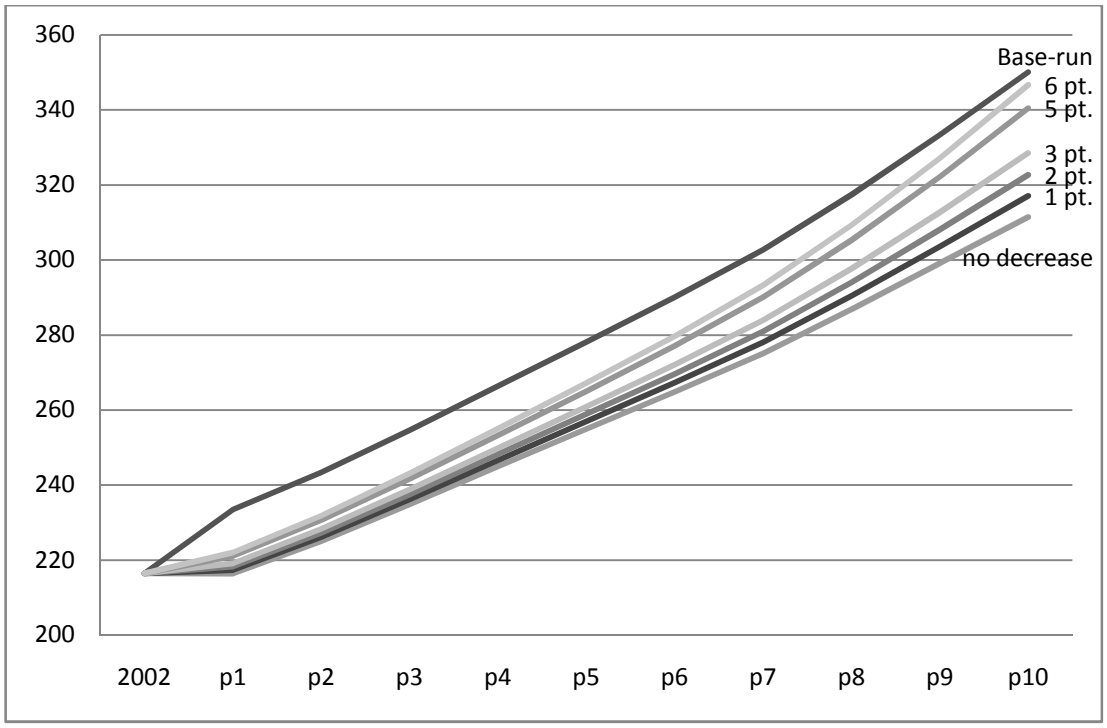

Figure 8: CO_2 emissions under a 10% energy tax and alternative payroll tax reductions (million tons)

- **Effects on the ratio of total tax revenues to GDP**

The tax burden on the economy is the highest with only a 10% energy tax in presence. Then, this burden decreases with each incremental percentage point decrease in the payroll taxes, 6 point decrease in payroll tax revealing the closest figure to the base-run ratio of total tax revenues to GDP. Figure 9 presents the decreasing trend of the tax burden with higher level of reductions in payroll tax.

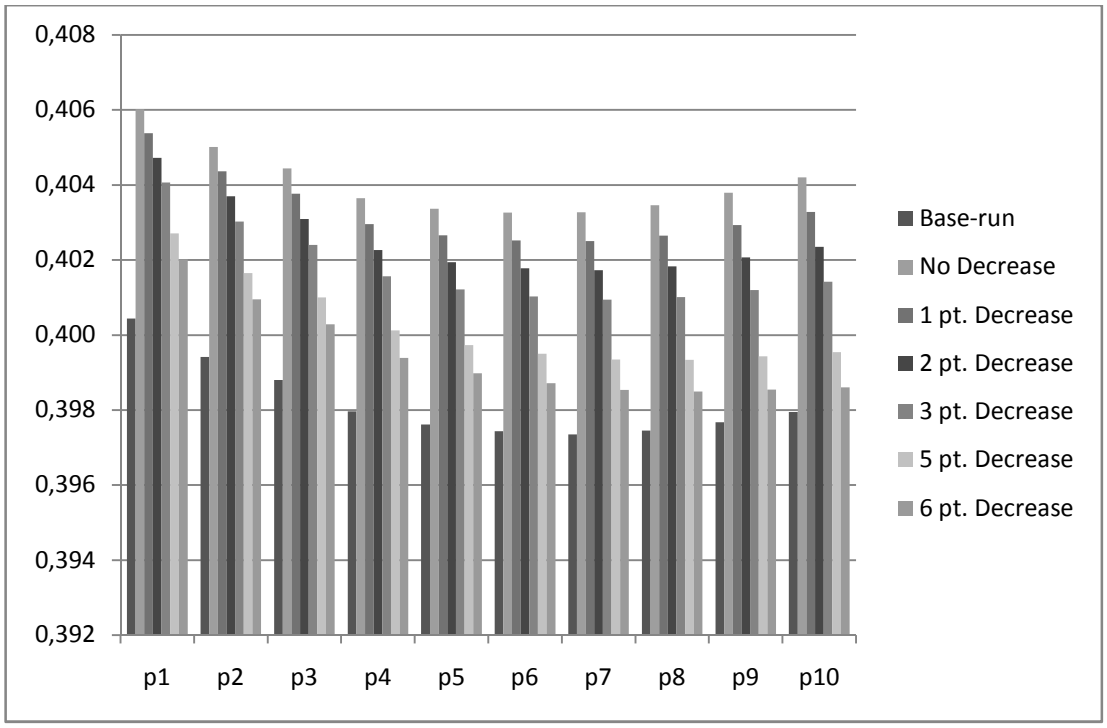

Figure 9: Total tax revenues to GDP ratio under 10% energy tax and alternative payroll tax reductions

Having observed these figures, it is now possible to make comments about the alternative tax schemes with the objective of "double dividend". It is evident that a 6 percentage point decrease in the payroll tax in the presence of a 10% energy tax gives an enhanced GDP level (with an annual average growth rate of 5.5%) and a close to zero unemployment rate with no excess tax burden on the economy. But this tax scheme presents a poor performance regarding the reduction in CO_2 emissions. Although, it manages to reduce the emission levels, still the emissions are higher compared to other tax schemes and eventually the emission level is converging to the base-run level by the end of the period.

Figures reveal that, instead of taking a drastic measure and decreasing the payroll tax by 6 percentage point, following a mild regime would be more beneficial

for the sake of reducing CO_2 emission levels along with improvements in unemployment figures. A 3 percentage point decrease in payroll tax would not only characterize an economy which behaves similar to the base-run path (with a 9.7% unemployment rate and a 5% real GDP growth rate on the average) but also decreases the emissions by 6.2% by the end of the period, compared to the base-run. In this case, the tax burden is only slightly increased (from the base-run value of 39.8% to 40.1%). Depending on the priority of the policy objectives, a 2 point decrease would also yield desirable results. It is possible to reduce emissions by an additional 1.8% (of the level achieved under 3 point decrease) with the risk of increasing unemployment by about 2.1 points in absolute terms. In this scenario the economy grows by 4.8% annually on average and the total tax burden is 40.2%. Table 11 summarizes these observations.

Table 11: Comparison of the outcomes of alternative labor tax reductions under a 10% energy tax

	CO2 Emissions (million tons)	Unemployment Rate (%)	Average GDP Growth Rate (%)	Tax Burden (Tax Rev./GDP)
Base-run	350	10.04	4.9	0.398
No decrease	311	15.97	4.5	0.404
1 pt. decrease	317	13.94	4.6	0.403
2 pt. decrease	323	11.85	4.8	0.402
3 pt. decrease	328	9.70	5.0	0.401
5 pt. decrease	340	5.24	5.3	0.400
6 pt. decrease	347	2.94	5.5	0.398

ii. Effects of Reduced Payroll Tax When a 20% Energy Tax is Present

The case of the 20% energy tax also presents a pattern which is similar to that of 10% energy tax. Although 7 percentage point decrease in the payroll tax gives a close to natural unemployment rate and an annual GDP growth rate of 5.6% on

average, with a 4 percentage point decrease in the payroll tax, the economy behaves closer to the base-run path (with 9.5% unemployment rate on average and 5% annual GDP growth rate). Under this tax scheme, the ratio of tax revenues to GDP increases from the base-run value of 39.8% to 40.5% by the end of the period. Regarding the emission levels, with 4 percentage point decrease in payroll tax, emissions are expected to decrease by 10% compared to the base-run, whereas with 8 percentage point decrease, this value is only 4%. Between the reduction rates 3 and 4 points, there again exists the dilemma of further decreasing the emissions[14] at the expense of increasing unemployment rate (by around 2.2 points to a rate of 11.84%). Thus, deciding on the optimal payroll tax reduction rate requires the knowledge of the prioritization of the objectives. Related figures and a comparison table, regarding the consequences of alternative payroll tax reductions under a 20% energy tax, are presented in Appendix D.

5.3.2. Experiment 2: Consumption Tax

Now, we change the source of taxation and apply a CO_2 on the consumption of coal, petroleum and gas and electricity by the households. Imposed emission taxes are at rates of 20, 10, 5, 3, 2 and 1%.

Increasing levels of emission taxes on the final consumption of the energy sources affect the emission levels inversely. Although a 20% consumption tax decreases the emissions by 4.6% compared to the base-run, it is the lowest ratio

[14] A 3 point decrease in payroll tax is associated with a 1.7% more reduction in CO_2 emissions compared to the case of 4 point reduction.

among the emission reduction ratios under the alternative consumption tax levels. So, in this pattern a 1% emission tax on the consumption of energy goods leads to the highest reduction in the emission compared to the base-run by the end of the period (emissions decrease by 6.8%). (Figure 10)

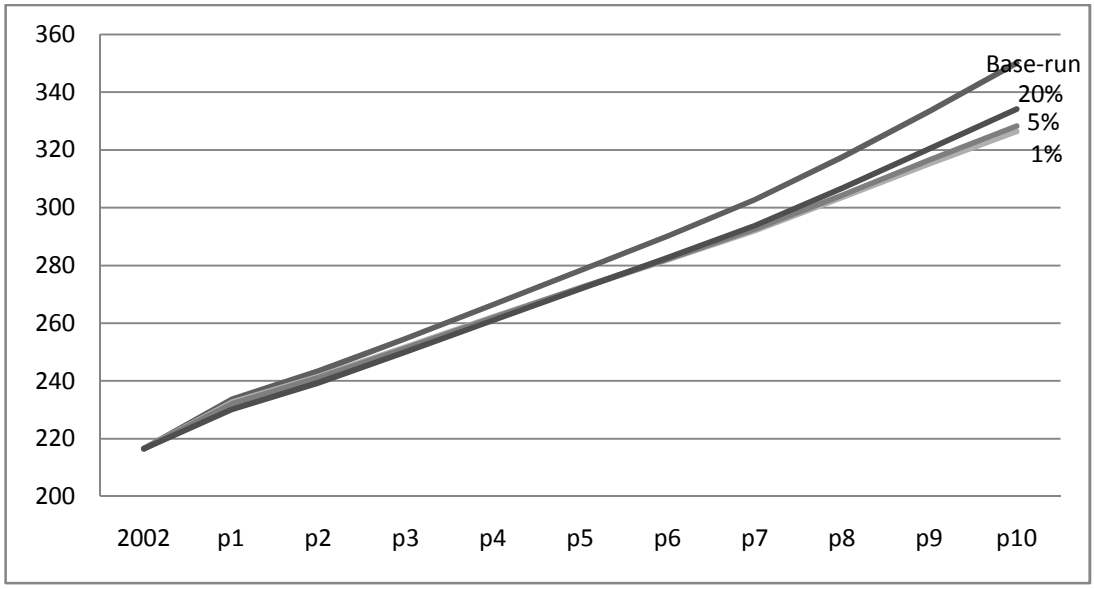

Figure 10: CO_2 emissions under alternative consumption tax rates (million tons)

The decrease in the emissions is again associated with a decrease in GDP level and an increase in unemployment ratio accordingly. With a 1% emission tax on consumption, GDP level decreases by 7% (Figure 11) compared to base-run and unemployment rate reaches to 15.2% by the end of the period (Figure 12).

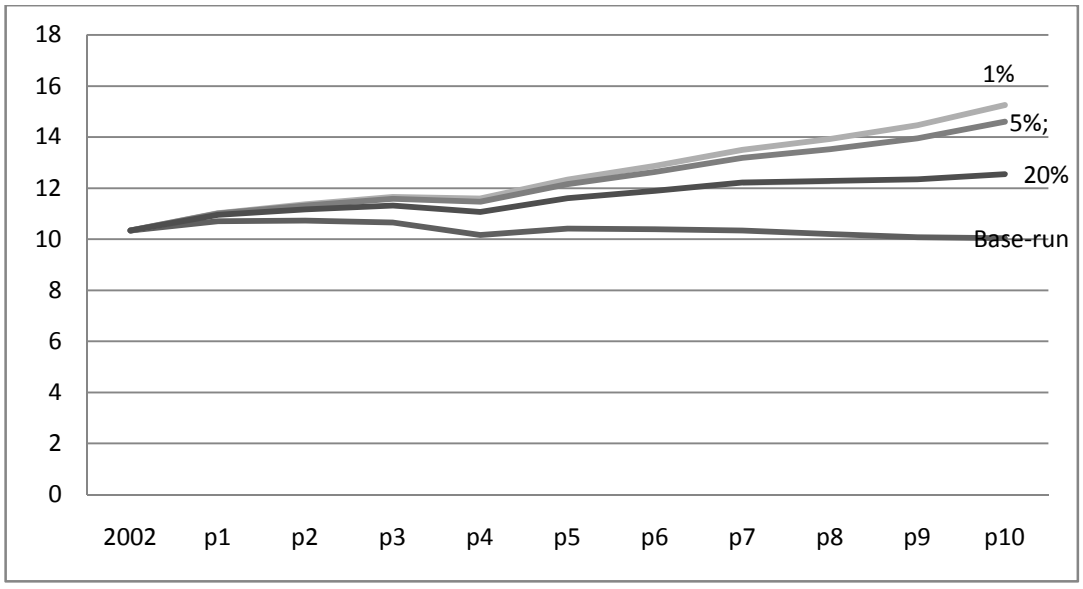

Figure 11: Unemployment rate under alternative consumption tax rates (%)

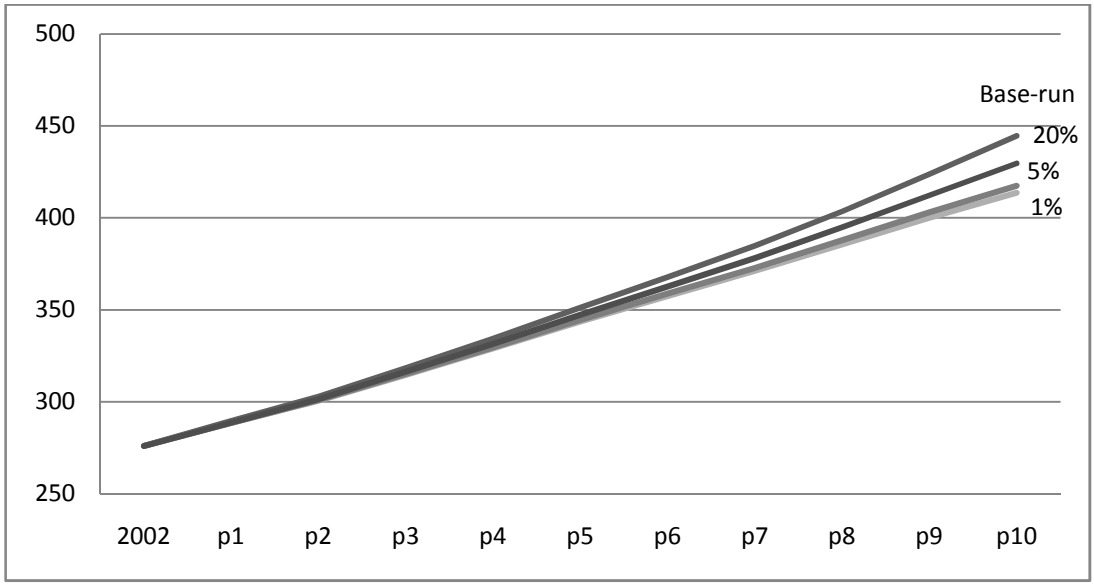

Figure 12: GDP under alternative consumption tax rates (million tons)

i. Introducing a Reduction in Payroll Tax in the Presence of a Consumer Tax

As mentioned above, although a 1% consumption tax has the best performance in reducing CO_2 emission; it also causes the highest drop in GDP level and eventually the highest unemployment rate, when compared to the figures under

alternative consumption tax rates. In accordance with the objective of this study, we try to eliminate those adverse effects through reductions in payroll taxes in this section. Here we implement 4, 3, 2 and 1 point decreases in the payroll tax on top of 1% consumption tax on the energy sources and examine the results.

Each incremental point reduction in the payroll tax enhances GDP and increases employment figures. But, since the overall emission levels are linked to the economic activity, CO_2 emissions increase as well. A 4 point decrease in the payroll tax pulls GDP up to its base-run level and decreases the unemployment rate to as low as 6.7% but leaves the emission levels unchanged by the end of the period. Thus, there is no double dividend in this tax scheme. On the other hand a 2 percentage point decrease in payroll tax on top of a 1% consumption tax on energy sources reveals an unemployment rate of 11.1% and a decrease in the emissions by 3.4% by the end of the period. Even though, under this tax scenario the GDP seems to decrease by 4%, by the end of the period, compared to the base-run, the economy pursues an annual growth rate of 4.5% on average and the tax burden remains stable at its base-run level (39.8% of the GDP). Table 12 summarizes these results.

Table 12: Comparison of the outcomes of alternative labor tax reductions under a 1% consumption tax

	CO2 Emissions (million tons)	Unemployment Rate (%)	Average GDP Growth Rate (%)	Tax Burden (Tax Rev./GDP)
Base-run	350	10.04	4.9	0.398
1 pt. decrease	332	13.20	4.3	0.398
2 pt. decrease	338	11.11	4.5	0.398
3 pt. decrease	344	8.96	4.6	0.397
4 pt. decrease	351	6.75	4.8	0.396

5.3.3. Experiment 3: Tax Mix

Here, first we compare and contrast the results of implementing two tax schemes (a 10% energy tax on the intermediate use of the energy sources and a 1% consumption tax on the final uses of energy sources) individually. Then, we examine the results of implementing these two taxes simultaneously and introduce payroll tax reductions.

i. Comparison of the Alternative Sources of Taxation

Evidently, a 10% energy tax offers a greater decrease in the emissions than the rates offered by a 1% consumption tax. The reduction rates are 11% and 6.7% compared to the base-run and to 1% consumption tax levels, respectively (Figure 13).

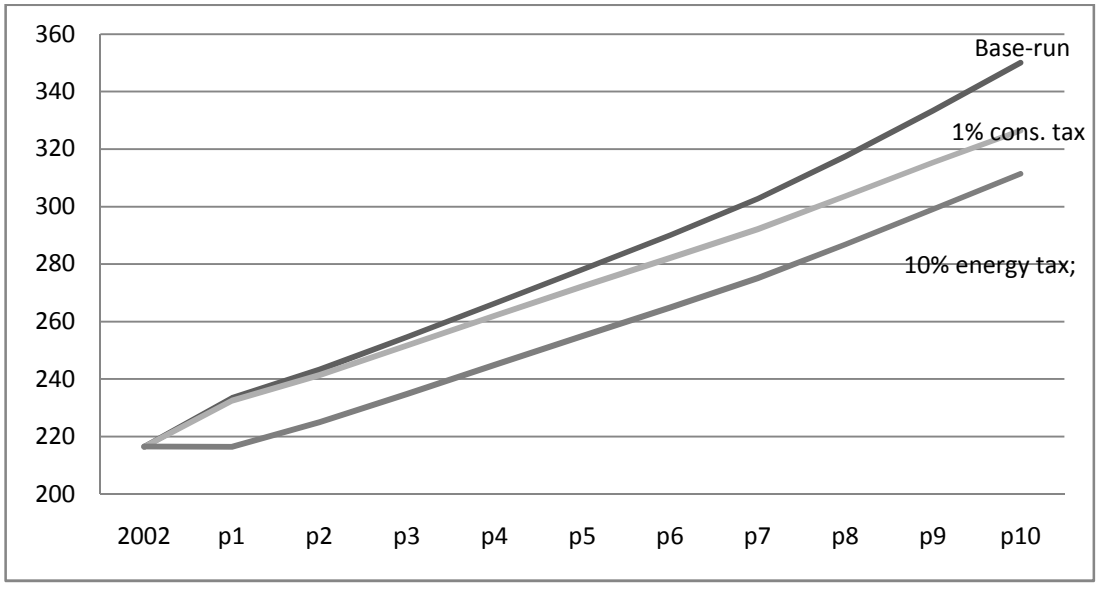

Figure 13: CO_2 emission under alternative tax sources (million tons)

While the difference between the emission values is considerable, a 10% energy tax displays an unemployment rate which is very close to that under a 1% consumption tax (rates are 15.9% and 15.2%, respectively, see figure 14).

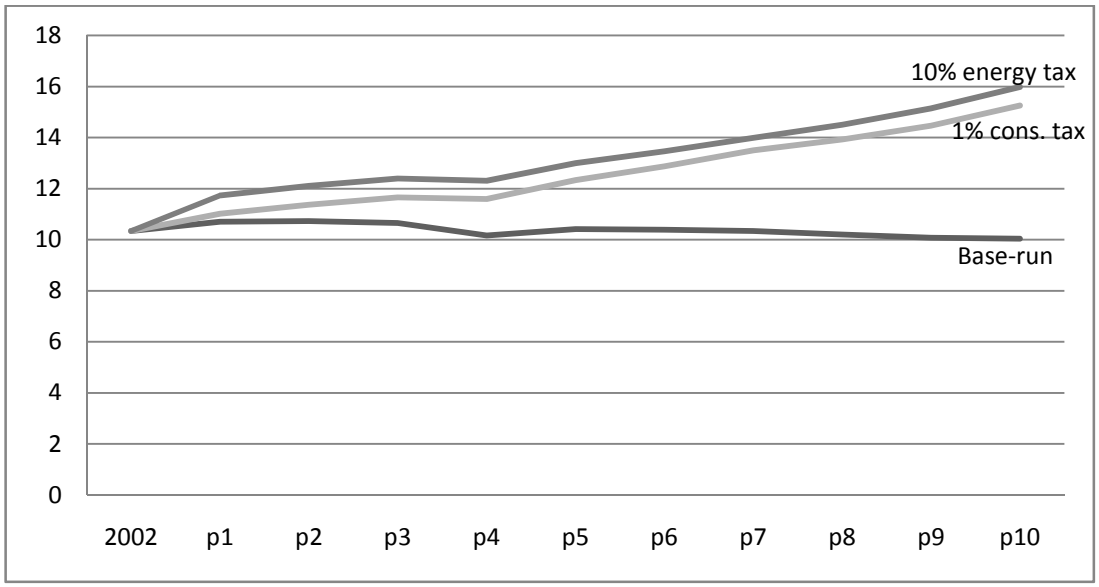

Figure 14: Employment rate under alternative tax sources (%)

Also, GDP level is higher in the case of 10% energy tax when compared to the case of a 1% consumption tax (the difference is 3.4% of the GDP value under a 1% consumption tax, see Figure 15).

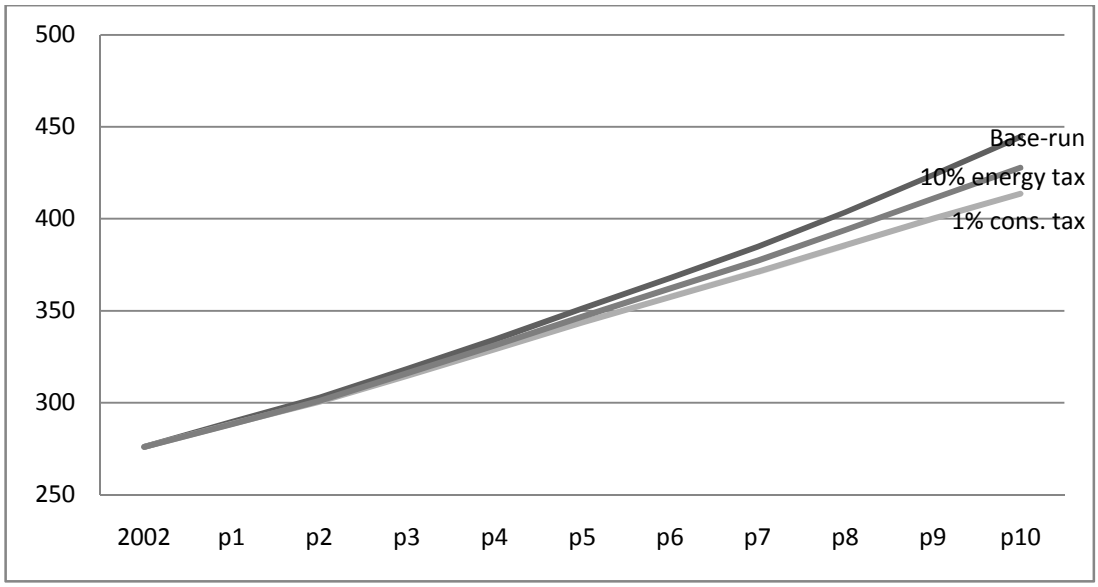

Figure 15: GDP under alternative tax sources (2002 prices, billion TL)

Although 10% energy tax reveals more desirable results than a 1% consumption tax, high unemployment rate is still a problem and can be solved through introduction of a decrease in payroll tax as previously examined.

ii. A Mixed Tax Scheme

When we apply a combination of the two taxes the trajectories of unemployment rate, GDP levels and CO_2 emissions reveal a path which is closer to that of a 10% energy tax. CO_2 emissions are slightly over the level under a 10% energy tax (by 0.1%), GDP level is higher by 0.2% with an annual growth rate of 5.1% on average and unemployment rate is lower by a1 percentage point, but still at 14.2% level (Figures are presented in Appendix D).

iii. Addressing to the Problem of Unemployment under a Mixed Tax

To address the problem of high unemployment rate under the combined tax scheme, we introduce payroll tax reductions at alternative levels to search for the traces of double dividend. Payroll tax is reduced by 4, 3, 2 and 1 percentage points and the results are presented below.

Each incremental point decrease in payroll tax is associated with lower levels of unemployment. With a 4 point decrease unemployment level reaches to 6.3%. The closest unemployment rate to the base-run path is when the payroll tax is decreased by 2 points (annual unemployment rate is 10.5% on the average). A 1 point decrease gives a higher unemployment rate than the previous case but it is still below the rate revealed under no decrease in payroll tax (Figure 16).

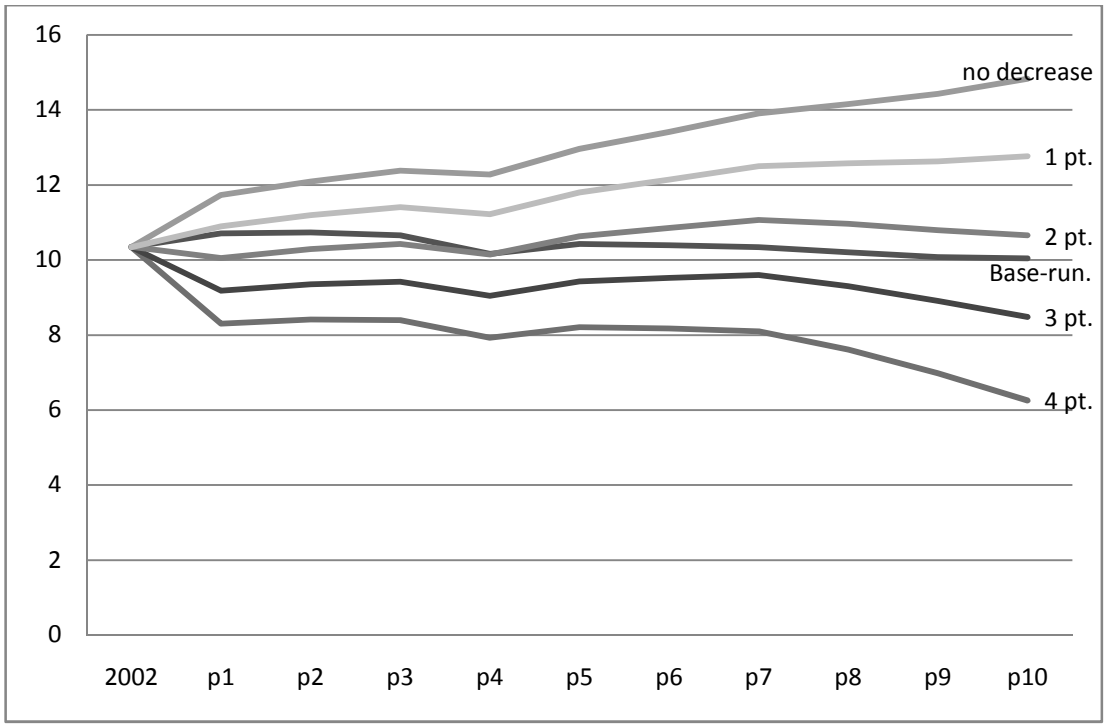

Figure 16: Unemployment rate under combined tax rates and alternative payroll tax reductions (%)

The pattern is similar for the behavior of GDP level, as anticipated. With 4 point decrease, the economy expands the most (GDP level is 2.8% higher than the base-run level and 6.6% higher than the level under no payroll tax reduction). The case of 2 point decrease again displays a GDP level which is closest to the base-run path (Figure 17).

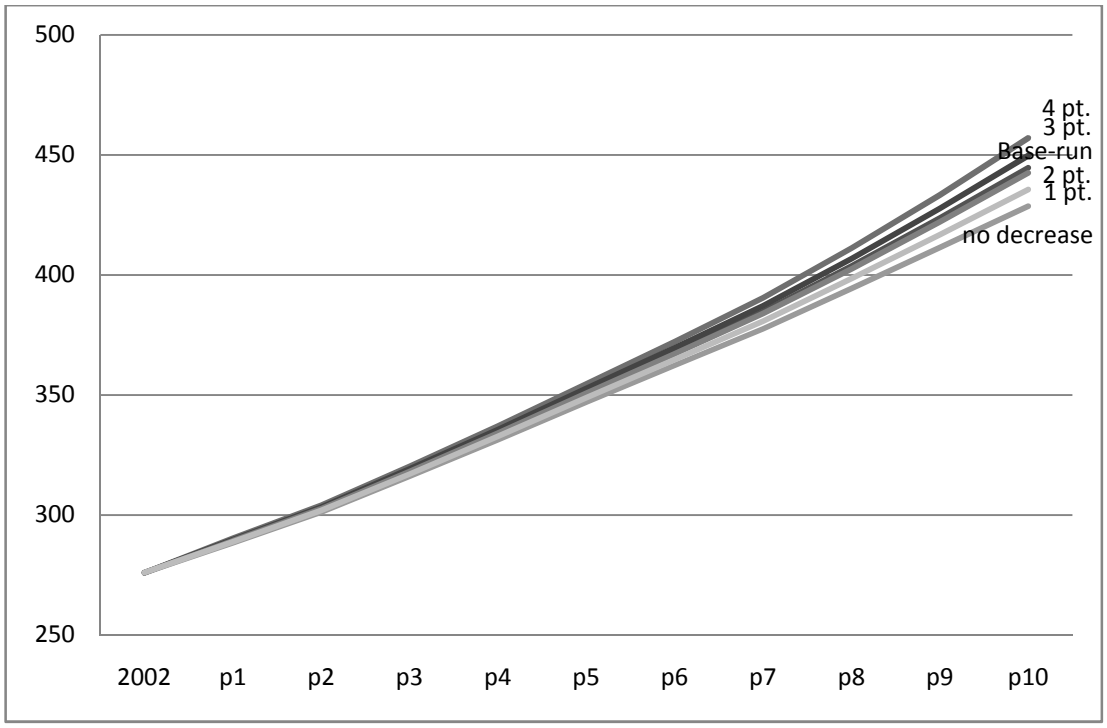

Figure 17: GDP under combined tax rates and alternative payroll tax reductions (2002 prices, billion TL)

Considering the CO_2 emission levels, the performance of the tax schemes with reductions in payroll tax gets worse as the level of reduction increases. A 4 percentage point reduction performs the worst with a decrease in emissions by only 4.4% compared to the base-run value. Reducing the payroll tax by 1 point gives the closest level of emissions to the combined tax scheme with no further reductions in the payroll tax. CO_2 emission reductions for a 2 and a 3 point decreases in payroll tax are 7.7% and 6.1% compared to the base-run, respectively (Figure 18).

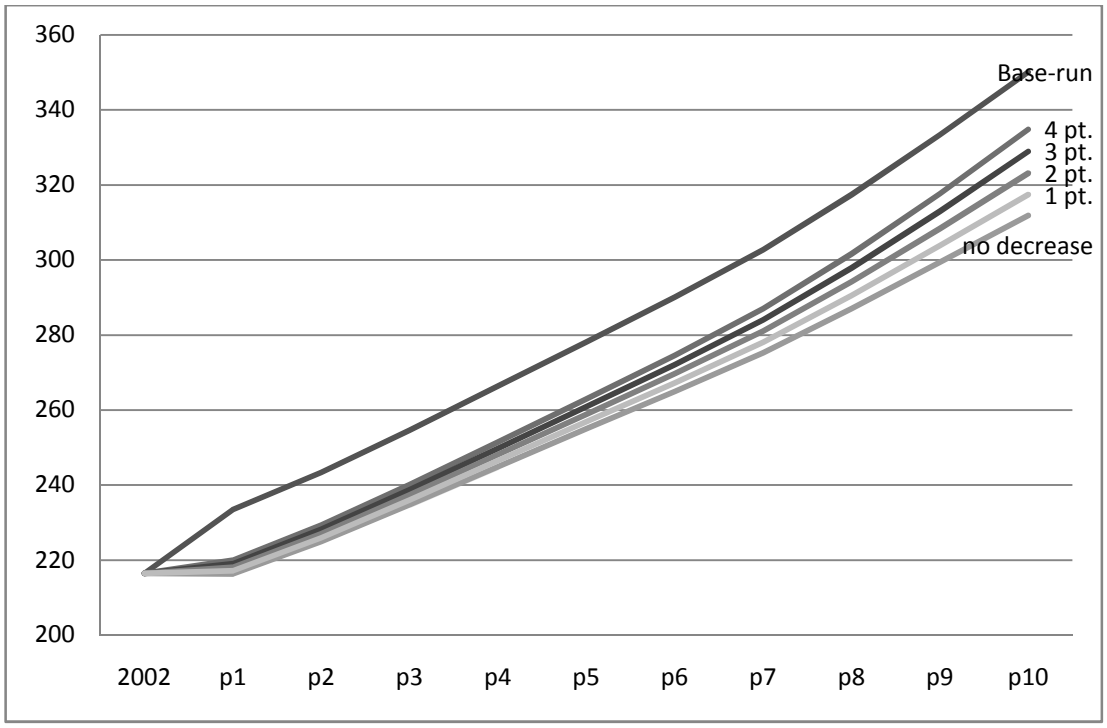

Figure 18: CO_2 emission under combined tax rates and alternative payroll tax reductions (million tons)

As we assess the effects of different levels of payroll tax reductions in the presence of a combined tax regime on energy inputs and final use, a 2 and a 3 point reduction reveal similar results (Table 13). At the expense of a 2.2 point increase in unemployment rate a 2 point reduction in payroll tax promises a higher reduction in emissions than does a 3 point reduction (the difference is 1.8% of the emission level under a 3 point reduction). Average GDP growth rate is also slightly decreased with no further tax burden on the economy. Again, depending on the prioritization of the policy objectives, both reduction rates on payroll tax are viable.

Table 13: Comparison of outcomes of alternative reductions in payroll tax under the combination of energy and consumption taxes

	CO2 Emissions (million tons)	Unemployment Rate (%)	Average GDP Growth Rate (%)	Tax Burden (Tax Rev./GDP)
Base-run	350	10.04	4.9	0.398
No decrease	312	14.83	4.5	0.404
1 pt. decrease	317	12.77	4.7	0.403
2 pt. decrease	323	10.65	4.8	0.402
3 pt. decrease	329	8.48	5.0	0.402
4 pt. decrease	335	6.25	5.2	0.401

When we compare the effectiveness of implemented three environmental tax schemes along with alternative payroll tax reductions, the optimal taxing scheme is revealed to be the tax mix (A 10% energy tax with a 1% consumption tax) accompanied with a 2 point reduction in payroll tax. Such a tax scheme manages to decrease emissions by 7.7% by the end of the period, compared to the base-run level, with a 10.65% unemployment rate and a 4.8% annual GDP growth rate on average. The same level of emission reduction is accomplished by a 10% energy tax with a 2 point payroll tax reduction but this time the backlash is an unemployment rate reaching 11.85% by the end of the period. Use of a 1% consumption tax fails to keep up with the performance of both the energy tax and the tax mix; lower levels of emission are associated with unbearable unemployment rates and reciprocally, a base-run compatible unemployment rate comes with a negligible reduction of the emissions. Table 14, summarizes these results.

Table 14: Comparison of outcomes of alternative reductions in payroll tax under three alternative environmental tax schemes

	Base-run	10% Energy Tax		1% Consumption Tax		10% Energy + 1% Consumption Tax	
Rate of payroll tax reduction		**2 pt.**	**3 pt.**	**2 pt.**	**3 pt.**	**2 pt.**	**3 pt.**
CO2 Emissions (million tons)	350	323	328	338	344	323	329
Unemployment Rate (%)	10.04	11.85	9.70	11.11	8.96	10.65	8.48
Average GDP Growth Rate (%)	4.9	4.8	5.0	4.5	4.7	4.8	5.0
Tax Burden (Tax Rev./GDP)	0.398	0.402	0.401	0.398	0.397	0.402	0.402

CHAPTER 6

CONCLUSION

The threat of the global warming trend that is cast upon all the species, including mankind, has directed the policy agenda towards this issue and forced the governments to take strict measures at the international level. Pursuing the double goal of sustainable economy in a sustainable environment has become the policy objective of many governments, if not all, for the last 20-25 years. In such a setting, evaluating both environmental and economic effects of measures taken to reduce emissions and correcting for any possible adverse effects through alternative policies has gained importance.

Turkey, as a developing country, is also troubled with its high leveled and rapidly increasing emissions, and is expected to decrease these emissions as a party to UNFCCC. Yet, the studies revealing the energy-environment-economy relations are scarce in the Turkish concept, leaving the costs of environmental policies and alternatives to these policies in order to ease these costs, in disguise. This thesis aims

to shed a slight beam of light on this area of research and tries to show if a sustainable environment is possible along with a sustainable economy. For this purpose this study employs a 10 sector CGE model for Turkey based on the 2002 data, which runs for 10 periods, and examines the results of alternative tax scenarios.

First, a 10% energy tax is imposed on the intermediate use of the energy sources. Although CO_2 emissions are reduced, unemployment rate and GDP level are adversely affected from such a tax scenario. At the second step, these adverse effects are addressed through payroll reductions. A 3 percentage point reduction in the payroll tax reveals an economy which is very much in line with the base path (in case of unemployment rate and GDP) and still manages to decrease emissions by 6.2% compared to the base-run levels. It is possible to reduce emissions further through a 2 point reduction in the payroll tax but this time the economy ends up with a higher unemployment rate and a lower GDP level.

Secondly, alternative rates of consumption tax are imposed on the final consumption of energy sources by the households. Among the imposed rates, 1% consumption tax displayed the best performance in reducing the emission levels, but again with a higher unemployment rate than the base-run. Similar to the energy tax case, it is possible to correct for the adverse effects of the consumption tax through payroll tax reductions. A 2 percentage point reduction gives a close-to-base-run trajectory (in terms of unemployment rate and GDP level) but its performance on the emission reduction is poor, only a 3.4% reduction is achieved.

Lastly, a tax mix of a 10% energy tax and a 1% consumption tax is considered. The adverse effects on unemployment rate and GDP level are still present along with emission reductions. With further inference in the economy through payroll reductions, the rising unemployment rate and falling GDP are banished. A 2 point reduction in payroll tax under a mixed tax scheme seems to reveal the most efficient tax combination among other tax scenarios; achieving the highest emission reduction (7.7% of the base-run level) with the lowest cost (10.65% unemployment rate and 4.8% GDP annual growth rate, on average).

The findings of this paper reveal that an environmental policy directed to the reduction of CO_2 emissions, although costly when implemented on its own, is viable through payroll tax reductions, which is the focus of this study. By reducing the payroll taxes, the cost burden on firms, which is elevated because of the implemented environmental taxes, is reduced. So, the firms may keep up with their previous output levels and the economic activity picks up.

SELECT BIBLIOGRAPHY

Allan, G. J., P.G. McGregor, J. K. Swales and K. R. Turner. 2007. "The UK Climate Change Levy and Potential for Double-Dividend Effects Under Different Labor Market Specifications: A Computable General Equilibrium Analysis for the United Kingdom." *Strathclyde Discussion Papers in Economics,* 07-02.

Arıkan, Y. and G. Kumbaroğlu. 2001. "Endogenising Emission Taxes: A General Equilibrium Type Optimization Model Applied for Turkey." *Energy Policy,* 29:1045-1056.

Arrhenius, S. A. 1896. "On the Influence of Carbonic Acid in the Air upon the Temperature of the Ground." *Philosophical Magazine*, 41: 237-76.

Bosquet, B. 2000. "Environmental tax reform: Does it Work? A survey of the Empirical Evidence." *Ecological Economics*, 34:19-32.

Demirbaş, A. 2002. "Energy and Environmental Issues Relating to Greenhouse Gas Emissions in Turkey." *Energy Conversion and Management*, 44:203-213.

Goulder, L. 1995. "Environmental Taxation and the Double Dividend: A Reader's Guide." *International Tax and Public Finance*, 2:157-183.

Goulder, L., I. Parry and D. Burtraw. 1997. "Revenue-Raising vs. Other Approaches to Environmental Protection: The Critical Significance of the Pre-Existing Tax Distortions." *Rand Journal of Economics*, 28:708-731.

Intergovernmental Panel on Climate Change. 2001. *IPCC Third Assessment Report: Climate Change 2001.*

Intergovernmental Panel on Climate Change. 2007a. *IPCC Fourth Assessment Report: Climate Change 2007.*

Intergovernmental Panel on Climate Change. 2007b. *Working Group I Report: The Physical Science Basis.*

Intergovernmental Panel on Climate Change. 2007c. *Working Group II Report: Impact, Adaptation and Vulnerability.*

Kaygusuz, K. and A. Kaygusuz. 2004. “Energy and Sustainable Development. Part II: Environmental Impacts of Energy Use.” *Energy Source*, 26:1071-1082.

Küçükkale, Y. 2002. “An Examination of Hysteresis Hypothesis on Natural Rate of Unemployment in the Case of Turkey.” *Labor and Demography*, No: 0211003.

Kumbaroğlu, G. S. 2003. “Environmental Taxation and Economic Effects: A Computable General Equilibrium Analysis for Turkey.” *Journal of Policy Modelling*, 25:795-810.

Lee, D. and W. Misiolek. 1986. “Substituting Pollution Taxation for General Taxation: Some Implications for Efficiency in Pollution Taxation.” *Journal of Environmental Economics and Management*, 13:338-347.

McKibbin, W. J. and P. Wilcoxen. 2002. “The Role of Economics in Climate Change Policy.” *The Journal of Economic Perspectives*, 16:107-129.

McKibbin, W. J. and P. Wilcoxen. 2008. “Building on Kyoto: Towards a Realistic Global Climate Agreement.” *CAMA Working Paper Series*, 13/2008.

Pearce, D. 1991. “The Role of Carbon Taxes in Adjusting to Global Warming.” *The Economic Journal*, 101:938-948.

Plinke, E., Haasis, H. D., Rentz, O., and Sivrioğlu, M. 1990. “Analysis of Energy and Environmental Problems in Turkey by Using a Decision Support Model.” *AMBIO*, 19: 75–81.

Republic of Turkey Ministry of Environment and Forestry. 2007. *First National Communication of Turkey on Climate Change*.

Taşdemiroğlu, E. 1992. “Air Pollutant Emissions due to Energy Utilization in Turkey.” *Energy*, 17:95-97.

Telli, Ç., E. Voyvoda and E. Yeldan. 2008. “Economics of Environmental Policy in Turkey: A General Equilibrium Investigation of the Economic Evaluation of Sectoral Emission Reduction Policies for Climate Change.” *Journal of Policy Modelling*, 30:321-340.

Terkla, D. 1984. “The Efficiency Value of Effluent Tax Revenues.” *Journal of Environmental Economics and Management*, 11:107-123.

Tullock, G. 1967. “Excess Benefit.” *Water Resources Research*, 3:643-644.

Yavan, Z. A. 1999. “Structural and Non-Structural Aspects of Unemployment: A NAIRU Estimation for Turkey.” *TUSIAD Publication*, No: T/99-6/259.

APPENDICES

APPENDIX A

Model Equations

PRICE BLOCK

$$\mathrm{P_i^m} = ePW_i^m(1+t_i^m)$$

$$\mathrm{P_i^e} = ePW_i^e(1-t_i^e)$$

$$PC_iCC_i = [PD_iDC_i + P_i^mM_i](1+t_{Sal,i})$$

$$PX_iXS_i = PD_iDC_i + P_i^eE_i$$

$$PINDEX = \sum_{\mathrm{i}} \mathrm{p}wts_{\mathrm{i}}\ \mathrm{PC_i}$$

OUTPUT AND FACTORS OF PRODUCTION BLOCK

$$XS_i = AX_i\left[K_i^{\lambda_{K,i}}L_i^{\lambda_{L,i}}\left(\prod_j ID_{j,i}^{\lambda_{ID,j,i}}\right)ENG_i^{\lambda_{E,i}}\right]$$

$$(1+CO_2tN_j)PC_jID_{j,i} = \lambda_{ID,j,i}(1-t_{\mathrm{Prod},i})PX_iXS_i$$

$$(1+pyrltax)\overline{w}L_i = \lambda_{L,i}(1-t_{\mathrm{Prod},i})PX_iXS_i$$

$$w = \overline{w} \Rightarrow \overline{L}^S - \sum_i L_i = UNEMP$$

$$rK_i = \lambda_{K,i}(1 - t_{\mathrm{Prod},i})PX_i XS_i$$

$$\sum_{\mathrm{i}} \mathrm{K_i} = \overline{K}^S$$

$$PEG_i ENG_i = \lambda_{E,i}(1 - t_{\mathrm{Prod},i})PX_i XS_i$$

$$\lambda_{K,i} + \lambda_{L,i} + \sum_j \lambda_{ID,j,i} + \lambda_{E,i} = 1$$

$$ENG_i = AE_i \left[BCO_i ID_{CO,i}^{-\rho e_i} + BPG_i ID_{PG,i}^{-\rho e_i} + BEL_i ID_{EL,i}^{-\rho e_i} \right]^{-1/\rho e_i}$$

$$\frac{ID_{CO,i}}{ENG_i} = \left[\frac{BCO_i PEG_i}{AE_i^{-pe_i}(1 + CO_2 tN_{CO})PC_{CO}} \right]^{1/(1+\rho e_i)}$$

$$\frac{ID_{PG,i}}{ENG_i} = \left[\frac{BPG_i PEG_i}{AE_i^{-pe_i}(1 + CO_2 tN_{PG})PC_{PG}} \right]^{1/(1+\rho e_i)}$$

$$\frac{ID_{EL,i}}{ENG_i} = \left[\frac{BEL_i PEG_i}{AE_i^{-pe_i}(1 + CO_2 tN_{EL})PC_{EL}} \right]^{1/(1+\rho e_i)}$$

$$PEG_i ENG_i = PC_{CO} ID_{CO,i} + PC_{PG} ID_{PG,i} + PC_{EL} ID_{EL,i}$$

ENVIRONMENTAL POLLUTION AND CO2 TAXES

$$CO_2 EM_i = \sum_j CO_2 EM_{j,i}^{PRM} + \sum_j CO_2 EM_{j,i}^{SEC} + \sum_j CO_2 EM_{j,i}^{IND}$$

$$CO_2 EM_{j,i}^{PRM} = \varpi_{\mathrm{j,i}}\ ID_{j,i} \qquad j = CO, PG$$

$$CO_2EM^{SEC}_{j,i} = \bar{\varepsilon}_{j,i}\ ID_{j,i} \qquad j = RP$$

$$CO_2EM^{IND}_i = \bar{\delta}_i XS_i$$

$$TOTCO_2ENG = \sum_i \left[\sum_j \left(CO_2EM^{PRM}_{j,i} + CO_2EM^{SEC}_{j,i} \right) \right]$$

$$TOTCO_2IND = \sum_i CO_2EM^{IND}_i$$

$$TOTCO_2HH = \sum_i \bar{\psi}_i CD_i$$

$$TOTCO_2 = TOTCO_2ENG + TOTCO_2IND + TOTCO_2HH$$

$$TOTCO_2TAX = \sum_i \sum_j \mathrm{CO_2tN_i} PC_i ID_{i,j} + \sum_i \mathrm{CO_2tC_i} PC_i CD_i$$

TRADE BLOCK

$$XS_i = \alpha_i \left[\beta_i \mathrm{E}_i^{\rho t_i} + (1-\beta_i)\mathrm{DC}_i^{\rho t_i} \right]^{1/\rho t_i}$$

$$\frac{\mathrm{E_i}}{\mathrm{DC_i}} = \left[\frac{P_i^e}{PD_i} \frac{(1-\beta_i)}{\beta_i} \right]^{\frac{1}{\rho t_i - 1}}$$

$$\mathrm{CC_i} = \varphi_i \left[\theta_i \mathrm{M}_i^{-\rho c_i} + (1-\theta_i)\mathrm{DC}_i^{-\rho c_i} \right]^{-1/\rho c_i}$$

$$\frac{\mathrm{M_i}}{\mathrm{DC_i}} = \left[\frac{\mathrm{PD_i}}{\mathrm{P_i^m}} \frac{\theta_i}{(1-\theta_i)} \right]^{\frac{1}{1+\rho c_i}}$$

INCOME GENERATION AND DEMAND BLOCK

$$EtrHH = (1\text{-}t_{Corp}) \sum_{i} \mathrm{r\,K_i} \; - EERPtrROW - NFI^{G} + GtrEE$$

$$r^{D} DomDebt^{G} - r^{F} eForDebt^{E} + eForBOR^{E}$$

$$EERPtrROW = trrow \sum (1 - t_{Corp}) rK_i$$

$$NFI^{G} = (1\text{-}t_{Corp}) \sum_{i} shrg_i \, r K_i$$

$$YHWnet = (1 - sstax)\overline{w} \sum_{i} L_i^{D}$$

$$YHH = YHWnet + EtrHH + GtrHH + SSItrHH + eROWtrHH$$

$$YHnet = (1 - t_{Inc}) YHH$$

PUBLIC SECTOR BALANCES

$$GREV = \sum_{i} t_{\mathrm{Prod},i} PX_i XS_i + \sum_{i} t_{Sal,i} PC_i CC_i + \sum_{i} tm_i ePW_i^{m} M_i + \sum_{i} te_i ePW_i^{e} E_i + t_{Inc} YHH$$
$$+ t_{Corp} \sum_{i} rK_i + \sum_{i} NFI^{G} + \mathrm{TOTCO_2TAX}$$

$$GPRMBAL = GREV - GCON - GINV - GTrans$$

$$\mathrm{GPRMBAL} = prbrat \cdot GDP$$

$$GCON = gcr * GREV$$

$$GtrHH = rtgtrhh .* GTrans$$

$$GtrEE = rtgtree * GTrans$$

$$GTrans = gtrs * GREV$$

$GTrans = GtrHH + GtrEE + GtrSSI$

$$revSSI = (pyrltax + sstax)\overline{w}\sum_i L_i$$

$GtrSSI = SSItrHH - revSSI$

FINANCIAL ACCOUNTS

$PSAV = s^P YHnet$

$GSAV = GREV - GCON - r^F eForDebt^G - r^D DomDebt^G - GtrHH - GtrEE - GtrSSI + eForBor^G$

$PSAV + GSAV + e\ CAdef = PINV + GINV$

SECTORAL DEMANDS

$PRIVCON = (1 - s^P)YHnet$

$$CD_i = cles_i \frac{PRIVCON}{(1 + CO_2tC_i)PC_i}$$

$$GD_i = gles_i \frac{GCON}{PC_i}$$

$$IDP_i = iples_i \frac{PINV}{PC_i}$$

$$IDG_i = igles_i \frac{GINV}{PC_i}$$

MARKET CLEARING

$CC_i = INT_i + CD_i + GD_i + IDP_i + IDG_i$

$$INT_i = \sum_j \mathrm{ID}_{i,j}$$

$$CAdef = \sum P_i^W E_i + ROWtrHH + ForBor^E + ForBor^G$$
$$-\left[\sum P_i^W M_i + \left(trrow \sum (1 - t_{Corp}) rK_i\right)/e + r^F ForDebt^E + r^F ForDebt^G\right]$$

$$GDP = \sum_i \left[\mathrm{PC}_i(\mathrm{CD}_i + \mathrm{GD}_i + \mathrm{GID}_i + \mathrm{ID}_i) + \mathrm{PW}_i^e \, \mathrm{e} \, \mathrm{E}_i - \mathrm{PW}_i^m \mathrm{eM}_i \right]$$

Dynamics

Dprt	Depreciation Rate
Popgr	Population Growth Rate
$tfpGR_i$	Total Factor Productivity Growth Rate

Evolution of government and private debt

Public Sector Borrowing Requirement

$PSBR = GREV - GCON - GINV - r^F eForDebt^G - r^D DomDebt^G - GTrans$

Government's Foreign Borrowing is a ratio of PSBR:

$eForBor^G = (gfborrat)PSBR$

$DomBor = (1 - gfborrat)PSBR$

Government Domestic Debt

$DomDebt_{t+1} = DomDebt_t + DomBor_t$

Government Foreign Debt

$$ForDebt^{G}_{t+1} = ForDebt^{G}_{t} + ForBor^{G}_{t}$$

Private foreign debt

$$ForDebt^{E}_{t+1} = ForDebt^{E}_{t} + ForBor^{E}_{t}$$

$$\overline{K}^{S}_{t+1} = (1 - dprt)K^{S}_{t} + \sum_{i}\left(IDP_{i} + IDG_{i}\right)$$

$$\overline{L}^{S}_{t+1} = (1 + popgr_{t})\overline{L}^{S}_{t}$$

$$AX^{i}_{t+1} = (1 + tfpGR_{i})AX^{i}_{t}$$

Table A. 1: Sectoral Mapping

59 Sectors of the 2002 Input-Output Matrix		10 Sectors of the Model
Products of agriculture, hunting and related services		AGRICULTURE(AG)
Other non-metallic mineral products		CEMENT (CE)
Coal and lignite; peat		COAL (CO)
Electrical energy, gas, steam and hot water		ELECTRICITY (EL)
Basic metals		IRON AND STEEL (IS)
Pulp, paper and paper products		PAPER PRODUCTS (PA)
Crude petroleum and natural gas; services incidental to oil and gas extraction excluding surveying		PETROLEUM AND GAS (PG)
Coke, refined petroleum products and nuclear fuels		REFINED PETROLEUM (RP)
Land transport; transport via pipeline services		TRANSPORTATION (TR)
Water transport services		TRANSPORTATION (TR)
Air transport services		TRANSPORTATION (TR)
Supporting and auxiliary transport services; travel agency services		TRANSPORTATION (TR)
Products of forestry, logging and related services		OTHER ECONOMY (OE)
Fish and other fishing products; services incidental of fishing		OTHER ECONOMY (OE)
Uranium and thorium ores		OTHER ECONOMY (OE)
Metal ores		OTHER ECONOMY (OE)
Other mining and quarrying products		OTHER ECONOMY (OE)
Food products and beverages		OTHER ECONOMY (OE)
Tobacco products		OTHER ECONOMY (OE)
Textiles		OTHER ECONOMY (OE)
Wearing apparel; furs		OTHER ECONOMY (OE)
Leather and leather products		OTHER ECONOMY (OE)
Wood and products of wood and cork (except furniture); articles of straw and plaiting materials		OTHER ECONOMY (OE)
Printed matter and recorded media		OTHER ECONOMY (OE)
Chemicals, chemical products and man-made fibres		OTHER ECONOMY (OE)
Rubber and plastic products		OTHER ECONOMY (OE)
Fabricated metal products, except machinery and equipment		OTHER ECONOMY (OE)
Machinery and equipment n.e.c.		OTHER ECONOMY (OE)
Office machinery and computers		OTHER ECONOMY (OE)
Electrical machinery and apparatus n.e.c.		OTHER ECONOMY (OE)
Radio, television and communication equipment and apparatus		OTHER ECONOMY (OE)

Medical, precision and optical instruments, watches and clocks		OTHER ECONOMY (OE)
Motor vehicles, trailers and semi-trailers		OTHER ECONOMY (OE)
Other transport equipment		OTHER ECONOMY (OE)
Furniture; other manufactured goods n.e.c.		OTHER ECONOMY (OE)
Secondary raw materials		OTHER ECONOMY (OE)
Collected and purified water, distribution services of water		OTHER ECONOMY (OE)
Construction work		OTHER ECONOMY (OE)
Trade, maintenance and repair services of motor vehicles and motorcycles; retail sale of automotive fuel		OTHER ECONOMY (OE)
Wholesale trade and commission trade services, except of motor vehicles and motorcycles		OTHER ECONOMY (OE)
Retail trade services, except of motor vehicles and motorcycles; repair services of personal and household goods		OTHER ECONOMY (OE)
Hotel and restaurant services		OTHER ECONOMY (OE)
Post and telecommunication services		OTHER ECONOMY (OE)
Financial intermediation services, except insurance and pension funding services		OTHER ECONOMY (OE)
Insurance and pension funding services, except compulsory social security services		OTHER ECONOMY (OE)
Services auxiliary to financial intermediation		OTHER ECONOMY (OE)
Real estate services		OTHER ECONOMY (OE)
Renting services of machinery and equipment without operator and of personal and household goods		OTHER ECONOMY (OE)
Computer and related services		OTHER ECONOMY (OE)
Research and development services		OTHER ECONOMY (OE)
Other business services		OTHER ECONOMY (OE)
Public administration and defense services; compulsory social security services		OTHER ECONOMY (OE)
Education services		OTHER ECONOMY (OE)
Health and social work services		OTHER ECONOMY (OE)
Sewage and refuse disposal services, sanitation and similar services		OTHER ECONOMY (OE)
Membership organization services n.e.c.		OTHER ECONOMY (OE)
Recreational, cultural and sporting services		OTHER ECONOMY (OE)
Other services		OTHER ECONOMY (OE)
Private households with employed persons		OTHER ECONOMY (OE)

Table B. 1: Social Accounting Matrix for Turkey (2002, billion TL)

		ACTIVITIES										
		AG	CO	PG	PA	RP	CE	IS	EL	TR	OE	
ACTIVITIES	AG											
	CO											
	PG											
	PA											
	RP											
	CE											
	IS											
	EL											
	TR											
	OE											
COMMODITIES	AG	7,296,542.24	23.57	248.88	13,945.32	12,493.57	1,077.72	860.55	5,796.17	24,004.55	21,628,643.43	
	CO	12,746.44	23,458.19	0.85	1,620.72	477.24	146,904.37	43,953.04	508,961.01	2,474.85	840,002.63	
	PG	108.76	1.00	12,715.32	59,162.37	4,337,641.50	99,330.24	43,915.21	2,744,661.38	1.00	1,124,444.59	
	PA	14,124.99	2,647.59	280.14	1,396,601.22	3,490.64	228,284.69	27,372.47	6,931.56	49,217.71	4,643,004.46	
	RP	824,700.25	54,961.51	2,828.74	71,609.52	599,449.80	297,753.43	97,100.51	68,386.55	3,197,350.70	3,979,363.45	
	CE	40,974.40	4,444.84	1,115.94	16,934.76	36,049.44	1,434,514.82	455,418.27	3,204.79	2,743.50	7,074,453.38	
	IS	1,806.68	41,983.19	15,936.34	14,503.03	51,436.10	65,772.64	6,008,158.45	91,638.26	323,731.76	13,180,740.32	
	EL	233,149.37	70,319.28	27,475.56	241,901.52	64,495.25	312,640.37	723,202.88	7,687,349.57	81,511.65	5,612,627.35	
	TR	763,485.08	41,785.10	9,936.04	258,990.13	559,362.99	535,380.65	763,294.53	375,094.95	13,994,612.86	18,915,514.66	
	OE	7,632,199.89	372,721.64	119,377.10	1,762,734.59	896,465.79	3,295,675.43	2,838,467.91	1,296,541.38	13,548,492.89	163,466,361.87	
FACTORS	L	8,676,622.88	950,098.47	31,021.39	372,837.44	175,189.62	449,878.54	1,177,539.57	1,307,804.42	8,629,730.45	77,977,634.99	
	K	14,609,344.86	53,578.22	464,692.47	725,271.14	355,833.73	2,583,263.97	1,615,014.09	3,022,190.54	19,182,080.96	80,378,720.71	
HOUSEHOLDS												
ENTERPRISES												
SOCIAL SECURITY INST.		264,402.54	135,148.97	3,519.54	53,035.13	19,876.21	63,994.02	133,598.20	222,246.30	979,689.35	8,846,982.26	
GOVERNMENT		3,140,309.28	59,020.05	10,047.97	57,561.75	531,173.79	163,334.85	159,231.81	166,924.88	3,812,846.38	11,918,119.64	
	VAT											
	IMPTAX											
	PROTAX	3,140,309.28	59,020.05	10,047.97	57,561.75	531,173.79	163,334.85	159,231.81	166,924.88	3,812,846.38	11,918,119.64	
	NONTAX											
	DIRTAX											
	FACINC											
	ENTTAX											
PRIVATE CAPITAL Acc												
PUBLIC CAPITAL Acc												
REST OF THE WORLD												
TOTAL EXPENDITURES		43,510,517.65	1,810,184.63	699,316.29	5,046,708.66	7,643,435.77	9,677,805.75	14,087,127.49	17,507,731.78	63,827,888.61	419,586,613.73	

Table B.1 (cont'd)

		COMMODITIES											FACTORS		HOUSEHOLDS	ENTERPRISES
		AG	CO	PG	IPA	RP	CE	IS	EL	TR	OE		L	K		
ACTIVITIES	AG	40,729,574.70														
	CO		1,888,027.43													
	PG			694,345.04												
	PA				4,573,863.53											
	RP					6,688,943.90										
	CE						7,457,958.39									
	IS							8,990,165.27								
	EL								17,478,686.52							
	TR									53,364,588.72						
	OE										361,208,588.04					
COMMODITIES	AG														16,045,532.38	
	CO														1,352,412.10	
	PG														0.00	
	PA														790,500.61	
	RP														5,504,179.32	
	CE														480,000.00	
	IS														7,036.68	
	EL														3,092,801.02	
	TR														22,954,880.81	
	OE														180,064,445.72	
FACTORS	L															
	K															
HOUSEHOLDS													95,911,422.31			14,485,000,000.48
ENTERPRISES													122,989,990.69			
SOCIAL SECURITY INST.													5,856,935.48			
GOVERNMENT		1,991,903.25	160,107.03	2,363.50	96,391.95	296,010.40	61,399.51	4,001.28	378,312.33	2,678,440.97	16,851,477.35				24,212,254.00	27,954,420.00
	VAT	1,872,099.83	157,803.80	0.00	92,258.16	292,195.75	57,059.14	821.06	360,877.98	2,678,440.97	16,343,193.65					
	IMPTAX	119,953.43	2,303.24	2,363.50	4,133.79	4,022.68	4,340.37	3,980.21	17,434.36	0.00	508,283.70					
	PROTAX														8,401,546.00	21,549,541.00
	INVTAX														13,810,669.00	6,404,887.000
	DIRTAX															
	FACINC															
	ENTTAX															
PRIVATE CAPITAL Acc															41,345,461.615	
PUBLIC CAPITAL Acc															27,027,488.400	
REST OF THE WORLD		2,389,170.32	1,013,720.97	956,570.83	2,402,200.60	475,344.43	2,462,104.02	10,957,856.91	566,474.97	4,401,176.86	48,191,911.11					4,485,505.84
TOTAL EXPENDITURES		45,110,708.27	2,981,868.43	8,421,979.38	7,162,456.09	11,741,527.73	9,566,561.83	19,982,963.45	183,479,473.82	69,877,967.55	426,901,660.49		99,768,357.79	122,989,990.69	279,487,261.00	177,230,542.72

Table B.1 (cont'd)

		SOCIAL SECURITY INST.	GOVERNMENT	PUBCONS	IBTRA	PRO SUB	DOMINT	FORINT	SSTRA	PUBSAV	PRIVATE CAPITAL	PUBLIC CAPITAL	REST OF THE WORLD	TOTAL RECEIPTS
ACTIVITIES	AG												2,789,942.95	43,519,517.65
	CO												2,157.21	1,810,184.63
	PG												4,971.25	699,316.29
	PA												472,845.13	5,046,708.66
	RP												954,498.88	7,643,435.77
	CE												2,240,747.44	9,677,805.75
	IS												5,136,962.22	14,087,127.49
	EL												29,045.25	17,507,731.78
	TR												10,033,998.89	63,827,888.61
	OE												57,818,024.79	419,586,613.73
COMMODITIES	AG		62,366.71	62,366.71							18,955.28	2,227.90		43,119,708.27
	CO		48,862.98	48,862.98							0.00	0.00		2,981,867.43
	PG		0.00	0.00							0.00	0.00		8,421,981.38
	PA		0.00	0.00							0.00	0.00		7,162,456.08
	RP		43,692.64	43,692.64							0.00	0.00		11,741,376.73
	CE		0.00	0.00							0.00	1,698.70		9,569,561.83
	IS		0.00	0.00							0.00	0.00		19,802,803.45
	EL		0.00	0.00							0.00	0.00		18,147,473.82
	TR		127,603.87	127,603.87							1,302,154.33	275,822.56		60,877,906.55
	OE		34,544,097.81	34,544,097.81							40,032,306.54	16,541,557.85		426,801,646.40
FACTORS	L													99,748,357.79
	K													122,980,949.69
HOUSEHOLDS		25,395,730.00	12,686,902.00		12,686,902.00								3,040,296.64	279,887,240.43
ENTERPRISES			49,615,228.10			1,272,360.00	48,342,668.10						4,688,323.93	177,290,542.72
SOCIAL SECURITY INST.			8,836,902.00						8,836,902.00					25,395,730.00
GOVERNMENT														94,714,419.00
	VAT													
	IMPTAX													
	PROTAX													
	NONTAX													
	DIRTAX													
	FACINC													
	EVTTAX													
PRIVATE CAPITAL Acc			-17,033,473.00						-17,033,473.00					-41,343,416.15
PUBLIC CAPITAL Acc			5,782,234.90					5,782,234.90					7,227,096.00	18,221,307.00
REST OF THE WORLD														94,418,503.14
TOTAL EXPENDITURES		25,395,730.00	94,714,419.00	34,826,624.00	12,686,902.00	1,272,360.00	48,342,668.10	5,782,234.90	8,836,902.00	-17,033,473.00	41,343,416.15	17,221,307.00	94,418,503.14	

Table B. 2: Definition of SAM

		Activities	Commodities	Factors		Households	Enterprises	Social Sec. Inst.	Government	Capital Account		ROW	Total Receipts
				Labor	Capital					Private Investment	Public Investment		
Activities			Domestic Supply									Exports	Total Sales Revenue
Commodities		Intermediate Inputs				Private Consumption			Government Consumption	Private Investment	Public Investment		Domestic Absorption
Factors	Labor	Wages											Labor Income
	Capital	Operating Surplus + Depreciation											Capital Income
Households				Labor Income			Distributed Profits (Net)	Social Security Expenditures	Current Transfers to Households			Remittances	Private Income
Enterprises					Capital Income				Transfers to SEEs			Private For. Transfers	Corporate Income
Social Sec. Inst.		Soc. Sec. Taxes by Employers		Soc. Sec. Taxes by Workers					Current Transfers to Soc. Sec. Institutions				Social Security Income
Government		Net Indirect Taxes on Production	Sales Taxes (VAT) + Tariffs			HH Income Tax+ NonTax Rev	Pub. Sector Factor Income + Corporate Taxes					Public For. Transfers	Public Income
Capital Account	Private Investment					Private Investment							Private Investment
	Public Investment					Private Saving Surplus			Public Savings			Foreign Resources	Public Investment
Rest of the World			Imports				Profit Transfers Abroad		Foreign Interest Payments on Ext Pub. Debt				For. Exch. Earnings
Total Expenditures		Production Costs	Aggregate Absorption	Labor Costs	Capital Expenditures	Private HH Expenditures	Corporate Expenditures	Social Security Expenditures	Public Expenditures	Private Investment	Public Investment	For. Exch. Expenses	

Table C. 1: Simulation Results of Business-As-Usual Scenario

	PERIODS										
	2002	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
GDP	276.002	289.516	302.822	318.354	334.386	351.188	367.736	384.723	403.644	423.676	444.635
GDP growth rate		4.896	4.596	5.129	5.036	5.025	4.712	4.619	4.918	4.963	4.947
Sectoral Output											
Agriculture	43.514	43.946	45.537	47.262	49.459	51.706	53.814	56.065	58.478	60.907	63.523
Coal	1.81	1.953	1.998	2.044	2.113	2.167	2.222	2.283	2.353	2.43	2.51
Petroleum and Gas	0.699	0.695	0.725	0.763	0.803	0.847	0.89	0.933	0.978	1.025	1.073
Paper Products	5.047	5.553	5.834	6.154	6.465	6.785	7.107	7.448	7.852	8.289	8.748
Refined Petroleum	7.644	8.435	8.868	9.365	9.832	10.329	10.835	11.377	12.035	12.752	13.51
Cement	9.678	10.522	11.073	11.708	12.326	12.969	13.616	14.288	15.069	15.912	16.792
Iron and Steel	14.087	17.783	18.904	20.023	21.026	21.914	22.864	23.976	25.513	27.261	29.115
Electricity	17.509	19.192	20.127	21.194	22.23	23.305	24.395	25.556	26.943	28.452	30.038
Transportation	63.832	66.832	69.462	72.586	75.939	79.376	82.801	86.339	90.277	94.495	98.881
Other Economy	419.573	440.361	461.532	486.445	511.604	538.214	564.452	591.148	620.805	652.222	685.022
Unemployment rate	10.342	10.708	10.73	10.655	10.159	10.419	10.389	10.337	10.199	10.069	10.036
Private investment	41.302	52.417	55.961	59.055	62.376	64.587	66.575	68.483	70.708	73.007	75.28
Private investment (%GDP)	0.150	0.181	0.185	0.186	0.187	0.184	0.181	0.178	0.175	0.172	0.169
Private Consumption	187.34	187.9	195.032	204.354	213.829	224.923	236.027	247.557	260.371	274.03	288.46
Agriculture	16.047	15.86	16.374	16.997	17.746	18.583	19.39	20.251	21.185	22.145	23.178
Coal	1.353	1.388	1.43	1.482	1.542	1.605	1.669	1.737	1.814	1.896	1.983
Paper Products	0.791	0.81	0.842	0.883	0.923	0.97	1.017	1.067	1.124	1.185	1.25
Refined Petroleum	2.505	2.572	2.675	2.808	2.937	3.087	3.24	3.4	3.585	3.785	3.996
Cement	0.489	0.497	0.517	0.543	0.568	0.598	0.627	0.659	0.694	0.732	0.772
Iron and Steel	0.007	0.007	0.008	0.008	0.008	0.009	0.009	0.01	0.01	0.011	0.011
Electricity	3.093	3.206	3.333	3.492	3.65	3.83	4.013	4.207	4.431	4.674	4.931
Transportation	22.96	23.205	24.022	25.087	26.197	27.46	28.73	30.051	31.52	33.095	34.751
Other Economy	140.095	140.353	145.832	153.054	160.258	168.781	177.332	186.176	196.008	206.507	217.588

Table C.1 (cont'd)

	PERIODS									
	2002	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
Public investment	17.221	17.676	18.395	19.289	20.193	21.199	22.202	23.239	24.403	25.645	26.953
Public consumption	34.826	36.232	37.798	39.679	41.589	43.647	45.689	47.795	50.16	52.681	55.327
Public investment (%GDP)	0.06239	0.06105	0.06075	0.06059	0.06039	0.06036	0.06037	0.06040	0.06046	0.06053	0.06062
Public consumption (%GDP)	0.12618	0.12515	0.12482	0.12464	0.12437	0.12428	0.12424	0.12423	0.12427	0.12434	0.12443
Payroll tax revenue	10.722	11.264	11.757	12.336	12.93	13.556	14.176	14.82	15.549	16.327	17.143
Payroll tax revenue (%total tax revenue)	0.09636	0.09716	0.09720	0.09716	0.09716	0.09708	0.09700	0.09694	0.09692	0.09690	0.09688
ENVIRONMENTAL INDICATORS											
Total CO2 emissions	216.444	233.404	243.308	254.584	266.346	278.170	290.065	302.691	317.418	333.361	350.070
Energy use related emissions	177.333	192.718	200.958	210.22	219.906	229.487	239.142	249.431	261.514	274.626	288.361
Industrial process related emissions	19.107	20.151	21.094	22.19	23.312	24.485	25.644	26.837	28.176	29.599	31.088
Sectoral CO2 emissions											
Agriculture	6.067	6.224	6.455	6.718	7.026	7.343	7.649	7.972	8.325	8.692	9.081
Coal	12.636	13.063	13.457	13.943	14.5	15.079	15.662	16.284	16.984	17.741	18.533
Petroleum and Gas	1.782	1.847	1.931	2.032	2.134	2.245	2.355	2.467	2.591	2.724	2.861
Paper Products	41.892	45.656	47.67	49.921	52.27	54.579	56.896	59.347	62.206	65.299	68.531
Refined Petroleum	65.706	71.349	74.428	77.954	81.533	85.201	88.92	92.912	97.654	102.816	108.245
Cement	6.976	7.629	7.989	8.391	8.805	9.213	9.623	10.054	10.557	11.1	11.667
Iron and Steel	6.483	8.024	8.478	8.926	9.35	9.71	10.094	10.544	11.159	11.856	12.593
Electricity	19.207	20.778	21.672	22.689	23.74	24.796	25.86	26.991	28.316	29.755	31.262
Transportation	36.511	38.588	40.038	41.724	43.578	45.428	47.276	49.214	51.403	53.761	56.219
Other Economy	19.181	20.246	21.189	22.286	23.411	24.577	25.73	26.907	28.222	29.619	31.077

Table C. 2: Simulation Results of a 10% Energy Tax Levy

	PERIODS										
	2002	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
GDP	276.002	288.339	301.119	315.981	331.155	346.866	362.015	377.198	393.759	410.717	427.658
GDP growth rate		4.47	4.432	4.936	4.802	4.744	4.367	4.194	4.391	4.306	4.125
Sectoral Output											
Agriculture	43.514	43.803	45.29	46.892	48.934	50.993	52.869	54.83	56.878	58.853	60.891
Coal	1.81	1.825	1.859	1.893	1.948	1.987	2.026	2.068	2.115	2.166	2.214
Petroleum and Gas	0.699	0.592	0.616	0.648	0.681	0.717	0.751	0.785	0.819	0.853	0.887
Paper Products	5.047	5.392	5.655	5.952	6.237	6.526	6.812	7.107	7.453	7.816	8.182
Refined Petroleum	7.644	7.395	7.758	8.174	8.561	8.969	9.376	9.804	10.315	10.858	11.411
Cement	9.678	10.2	10.714	11.305	11.873	12.458	13.033	13.619	14.287	14.988	15.689
Iron and Steel	14.087	16.29	17.239	18.183	19.018	19.744	20.498	21.361	22.542	23.849	25.178
Electricity	17.509	14.379	15.042	15.802	16.53	17.281	18.027	18.803	19.716	20.68	21.655
Transportation	63.832	66.323	68.784	71.704	74.81	77.946	81.002	84.082	87.439	90.924	94.382
Other Economy	419.573	438.636	459.125	483.132	507.102	532.153	556.366	580.425	606.602	633.432	660.165
Unemployment rate	10.342	11.733	12.104	12.397	12.31	12.998	13.463	13.979	14.5	15.13	15.972
Private investment	41.302	51.966	55.364	58.272	61.355	63.261	64.85	66.234	67.761	69.138	70.198
Private investment (%GDP)	0.150	0.180	0.184	0.184	0.185	0.182	0.179	0.176	0.172	0.168	0.164
Private Consumption	187.34	186.273	193.084	202	210.972	221.436	231.751	242.28	253.795	265.782	278.047
Agriculture	16.047	15.779	16.258	16.841	17.54	18.317	19.049	19.817	20.635	21.448	22.295
Coal	1.353	1.369	1.406	1.454	1.508	1.565	1.621	1.68	1.745	1.813	1.882
Paper Products	0.791	0.798	0.828	0.867	0.904	0.948	0.992	1.037	1.087	1.141	1.195
Refined Petroleum	2.505	2.45	2.544	2.666	2.783	2.919	3.055	3.196	3.355	3.523	3.696
Cement	0.489	0.49	0.508	0.533	0.556	0.584	0.611	0.64	0.671	0.704	0.738
Iron and Steel	0.007	0.007	0.007	0.008	0.008	0.008	0.009	0.009	0.01	0.01	0.011
Electricity	3.093	2.876	2.984	3.121	3.255	3.407	3.56	3.718	3.899	4.09	4.287
Transportation	22.96	23.07	23.841	24.85	25.892	27.07	28.235	29.425	30.726	32.087	33.47
Other Economy	140.095	139.436	144.707	151.66	158.526	166.617	174.619	182.758	191.668	200.964	210.473

Table C.2 (cont'd)

	PERIODS										
	2002	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
Public investment	17.221	18.284	19.005	19.899	20.792	21.777	22.742	23.719	24.796	25.914	27.046
Public consumption	34.826	36.767	38.301	40.14	41.986	43.955	45.871	47.803	49.93	52.129	54.34
Public investment (%GDP)	0.06239	0.06341	0.06311	0.06298	0.06279	0.06278	0.06282	0.06288	0.06297	0.06309	0.06324
Public consumption (%GDP)	0.12618	0.12751	0.12720	0.12703	0.12679	0.12672	0.12671	0.12673	0.12680	0.12692	0.12706
Payroll tax revenue	10.722	11.059	11.522	12.064	12.617	13.192	13.75	14.316	14.942	15.589	16.239
Payroll tax revenue (%total tax revenue)	0.09636	0.09446	0.09448	0.09440	0.09439	0.09429	0.09419	0.09411	0.09405	0.09400	0.09394
Tax burden (Total tax rev. /GDP)	0.40316	0.40602	0.40502	0.40444	0.40364	0.40337	0.40326	0.40327	0.40346	0.40379	0.40421
ENVIRONMENTAL INDICATORS											
Total CO2 emissions	216.444	216.383	224.987	234.788	244.928	254.991	264.876	275.113	286.819	299.109	311.432
Energy use related emissions	177.333	176.672	183.726	191.653	199.879	207.893	215.772	223.96	233.395	243.32	253.257
Industrial process related emissions	19.107	19.809	20.702	21.737	22.785	23.868	24.916	25.968	27.123	28.311	29.498
Sectoral CO2 emissions											
Agriculture	6.067	6.147	6.36	6.604	6.888	7.176	7.448	7.727	8.026	8.326	8.629
Coal	12.636	12.686	13.036	13.471	13.966	14.476	14.978	15.503	16.082	16.693	17.307
Petroleum and Gas	1.782	1.546	1.613	1.694	1.775	1.862	1.948	2.033	2.124	2.218	2.312
Paper Products	41.892	43.586	45.397	47.414	49.497	51.508	53.476	55.509	57.842	60.288	62.725
Refined Petroleum	65.706	63.859	66.449	69.424	72.412	75.451	78.464	81.623	85.311	89.213	93.157
Cement	6.976	7.205	7.527	7.887	8.251	8.606	8.954	9.31	9.719	10.147	10.573
Iron and Steel	6.483	7.276	7.651	8.018	8.362	8.648	8.943	9.282	9.738	10.241	10.75
Electricity	19.207	16.684	17.354	18.119	18.9	19.681	20.448	21.244	22.16	23.121	24.087
Transportation	36.511	37.406	38.712	40.229	41.888	43.515	45.102	46.724	48.52	50.393	52.256
Other Economy	19.181	19.989	20.888	21.93	22.986	24.069	25.116	26.159	27.299	28.471	29.635
Environmental tax revenue		2.212	2.311	2.427	2.541	2.66	2.777	2.895	3.029	3.169	3.309
Environmental tax revenue (%total tax revenue)		0.019	0.020	0.021	0.022	0.023	0.024	0.025	0.026	0.027	0.028

Table C. 3: Simulation Results of a 20% Energy Tax Levy

	PERIODS										
	2002	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
GDP	276.002	287.591	300.51	315.51	330.82	346.658	361.933	377.239	393.926	411.018	428.111
GDP growth rate		4.199	4.492	4.991	4.852	4.788	4.406	4.229	4.423	4.339	4.159
Sectoral Output											
Agriculture	43.514	43.751	45.235	46.83	48.861	50.904	52.76	54.697	56.718	58.665	60.673
Coal	1.81	1.727	1.756	1.785	1.834	1.867	1.899	1.934	1.974	2.016	2.056
Petroleum and Gas	0.699	0.517	0.539	0.567	0.596	0.628	0.659	0.689	0.719	0.75	0.78
Paper Products	5.047	5.264	5.522	5.813	6.093	6.377	6.656	6.945	7.282	7.637	7.994
Refined Petroleum	7.644	6.607	6.932	7.305	7.652	8.019	8.384	8.767	9.222	9.706	10.198
Cement	9.678	9.948	10.455	11.035	11.594	12.169	12.734	13.309	13.964	14.651	15.338
Iron and Steel	14.087	15.177	16.035	16.893	17.654	18.319	19.004	19.779	20.829	21.985	23.154
Electricity	17.509	11.279	11.797	12.392	12.964	13.557	14.144	14.754	15.466	16.219	16.98
Transportation	63.832	66.035	68.484	71.387	74.47	77.578	80.599	83.638	86.949	90.383	93.789
Other Economy	419.573	437.811	458.641	482.994	507.314	532.714	557.289	581.729	608.324	635.61	662.844
Unemployment rate	10.342	12.398	12.905	13.334	13.391	14.219	14.836	15.513	16.204	17.001	18.003
Private investment	41.302	51.701	55.135	58.081	61.206	63.156	64.791	66.221	67.793	69.221	70.339
Private investment (%GDP)	0.150	0.180	0.183	0.184	0.185	0.182	0.179	0.176	0.172	0.168	0.164
Private Consumption	187.34	185.225	192.098	201.069	210.094	220.605	230.964	241.533	253.084	265.108	277.417
Agriculture	16.047	15.736	16.214	16.795	17.49	18.263	18.989	19.75	20.558	21.361	22.198
Coal	1.353	1.354	1.391	1.437	1.49	1.545	1.6	1.657	1.72	1.786	1.852
Paper Products	0.791	0.788	0.818	0.857	0.895	0.938	0.981	1.026	1.076	1.129	1.184
Refined Petroleum	2.505	2.353	2.445	2.562	2.676	2.808	2.94	3.076	3.23	3.392	3.559
Cement	0.489	0.484	0.502	0.527	0.55	0.578	0.605	0.633	0.665	0.698	0.731
Iron and Steel	0.007	0.007	0.007	0.008	0.008	0.008	0.009	0.009	0.01	0.01	0.011
Electricity	3.093	2.615	2.714	2.84	2.962	3.101	3.24	3.384	3.549	3.723	3.901
Transportation	22.96	22.996	23.769	24.779	25.82	26.997	28.158	29.343	30.637	31.99	33.365
Other Economy	140.095	138.892	144.238	151.264	158.203	166.366	174.442	182.654	191.641	201.019	210.618

Table C.3 (cont'd)

	PERIODS										
	2002	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
Public investment	17.221	18.725	19.478	20.407	21.335	22.356	23.356	24.369	25.484	26.642	27.815
Public consumption	34.826	37.17	38.745	40.628	42.52	44.536	46.498	48.475	50.65	52.898	55.16
Public investment (%GDP)	0.06239	0.06511	0.06482	0.06468	0.06449	0.06449	0.06453	0.06460	0.06469	0.06482	0.06497
Public consumption (%GDP)	0.12618	0.12925	0.12893	0.12877	0.12853	0.12847	0.12847	0.12850	0.12858	0.12870	0.12885
Payroll tax revenue	10.722	10.92	11.381	11.921	12.471	13.045	13.6	14.163	14.784	15.425	16.069
Payroll tax revenue (%total tax revenue)	0.09636	0.09258	0.09257	0.09248	0.09245	0.09234	0.09223	0.09214	0.09207	0.09199	0.09191
Tax burden (Total tax rev. /GDP)	0.40316	0.41014	0.40913	0.40855	0.40777	0.40751	0.40742	0.40745	0.40763	0.40797	0.40838
ENVIRONMENTAL INDICATORS											
Total CO2 emissions	216.444	203.736	211.779	220.964	230.475	239.922	249.173	258.719	269.593	280.988	292.408
Energy use related emissions	177.333	164.74	171.251	178.585	186.205	193.629	200.903	208.433	217.075	226.151	235.229
Industrial process related emissions	19.107	19.589	20.482	21.518	22.567	23.651	24.699	25.75	26.903	28.088	29.273
Sectoral CO2 emissions											
Agriculture	6.067	6.088	6.3	6.541	6.822	7.106	7.373	7.647	7.942	8.235	8.533
Coal	12.636	12.402	12.736	13.155	13.631	14.122	14.603	15.103	15.657	16.238	16.822
Petroleum and Gas	1.782	1.331	1.389	1.46	1.531	1.607	1.681	1.754	1.833	1.914	1.996
Paper Products	41.892	41.893	43.627	45.555	47.549	49.468	51.344	53.275	55.491	57.81	60.122
Refined Petroleum	65.706	58.252	60.603	63.315	66.04	68.818	71.566	74.435	77.768	81.289	84.847
Cement	6.976	6.865	7.171	7.514	7.861	8.199	8.529	8.867	9.253	9.658	10.06
Iron and Steel	6.483	6.715	7.047	7.374	7.683	7.94	8.202	8.5	8.897	9.333	9.77
Electricity	19.207	13.919	14.471	15.105	15.754	16.404	17.042	17.701	18.456	19.248	20.044
Transportation	36.511	36.476	37.734	39.199	40.8	42.367	43.891	45.444	47.161	48.95	50.729
Other Economy	19.181	19.795	20.699	21.747	22.806	23.893	24.944	25.991	27.136	28.313	29.485
Environmental tax revenue		3.775	3.947	4.146	4.343	4.549	4.749	4.953	5.183	5.422	5.662
Environmental tax revenue (%total tax revenue)		0.03200	0.03210	0.03216	0.03219	0.03220	0.03221	0.03222	0.03228	0.03233	0.03239

Table C. 4: Simulation Results of a 10% Energy Tax Levy with a 1 point payroll tax reduction

		PERIODS									
	2002	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
GDP	276.002	288.833	301.852	317.014	332.559	348.728	364.449	380.356	397.856	416.033	434.567
GDP growth rate		4.649	4.507	5.023	4.904	4.862	4.508	4.365	4.601	4.569	4.455
Sectoral Output											
Agriculture	43.514	43.976	45.501	47.147	49.247	51.373	53.331	55.395	57.573	59.712	61.962
Coal	1.81	1.844	1.88	1.916	1.974	2.016	2.057	2.104	2.156	2.213	2.269
Petroleum and Gas	0.699	0.592	0.617	0.649	0.682	0.719	0.755	0.79	0.825	0.862	0.899
Paper Products	5.047	5.406	5.674	5.977	6.269	6.567	6.864	7.173	7.537	7.924	8.321
Refined Petroleum	7.644	7.412	7.781	8.205	8.601	9.021	9.442	9.888	10.423	10.998	11.592
Cement	9.678	10.218	10.741	11.343	11.925	12.526	13.123	13.736	14.439	15.185	15.947
Iron and Steel	14.087	16.403	17.373	18.342	19.204	19.96	20.752	21.663	22.911	24.306	25.747
Electricity	17.509	14.419	15.095	15.871	16.617	17.392	18.165	18.978	19.937	20.963	22.017
Transportation	63.832	66.569	69.088	72.078	75.271	78.511	81.693	84.931	88.491	92.235	96.028
Other Economy	419.573	439.044	459.886	484.339	508.866	534.614	559.704	584.879	612.51	641.24	670.466
Unemployment rate	10.342	10.898	11.207	11.428	11.251	11.846	12.196	12.574	12.926	13.348	13.937
Private investment	41.302	52.093	55.557	58.549	61.738	63.777	65.535	67.135	68.945	70.694	72.242
Private investment (%GDP)	0.150	0.180	0.184	0.185	0.186	0.183	0.180	0.177	0.173	0.170	0.166
Private Consumption	187.34	186.551	193.49	202.565	211.735	222.44	233.054	243.958	255.96	268.576	281.663
Agriculture	16.047	15.832	16.324	16.921	17.638	18.436	19.194	19.995	20.853	21.719	22.633
Coal	1.353	1.376	1.414	1.464	1.519	1.578	1.636	1.698	1.766	1.839	1.914
Paper Products	0.791	0.799	0.83	0.869	0.908	0.953	0.998	1.044	1.097	1.153	1.211
Refined Petroleum	2.505	2.454	2.55	2.674	2.793	2.933	3.072	3.218	3.384	3.561	3.745
Cement	0.489	0.49	0.509	0.534	0.558	0.587	0.615	0.644	0.677	0.712	0.748
Iron and Steel	0.007	0.007	0.007	0.008	0.008	0.009	0.009	0.009	0.01	0.01	0.011
Electricity	3.093	2.883	2.993	3.133	3.27	3.426	3.583	3.747	3.936	4.138	4.347
Transportation	22.96	23.133	23.921	24.951	26.018	27.228	28.431	29.667	31.029	32.468	33.951
Other Economy	140.095	139.576	144.941	152.012	159.022	167.292	175.516	183.935	193.208	202.977	213.104

Table C.4 (cont'd)

	PERIODS										
	2002	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
Public investment	17.221	18.311	19.047	19.957	20.871	21.882	22.879	23.897	25.026	26.214	27.436
Public consumption	34.826	36.826	38.389	40.263	42.154	44.178	46.163	48.181	50.421	52.767	55.17
Public investment (%GDP)	0.06239	0.06340	0.06310	0.06295	0.06276	0.06275	0.06278	0.06283	0.06290	0.06301	0.06313
Public consumption (%GDP)	0.12618	0.12750	0.12718	0.12701	0.12676	0.12668	0.12667	0.12667	0.12673	0.12683	0.12695
Payroll tax revenue	10.722	10.856	11.318	11.86	12.415	12.995	13.563	14.143	14.79	15.468	16.162
Payroll tax revenue (%total tax revenue)	0.09636	0.09272	0.09273	0.09266	0.09264	0.09255	0.09245	0.09238	0.09232	0.09227	0.09222
Tax burden (Total tax rev. /GDP)	0.40316	0.40538	0.40436	0.40377	0.40296	0.40266	0.40253	0.40250	0.40265	0.40293	0.40328
ENVIRONMENTAL INDICATORS											
Total CO2 emissions	216.444	217.285	226.078	236.11	246.536	256.936	267.236	277.995	290.379	303.544	316.999
Energy use related emissions	177.333	177.472	184.685	192.803	201.268	209.561	217.783	226.403	236.398	247.047	257.918
Industrial process related emissions	19.107	19.843	20.752	21.808	22.882	23.997	25.084	26.186	27.406	28.678	29.975
Sectoral CO2 emissions											
Agriculture	6.067	6.17	6.389	6.638	6.931	7.229	7.511	7.805	8.122	8.445	8.778
Coal	12.636	12.756	13.116	13.563	14.074	14.601	15.124	15.675	16.289	16.941	17.61
Petroleum and Gas	1.782	1.548	1.616	1.699	1.782	1.873	1.96	2.048	2.144	2.245	2.347
Paper Products	41.892	43.772	45.623	47.687	49.83	51.911	53.968	56.11	58.585	61.214	63.889
Refined Petroleum	65.706	64.117	66.762	69.804	72.874	76.008	79.141	82.452	86.335	90.49	94.764
Cement	6.976	7.232	7.561	7.929	8.303	8.669	9.032	9.407	9.84	10.299	10.766
Iron and Steel	6.483	7.333	7.718	8.095	8.452	8.751	9.063	9.42	9.906	10.446	11.001
Electricity	19.207	16.751	17.436	18.218	19.022	19.829	20.628	21.465	22.432	23.462	24.515
Transportation	36.511	37.582	38.92	40.477	42.184	43.868	45.526	47.236	49.143	51.16	53.208
Other Economy	19.181	20.022	20.938	22.001	23.083	24.197	25.283	26.378	27.584	28.841	30.119
Environmental tax revenue		2.216	2.317	2.436	2.552	2.675	2.796	2.92	3.061	3.21	3.362
Environmental tax revenue (%total tax revenue)		0.01893	0.01898	0.01903	0.01904	0.01905	0.01906	0.01907	0.01911	0.01915	0.01918

Table C. 5: Simulation Results of a 10% Energy Tax Levy with a 2 point payroll tax reduction

	PERIODS									
	2002	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
GDP	276.002	289.332	302.594	318.058	333.98	350.614	366.916	383.558	402.014	421.434	441.592
GDP growth rate		4.83	4.583	5.111	5.006	4.981	4.649	4.536	4.812	4.831	4.783
Sectoral Output											
Agriculture	43.514	44.152	45.714	47.406	49.563	51.759	53.801	55.969	58.28	60.587	63.053
Coal	1.81	1.864	1.901	1.939	2	2.045	2.09	2.14	2.198	2.261	2.325
Petroleum and Gas	0.699	0.592	0.617	0.65	0.684	0.722	0.759	0.795	0.832	0.871	0.912
Paper Products	5.047	5.42	5.693	6.002	6.301	6.609	6.917	7.24	7.623	8.034	8.463
Refined Petroleum	7.644	7.429	7.804	8.236	8.642	9.073	9.509	9.974	10.533	11.14	11.777
Cement	9.678	10.236	10.769	11.382	11.977	12.596	13.214	13.854	14.593	15.386	16.209
Iron and Steel	14.087	16.518	17.51	18.504	19.393	20.18	21.011	21.972	23.289	24.773	26.331
Electricity	17.509	14.461	15.15	15.94	16.706	17.504	18.306	19.155	20.162	21.25	22.386
Transportation	63.832	66.818	69.395	72.457	75.738	79.084	82.395	85.794	89.561	93.571	97.705
Other Economy	419.573	439.455	460.654	485.558	510.649	537.103	563.082	589.391	618.501	649.163	680.927
Unemployment rate	10.342	10.049	10.294	10.441	10.172	10.672	10.903	11.138	11.315	11.523	11.848
Private investment	41.302	52.221	55.753	58.83	62.125	64.299	66.228	68.049	70.147	72.274	74.319
Private investment (%GDP)	0.150	0.180	0.184	0.185	0.186	0.183	0.180	0.177	0.174	0.171	0.168
Private Consumption	187.34	186.831	193.901	203.137	212.507	223.457	234.374	245.661	258.158	271.417	285.342
Agriculture	16.047	15.887	16.39	17.001	17.737	18.557	19.341	20.175	21.075	21.994	22.976
Coal	1.353	1.383	1.422	1.473	1.53	1.591	1.652	1.716	1.788	1.866	1.946
Paper Products	0.791	0.801	0.832	0.872	0.912	0.958	1.004	1.052	1.107	1.166	1.228
Refined Petroleum	2.505	2.458	2.556	2.681	2.804	2.946	3.09	3.241	3.413	3.599	3.794
Cement	0.489	0.491	0.51	0.536	0.56	0.589	0.618	0.649	0.683	0.719	0.758
Iron and Steel	0.007	0.007	0.007	0.008	0.008	0.009	0.009	0.009	0.01	0.01	0.011
Electricity	3.093	2.89	3.003	3.145	3.285	3.445	3.607	3.777	3.974	4.186	4.408
Transportation	22.96	23.197	24.001	25.053	26.146	27.387	28.629	29.914	31.337	32.856	34.441
Other Economy	140.095	139.718	145.178	152.368	159.525	167.975	176.424	185.128	194.771	205.021	215.779

Table C.5 (cont'd)

	PERIODS										
	2002	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
Public investment	17.221	18.339	19.088	20.016	20.951	21.988	23.018	24.077	25.26	26.518	27.831
Public consumption	34.826	36.885	38.477	40.388	42.324	44.404	46.458	48.564	50.919	53.415	56.014
Public investment (%GDP)	0.06239	0.06338	0.06308	0.06293	0.06273	0.06271	0.06273	0.06277	0.06283	0.06292	0.06302
Public consumption (%GDP)	0.12618	0.12748	0.12716	0.12698	0.12673	0.12665	0.12662	0.12661	0.12666	0.12675	0.12685
Payroll tax revenue	10.722	10.649	11.11	11.652	12.208	12.792	13.368	13.962	14.63	15.338	16.074
Payroll tax revenue (%total tax revenue)	0.09636	0.09094	0.09095	0.09088	0.09087	0.09077	0.09068	0.09061	0.09056	0.09052	0.09047
Tax burden (Total tax rev. /GDP)	0.40316	0.40472	0.40370	0.40309	0.40226	0.40194	0.40178	0.40173	0.40183	0.40207	0.40235
ENVIRONMENTAL INDICATORS											
Total CO2 emissions	216.444	218.2	227.186	237.453	248.169	258.913	269.637	280.929	294.006	308.067	322.682
Energy use related emissions	177.333	178.284	185.659	193.973	202.679	211.257	219.829	228.891	239.459	250.849	262.678
Industrial process related emissions	19.107	19.878	20.804	21.88	22.98	24.127	25.254	26.407	27.694	29.052	30.462
Sectoral CO2 emissions											
Agriculture	6.067	6.194	6.419	6.674	6.974	7.281	7.576	7.884	8.22	8.566	8.931
Coal	12.636	12.827	13.197	13.657	14.183	14.729	15.274	15.851	16.499	17.196	17.92
Petroleum and Gas	1.782	1.55	1.62	1.704	1.789	1.882	1.973	2.064	2.165	2.273	2.383
Paper Products	41.892	43.961	45.851	47.965	50.168	52.321	54.467	56.721	59.341	62.158	65.076
Refined Petroleum	65.706	64.38	67.081	70.189	73.343	76.577	79.831	83.295	87.378	91.794	96.404
Cement	6.976	7.258	7.594	7.971	8.354	8.734	9.112	9.506	9.963	10.455	10.963
Iron and Steel	6.483	7.393	7.786	8.175	8.543	8.856	9.184	9.564	10.079	10.656	11.26
Electricity	19.207	16.82	17.519	18.32	19.146	19.978	20.811	21.688	22.709	23.809	24.952
Transportation	36.511	37.761	39.132	40.728	42.486	44.228	45.958	47.756	49.778	51.943	54.181
Other Economy	19.181	20.056	20.988	22.073	23.18	24.327	25.454	26.599	27.874	29.218	30.61
Environmental tax revenue		2.22	2.323	2.444	2.564	2.69	2.815	2.944	3.093	3.251	3.416
Environmental tax revenue (%total tax revenue)		0.01896	0.01902	0.01906	0.01908	0.01909	0.01910	0.01911	0.01915	0.01919	0.01923

Table C. 6: Simulation Results of a 10% Energy Tax Levy with a 3 point payroll tax reduction

	PERIODS										
	2002	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
GDP	276.002	289.836	303.343	319.114	335.418	352.524	369.415	386.807	406.235	426.921	448.736
GDP growth rate		5.012	4.66	5.199	5.109	5.1	4.792	4.708	5.023	5.092	5.11
Sectoral Output											
Agriculture	43.514	44.33	45.931	47.668	49.884	52.151	54.278	56.553	58.999	61.478	64.167
Coal	1.81	1.884	1.923	1.963	2.027	2.075	2.123	2.178	2.241	2.31	2.383
Petroleum and Gas	0.699	0.592	0.618	0.651	0.686	0.724	0.762	0.8	0.839	0.881	0.924
Paper Products	5.047	5.434	5.712	6.027	6.334	6.651	6.97	7.308	7.71	8.146	8.608
Refined Petroleum	7.644	7.446	7.828	8.267	8.683	9.126	9.577	10.06	10.645	11.284	11.964
Cement	9.678	10.255	10.796	11.421	12.03	12.667	13.307	13.974	14.749	15.59	16.475
Iron and Steel	14.087	16.635	17.649	18.668	19.586	20.405	21.275	22.287	23.675	25.252	26.929
Electricity	17.509	14.502	15.204	16.011	16.796	17.617	18.449	19.335	20.39	21.543	22.762
Transportation	63.832	67.071	69.707	72.841	76.212	79.665	83.108	86.672	90.649	94.931	99.415
Other Economy	419.573	439.87	461.429	486.79	512.451	539.622	566.504	593.963	624.576	657.205	691.554
Unemployment rate	10.342	9.185	9.365	9.436	9.072	9.473	9.582	9.669	9.665	9.651	9.704
Private investment	41.302	52.35	55.95	59.114	62.517	64.828	66.932	68.976	71.368	73.88	76.432
Private investment (%GDP)	0.150	0.181	0.184	0.185	0.186	0.184	0.181	0.178	0.176	0.173	0.170
Private Consumption	187.34	187.114	194.316	203.716	213.289	224.487	235.713	247.388	260.39	274.303	289.083
Agriculture	16.047	15.942	16.458	17.083	17.837	18.68	19.491	20.358	21.301	22.274	23.327
Coal	1.353	1.39	1.431	1.483	1.541	1.604	1.667	1.735	1.81	1.893	1.979
Paper Products	0.791	0.802	0.834	0.875	0.916	0.962	1.01	1.06	1.117	1.179	1.244
Refined Petroleum	2.505	2.462	2.561	2.689	2.814	2.96	3.108	3.264	3.443	3.637	3.844
Cement	0.489	0.492	0.512	0.537	0.562	0.592	0.622	0.653	0.689	0.727	0.767
Iron and Steel	0.007	0.007	0.007	0.008	0.008	0.009	0.009	0.009	0.01	0.011	0.011
Electricity	3.093	2.897	3.012	3.157	3.3	3.464	3.631	3.808	4.012	4.235	4.471
Transportation	22.96	23.261	24.083	25.156	26.276	27.549	28.83	30.164	31.65	33.25	34.941
Other Economy	140.095	139.861	145.418	152.727	160.033	168.667	177.344	186.337	196.357	207.098	218.498

Table C.6 (cont'd)

	PERIODS										
	2002	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
Public investment	17.221	18.368	19.131	20.076	21.032	22.096	23.159	24.26	25.498	26.827	28.234
Public consumption	34.826	36.945	38.567	40.514	42.496	44.632	46.757	48.953	51.425	54.074	56.873
Public investment (%GDP)	0.06239	0.06337	0.06307	0.06291	0.06270	0.06268	0.06269	0.06272	0.06277	0.06284	0.06292
Public consumption (%GDP)	0.12618	0.12747	0.12714	0.12696	0.12670	0.12661	0.12657	0.12656	0.12659	0.12666	0.12674
Payroll tax revenue	10.722	10.437	10.897	11.438	11.995	12.583	13.167	13.774	14.46	15.197	15.974
Payroll tax revenue (%total tax revenue)	0.09636	0.08912	0.08913	0.08907	0.08906	0.08897	0.08888	0.08882	0.08876	0.08873	0.08868
Tax burden (Total tax rev. /GDP)	0.40316	0.40406	0.40303	0.40240	0.40156	0.40121	0.40103	0.40094	0.40101	0.40120	0.40142
ENVIRONMENTAL INDICATORS											
Total CO2 emissions	216.444	219.13	228.312	238.817	249.83	260.924	272.079	283.916	297.701	312.679	328.482
Energy use related emissions	177.333	179.11	186.648	195.161	204.114	212.982	221.912	231.425	242.579	254.728	267.539
Industrial process related emissions	19.107	19.913	20.856	21.953	23.079	24.259	25.427	26.631	27.985	29.431	30.956
Sectoral CO2 emissions											
Agriculture	6.067	6.219	6.448	6.71	7.019	7.335	7.642	7.964	8.319	8.689	9.086
Coal	12.636	12.9	13.279	13.751	14.294	14.858	15.426	16.031	16.714	17.456	18.238
Petroleum and Gas	1.782	1.552	1.623	1.709	1.796	1.891	1.985	2.081	2.186	2.3	2.419
Paper Products	41.892	44.151	46.083	48.246	50.512	52.739	54.974	57.342	60.112	63.121	66.288
Refined Petroleum	65.706	64.647	67.404	70.581	73.82	77.154	80.533	84.153	88.442	93.123	98.079
Cement	6.976	7.286	7.629	8.013	8.407	8.799	9.192	9.606	10.088	10.613	11.165
Iron and Steel	6.483	7.453	7.856	8.255	8.637	8.963	9.309	9.71	10.254	10.872	11.526
Electricity	19.207	16.889	17.604	18.422	19.272	20.132	20.997	21.916	22.992	24.163	25.397
Transportation	36.511	37.943	39.346	40.984	42.792	44.594	46.396	48.287	50.426	52.741	55.174
Other Economy	19.181	20.089	21.039	22.145	23.279	24.459	25.627	26.825	28.167	29.6	31.109
Environmental tax revenue		2.224	2.33	2.452	2.575	2.705	2.834	2.969	3.125	3.293	3.471
Environmental tax revenue (%total tax revenue)		0.01899	0.01906	0.01909	0.01912	0.01913	0.01913	0.01914	0.01918	0.01923	0.01927

Table C. 7: Simulation Results of a 10% Energy Tax Levy with a 5 point payroll tax reduction

	PERIODS										
	2002	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
GDP	276.002	290.859	304.864	321.262	338.345	356.417	374.517	393.444	414.872	438.163	463.392
GDP growth rate		5.383	4.815	5.379	5.317	5.341	5.078	5.054	5.446	5.614	5.758
Sectoral Output											
Agriculture	43.514	44.692	46.371	48.203	50.541	52.952	55.254	57.75	60.477	63.31	66.46
Coal	1.81	1.926	1.969	2.013	2.082	2.136	2.192	2.255	2.329	2.413	2.503
Petroleum and Gas	0.699	0.592	0.619	0.653	0.689	0.73	0.77	0.81	0.854	0.9	0.95
Paper Products	5.047	5.463	5.751	6.079	6.401	6.737	7.079	7.447	7.888	8.376	8.904
Refined Petroleum	7.644	7.48	7.875	8.331	8.766	9.234	9.715	10.237	10.874	11.581	12.35
Cement	9.678	10.292	10.852	11.501	12.138	12.81	13.495	14.219	15.069	16.008	17.022
Iron and Steel	14.087	16.876	17.936	19.008	19.984	20.869	21.821	22.939	24.475	26.246	28.173
Electricity	17.509	14.587	15.316	16.155	16.98	17.849	18.741	19.703	20.86	22.143	23.534
Transportation	63.832	67.585	70.341	73.625	77.179	80.854	84.569	88.472	92.885	97.728	102.938
Other Economy	419.573	440.708	463.001	489.291	516.117	544.749	573.477	603.293	636.987	673.653	713.317
Unemployment rate	10.342	7.41	7.455	7.368	6.808	7.001	6.856	6.633	6.248	5.766	5.242
Private investment	41.302	52.614	56.353	59.692	63.317	65.908	68.368	70.871	73.866	77.17	80.764
Private investment (%GDP)	0.150	0.181	0.185	0.186	0.187	0.185	0.183	0.180	0.178	0.176	0.174
Private Consumption	187.34	187.69	195.16	204.894	214.882	226.589	238.446	250.92	264.958	280.219	296.761
Agriculture	16.047	16.054	16.595	17.251	18.042	18.931	19.797	20.734	21.765	22.85	24.048
Coal	1.353	1.405	1.448	1.502	1.565	1.631	1.699	1.773	1.856	1.948	2.048
Paper Products	0.791	0.805	0.839	0.881	0.923	0.972	1.022	1.076	1.138	1.205	1.279
Refined Petroleum	2.505	2.47	2.573	2.705	2.836	2.989	3.145	3.311	3.504	3.717	3.947
Cement	0.489	0.493	0.514	0.54	0.567	0.598	0.629	0.663	0.701	0.743	0.788
Iron and Steel	0.007	0.007	0.008	0.008	0.008	0.009	0.009	0.01	0.01	0.011	0.011
Electricity	3.093	2.912	3.031	3.182	3.332	3.504	3.681	3.87	4.091	4.335	4.599
Transportation	22.96	23.392	24.249	25.367	26.541	27.879	29.241	30.676	32.292	34.06	35.968
Other Economy	140.095	140.152	145.904	153.458	161.068	170.077	179.222	188.809	199.601	211.35	224.073

Table C.7 (cont'd)

	PERIODS										
	2002	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
Public investment	17.221	18.425	19.217	20.197	21.198	22.316	23.446	24.634	25.985	27.46	29.06
Public consumption	34.826	37.067	38.749	40.772	42.847	45.099	47.369	49.749	52.461	55.424	58.635
Public investment (%GDP)	0.06239	0.06335	0.06303	0.06287	0.06265	0.06261	0.06260	0.06261	0.06263	0.06267	0.06271
Public consumption (%GDP)	0.12618	0.12744	0.12710	0.12691	0.12664	0.12653	0.12648	0.12644	0.12645	0.12649	0.12653
Payroll tax revenue	10.722	10.001	10.457	10.994	11.552	12.145	12.742	13.371	14.093	14.881	15.736
Payroll tax revenue (%total tax revenue)	0.09636	0.08538	0.08540	0.08534	0.08533	0.08524	0.08516	0.08510	0.08506	0.08503	0.08499
Tax burden (Total tax rev. /GDP)	0.40316	0.40271	0.40165	0.40100	0.40013	0.39973	0.39950	0.39935	0.39934	0.39944	0.39955
ENVIRONMENTAL INDICATORS											
Total CO2 emissions	216.444	221.033	230.618	241.611	253.232	265.047	277.093	290.054	305.304	322.181	340.448
Energy use related emissions	177.333	180.801	188.676	197.596	207.057	216.523	226.19	236.634	249.003	262.725	277.575
Industrial process related emissions	19.107	19.985	20.962	22.102	23.282	24.528	25.779	27.089	28.582	30.208	31.97
Sectoral CO2 emissions											
Agriculture	6.067	6.269	6.509	6.784	7.109	7.445	7.776	8.13	8.524	8.944	9.406
Coal	12.636	13.047	13.448	13.947	14.522	15.124	15.739	16.401	17.157	17.993	18.894
Petroleum and Gas	1.782	1.557	1.63	1.719	1.811	1.91	2.01	2.115	2.231	2.357	2.494
Paper Products	41.892	44.543	46.557	48.823	51.217	53.595	56.017	58.621	61.696	65.103	68.788
Refined Petroleum	65.706	65.193	68.066	71.384	74.797	78.338	81.973	85.916	90.629	95.861	101.531
Cement	6.976	7.342	7.697	8.1	8.516	8.933	9.357	9.811	10.346	10.938	11.579
Iron and Steel	6.483	7.578	8.001	8.424	8.83	9.184	9.566	10.013	10.621	11.321	12.08
Electricity	19.207	17.032	17.778	18.634	19.53	20.445	21.379	22.384	23.573	24.891	26.317
Transportation	36.511	38.315	39.787	41.506	43.42	45.345	47.298	49.377	51.759	54.388	57.224
Other Economy	19.181	20.159	21.143	22.292	23.48	24.727	25.98	27.286	28.768	30.385	32.134
Environmental tax revenue		2.233	2.342	2.47	2.598	2.735	2.874	3.02	3.191	3.379	3.583
Environmental tax revenue (%total tax revenue)		0.01906	0.01913	0.01917	0.01919	0.01920	0.01921	0.01922	0.01926	0.01931	0.01935

Table C. 8: Simulation Results of a 10% Energy Tax Levy with a 6 point payroll tax reduction

	PERIODS										
	2002	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
GDP	276.002	291.377	305.637	322.355	339.835	358.401	377.121	396.835	419.29	443.922	470.91
GDP growth rate		5.571	4.894	5.47	5.423	5.463	5.223	5.227	5.659	5.875	6.079
Sectoral Output											
Agriculture	43.514	44.876	46.596	48.476	50.876	53.362	55.754	58.364	61.235	64.253	67.642
Coal	1.81	1.947	1.992	2.039	2.111	2.168	2.227	2.295	2.375	2.467	2.566
Petroleum and Gas	0.699	0.592	0.619	0.654	0.691	0.732	0.774	0.816	0.861	0.91	0.963
Paper Products	5.047	5.478	5.771	6.105	6.435	6.78	7.135	7.519	7.979	8.494	9.057
Refined Petroleum	7.644	7.498	7.899	8.363	8.809	9.289	9.786	10.328	10.991	11.733	12.548
Cement	9.678	10.312	10.881	11.541	12.193	12.883	13.591	14.344	15.233	16.222	17.303
Iron and Steel	14.087	17	18.083	19.182	20.189	21.108	22.103	23.277	24.889	26.761	28.819
Electricity	17.509	14.63	15.372	16.229	17.074	17.968	18.89	19.892	21.1	22.452	23.932
Transportation	63.832	67.847	70.665	74.025	77.674	81.461	85.316	89.394	94.032	99.166	104.753
Other Economy	419.573	441.132	463.798	490.561	517.981	547.359	577.03	608.053	643.326	682.065	724.46
Unemployment rate	10.342	6.499	6.473	6.304	5.641	5.727	5.448	5.063	4.478	3.749	2.92
Private investment	41.302	52.748	56.557	59.986	63.725	66.459	69.101	71.84	75.144	78.855	82.986
Private investment (%GDP)	0.150	0.181	0.185	0.186	0.188	0.185	0.183	0.181	0.179	0.178	0.176
Private Consumption	187.34	187.981	195.589	205.495	215.693	227.66	239.841	252.725	267.296	283.25	300.701
Agriculture	16.047	16.111	16.664	17.336	18.147	19.059	19.954	20.926	22.003	23.146	24.419
Coal	1.353	1.412	1.456	1.513	1.576	1.645	1.716	1.792	1.88	1.977	2.083
Paper Products	0.791	0.807	0.841	0.884	0.927	0.977	1.029	1.084	1.148	1.219	1.296
Refined Petroleum	2.505	2.474	2.579	2.714	2.847	3.003	3.163	3.335	3.536	3.757	4
Cement	0.489	0.494	0.515	0.542	0.569	0.6	0.633	0.667	0.707	0.751	0.798
Iron and Steel	0.007	0.007	0.008	0.008	0.008	0.009	0.009	0.01	0.01	0.011	0.012
Electricity	3.093	2.919	3.041	3.194	3.348	3.524	3.706	3.902	4.132	4.387	4.665
Transportation	22.96	23.458	24.334	25.474	26.676	28.048	29.451	30.938	32.621	34.475	36.496
Other Economy	140.095	140.299	146.151	153.83	161.595	170.795	180.18	190.071	201.259	213.527	226.932

Table C.8 (cont'd)

	PERIODS										
	2002	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
Public investment	17.221	18.454	19.26	20.259	21.282	22.428	23.593	24.825	26.234	27.785	29.484
Public consumption	34.826	37.13	38.842	40.903	43.026	45.337	47.681	50.156	52.992	56.116	59.539
Public investment (%GDP)	0.06239	0.06333	0.06302	0.06285	0.06262	0.06258	0.06256	0.06256	0.06257	0.06259	0.06261
Public consumption (%GDP)	0.12618	0.12743	0.12709	0.12689	0.12661	0.12650	0.12643	0.12639	0.12639	0.12641	0.12643
Payroll tax revenue	10.722	9.777	10.229	10.763	11.321	11.915	12.517	13.157	13.894	14.706	15.597
Payroll tax revenue (%total tax revenue)	0.09636	0.08346	0.08347	0.08341	0.08341	0.08332	0.08324	0.08319	0.08316	0.08312	0.08309
Tax burden (Total tax rev. /GDP)	0.40316	0.40202	0.40095	0.40028	0.39939	0.39898	0.39872	0.39854	0.39849	0.39855	0.39860
ENVIRONMENTAL INDICATORS											
Total CO2 emissions	216.444	222.008	231.798	243.043	254.976	267.162	279.666	293.208	309.215	327.075	346.621
Energy use related emissions	177.333	181.667	189.714	198.844	208.566	218.339	228.388	239.313	252.309	266.847	282.756
Industrial process related emissions	19.107	20.021	21.016	22.178	23.385	24.665	25.959	27.324	28.887	30.607	32.491
Sectoral CO2 emissions											
Agriculture	6.067	6.294	6.54	6.822	7.155	7.502	7.845	8.214	8.629	9.075	9.57
Coal	12.636	13.122	13.535	14.047	14.639	15.26	15.898	16.59	17.386	18.269	19.233
Petroleum and Gas	1.782	1.559	1.634	1.724	1.819	1.92	2.023	2.132	2.253	2.387	2.533
Paper Products	41.892	44.742	46.801	49.118	51.577	54.033	56.551	59.277	62.51	66.124	70.077
Refined Petroleum	65.706	65.474	68.405	71.794	75.298	78.946	82.711	86.823	91.754	97.271	103.313
Cement	6.976	7.37	7.733	8.144	8.571	9.001	9.442	9.917	10.478	11.106	11.792
Iron and Steel	6.483	7.642	8.076	8.509	8.93	9.299	9.699	10.17	10.81	11.553	12.368
Electricity	19.207	17.105	17.866	18.743	19.662	20.605	21.575	22.625	23.873	25.266	26.791
Transprotation	36.511	38.506	40.012	41.774	43.742	45.73	47.76	49.938	52.446	55.237	58.283
Other Economy	19.181	20.195	21.196	22.367	23.584	24.865	26.16	27.521	29.076	30.786	32.66
Environmental tax revenue		2.237	2.348	2.479	2.61	2.75	2.894	3.046	3.225	3.424	3.641
Environmental tax revenue (%total tax revenue)		0.01910	0.01916	0.01921	0.01923	0.01923	0.01925	0.01926	0.01930	0.01935	0.01940

Table C. 9: Simulation Results of a 20% Energy Tax Levy with a 3 point payroll tax reduction

		PERIODS									
	2002	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
GDP	276.002	289.084	302.732	318.645	335.087	352.327	369.351	386.871	406.432	427.258	449.224
GDP growth rate		4.74	4.721	5.256	5.16	5.145	4.832	4.744	5.056	5.124	5.141
Sectoral Output											
Agriculture	43.514	44.279	45.876	47.608	49.815	52.067	54.175	56.426	58.846	61.295	63.952
Coal	1.81	1.783	1.817	1.852	1.908	1.949	1.991	2.038	2.091	2.151	2.214
Petroleum and Gas	0.699	0.517	0.54	0.57	0.601	0.635	0.669	0.702	0.737	0.774	0.813
Paper Products	5.047	5.305	5.578	5.887	6.188	6.499	6.811	7.142	7.534	7.961	8.412
Refined Petroleum	7.644	6.652	6.994	7.387	7.761	8.159	8.563	8.996	9.517	10.087	10.692
Cement	9.678	10.002	10.535	11.149	11.748	12.373	13.002	13.657	14.417	15.241	16.108
Iron and Steel	14.087	15.483	16.4	17.326	18.163	18.914	19.706	20.618	21.856	23.257	24.741
Electricity	17.509	11.373	11.921	12.554	13.17	13.817	14.472	15.167	15.991	16.89	17.84
Transportation	63.832	66.781	69.405	72.523	75.872	79.297	82.707	86.229	90.157	94.384	98.809
Other Economy	419.573	439.055	460.958	486.67	512.689	540.218	567.475	595.331	626.383	659.491	694.363
Unemployment rate	10.342	9.875	10.192	10.4	10.182	10.725	10.992	11.248	11.427	11.598	11.836
Private investment	41.302	52.08	55.715	58.916	62.362	64.717	66.866	68.957	71.395	73.956	76.563
Private investment (%GDP)	0.150	0.180	0.184	0.185	0.186	0.184	0.181	0.178	0.176	0.173	0.170
Private Consumption	187.34	186.06	193.323	202.778	212.404	223.649	234.918	246.633	259.667	273.612	288.425
Agriculture	16.047	15.898	16.413	17.037	17.788	18.626	19.432	20.291	21.225	22.187	23.228
Coal	1.353	1.375	1.415	1.465	1.523	1.584	1.646	1.711	1.784	1.864	1.948
Paper Products	0.791	0.793	0.825	0.865	0.906	0.952	1	1.049	1.106	1.167	1.232
Refined Petroleum	2.505	2.364	2.461	2.585	2.706	2.848	2.991	3.142	3.315	3.502	3.701
Cement	0.489	0.486	0.506	0.531	0.556	0.586	0.616	0.647	0.682	0.72	0.76
Iron and Steel	0.007	0.007	0.007	0.008	0.008	0.008	0.009	0.009	0.01	0.01	0.011
Electricity	3.093	2.635	2.739	2.872	3.003	3.153	3.305	3.466	3.652	3.854	4.068
Transportation	22.96	23.186	24.01	25.085	26.204	27.476	28.754	30.082	31.562	33.153	34.835
Other Economy	140.095	139.316	144.947	152.33	159.709	168.415	177.167	186.235	196.332	207.154	218.642

Table C.9 (cont'd)

	PERIODS										
	2002	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
Public investment	17.221	18.81	19.606	20.588	21.581	22.684	23.785	24.925	26.207	27.581	29.037
Public consumption	34.826	37.349	39.012	41.006	43.035	45.221	47.395	49.641	52.166	54.87	57.728
Public investment (%GDP)	0.06239	0.06507	0.06476	0.06461	0.06440	0.06438	0.06440	0.06443	0.06448	0.06455	0.06464
Public consumption (%GDP)	0.12618	0.12920	0.12887	0.12869	0.12843	0.12835	0.12832	0.12831	0.12835	0.12842	0.12851
Payroll tax revenue	10.722	10.305	10.763	11.301	11.856	12.442	13.023	13.626	14.306	15.035	15.805
Payroll tax revenue (%total tax revenue)	0.09636	0.08733	0.08733	0.08724	0.08722	0.08712	0.08702	0.08694	0.08688	0.08681	0.08675
Tax burden (Total tax rev. /GDP)	0.40316	0.40818	0.40713	0.40651	0.40567	0.40535	0.40518	0.40510	0.40516	0.40535	0.40556
ENVIRONMENTAL INDICATORS											
Total CO2 emissions	216.444	206.28	214.867	224.714	235.048	245.467	255.916	266.966	279.789	293.701	308.375
Energy use related emissions	177.333	166.983	173.945	181.825	190.123	198.345	206.6	215.363	225.601	236.737	248.474
Industrial process related emissions	19.107	19.691	20.634	21.731	22.858	24.037	25.204	26.408	27.758	29.199	30.719
Sectoral CO2 emissions											
Agriculture	6.067	6.16	6.388	6.646	6.951	7.264	7.566	7.884	8.232	8.596	8.986
Coal	12.636	12.607	12.973	13.428	13.949	14.493	15.039	15.619	16.272	16.98	17.726
Petroleum and Gas	1.782	1.337	1.398	1.473	1.549	1.631	1.712	1.795	1.887	1.985	2.088
Paper Products	41.892	42.436	44.285	46.356	48.525	50.653	52.785	55.04	57.673	60.533	63.543
Refined Petroleum	65.706	58.947	61.449	64.345	67.297	70.346	73.426	76.716	80.595	84.822	89.296
Cement	6.976	6.941	7.266	7.633	8.009	8.381	8.756	9.148	9.605	10.101	10.623
Iron and Steel	6.483	6.872	7.23	7.586	7.928	8.221	8.529	8.885	9.362	9.9	10.467
Electricity	19.207	14.087	14.676	15.355	16.059	16.776	17.495	18.257	19.144	20.108	21.125
Transportation	36.511	37	38.354	39.935	41.683	43.421	45.156	46.97	49.021	51.239	53.569
Other Economy	19.181	19.895	20.849	21.958	23.096	24.28	25.452	26.654	27.999	29.436	30.95
Environmental tax revenue		3.796	3.977	4.189	4.4	4.623	4.847	5.079	5.346	5.633	5.937
Environmental tax revenue (%total tax revenue)		0.03217	0.03227	0.03234	0.03237	0.03237	0.03239	0.03241	0.03246	0.03253	0.03259

Table C. 10: Simulation Results of a 20% Energy Tax Levy with a 4 point payroll tax reduction

	PERIODS										
	2002	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
GDP	276.002	289.592	303.489	319.713	336.544	354.266	371.891	390.175	410.73	432.848	456.505
GDP growth rate	4.92E+00	4.799	5.346		5.264	5.266	4.975	4.917	5.268	5.385	5.466
Sectoral Output											
Agriculture	43.514	44.459	46.096	47.875	50.142	52.466	54.661	57.022	59.581	62.206	65.09
Coal	1.81	1.803	1.838	1.875	1.934	1.978	2.023	2.074	2.133	2.199	2.269
Petroleum and Gas	0.699	0.517	0.541	0.571	0.602	0.637	0.672	0.707	0.743	0.783	0.824
Paper Products	5.047	5.319	5.597	5.912	6.221	6.54	6.865	7.21	7.621	8.073	8.556
Refined Petroleum	7.644	6.667	7.014	7.415	7.798	8.207	8.624	9.074	9.618	10.218	10.863
Cement	9.678	10.02	10.562	11.187	11.8	12.443	13.094	13.776	14.573	15.444	16.374
Iron and Steel	14.087	15.588	16.526	17.476	18.339	19.121	19.949	20.91	22.214	23.701	25.297
Electricity	17.509	11.405	11.964	12.609	13.241	13.907	14.584	15.309	16.172	17.122	18.138
Transportation	63.832	67.035	69.72	72.912	76.352	79.887	83.431	87.122	91.265	95.768	100.55
Other Economy	419.573	439.476	461.745	487.92	514.521	542.779	570.957	599.988	632.575	667.693	705.208
Unemployment rate	10.342	9.004	9.255	9.385	9.071	9.512	9.656	9.762	9.757	9.705	9.667
Private investment	41.302	52.21	55.913	59.202	62.757	65.252	67.578	69.896	72.633	75.586	78.708
Private investment (%GDP)	0.150	0.180	0.184	0.185	0.186	0.184	0.182	0.179	0.177	0.175	0.172
Private Consumption	187.34	186.344	193.741	203.361	213.193	224.69	236.273	248.383	261.93	276.541	292.224
Agriculture	16.047	15.954	16.481	17.12	17.89	18.751	19.584	20.478	21.455	22.473	23.585
Coal	1.353	1.382	1.423	1.475	1.534	1.597	1.661	1.73	1.807	1.891	1.981
Paper Products	0.791	0.794	0.827	0.868	0.909	0.957	1.006	1.057	1.116	1.18	1.249
Refined Petroleum	2.505	2.368	2.466	2.592	2.716	2.861	3.008	3.164	3.344	3.539	3.75
Cement	0.489	0.487	0.507	0.533	0.558	0.589	0.619	0.651	0.688	0.728	0.771
Iron and Steel	0.007	0.007	0.007	0.008	0.008	0.009	0.009	0.009	0.01	0.011	0.011
Electricity	3.093	2.641	2.748	2.883	3.017	3.171	3.327	3.494	3.688	3.899	4.126
Transportation	22.96	23.251	24.093	25.189	26.336	27.64	28.958	30.337	31.88	33.555	35.343
Other Economy	140.095	139.46	145.188	152.693	160.224	169.116	178.1	187.463	197.943	209.265	221.407

Table C.10 (cont'd)

	PERIODS										
	2002	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
Public investment	17.221	18.84	19.65	20.649	21.666	22.796	23.932	25.117	26.456	27.905	29.459
Public consumption	34.826	37.41	39.103	41.135	43.212	45.456	47.703	50.042	52.687	55.549	58.614
Public investment (%GDP)	0.06239	0.06506	0.06475	0.06459	0.06438	0.06435	0.06435	0.06437	0.06441	0.06447	0.06453
Public consumption (%GDP)	0.12618	0.12918	0.12884	0.12866	0.12840	0.12831	0.12827	0.12826	0.12828	0.12833	0.12840
Payroll tax revenue	10.722	10.092	10.548	11.084	11.64	12.228	12.816	13.43	14.129	14.884	15.693
Payroll tax revenue (%total tax revenue)	0.09636	0.08552	0.08551	0.08543	0.08541	0.08531	0.08521	0.08514	0.08508	0.08502	0.08496
Tax burden (Total tax rev. /GDP)	0.40316	0.40751	0.40645	0.40581	0.40496	0.40461	0.40441	0.40430	0.40433	0.40446	0.40461
ENVIRONMENTAL INDICATORS											
Total CO2 emissions	216.444	207.155	215.929	226.004	236.622	247.378	258.242	269.816	283.318	298.11	313.921
Energy use related emissions	177.333	167.754	174.871	182.94	191.473	199.972	208.567	217.759	228.555	240.411	253.08
Industrial process related emissions	19.107	19.726	20.686	21.804	22.957	24.169	25.378	26.633	28.051	29.581	31.217
Sectoral CO2 emissions											
Agriculture	6.067	6.184	6.418	6.683	6.996	7.318	7.632	7.966	8.333	8.722	9.143
Coal	12.636	12.678	13.053	13.521	14.059	14.621	15.189	15.796	16.486	17.238	18.041
Petroleum and Gas	1.782	1.339	1.401	1.477	1.555	1.639	1.723	1.81	1.905	2.01	2.12
Paper Products	41.892	42.621	44.51	46.631	48.861	51.061	53.283	55.649	58.429	61.477	64.732
Refined Petroleum	65.706	59.186	61.74	64.7	67.73	70.873	74.068	77.503	81.572	86.048	90.841
Cement	6.976	6.966	7.299	7.673	8.059	8.445	8.833	9.245	9.726	10.255	10.817
Iron and Steel	6.483	6.927	7.293	7.659	8.014	8.32	8.643	9.019	9.524	10.097	10.713
Electricity	19.207	14.145	14.747	15.441	16.165	16.903	17.651	18.448	19.382	20.406	21.501
Transportation	36.511	37.18	38.567	40.189	41.988	43.785	45.592	47.497	49.665	52.034	54.557
Other Economy	19.181	19.928	20.9	22.03	23.195	24.412	25.626	26.88	28.296	29.824	31.455
Environmental tax revenue		3.803	3.988	4.203	4.419	4.649	4.88	5.122	5.402	5.706	6.032
Environmental tax revenue (%total tax revenue)		0.03223	0.03233	0.03239	0.03242	0.03243	0.03245	0.03247	0.03253	0.03259	0.03266

Table C. 11: Simulation Results of a 20% Energy Tax Levy with a 5 point payroll tax reduction

	PERIODS										
	2002	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
GDP	276.002	290.104	304.253	320.794	338.019	356.229	374.466	393.528	415.094	438.53	463.913
GDP growth rate		5.11	4.877	5.437	5.369	5.387	5.119	5.09	5.48	5.646	5.788
Sectoral Output											
Agriculture	43.514	44.641	46.318	48.145	50.473	52.871	55.155	57.629	60.329	63.134	66.251
Coal	1.81	1.822	1.86	1.898	1.96	2.007	2.055	2.11	2.175	2.248	2.326
Petroleum and Gas	0.699	0.517	0.541	0.571	0.604	0.639	0.675	0.711	0.75	0.791	0.835
Paper Products	5.047	5.333	5.616	5.937	6.254	6.583	6.919	7.279	7.709	8.186	8.703
Refined Petroleum	7.644	6.682	7.036	7.444	7.835	8.255	8.687	9.154	9.722	10.352	11.036
Cement	9.678	10.039	10.589	11.226	11.854	12.514	13.186	13.897	14.731	15.65	16.644
Iron and Steel	14.087	15.696	16.654	17.628	18.519	19.331	20.198	21.208	22.58	24.156	25.867
Electricity	17.509	11.438	12.007	12.665	13.312	13.997	14.698	15.453	16.356	17.357	18.441
Transportation	63.832	67.293	70.038	73.306	76.84	80.487	84.168	88.029	92.393	97.179	102.327
Other Economy	419.573	439.9	462.539	489.184	516.373	545.371	574.484	604.709	638.857	676.021	716.229
Unemployment rate	10.342	8.118	8.3	8.351	7.937	8.275	8.29	8.242	8.048	7.763	7.44
Private investment	41.302	52.341	56.113	59.49	63.157	65.793	68.299	70.849	73.89	77.242	80.89
Private investment (%GDP)	0.150	0.180	0.184	0.185	0.187	0.185	0.182	0.180	0.178	0.176	0.174
Private Consumption	187.34	186.631	194.163	203.951	213.992	225.746	237.646	250.159	264.229	279.519	296.089
Agriculture	16.047	16.01	16.55	17.204	17.993	18.877	19.738	20.667	21.689	22.763	23.949
Coal	1.353	1.389	1.431	1.485	1.546	1.611	1.677	1.749	1.83	1.919	2.015
Paper Products	0.791	0.796	0.829	0.871	0.913	0.962	1.012	1.065	1.126	1.193	1.266
Refined Petroleum	2.505	2.372	2.472	2.6	2.727	2.875	3.026	3.187	3.373	3.578	3.8
Cement	0.489	0.487	0.508	0.534	0.561	0.591	0.623	0.656	0.694	0.736	0.781
Iron and Steel	0.007	0.007	0.007	0.008	0.008	0.009	0.009	0.009	0.01	0.011	0.011
Electricity	3.093	2.648	2.757	2.894	3.032	3.189	3.35	3.523	3.724	3.945	4.185
Transportation	22.96	23.317	24.176	25.295	26.469	27.807	29.165	30.595	32.205	33.964	35.861
Other Economy	140.095	139.605	145.432	153.06	160.744	169.825	179.046	188.708	199.578	211.41	224.22

Table C.11 (cont'd)

	PERIODS										
	2002	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
Public investment	17.221	18.869	19.694	20.712	21.751	22.91	24.081	25.31	26.708	28.234	29.888
Public consumption	34.826	37.471	39.196	41.266	43.39	45.694	48.015	50.448	53.217	56.24	59.515
Public investment (%GDP)	0.06239	0.06504	0.06473	0.06456	0.06435	0.06431	0.06431	0.06432	0.06434	0.06438	0.06443
Public consumption (%GDP)	0.12618	0.12916	0.12883	0.12864	0.12837	0.12827	0.12822	0.12819	0.12820	0.12825	0.12829
Payroll tax revenue	10.722	9.874	10.328	10.862	11.417	12.008	12.601	13.227	13.942	14.722	15.568
Payroll tax revenue (%total tax revenue)	0.09636	0.08366	0.08366	0.08358	0.08356	0.08347	0.08337	0.08330	0.08324	0.08319	0.08313
Tax burden (Total tax rev. /GDP)	0.40316	0.40683	0.40575	0.40510	0.40423	0.40386	0.40364	0.40349	0.40348	0.40357	0.40366
ENVIRONMENTAL INDICATORS											
Total CO2 emissions	216.444	208.043	217.007	227.315	238.222	249.321	260.609	272.718	286.915	302.607	319.586
Energy use related emissions	177.333	168.538	175.813	184.074	192.846	201.627	210.57	220.2	231.567	244.161	257.786
Industrial process related emissions	19.107	19.761	20.738	21.878	23.058	24.303	25.553	26.862	28.35	29.97	31.725
Sectoral CO2 emissions											
Agriculture	6.067	6.209	6.448	6.72	7.041	7.374	7.699	8.048	8.436	8.85	9.304
Coal	12.636	12.75	13.135	13.616	14.17	14.753	15.342	15.978	16.703	17.503	18.364
Petroleum and Gas	1.782	1.341	1.404	1.481	1.561	1.647	1.734	1.824	1.925	2.035	2.152
Paper Products	41.892	42.811	44.74	46.91	49.202	51.477	53.789	56.27	59.197	62.44	65.946
Refined Petroleum	65.706	59.429	62.036	65.06	68.172	71.408	74.722	78.306	82.57	87.296	92.418
Cement	6.976	6.993	7.332	7.715	8.111	8.509	8.913	9.343	9.85	10.411	11.016
Iron and Steel	6.483	6.982	7.358	7.735	8.101	8.42	8.761	9.157	9.69	10.301	10.963
Electricity	19.207	14.204	14.818	15.528	16.272	17.033	17.81	18.643	19.625	20.709	21.884
Transportation	36.511	37.363	38.784	40.446	42.297	44.155	46.037	48.036	50.323	52.846	55.567
Other Economy	19.181	19.962	20.951	22.103	23.296	24.547	25.802	27.111	28.596	30.217	31.969
Environmental tax revenue		3.811	3.998	4.218	4.439	4.675	4.914	5.166	5.459	5.78	6.129
Environmental tax revenue (%total tax revenue)		0.03229	0.03239	0.03246	0.03249	0.03250	0.03251	0.03253	0.03259	0.03266	0.03273

Table C. 12: Simulation Results of a 20% Energy Tax Levy with an 8 point payroll tax reduction

	PERIODS									
	2002	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
GDP	276.002	291.672	306.595	324.111	342.553	362.275	382.409	403.885	428.6	456.147	486.925
GDP growth rate		5.678	5.116	5.713	5.69	5.758	5.558	5.616	6.119	6.427	6.747
Sectoral Output											
Agriculture	43.514	45.202	47.002	48.978	51.497	54.125	56.687	59.511	62.657	66.026	69.878
Coal	1.81	1.884	1.927	1.972	2.042	2.098	2.158	2.227	2.308	2.402	2.508
Petroleum and Gas	0.699	0.517	0.542	0.574	0.608	0.647	0.685	0.726	0.769	0.817	0.87
Paper Products	5.047	5.377	5.675	6.015	6.355	6.713	7.085	7.491	7.983	8.539	9.16
Refined Petroleum	7.644	6.729	7.101	7.532	7.951	8.405	8.879	9.401	10.041	10.767	11.578
Cement	9.678	10.095	10.674	11.346	12.017	12.732	13.473	14.271	15.219	16.291	17.483
Iron and Steel	14.087	16.03	17.054	18.104	19.08	19.989	20.977	22.143	23.731	25.59	27.669
Electricity	17.509	11.538	12.139	12.837	13.533	14.277	15.052	15.9	16.928	18.091	19.387
Transportation	63.832	68.086	71.02	74.522	78.345	82.34	86.449	90.847	95.9	101.576	107.876
Other Economy	419.573	441.194	464.967	493.056	522.058	553.339	585.342	619.266	658.261	701.787	750.383
Unemployment rate	10.342	5.36	5.327	5.126	4.398	4.405	4.011	3.467	2.664	1.63	0.383
Private investment	41.302	52.742	56.729	60.378	64.39	67.463	70.526	73.794	77.781	82.377	87.667
Private investment (%GDP)	0.150	0.181	0.185	0.186	0.188	0.186	0.184	0.183	0.181	0.181	0.180
Private Consumption	187.34	187.512	195.458	205.765	216.451	228.997	241.886	255.651	271.348	288.757	308.103
Agriculture	16.047	16.183	16.761	17.463	18.312	19.268	20.216	21.255	22.417	23.669	25.085
Coal	1.353	1.412	1.458	1.515	1.581	1.653	1.727	1.808	1.901	2.006	2.122
Paper Products	0.791	0.801	0.835	0.88	0.925	0.977	1.031	1.09	1.158	1.235	1.32
Refined Petroleum	2.505	2.384	2.489	2.624	2.759	2.917	3.081	3.258	3.465	3.697	3.955
Cement	0.489	0.49	0.511	0.539	0.567	0.6	0.634	0.671	0.713	0.76	0.813
Iron and Steel	0.007	0.007	0.007	0.008	0.008	0.009	0.009	0.01	0.01	0.011	0.012
Electricity	3.093	2.668	2.783	2.929	3.076	3.245	3.42	3.611	3.836	4.089	4.369
Transportation	22.96	23.518	24.433	25.621	26.88	28.321	29.806	31.396	33.21	35.235	37.477
Other Economy	140.095	140.05	146.18	154.186	162.343	172.009	181.961	192.554	204.638	218.056	232.951

Table C.12 (cont'd)

	PERIODS										
	2002	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
Public investment	17.221	18.96	19.83	20.905	22.014	23.261	24.541	25.91	27.49	29.254	31.221
Public consumption	34.826	37.661	39.479	41.668	43.94	46.427	48.978	51.704	54.857	58.381	62.316
Public investment (%GDP)	0.06239	0.06500	0.06468	0.06450	0.06426	0.06421	0.06417	0.06415	0.06414	0.06413	0.06412
Public consumption (%GDP)	0.12618	0.12912	0.12877	0.12856	0.12827	0.12815	0.12808	0.12802	0.12799	0.12799	0.12798
Payroll tax revenue	10.722	9.193	9.636	10.16	10.712	11.303	11.91	12.561	13.318	14.164	15.11
Payroll tax revenue (%total tax revenue)	0.09636	0.07788	0.07787	0.07780	0.07779	0.07770	0.07762	0.07755	0.07751	0.07746	0.07743
Tax burden (Total tax rev. /GDP)	0.40316	0.40473	0.40362	0.40291	0.40200	0.40156	0.40126	0.40102	0.40090	0.40086	0.40079
ENVIRONMENTAL INDICATORS											
Total CO2 emissions	216.444	210.794	220.348	231.378	243.185	255.355	267.968	281.752	298.132	316.657	337.317
Energy use related emissions	177.333	170.967	178.732	187.59	197.108	206.769	216.801	227.807	240.966	255.887	272.531
Industrial process related emissions	19.107	19.869	20.899	22.105	23.368	24.716	26.096	27.569	29.273	31.176	33.301
Sectoral CO2 emissions											
Agriculture	6.067	6.286	6.541	6.833	7.182	7.546	7.91	8.306	8.755	9.248	9.805
Coal	12.636	12.972	13.39	13.913	14.518	15.157	15.82	16.544	17.384	18.328	19.377
Petroleum and Gas	1.782	1.346	1.413	1.495	1.58	1.673	1.768	1.869	1.984	2.112	2.254
Paper Products	41.892	43.395	45.451	47.775	50.26	52.764	55.361	58.202	61.598	65.449	69.745
Refined Petroleum	65.706	60.181	62.952	66.176	69.536	73.072	76.754	80.804	85.678	91.199	97.356
Cement	6.976	7.074	7.435	7.843	8.271	8.707	9.158	9.649	10.234	10.899	11.639
Iron and Steel	6.483	7.156	7.561	7.97	8.373	8.734	9.126	9.589	10.213	10.944	11.76
Electricity	19.207	14.385	15.041	15.798	16.603	17.438	18.304	19.251	20.38	21.659	23.085
Transportation	36.511	37.931	39.456	41.246	43.258	45.306	47.42	49.712	52.376	55.384	58.733
Other Economy	19.181	20.068	21.109	22.329	23.605	24.96	26.348	27.825	29.529	31.436	33.566
Environmental tax revenue		3.833	4.03	4.263	4.5	4.755	5.018	5.302	5.635	6.011	6.429
Environmental tax revenue (%total tax revenue)		0.03247	0.03257	0.03264	0.03268	0.03269	0.03270	0.03274	0.03279	0.03287	0.03294

Table C. 13: Simulation Results of a 20% Consumption Tax Levy

	PERIODS										
	2002	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
GDP	276.002	288.66	301.443	316.326	331.549	347.344	362.624	377.997	394.821	412.132	429.548
GDP growth rate		4.586	4.429	4.937	4.813	4.764	4.399	4.239	4.451	4.385	4.226
Sectoral Output											
Agriculture	43.514	43.998	45.657	47.463	49.759	52.13	54.388	56.827	59.478	62.211	65.22
Coal	1.81	1.796	1.84	1.885	1.952	2.005	2.059	2.12	2.192	2.272	2.356
Petroleum and Gas	0.699	0.686	0.717	0.756	0.797	0.843	0.888	0.934	0.982	1.034	1.089
Paper Products	5.047	5.541	5.83	6.16	6.484	6.821	7.165	7.533	7.97	8.45	8.965
Refined Petroleum	7.644	8.459	8.908	9.423	9.91	10.433	10.97	11.554	12.268	13.059	13.913
Cement	9.678	10.496	11.065	11.725	12.372	13.055	13.749	14.479	15.332	16.266	17.266
Iron and Steel	14.087	17.57	18.688	19.823	20.857	21.802	22.815	23.998	25.61	27.458	29.456
Electricity	17.509	17.943	18.834	19.872	20.893	21.981	23.087	24.265	25.654	27.179	28.819
Transportation	63.832	66.884	69.618	72.867	76.374	79.996	83.652	87.482	91.794	96.494	101.503
Other Economy	419.573	440.952	462.935	488.851	515.224	543.351	571.466	600.505	633.146	668.389	706.139
Unemployment rate	10.342	10.951	11.17	11.313	11.068	11.602	11.894	12.221	12.277	12.347	12.542
Private investment	41.302	52.275	55.682	58.602	61.701	63.631	65.256	66.694	68.301	69.788	70.993
Private investment (%GDP)	0.150	0.181	0.185	0.185	0.186	0.183	0.180	0.176	0.173	0.169	0.165
Private Consumption	187.34	186.742	193.567	202.508	211.519	222.043	232.442	243.085	254.758	266.951	279.487
Agriculture	16.047	15.868	16.403	17.052	17.834	18.71	19.565	20.486	21.496	22.552	23.71
Coal	1.353	1.156	1.192	1.238	1.29	1.345	1.402	1.463	1.532	1.607	1.688
Paper Products	0.791	0.81	0.843	0.885	0.927	0.976	1.026	1.079	1.14	1.206	1.278
Refined Petroleum	2.505	2.575	2.683	2.82	2.955	3.112	3.273	3.445	3.644	3.861	4.096
Cement	0.489	0.497	0.517	0.544	0.57	0.601	0.633	0.666	0.704	0.745	0.79
Iron and Steel	0.007	0.007	0.008	0.008	0.008	0.009	0.009	0.01	0.01	0.011	0.011
Electricity	3.093	2.638	2.744	2.88	3.016	3.174	3.335	3.506	3.702	3.917	4.147
Transportation	22.96	23.221	24.07	25.176	26.335	27.657	29	30.412	31.997	33.721	35.567
Other Economy	140.095	140.366	146.058	153.541	161.06	169.973	179.002	188.437	199.017	210.47	222.783

Table C.13 (cont'd)

	PERIODS										
	2002	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
Public investment	17.221	17.988	18.747	19.691	20.652	21.73	22.816	23.953	25.24	26.636	28.138
Public consumption	34.826	36.522	38.158	40.127	42.141	44.33	46.529	48.826	51.43	54.255	57.288
Public investment (%GDP)	0.06239	0.06232	0.06219	0.06225	0.06229	0.06256	0.06292	0.06337	0.06393	0.06463	0.06551
Public consumption (%GDP)	0.12618	0.12652	0.12658	0.12685	0.12710	0.12763	0.12831	0.12917	0.13026	0.13164	0.13337
Payroll tax revenue	10.722	11.195	11.666	12.218	12.78	13.366	13.937	14.518	15.165	15.838	16.519
Payroll tax revenue (%total tax revenue)	0.09636	0.09618	0.09621	0.09617	0.09616	0.09607	0.09598	0.09592	0.09588	0.09585	0.09581
Tax burden (Total tax rev. /GDP)	0.40316	0.40325	0.40224	0.40165	0.40084	0.40054	0.40042	0.40042	0.40061	0.40095	0.40137
ENVIRONMENTAL INDICATORS											
Total CO2 emissions	216.444	229.985	239.352	249.971	260.941	271.822	282.577	293.793	306.716	320.368	334.159
Energy use related emissions	177.333	191.11	198.93	207.682	216.752	225.594	234.345	243.507	254.14	265.398	276.756
Industrial process related emissions	19.107	20.082	20.987	22.038	23.103	24.205	25.275	26.354	27.545	28.776	30.015
Sectoral CO2 emissions											
Agriculture	6.067	6.242	6.483	6.758	7.082	7.415	7.743	8.093	8.482	8.894	9.342
Coal	12.636	11.134	11.485	11.917	12.413	12.931	13.458	14.024	14.671	15.379	16.138
Petroleum and Gas	1.782	1.825	1.911	2.016	2.121	2.236	2.351	2.471	2.604	2.751	2.907
Paper Products	41.892	45.776	47.869	50.212	52.672	55.115	57.6	60.264	63.404	66.859	70.56
Refined Petroleum	65.706	71.447	74.644	78.307	82.048	85.914	89.881	94.19	99.35	105.052	111.186
Cement	6.976	7.636	8.009	8.43	8.862	9.297	9.737	10.207	10.76	11.368	12.018
Iron and Steel	6.483	7.97	8.429	8.885	9.324	9.709	10.12	10.603	11.255	12.002	12.808
Electricity	19.207	19.728	20.61	21.618	22.665	23.732	24.817	25.981	27.351	28.857	30.475
Transportation	36.511	38.744	40.262	42.024	43.967	45.918	47.897	50.002	52.415	55.061	57.89
Other Economy	19.181	20.292	21.273	22.415	23.594	24.829	26.065	27.349	28.8	30.372	32.054
Environmental tax revenue		0.745	0.771	0.807	0.842	0.882	0.923	0.965	1.011	1.059	1.109
Environmental tax revenue (%total tax revenue)		0.00640	0.00636	0.00635	0.00634	0.00634	0.00636	0.00638	0.00639	0.00641	0.00643

Table C. 14: Simulation Results of a 10% Consumption Tax Levy

		PERIODS									
	2002	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
GDP	276.002	288.568	301.042	315.549	330.316	345.556	360.152	374.668	390.389	406.278	421.844
GDP growth rate		4.553	4.322	4.819	4.68	4.614	4.224	4.03	4.196	4.07	3.831
Sectoral Output											
Agriculture	43.514	43.962	45.578	47.334	49.569	51.865	54.032	56.356	58.861	61.405	64.169
Coal	1.81	1.868	1.912	1.957	2.025	2.078	2.132	2.192	2.262	2.34	2.421
Petroleum and Gas	0.699	0.691	0.721	0.759	0.799	0.844	0.888	0.932	0.978	1.027	1.078
Paper Products	5.047	5.536	5.82	6.142	6.457	6.784	7.115	7.465	7.88	8.332	8.809
Refined Petroleum	7.644	8.455	8.895	9.399	9.874	10.38	10.898	11.458	12.139	12.887	13.684
Cement	9.678	10.49	11.047	11.693	12.322	12.984	13.652	14.348	15.157	16.034	16.96
Iron and Steel	14.087	17.568	18.671	19.786	20.796	21.71	22.685	23.818	25.363	27.121	28.999
Electricity	17.509	18.334	19.222	20.257	21.271	22.348	23.436	24.586	25.936	27.402	28.957
Transportation	63.832	66.855	69.526	72.697	76.109	79.617	83.132	86.784	90.866	95.268	99.89
Other Economy	419.573	440.493	461.967	487.26	512.878	540.079	567.051	594.656	625.452	658.31	692.958
Unemployment rate	10.342	10.984	11.266	11.481	11.322	11.954	12.364	12.834	13.071	13.368	13.85
Private investment	41.302	52.214	55.537	58.352	61.322	63.09	64.513	65.696	66.97	68.025	68.665
Private investment (%GDP)	0.150	0.181	0.184	0.185	0.186	0.183	0.179	0.175	0.172	0.167	0.163
Private Consumption	187.34	186.998	193.66	202.407	211.181	221.42	231.468	241.673	252.782	264.246	275.834
Agriculture	16.047	15.859	16.381	17.013	17.775	18.628	19.453	20.338	21.301	22.298	23.377
Coal	1.353	1.26	1.299	1.347	1.402	1.461	1.521	1.585	1.656	1.734	1.816
Paper Products	0.791	0.809	0.841	0.883	0.924	0.971	1.02	1.071	1.129	1.192	1.259
Refined Petroleum	2.505	2.574	2.679	2.813	2.944	3.097	3.253	3.418	3.608	3.815	4.035
Cement	0.489	0.497	0.517	0.543	0.568	0.599	0.629	0.661	0.697	0.737	0.778
Iron and Steel	0.007	0.007	0.008	0.008	0.008	0.009	0.009	0.01	0.01	0.011	0.011
Electricity	3.093	2.876	2.989	3.134	3.279	3.446	3.616	3.795	4	4.222	4.458
Transportation	22.96	23.209	24.038	25.119	26.248	27.534	28.832	30.189	31.703	33.335	35.063
Other Economy	140.095	140.299	145.857	153.178	160.501	169.177	177.917	186.991	197.11	207.967	219.508

Table C.14 (cont'd)

	PERIODS										
	2002	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
Public investment	17.221	17.836	18.571	19.487	20.414	21.451	22.489	23.568	24.781	26.084	27.467
Public consumption	34.826	36.368	37.96	39.876	41.827	43.939	46.045	48.227	50.685	53.322	56.113
Public investment (%GDP)	0.06239	0.06181	0.06169	0.06176	0.06180	0.06208	0.06244	0.06290	0.06348	0.06420	0.06511
Public consumption (%GDP)	0.12618	0.12603	0.12610	0.12637	0.12663	0.12715	0.12785	0.12872	0.12983	0.13125	0.13302
Payroll tax revenue	10.722	11.208	11.669	12.208	12.754	13.32	13.866	14.417	15.025	15.646	16.259
Payroll tax revenue (%total tax revenue)	0.09636	0.09662	0.09666	0.09661	0.09661	0.09652	0.09642	0.09636	0.09633	0.09629	0.09625
Tax burden (Total tax rev. /GDP)	0.40316	0.40200	0.40101	0.40044	0.39965	0.39938	0.39928	0.39931	0.39954	0.39994	0.40043
ENVIRONMENTAL INDICATORS											
Total CO2 emissions	216.444	231.166	240.352	250.755	261.454	272.002	282.331	292.998	305.197	317.891	330.412
Energy use related emissions	177.333	191.53	199.187	207.741	216.565	225.108	233.484	242.167	252.172	262.606	272.879
Industrial process related emissions	19.107	20.08	20.964	21.989	23.022	24.085	25.107	26.127	27.241	28.372	29.482
Sectoral CO2 emissions											
Agriculture	6.067	6.237	6.473	6.739	7.054	7.378	7.693	8.026	8.394	8.778	9.191
Coal	12.636	12.006	12.376	12.831	13.352	13.895	14.445	15.032	15.697	16.419	17.181
Petroleum and Gas	1.782	1.838	1.923	2.025	2.128	2.24	2.351	2.467	2.594	2.733	2.877
Paper Products	41.892	45.734	47.782	50.068	52.461	54.822	57.204	59.739	62.709	65.944	69.358
Refined Petroleum	65.706	71.41	74.54	78.122	81.763	85.51	89.328	93.447	98.36	103.738	109.448
Cement	6.976	7.63	7.996	8.407	8.828	9.247	9.67	10.118	10.641	11.211	11.81
Iron and Steel	6.483	7.969	8.42	8.869	9.297	9.668	10.064	10.525	11.149	11.857	12.612
Electricity	19.207	20.157	21.037	22.039	23.081	24.135	25.201	26.334	27.661	29.107	30.636
Transportation	36.511	38.722	40.205	41.924	43.814	45.701	47.601	49.605	51.889	54.367	56.978
Other Economy	19.181	20.27	21.227	22.342	23.487	24.681	25.866	27.086	28.453	29.917	31.461
Environmental tax revenue		0.406	0.42	0.439	0.457	0.479	0.5	0.522	0.546	0.571	0.596
Environmental tax revenue (%total tax revenue)		0.00350	0.00348	0.00347	0.00346	0.00347	0.00348	0.00349	0.00350	0.00351	0.00353

Table C. 15: Simulation Results of a 5% Consumption Tax Levy

	PERIODS										
	2002	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
GDP	276.002	289.205	302.503	318.039	334.079	350.919	367.514	384.549	403.507	423.568	444.557
GDP growth rate		4.784	4.598	5.136	5.043	5.041	4.729	4.635	4.93	4.972	4.955
Sectoral Output											
Agriculture	43.514	43.941	45.534	47.261	49.461	51.714	53.829	56.088	58.509	60.946	63.571
Coal	1.81	1.908	1.953	1.998	2.066	2.119	2.173	2.233	2.302	2.378	2.456
Petroleum and Gas	0.699	0.693	0.723	0.761	0.801	0.845	0.888	0.931	0.976	1.023	1.072
Paper Products	5.047	5.534	5.814	6.132	6.442	6.763	7.086	7.427	7.829	8.264	8.72
Refined Petroleum	7.644	8.452	8.887	9.386	9.853	10.351	10.857	11.403	12.065	12.789	13.554
Cement	9.678	10.487	11.037	11.675	12.294	12.944	13.596	14.274	15.058	15.903	16.786
Iron and Steel	14.087	17.567	18.661	19.765	20.76	21.658	22.611	23.716	25.222	26.929	28.738
Electricity	17.509	18.557	19.444	20.477	21.486	22.557	23.634	24.767	26.092	27.524	29.029
Transportation	63.832	66.839	69.474	72.601	75.959	79.402	82.836	86.386	90.338	94.571	98.973
Other Economy	419.573	440.231	461.414	486.353	511.54	538.215	564.538	591.329	621.078	652.583	685.473
Unemployment rate	10.342	10.814	10.836	10.754	10.251	10.494	10.448	10.384	9.974	9.486	9.003
Private investment	41.302	52.344	55.882	58.975	62.295	64.514	66.512	68.429	70.658	72.958	75.231
Private investment (%GDP)	0.150	0.181	0.185	0.185	0.186	0.184	0.181	0.178	0.175	0.172	0.169
Private Consumption	187.34	187.534	194.658	203.976	213.45	224.558	235.682	247.232	260.059	273.726	288.164
Agriculture	16.047	15.854	16.368	16.991	17.741	18.581	19.389	20.253	21.19	22.153	23.188
Coal	1.353	1.32	1.359	1.41	1.466	1.527	1.588	1.653	1.726	1.805	1.888
Paper Products	0.791	0.809	0.841	0.881	0.922	0.969	1.016	1.066	1.123	1.184	1.249
Refined Petroleum	2.505	2.572	2.676	2.809	2.938	3.089	3.242	3.403	3.588	3.789	4.001
Cement	0.489	0.497	0.516	0.542	0.567	0.597	0.627	0.658	0.694	0.732	0.772
Iron and Steel	0.007	0.007	0.008	0.008	0.008	0.009	0.009	0.01	0.01	0.011	0.011
Electricity	3.093	3.012	3.129	3.279	3.428	3.6	3.775	3.958	4.168	4.393	4.631
Transportation	22.96	23.202	24.019	25.086	26.198	27.463	28.737	30.062	31.536	33.116	34.776
Other Economy	140.095	140.262	145.742	152.97	160.182	168.724	177.299	186.169	196.025	206.545	217.648

Table C.15 (cont'd)

	PERIODS										
	2002	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
Public investment	17.221	17.749	18.471	19.37	20.278	21.292	22.304	23.349	24.521	25.772	27.089
Public consumption	34.826	36.279	37.847	39.733	41.648	43.717	45.77	47.887	50.262	52.793	55.448
Public investment (%GDP)	0.06239	0.06137	0.06106	0.06090	0.06070	0.06067	0.06069	0.06072	0.06077	0.06085	0.06093
Public consumption (%GDP)	0.12618	0.12544	0.12511	0.12493	0.12467	0.12458	0.12454	0.12453	0.12456	0.12464	0.12473
Payroll tax revenue	10.722	11.236	11.728	12.305	12.9	13.526	14.148	14.793	15.522	16.299	17.114
Payroll tax revenue (%total tax revenue)	0.09636	0.09685	0.09689	0.09684	0.09685	0.09676	0.09669	0.09664	0.09661	0.09659	0.09657
Tax burden (Total tax rev. /GDP)	0.40316	0.40117	0.40013	0.39951	0.39868	0.39833	0.39815	0.39808	0.39817	0.39839	0.39866
ENVIRONMENTAL INDICATORS											
Total CO2 emissions	216.444	232.645	242.547	253.814	265.557	277.375	289.273	301.911	316.659	332.622	349.356
Energy use related emissions	177.333	192.499	200.752	210.022	219.709	229.3	238.972	249.29	261.416	274.574	288.36
Industrial process related emissions	19.107	20.116	21.057	22.153	23.275	24.451	25.613	26.809	28.149	29.571	31.06
Sectoral CO2 emissions											
Agriculture	6.067	6.233	6.466	6.729	7.039	7.356	7.663	7.988	8.343	8.712	9.105
Coal	12.636	12.505	12.884	13.35	13.886	14.441	15.002	15.599	16.272	17.001	17.762
Petroleum and Gas	1.782	1.845	1.929	2.03	2.132	2.243	2.352	2.463	2.589	2.722	2.86
Paper Products	41.892	45.71	47.731	49.987	52.341	54.655	56.978	59.439	62.314	65.424	68.674
Refined Petroleum	65.706	71.389	74.481	78.017	81.602	85.279	89.013	93.024	97.796	102.991	108.459
Cement	6.976	7.626	7.987	8.393	8.808	9.219	9.632	10.066	10.573	11.121	11.693
Iron and Steel	6.483	7.968	8.416	8.859	9.282	9.645	10.032	10.481	11.088	11.775	12.5
Electricity	19.207	20.403	21.28	22.281	23.316	24.363	25.417	26.533	27.836	29.244	30.721
Transportation	36.511	38.709	40.172	41.866	43.726	45.577	47.431	49.38	51.591	53.972	56.458
Other Economy	19.181	20.256	21.202	22.301	23.427	24.596	25.752	26.936	28.257	29.66	31.124
Environmental tax revenue		0.213	0.221	0.231	0.242	0.254	0.266	0.279	0.294	0.309	0.325
Environmental tax revenue (%total tax revenue)		0.00184	0.00183	0.00182	0.00182	0.00182	0.00182	0.00182	0.00183	0.00183	0.00183

Table C. 16: Simulation Results of a 3% Consumption Tax Levy

	PERIODS										
	2002	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
GDP	276.002	289.182	302.404	317.848	333.775	350.478	366.902	383.723	402.405	422.109	442.634
GDP growth rate		4.775	4.572	5.107	5.011	5.004	4.686	4.585	4.869	4.897	4.862
Sectoral Output											
Agriculture	43.514	43.932	45.514	47.23	49.415	51.65	53.743	55.974	58.359	60.751	63.317
Coal	1.81	1.926	1.97	2.015	2.084	2.137	2.191	2.251	2.319	2.394	2.471
Petroleum and Gas	0.699	0.694	0.724	0.762	0.802	0.845	0.888	0.93	0.975	1.021	1.069
Paper Products	5.047	5.533	5.811	6.128	6.436	6.754	7.074	7.411	7.808	8.236	8.683
Refined Petroleum	7.644	8.451	8.884	9.38	9.844	10.338	10.84	11.379	12.034	12.747	13.499
Cement	9.678	10.485	11.033	11.667	12.282	12.927	13.573	14.242	15.016	15.847	16.712
Iron and Steel	14.087	17.567	18.657	19.756	20.745	21.635	22.579	23.672	25.162	26.847	28.627
Electricity	17.509	18.652	19.538	20.571	21.577	22.645	23.717	24.843	26.158	27.575	29.058
Transportation	63.832	66.832	69.451	72.559	75.895	79.31	82.709	86.216	90.113	94.274	98.582
Other Economy	419.573	440.119	461.178	485.966	510.97	537.421	563.466	589.911	619.214	650.144	682.286
Unemployment rate	10.342	10.823	10.86	10.796	10.314	10.581	10.565	10.536	10.172	9.741	9.33
Private investment	41.302	52.329	55.847	58.913	62.201	64.381	66.328	68.181	70.328	72.519	74.65
Private investment (%GDP)	0.150	0.181	0.185	0.185	0.186	0.184	0.181	0.178	0.175	0.172	0.169
Private Consumption	187.34	187.595	194.68	203.949	213.365	224.403	235.44	246.88	259.566	273.05	287.25
Agriculture	16.047	15.851	16.362	16.982	17.727	18.56	19.362	20.217	21.143	22.091	23.108
Coal	1.353	1.345	1.385	1.436	1.493	1.555	1.617	1.682	1.756	1.835	1.918
Paper Products	0.791	0.809	0.84	0.881	0.921	0.968	1.015	1.064	1.12	1.181	1.244
Refined Petroleum	2.505	2.572	2.675	2.807	2.935	3.085	3.237	3.396	3.58	3.777	3.986
Cement	0.489	0.496	0.516	0.542	0.567	0.596	0.626	0.657	0.692	0.729	0.769
Iron and Steel	0.007	0.007	0.008	0.008	0.008	0.009	0.009	0.01	0.01	0.011	0.011
Electricity	3.093	3.07	3.188	3.341	3.491	3.666	3.843	4.028	4.239	4.465	4.704
Transportation	22.96	23.199	24.011	25.072	26.176	27.433	28.696	30.008	31.464	33.022	34.654
Other Economy	140.095	140.245	145.693	152.882	160.046	168.531	177.036	185.818	195.562	205.939	216.855

Table C.16 (cont'd)

	PERIODS										
	2002	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
Public investment	17.221	17.712	18.429	19.32	20.221	21.225	22.225	23.257	24.411	25.64	26.928
Public consumption	34.826	36.242	37.799	39.672	41.572	43.622	45.653	47.743	50.082	52.568	55.165
Public investment (%GDP)	0.06239	0.06125	0.06094	0.06078	0.06058	0.06056	0.06057	0.06061	0.06066	0.06074	0.06084
Public consumption (%GDP)	0.12618	0.12533	0.12500	0.12481	0.12455	0.12446	0.12443	0.12442	0.12446	0.12454	0.12463
Payroll tax revenue	10.722	11.24	11.728	12.303	12.893	13.515	14.131	14.768	15.487	16.251	17.049
Payroll tax revenue (%total tax revenue)	0.09636	0.09696	0.09700	0.09696	0.09696	0.09688	0.09680	0.09675	0.09672	0.09670	0.09667
Tax burden (Total tax rev. /GDP)	0.40316	0.40086	0.39983	0.39922	0.39839	0.39805	0.39788	0.39781	0.39791	0.39815	0.39842
ENVIRONMENTAL INDICATORS											
Total CO2 emissions	216.444	232.932	242.79	254.004	265.68	277.417	289.208	301.71	316.277	332.001	348.416
Energy use related emissions	177.333	192.601	200.814	210.035	219.661	229.178	238.757	248.956	260.925	273.876	287.389
Industrial process related emissions	19.107	20.116	21.051	22.141	23.255	24.421	25.572	26.752	28.073	29.471	30.927
Sectoral CO2 emissions											
Agriculture	6.067	6.232	6.463	6.725	7.031	7.347	7.651	7.971	8.321	8.685	9.068
Coal	12.636	12.717	13.101	13.573	14.113	14.675	15.24	15.841	16.518	17.246	18.007
Petroleum and Gas	1.782	1.848	1.931	2.032	2.134	2.243	2.352	2.462	2.586	2.717	2.853
Paper Products	41.892	45.7	47.71	49.953	52.29	54.583	56.882	59.312	62.146	65.202	68.381
Refined Petroleum	65.706	71.38	74.456	77.972	81.532	85.182	88.878	92.844	97.556	102.672	108.037
Cement	6.976	7.625	7.984	8.388	8.799	9.207	9.616	10.045	10.545	11.083	11.642
Iron and Steel	6.483	7.968	8.414	8.855	9.274	9.636	10.017	10.461	11.062	11.739	12.453
Electricity	19.207	20.507	21.383	22.383	23.416	24.461	25.509	26.618	27.909	29.301	30.756
Transportation	36.511	38.704	40.158	41.841	43.689	45.523	47.359	49.284	51.462	53.805	56.237
Other Economy	19.181	20.251	21.19	22.283	23.401	24.56	25.704	26.871	28.173	29.55	30.981
Environmental tax revenue		0.13	0.135	0.141	0.148	0.155	0.163	0.171	0.179	0.189	0.198
Environmental tax revenue (%total tax revenue)		0.00112	0.00112	0.00111	0.00111	0.00111	0.00112	0.00112	0.00112	0.00112	0.00112

Table C. 17: Simulation Results of a 1% Consumption Tax Levy

		PERIODS									
	2002	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
GDP	276.002	289.158	302.301	317.649	333.459	350.019	366.267	382.866	401.262	420.596	440.638
GDP growth rate		4.767	4.545	5.077	4.977	4.966	4.642	4.532	4.805	4.818	4.765
Sectoral Output											
Agriculture	43.514	43.923	45.495	47.197	49.367	51.583	53.653	55.855	58.203	60.548	63.052
Coal	1.81	1.944	1.988	2.033	2.102	2.155	2.209	2.268	2.337	2.411	2.487
Petroleum and Gas	0.699	0.696	0.725	0.763	0.802	0.846	0.888	0.93	0.974	1.019	1.066
Paper Products	5.047	5.532	5.809	6.123	6.429	6.745	7.061	7.394	7.785	8.206	8.643
Refined Petroleum	7.644	8.45	8.881	9.374	9.835	10.325	10.822	11.355	12.002	12.704	13.441
Cement	9.678	10.484	11.029	11.659	12.269	12.909	13.548	14.209	14.972	15.789	16.635
Iron and Steel	14.087	17.566	18.652	19.747	20.73	21.612	22.546	23.626	25.1	26.762	28.511
Electricity	17.509	18.751	19.636	20.668	21.672	22.737	23.804	24.922	26.226	27.627	29.087
Transportation	63.832	66.825	69.428	72.516	75.828	79.214	82.578	86.04	89.879	93.965	98.176
Other Economy	419.573	440.003	460.933	485.564	510.377	536.595	562.354	588.439	617.28	647.613	678.98
Unemployment rate		10.342	10.885	10.839	10.379	10.671	10.685	10.694	10.377	10.005	9.67
Private investment		41.302	52.314	55.809	58.849	62.104	64.242	66.137	67.924	69.985	72.064	74.048
Private investment (%GDP)		0.150	0.181	0.185	0.185	0.186	0.184	0.181	0.177	0.174	0.171	0.168
Private Consumption		187.34	187.659	194.702	203.922	213.277	224.242	235.188	246.514	259.054	272.348	286.3
Agriculture		16.047	15.849	16.357	16.972	17.712	18.54	19.334	20.18	21.094	22.027	23.024
Coal		1.353	1.371	1.412	1.464	1.522	1.584	1.646	1.713	1.787	1.866	1.949
Paper Products		0.791	0.809	0.84	0.88	0.92	0.966	1.013	1.062	1.117	1.177	1.24
Refined Petroleum		2.505	2.572	2.674	2.805	2.933	3.081	3.232	3.389	3.571	3.766	3.971
Cement		0.489	0.496	0.516	0.541	0.566	0.596	0.625	0.656	0.69	0.727	0.766
Iron and Steel		0.007	0.007	0.008	0.008	0.008	0.009	0.009	0.01	0.01	0.011	0.011
Electricity		3.093	3.13	3.25	3.405	3.557	3.734	3.913	4.099	4.312	4.54	4.779
Transportation		22.96	23.196	24.003	25.057	26.154	27.402	28.654	29.952	31.39	32.925	34.527
Other Economy		140.095	140.229	145.642	152.79	159.905	168.33	176.762	185.454	195.082	205.31	216.033

Table C.17 (cont'd)

	PERIODS										
	2002	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
Public investment	17.221	17.673	18.384	19.269	20.161	21.155	22.143	23.16	24.296	25.502	26.761
Public consumption	34.826	36.203	37.749	39.608	41.493	43.524	45.532	47.593	49.896	52.335	54.871
Public investment (%GDP)	0.06239	0.06112	0.06081	0.06066	0.06046	0.06044	0.06046	0.06049	0.06055	0.06063	0.06073
Public consumption (%GDP)	0.12618	0.12520	0.12487	0.12469	0.12443	0.12435	0.12431	0.12431	0.12435	0.12443	0.12453
Payroll tax revenue	10.722	11.243	11.729	12.3	12.886	13.503	14.113	14.742	15.45	16.201	16.982
Payroll tax revenue (%total tax revenue)	0.09636	0.09707	0.09711	0.09707	0.09707	0.09699	0.09691	0.09686	0.09683	0.09681	0.09679
Tax burden (Total tax rev. /GDP)	0.03885	0.03888	0.03880	0.03872	0.03864	0.03858	0.03853	0.03850	0.03850	0.03852	0.03854
ENVIRONMENTAL INDICATORS											
Total CO2 emissions	216.444	233.231	243.043	254.202	265.809	277.459	289.141	301.5	315.88	331.354	347.438
Energy use related emissions	177.333	192.707	200.878	210.049	219.612	229.052	238.534	248.608	260.414	273.151	286.381
Industrial process related emissions	19.107	20.115	21.045	22.128	23.234	24.391	25.528	26.694	27.994	29.366	30.789
Sectoral CO2 emissions											
Agriculture	6.067	6.231	6.46	6.72	7.025	7.337	7.638	7.954	8.299	8.655	9.03
Coal	12.636	12.938	13.325	13.803	14.349	14.917	15.486	16.09	16.771	17.5	18.26
Petroleum and Gas	1.782	1.851	1.934	2.034	2.135	2.244	2.352	2.461	2.583	2.712	2.846
Paper Products	41.892	45.69	47.688	49.917	52.237	54.509	56.782	59.179	61.971	64.972	68.079
Refined Petroleum	65.706	71.371	74.429	77.925	81.461	85.079	88.738	92.657	97.307	102.341	107.6
Cement	6.976	7.623	7.981	8.382	8.79	9.195	9.599	10.022	10.514	11.043	11.59
Iron and Steel	6.483	7.967	8.412	8.851	9.268	9.625	10.003	10.442	11.035	11.703	12.403
Electricity	19.207	20.616	21.491	22.489	23.52	24.561	25.604	26.704	27.984	29.36	30.792
Transportation	36.511	38.698	40.143	41.816	43.649	45.469	47.285	49.184	51.33	53.629	56.007
Other Economy	19.181	20.246	21.179	22.265	23.373	24.523	25.654	26.805	28.086	29.436	30.831
Environmental tax revenue		0.044	0.046	0.048	0.05	0.053	0.055	0.058	0.061	0.064	0.067
Environmental tax revenue (%total tax revenue)		0.00038	0.00038	0.00038	0.00038	0.00038	0.00038	0.00038	0.00038	0.00038	0.00038

Table C. 18: Simulation Results of a 1% Consumption Tax Levy with a 4 point payroll tax reduction

		PERIODS									
	2002	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
GDP	276.002	290.475	303.58	318.888	334.655	351.139	367.294	383.792	402.099	421.359	441.339
GDP growth rate		5.244	4.511	5.042	4.944	4.926	4.601	4.492	4.77	4.79	4.742
Sectoral Output											
Agriculture	43.514	44.502	46.076	47.78	49.959	52.181	54.251	56.454	58.803	61.148	63.656
Coal	1.81	2.023	2.068	2.114	2.184	2.237	2.291	2.352	2.421	2.497	2.574
Petroleum and Gas	0.699	0.692	0.721	0.759	0.797	0.84	0.883	0.924	0.967	1.012	1.058
Paper Products	5.047	5.591	5.87	6.186	6.493	6.809	7.125	7.458	7.851	8.275	8.715
Refined Petroleum	7.644	8.484	8.913	9.404	9.864	10.354	10.849	11.379	12.021	12.717	13.449
Cement	9.678	10.56	11.104	11.731	12.339	12.971	13.603	14.258	15.016	15.829	16.673
Iron and Steel	14.087	18.253	19.394	20.529	21.538	22.423	23.368	24.477	26.018	27.768	29.612
Electricity	17.509	19.3	20.225	21.282	22.303	23.36	24.426	25.559	26.911	28.375	29.902
Transportation	63.832	67.607	70.21	73.306	76.628	80.02	83.386	86.846	90.683	94.769	98.982
Other Economy	419.573	440.415	461.208	485.7	510.372	536.41	561.956	587.804	616.4	646.498	677.647
Unemployment rate	10.342	7.555	7.652	7.653	7.223	7.581	7.647	7.703	7.413	7.062	6.748
Private investment	41.302	52.674	56.175	59.218	62.475	64.607	66.495	68.275	70.338	72.427	74.428
Private investment (%GDP)	0.150	0.181	0.185	0.186	0.187	0.184	0.181	0.178	0.175	0.172	0.169
Private Consumption	187.34	188.406	195.413	204.596	213.914	224.819	235.693	246.941	259.406	272.632	286.518
Agriculture	16.047	16.031	16.538	17.154	17.896	18.724	19.518	20.363	21.277	22.21	23.208
Coal	1.353	1.399	1.44	1.492	1.55	1.612	1.675	1.741	1.816	1.896	1.979
Paper Products	0.791	0.814	0.845	0.886	0.926	0.972	1.018	1.067	1.122	1.182	1.244
Refined Petroleum	2.505	2.581	2.683	2.814	2.94	3.088	3.238	3.395	3.575	3.769	3.973
Cement	0.489	0.499	0.518	0.544	0.568	0.598	0.627	0.657	0.691	0.728	0.767
Iron and Steel	0.007	0.007	0.008	0.008	0.008	0.009	0.009	0.01	0.01	0.011	0.011
Electricity	3.093	3.197	3.32	3.477	3.631	3.807	3.985	4.172	4.39	4.624	4.87
Transportation	22.96	23.39	24.195	25.249	26.345	27.592	28.84	30.134	31.569	33.1	34.699
Other Economy	140.095	140.488	145.865	152.974	160.049	168.418	176.784	185.402	194.956	205.112	215.766

Table C.18 (cont'd)

	PERIODS										
	2002	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
Public investment	17.221	17.745	18.454	19.335	20.224	21.212	22.194	23.204	24.334	25.535	26.79
Public consumption	34.826	36.362	37.904	39.758	41.637	43.656	45.651	47.698	49.991	52.421	54.95
Public investment (%GDP)	0.06239	0.06109	0.06079	0.06063	0.06043	0.06041	0.06043	0.06046	0.06052	0.06060	0.06070
Public consumption (%GDP)	0.12618	0.12518	0.12486	0.12468	0.12442	0.12433	0.12429	0.12428	0.12433	0.12441	0.12451
Payroll tax revenue	10.722	10.375	10.821	11.343	11.88	12.443	12.998	13.573	14.221	14.908	15.624
Payroll tax revenue (%total tax revenue)	0.09636	0.08973	0.08978	0.08973	0.08973	0.08965	0.08957	0.08953	0.08951	0.08948	0.08947
Tax burden (Total tax rev. /GDP)	0.40316	0.39803	0.39703	0.39643	0.39560	0.39526	0.39508	0.39502	0.39513	0.39539	0.39569
ENVIRONMENTAL INDICATORS											
Total CO2 emissions	216.444	236.47	246.29	257.46	269.106	280.753	292.419	304.76	319.129	334.607	350.699
Energy use related emissions	177.333	195.598	203.78	212.964	222.568	232.013	241.49	251.556	263.358	276.102	289.341
Industrial process related emissions	19.107	20.222	21.15	22.231	23.335	24.485	25.616	26.774	28.071	29.44	30.86
Sectoral CO2 emissions											
Agriculture	6.067	6.301	6.529	6.788	7.093	7.406	7.707	8.022	8.365	8.72	9.092
Coal	12.636	13.202	13.591	14.069	14.62	15.188	15.758	16.364	17.046	17.78	18.543
Petroleum and Gas	1.782	1.85	1.932	2.032	2.132	2.241	2.348	2.456	2.577	2.704	2.836
Paper Products	41.892	46.289	48.286	50.517	52.844	55.119	57.391	59.785	62.572	65.568	68.672
Refined Petroleum	65.706	72.332	75.387	78.882	82.429	86.045	89.698	93.606	98.243	103.266	108.51
Cement	6.976	7.717	8.074	8.474	8.882	9.284	9.687	10.107	10.597	11.123	11.668
Iron and Steel	6.483	8.271	8.734	9.187	9.614	9.972	10.354	10.803	11.419	12.116	12.848
Electricity	19.207	20.999	21.885	22.891	23.928	24.967	26.008	27.111	28.403	29.797	31.246
Transportation	36.511	39.196	40.632	42.302	44.141	45.964	47.78	49.674	51.808	54.093	56.457
Other Economy	19.181	20.312	21.239	22.319	23.423	24.567	25.69	26.831	28.101	29.441	30.827
Environmental tax revenue		0.044	0.046	0.048	0.05	0.053	0.055	0.058	0.061	0.064	0.067
Environmental tax revenue (%total tax revenue)		0.00038	0.00038	0.00038	0.00038	0.00038	0.00038	0.00038	0.00038	0.00038	0.00038

Table C. 19: Simulation Results of a 1% Consumption Tax Levy with a 3 point payroll tax reduction

	PERIODS										
	2002	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
GDP	276.002	289.967	302.827	317.828	333.217	349.232	364.802	380.558	397.902	415.908	434.248
GDP growth rate		5.06	4.435	4.954	4.842	4.806	4.458	4.319	4.557	4.525	4.41
Sectoral Output											
Agriculture	43.514	44.323	45.858	47.517	49.637	51.789	53.776	55.872	58.087	60.262	62.549
Coal	1.81	2.001	2.044	2.087	2.155	2.205	2.255	2.311	2.375	2.443	2.512
Petroleum and Gas	0.699	0.692	0.72	0.757	0.795	0.837	0.878	0.918	0.959	1.001	1.043
Paper Products	5.047	5.576	5.85	6.16	6.46	6.766	7.07	7.388	7.762	8.16	8.568
Refined Petroleum	7.644	8.465	8.886	9.368	9.817	10.293	10.772	11.281	11.894	12.553	13.235
Cement	9.678	10.541	11.075	11.691	12.284	12.899	13.509	14.135	14.856	15.621	16.401
Iron and Steel	14.087	18.114	19.23	20.336	21.314	22.164	23.066	24.118	25.581	27.227	28.936
Electricity	17.509	19.242	20.15	21.185	22.18	23.206	24.234	25.317	26.604	27.983	29.4
Transportation	63.832	67.351	69.896	72.919	76.151	79.437	82.671	85.968	89.595	93.41	97.273
Other Economy	419.573	440.005	460.437	484.473	508.577	533.905	558.555	583.264	610.374	638.529	667.125
Unemployment rate	10.342	8.444	8.606	8.683	8.347	8.804	8.993	9.197	9.096	8.979	8.955
Private investment	41.302	52.54	55.973	58.929	62.078	64.074	65.788	67.345	69.115	70.821	72.319
Private investment (%GDP)	0.150	0.181	0.185	0.185	0.186	0.183	0.180	0.177	0.174	0.170	0.167
Private Consumption	187.34	188.118	194.993	204.011	213.126	223.783	234.35	245.211	257.174	269.747	282.783
Agriculture	16.047	15.975	16.47	17.071	17.795	18.601	19.368	20.18	21.051	21.931	22.859
Coal	1.353	1.392	1.431	1.482	1.539	1.599	1.659	1.722	1.793	1.869	1.946
Paper Products	0.791	0.812	0.843	0.883	0.922	0.967	1.012	1.059	1.112	1.169	1.228
Refined Petroleum	2.505	2.577	2.677	2.805	2.929	3.074	3.219	3.37	3.544	3.728	3.92
Cement	0.489	0.498	0.517	0.542	0.566	0.595	0.623	0.653	0.685	0.72	0.757
Iron and Steel	0.007	0.007	0.008	0.008	0.008	0.009	0.009	0.009	0.01	0.01	0.011
Electricity	3.093	3.189	3.31	3.463	3.614	3.785	3.958	4.139	4.347	4.57	4.801
Transportation	22.96	23.325	24.112	25.145	26.215	27.429	28.639	29.884	31.256	32.707	34.202
Other Economy	140.095	140.343	145.624	152.612	159.539	167.725	175.863	184.194	193.374	203.043	213.059

Table C.19 (cont'd)

	PERIODS										
	2002	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
Public investment	17.221	17.717	18.413	19.277	20.145	21.109	22.058	23.029	24.107	25.24	26.405
Public consumption	34.826	36.302	37.815	39.633	41.467	43.431	45.357	47.317	49.495	51.777	54.112
Public investment (%GDP)	0.06239	0.06110	0.06080	0.06065	0.06046	0.06044	0.06047	0.06051	0.06059	0.06069	0.06081
Public consumption (%GDP)	0.12618	0.12519	0.12487	0.12470	0.12444	0.12436	0.12433	0.12434	0.12439	0.12449	0.12461
Payroll tax revenue	10.722	10.594	11.041	11.565	12.1	12.66	13.208	13.769	14.398	15.057	15.732
Payroll tax revenue (%total tax revenue)	0.09636	0.09163	0.09167	0.09163	0.09163	0.09155	0.09147	0.09141	0.09138	0.09136	0.09134
Tax burden (Total tax rev. /GDP)	0.40316	0.39870	0.39771	0.39712	0.39631	0.39599	0.39584	0.39581	0.39596	0.39627	0.39663
ENVIRONMENTAL INDICATORS											
Total CO2 emissions	216.444	235.436	245.044	255.957	267.285	278.557	289.762	301.519	315.127	329.62	344.435
Energy use related emissions	177.333	194.671	202.674	211.642	220.978	230.109	239.199	248.776	259.941	271.859	284.03
Industrial process related emissions	19.107	20.185	21.097	22.156	23.233	24.351	25.441	26.547	27.776	29.057	30.362
Sectoral CO2 emissions											
Agriculture	6.067	6.276	6.499	6.751	7.049	7.352	7.64	7.94	8.264	8.595	8.937
Coal	12.636	13.128	13.504	13.97	14.505	15.054	15.602	16.179	16.826	17.513	18.218
Petroleum and Gas	1.782	1.847	1.928	2.025	2.124	2.229	2.333	2.437	2.551	2.671	2.792
Paper Products	41.892	46.087	48.042	50.22	52.483	54.682	56.861	59.136	61.768	64.564	67.41
Refined Petroleum	65.706	72.018	75.011	78.429	81.881	85.384	88.899	92.633	97.041	101.767	106.627
Cement	6.976	7.687	8.037	8.428	8.825	9.214	9.6	10.001	10.464	10.956	11.456
Iron and Steel	6.483	8.199	8.652	9.092	9.505	9.848	10.211	10.635	11.217	11.87	12.544
Electricity	19.207	20.909	21.777	22.76	23.769	24.774	25.774	26.825	28.048	29.353	30.689
Transportation	36.511	39.007	40.408	42.037	43.823	45.587	47.328	49.129	51.141	53.272	55.436
Other Economy	19.181	20.277	21.187	22.246	23.324	24.434	25.515	26.605	27.806	29.057	30.326
Environmental tax revenue		0.044	0.046	0.048	0.05	0.053	0.055	0.058	0.06	0.063	0.066
Environmental tax revenue (%total tax revenue)		0.00038	0.00038	0.00038	0.00038	0.00038	0.00038	0.00039	0.00038	0.00038	0.00038

Table C. 20: Simulation Results of a 1% Consumption Tax Levy with a 2 point payroll tax reduction

	PERIODS										
	2002	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
GDP	276.002	289.463	302.081	316.781	331.795	347.349	362.342	377.37	393.767	410.542	427.273
GDP growth rate		4.877	4.359	4.866	4.74	4.688	4.317	4.147	4.345	4.26	4.075
Sectoral Output											
Agriculture	43.514	44.146	45.644	47.258	49.32	51.404	53.307	55.3	57.383	59.392	61.463
Coal	1.81	1.979	2.021	2.062	2.126	2.174	2.22	2.272	2.33	2.391	2.451
Petroleum and Gas	0.699	0.692	0.72	0.756	0.793	0.834	0.874	0.912	0.951	0.99	1.029
Paper Products	5.047	5.562	5.831	6.135	6.426	6.723	7.016	7.32	7.675	8.048	8.423
Refined Petroleum	7.644	8.445	8.859	9.332	9.771	10.234	10.696	11.183	11.769	12.392	13.026
Cement	9.678	10.522	11.047	11.651	12.23	12.827	13.415	14.014	14.699	15.416	16.133
Iron and Steel	14.087	17.979	19.07	20.148	21.095	21.911	22.77	23.767	25.153	26.698	28.277
Electricity	17.509	19.185	20.076	21.09	22.059	23.054	24.044	25.079	26.302	27.598	28.906
Transportation	63.832	67.098	69.585	72.536	75.681	78.862	81.967	85.103	88.524	92.075	95.597
Other Economy	419.573	439.597	459.672	483.259	506.802	531.428	555.197	578.784	604.431	630.676	656.763
Unemployment rate	10.342	9.318	9.544	9.694	9.45	10.002	10.31	10.658	10.74	10.849	11.106
Private investment	41.302	52.409	55.774	58.644	61.686	63.547	65.09	66.429	67.911	69.241	70.244
Private investment (%GDP)	0.150	0.181	0.185	0.185	0.186	0.183	0.180	0.176	0.172	0.169	0.164
Private Consumption	187.34	187.833	194.577	203.433	212.348	222.761	233.025	243.505	254.975	266.909	279.11
Agriculture	16.047	15.92	16.403	16.99	17.695	18.48	19.22	20	20.829	21.656	22.516
Coal	1.353	1.384	1.423	1.472	1.527	1.586	1.644	1.704	1.771	1.842	1.913
Paper Products	0.791	0.811	0.841	0.88	0.918	0.962	1.006	1.051	1.102	1.156	1.211
Refined Petroleum	2.505	2.572	2.671	2.797	2.918	3.059	3.2	3.347	3.513	3.689	3.869
Cement	0.489	0.497	0.516	0.54	0.564	0.592	0.62	0.648	0.68	0.713	0.747
Iron and Steel	0.007	0.007	0.008	0.008	0.008	0.009	0.009	0.009	0.01	0.01	0.011
Electricity	3.093	3.181	3.299	3.45	3.597	3.764	3.931	4.106	4.306	4.517	4.734
Transportation	22.96	23.26	24.031	25.042	26.086	27.269	28.441	29.638	30.949	32.321	33.713
Other Economy	140.095	140.2	145.385	152.254	159.034	167.04	174.954	183.002	191.815	201.005	210.396

Table C.20 (cont'd)

	PERIODS										
	2002	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
Public investment	17.221	17.69	18.372	19.22	20.068	21.006	21.925	22.856	23.883	24.949	26.027
Public consumption	34.826	36.243	37.727	39.509	41.299	43.209	45.067	46.941	49.007	51.143	53.287
Public investment (%GDP)	0.06239	0.06111	0.06082	0.06067	0.06048	0.06048	0.06051	0.06057	0.06065	0.06077	0.06091
Public consumption (%GDP)	0.12618	0.12521	0.12489	0.12472	0.12447	0.12440	0.12438	0.12439	0.12446	0.12457	0.12471
Payroll tax revenue	10.722	10.808	11.256	11.78	12.314	12.87	13.409	13.957	14.566	15.196	15.828
Payroll tax revenue (%total tax revenue)	0.09636	0.09349	0.09353	0.09348	0.09348	0.09340	0.09331	0.09326	0.09323	0.09320	0.09318
Tax burden (Total tax rev. /GDP)	0.40316	0.39937	0.39839	0.39781	0.39702	0.39671	0.39659	0.39659	0.39679	0.39714	0.39757
ENVIRONMENTAL INDICATORS											
Total CO2 emissions	216.444	234.417	243.816	254.478	265.494	276.398	287.149	298.335	311.199	324.729	338.296
Energy use related emissions	177.333	193.76	201.585	210.341	219.415	228.237	236.948	246.046	256.588	267.7	278.827
Industrial process related emissions	19.107	20.149	21.043	22.082	23.132	24.218	25.268	26.323	27.485	28.68	29.871
Sectoral CO2 emissions											
Agriculture	6.067	6.251	6.469	6.716	7.004	7.299	7.575	7.86	8.166	8.472	8.783
Coal	12.636	13.053	13.42	13.874	14.392	14.921	15.449	15.998	16.61	17.253	17.9
Petroleum and Gas	1.782	1.845	1.924	2.019	2.115	2.218	2.319	2.418	2.526	2.638	2.75
Paper Products	41.892	45.887	47.8	49.927	52.126	54.251	56.338	58.497	60.978	63.58	66.172
Refined Petroleum	65.706	71.711	74.64	77.983	81.34	84.735	88.114	91.678	95.861	100.3	104.784
Cement	6.976	7.659	8.001	8.383	8.77	9.146	9.516	9.897	10.333	10.792	11.247
Iron and Steel	6.483	8.13	8.571	8.999	9.398	9.727	10.071	10.47	11.02	11.629	12.248
Electricity	19.207	20.821	21.669	22.63	23.611	24.583	25.543	26.543	27.699	28.919	30.142
Transportation	36.511	38.821	40.189	41.777	43.512	45.215	46.883	48.592	50.488	52.468	54.436
Other Economy	19.181	20.242	21.136	22.173	23.224	24.303	25.343	26.381	27.516	28.679	29.834
Environmental tax revenue		0.044	0.046	0.048	0.05	0.052	0.055	0.057	0.06	0.063	0.065
Environmental tax revenue (% total tax revenue)		0.00038	0.00038	0.00038	0.00038	0.00038	0.00038	0.00038	0.00038	0.00039	0.00038

Table C. 21: Simulation Results of a 1% Consumption Tax Levy with a 1 point payroll tax reduction

	PERIODS										
	2002	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
GDP	276.002	288.965	301.343	315.745	330.39	345.489	359.915	374.226	389.692	405.259	420.412
GDP growth rate		4.697	4.284	4.779	4.638	4.57	4.176	3.976	4.133	3.995	3.739
Sectoral Output											
Agriculture	43.514	43.971	45.432	47.002	49.008	51.024	52.846	54.737	56.692	58.538	60.398
Coal	1.81	1.958	1.998	2.036	2.098	2.143	2.186	2.233	2.286	2.341	2.392
Petroleum and Gas	0.699	0.692	0.719	0.755	0.791	0.831	0.87	0.906	0.943	0.979	1.015
Paper Products	5.047	5.547	5.811	6.109	6.394	6.681	6.963	7.252	7.589	7.938	8.281
Refined Petroleum	7.644	8.426	8.832	9.297	9.725	10.175	10.621	11.088	11.646	12.233	12.82
Cement	9.678	10.503	11.019	11.612	12.177	12.757	13.323	13.895	14.543	15.214	15.87
Iron and Steel	14.087	17.846	18.913	19.963	20.88	21.663	22.481	23.424	24.735	26.182	27.635
Electricity	17.509	19.128	20.002	20.995	21.94	22.905	23.857	24.845	26.005	27.22	28.422
Transportation	63.832	66.848	69.278	72.159	75.217	78.295	81.274	84.253	87.472	90.764	93.952
Other Economy	419.573	439.192	458.914	482.056	505.046	528.98	551.879	574.361	598.57	622.936	646.56
Unemployment rate	10.342	10.176	10.464	10.687	10.532	11.178	11.601	12.089	12.347	12.675	13.202
Private investment	41.302	52.278	55.577	58.363	61.299	63.027	64.402	65.525	66.725	67.685	68.202
Private investment (%GDP)	0.150	0.181	0.184	0.185	0.186	0.182	0.179	0.175	0.171	0.167	0.162
Private Consumption	187.34	187.551	194.166	202.862	211.579	221.752	231.718	241.823	252.809	264.115	275.498
Agriculture	16.047	15.865	16.337	16.909	17.597	18.36	19.075	19.822	20.611	21.386	22.179
Coal	1.353	1.377	1.415	1.463	1.516	1.573	1.628	1.686	1.75	1.816	1.882
Paper Products	0.791	0.809	0.839	0.877	0.914	0.957	1	1.043	1.092	1.143	1.195
Refined Petroleum	2.505	2.568	2.665	2.789	2.907	3.045	3.182	3.323	3.483	3.65	3.818
Cement	0.489	0.497	0.515	0.539	0.562	0.589	0.616	0.643	0.674	0.705	0.737
Iron and Steel	0.007	0.007	0.008	0.008	0.008	0.009	0.009	0.009	0.01	0.01	0.011
Electricity	3.093	3.173	3.289	3.437	3.58	3.743	3.905	4.074	4.265	4.466	4.668
Transportation	22.96	23.197	23.95	24.94	25.959	27.111	28.245	29.396	30.646	31.941	33.233
Other Economy	140.095	140.058	145.148	151.901	158.535	166.364	174.057	181.826	190.278	198.999	207.775

Table C.21 (cont'd)

	PERIODS										
	2002	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
Public investment	17.221	17.663	18.332	19.164	19.992	20.905	21.793	22.685	23.662	24.662	25.655
Public consumption	34.826	36.184	37.64	39.386	41.133	42.989	44.781	46.57	48.526	50.519	52.476
Public investment (%GDP)	0.06239	0.06113	0.06083	0.06069	0.06051	0.06051	0.06055	0.06062	0.06072	0.06085	0.06102
Public consumption (%GDP)	0.12618	0.12522	0.12491	0.12474	0.12450	0.12443	0.12442	0.12444	0.12452	0.12466	0.12482
Payroll tax revenue	10.722	11.017	11.466	11.991	12.523	13.073	13.604	14.137	14.725	15.324	15.911
Payroll tax revenue (%total tax revenue)	0.09636	0.09531	0.09535	0.09530	0.09531	0.09521	0.09513	0.09507	0.09504	0.09501	0.09497
Tax burden (Total tax rev. /GDP)	0.40316	0.40002	0.39905	0.39849	0.39771	0.39743	0.39733	0.39736	0.39760	0.39800	0.39850
ENVIRONMENTAL INDICATORS											
Total CO2 emissions	216.444	233.414	242.608	253.021	263.731	274.274	284.581	295.207	307.343	319.931	332.281
Energy use related emissions	177.333	192.862	200.514	209.062	217.877	226.397	234.735	243.366	253.298	263.622	273.731
Industrial process related emissions	19.107	20.113	20.991	22.008	23.033	24.087	25.097	26.103	27.199	28.308	29.389
Sectoral CO2 emissions											
Agriculture	6.067	6.227	6.44	6.679	6.961	7.245	7.511	7.782	8.07	8.352	8.633
Coal	12.636	12.979	13.336	13.777	14.28	14.793	15.297	15.82	16.397	16.997	17.589
Petroleum and Gas	1.782	1.842	1.92	2.014	2.107	2.207	2.303	2.399	2.502	2.606	2.708
Paper Products	41.892	45.69	47.561	49.639	51.776	53.828	55.824	57.87	60.204	62.614	64.959
Refined Petroleum	65.706	71.406	74.274	77.542	80.811	84.097	87.344	90.739	94.705	98.859	102.976
Cement	6.976	7.63	7.965	8.338	8.715	9.079	9.433	9.794	10.205	10.63	11.044
Iron and Steel	6.483	8.061	8.491	8.908	9.294	9.607	9.934	10.31	10.827	11.395	11.96
Electricity	19.207	20.734	21.564	22.503	23.457	24.396	25.316	26.267	27.358	28.492	29.606
Transportation	36.511	38.637	39.972	41.519	43.205	44.849	46.446	48.065	49.847	51.678	53.457
Other Economy	19.181	20.208	21.085	22.102	23.127	24.173	25.174	26.161	27.229	28.307	29.35
Environmental tax revenue		0.044	0.046	0.048	0.05	0.052	0.054	0.057	0.059	0.062	0.065
Environmental tax revenue (%total tax revenue)		0.00038	0.00038	0.00038	0.00038	0.00038	0.00038	0.00038	0.00038	0.00038	0.00039

Table C. 22: Simulation Results of a 10% Energy Tax and a 1% Consumption Tax Levy

		PERIODS									
	2002	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
GDP	276.002	288.347	301.164	316.071	331.301	347.078	362.31	377.597	394.29	411.418	428.581
GDP growth rate		4.473	4.445	4.95	4.818	4.762	4.389	4.219	4.421	4.344	4.172
Sectoral Output											
Agriculture	43.514	43.807	45.3	46.907	48.957	51.024	52.911	54.885	56.95	58.947	61.013
Coal	1.81	1.816	1.85	1.884	1.939	1.978	2.017	2.059	2.106	2.157	2.206
Petroleum and Gas	0.699	0.591	0.616	0.648	0.68	0.716	0.751	0.785	0.819	0.854	0.888
Paper Products	5.047	5.393	5.656	5.954	6.24	6.531	6.818	7.115	7.463	7.83	8.199
Refined Petroleum	7.644	7.396	7.76	8.177	8.565	8.975	9.384	9.814	10.328	10.876	11.434
Cement	9.678	10.2	10.716	11.309	11.879	12.466	13.045	13.634	14.307	15.014	15.723
Iron and Steel	14.087	16.291	17.241	18.188	19.025	19.754	20.512	21.38	22.569	23.885	25.227
Electricity	17.509	14.336	14.999	15.759	16.487	17.24	17.986	18.766	19.681	20.651	21.634
Transportation	63.832	66.326	68.795	71.724	74.841	77.991	81.063	84.163	87.547	91.066	94.569
Other Economy	419.573	438.691	459.241	483.322	507.382	532.543	556.89	581.117	607.509	634.614	661.706
Unemployment rate	10.342	11.729	12.092	12.377	12.28	12.957	13.408	13.907	14.156	14.427	14.827
Private investment	41.302	51.973	55.382	58.302	61.401	63.326	64.939	66.354	67.921	69.35	70.478
Private investment (%GDP)	0.150	0.180	0.184	0.184	0.185	0.182	0.179	0.176	0.172	0.169	0.164
Private Consumption	187.34	186.242	193.073	202.012	211.012	221.511	231.869	242.45	254.033	266.106	278.486
Agriculture	16.047	15.78	16.261	16.845	17.547	18.326	19.062	19.835	20.657	21.478	22.334
Coal	1.353	1.355	1.393	1.44	1.494	1.55	1.606	1.665	1.73	1.798	1.867
Paper Products	0.791	0.798	0.828	0.867	0.905	0.949	0.992	1.037	1.088	1.142	1.197
Refined Petroleum	2.505	2.45	2.545	2.667	2.784	2.921	3.057	3.199	3.359	3.529	3.703
Cement	0.489	0.49	0.508	0.533	0.557	0.584	0.612	0.64	0.672	0.705	0.739
Iron and Steel	0.007	0.007	0.007	0.008	0.008	0.008	0.009	0.009	0.01	0.01	0.011
Electricity	3.093	2.848	2.955	3.091	3.224	3.375	3.527	3.685	3.865	4.056	4.252
Transportation	22.96	23.072	23.845	24.857	25.902	27.085	28.255	29.451	30.76	32.132	33.528
Other Economy	140.095	139.443	144.731	151.704	158.592	166.712	174.748	182.929	191.892	201.256	210.855

Table C.22 (cont'd)

	PERIODS										
	2002	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
Public investment	17.221	18.302	19.027	19.924	20.821	21.811	22.782	23.766	24.851	25.981	27.127
Public consumption	34.826	36.786	38.325	40.17	42.024	44.002	45.93	47.874	50.019	52.24	54.479
Public investment (%GDP)	0.06239	0.06347	0.06318	0.06304	0.06285	0.06284	0.06288	0.06294	0.06303	0.06315	0.06329
Public consumption (%GDP)	0.12618	0.12758	0.12726	0.12709	0.12685	0.12678	0.12677	0.12679	0.12686	0.12698	0.12711
Payroll tax revenue	10.722	11.057	11.521	12.065	12.62	13.197	13.758	14.327	14.958	15.612	16.27
Payroll tax revenue (%total tax revenue)	0.09636	0.09441	0.09442	0.09435	0.09434	0.09423	0.09413	0.09405	0.09400	0.09395	0.09389
Tax burden (Total tax rev. /GDP)											
ENVIRONMENTAL INDICATORS											
Total CO2 emissions	216.444	216.235	224.859	234.684	244.855	254.955	264.887	275.185	286.972	299.367	311.831
Energy use related emissions	177.333	176.622	183.695	191.643	199.897	207.944	215.864	224.105	233.609	243.625	253.68
Industrial process related emissions	19.107	19.809	20.704	21.743	22.795	23.883	24.936	25.995	27.16	28.359	29.561
Sectoral CO2 emissions											
Agriculture	6.067	6.147	6.363	6.605	6.891	7.181	7.453	7.735	8.036	8.339	8.646
Coal	12.636	12.574	12.922	13.354	13.846	14.354	14.854	15.376	15.956	16.566	17.18
Petroleum and Gas	1.782	1.544	1.611	1.693	1.775	1.862	1.948	2.033	2.125	2.219	2.314
Paper Products	41.892	43.591	45.407	47.43	49.521	51.541	53.521	55.568	57.92	60.389	62.859
Refined Petroleum	65.706	63.863	66.46	69.444	72.443	75.493	78.522	81.701	85.414	89.35	93.338
Cement	6.976	7.206	7.529	7.89	8.255	8.611	8.961	9.321	9.732	10.165	10.596
Iron and Steel	6.483	7.276	7.651	8.02	8.365	8.652	8.95	9.289	9.749	10.257	10.77
Electricity	19.207	16.635	17.304	18.069	18.852	19.634	20.402	21.202	22.121	23.088	24.064
Transportation	36.511	37.409	38.718	40.241	41.906	43.54	45.136	46.769	48.579	50.471	52.359
Other Economy	19.181	19.992	20.894	21.939	22.999	24.086	25.139	26.189	27.34	28.523	29.705
Environmental tax revenue		2.253	2.355	2.473	2.589	2.711	2.83	2.952	3.09	3.233	3.378
Environmental tax revenue (%total tax revenue)		0.01924	0.01930	0.01934	0.01935	0.01936	0.01936	0.01938	0.01942	0.01945	0.01949

Table C. 23: Simulation Results of a 10% Energy Tax and a 1% Consumption Tax Levy with a 4 point payroll tax reduction

		PERIODS									
	2002	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
GDP	276.002	290.353	304.145	320.274	337.02	354.674	372.25	390.509	411.065	433.219	456.955
GDP growth rate		5.2	4.75	5.303	5.229	5.238	4.955	4.905	5.264	5.389	5.479
Sectoral Output											
Agriculture	43.514	44.514	46.159	47.95	50.233	52.581	54.805	57.204	59.806	62.483	65.429
Coal	1.81	1.895	1.936	1.979	2.045	2.095	2.147	2.207	2.275	2.352	2.434
Petroleum and Gas	0.699	0.591	0.618	0.652	0.687	0.727	0.766	0.805	0.847	0.891	0.938
Paper Products	5.047	5.449	5.733	6.055	6.371	6.698	7.03	7.385	7.809	8.274	8.773
Refined Petroleum	7.644	7.464	7.853	8.301	8.728	9.185	9.653	10.158	10.772	11.45	12.18
Cement	9.678	10.274	10.826	11.464	12.09	12.746	13.411	14.111	14.929	15.825	16.782
Iron and Steel	14.087	16.755	17.793	18.841	19.79	20.645	21.56	22.63	24.098	25.781	27.594
Electricity	17.509	14.501	15.216	16.039	16.844	17.69	18.552	19.478	20.587	21.809	23.121
Transportation	63.832	67.329	70.033	73.251	76.724	80.301	83.896	87.649	91.869	96.464	101.354
Other Economy	419.573	440.342	462.328	488.226	514.558	542.565	570.501	599.302	631.665	666.581	703.936
Unemployment rate	10.342	8.302	8.407	8.391	7.919	8.206	8.175	8.092	7.608	6.972	6.248
Private investment	41.302	52.489	56.168	59.431	62.961	65.431	67.736	70.039	72.771	75.729	78.868
Private investment (%GDP)	0.150	0.181	0.185	0.186	0.187	0.184	0.182	0.179	0.177	0.175	0.173
Private Consumption	187.34	187.369	194.725	204.314	214.12	225.606	237.19	249.315	262.899	277.571	293.34
Agriculture	16.047	15.999	16.528	17.171	17.946	18.814	19.657	20.563	21.555	22.59	23.724
Coal	1.353	1.383	1.425	1.478	1.538	1.602	1.668	1.738	1.817	1.904	1.997
Paper Products	0.791	0.804	0.837	0.878	0.92	0.968	1.017	1.069	1.128	1.194	1.264
Refined Petroleum	2.505	2.466	2.568	2.698	2.826	2.976	3.129	3.29	3.478	3.682	3.902
Cement	0.489	0.493	0.513	0.539	0.565	0.595	0.626	0.658	0.695	0.736	0.779
Iron and Steel	0.007	0.007	0.008	0.008	0.008	0.009	0.009	0.01	0.01	0.011	0.011
Electricity	3.093	2.876	2.992	3.139	3.284	3.451	3.622	3.804	4.016	4.248	4.497
Transportation	22.96	23.328	24.17	25.268	26.418	27.728	29.054	30.445	32.004	33.698	35.51
Other Economy	140.095	140.013	145.684	153.135	160.615	169.463	178.408	187.738	198.196	209.508	221.656

Table C.23 (cont'd)

	PERIODS										
	2002	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
Public investment	17.221	18.415	19.195	20.162	21.144	22.24	23.342	24.493	25.797	27.21	28.727
Public consumption	34.826	37.025	38.682	40.673	42.709	44.912	47.12	49.422	52.031	54.858	57.89
Public investment (%GDP)	0.06239	0.06342	0.06311	0.06295	0.06274	0.06271	0.06271	0.06272	0.06276	0.06281	0.06287
Public consumption (%GDP)	0.12618	0.12752	0.12718	0.12699	0.12673	0.12663	0.12658	0.12656	0.12658	0.12663	0.12669
Payroll tax revenue	10.722	10.22	10.679	11.22	11.78	12.372	12.966	13.588	14.297	15.066	15.891
Payroll tax revenue (%total tax revenue)	0.09636	0.08722	0.08723	0.08718	0.08717	0.08707	0.08699	0.08693	0.08688	0.08684	0.08681
Tax burden (Total tax rev. /GDP)	0.40316	0.40355	0.40250	0.40186	0.40100	0.40062	0.40041	0.40029	0.40031	0.40045	0.40061
ENVIRONMENTAL INDICATORS											
Total CO2 emissions	216.444	219.923	229.325	240.096	251.441	262.93	274.574	287.029	301.621	317.647	334.812
Energy use related emissions	177.333	179.898	187.622	196.359	205.591	214.789	224.127	234.155	245.981	259.001	272.943
Industrial process related emissions	19.107	19.949	20.912	22.034	23.19	24.407	25.622	26.886	28.319	29.866	31.524
Sectoral CO2 emissions											
Agriculture	6.067	6.244	6.48	6.748	7.066	7.395	7.714	8.054	8.432	8.829	9.263
Coal	12.636	12.857	13.246	13.73	14.284	14.865	15.451	16.083	16.801	17.586	18.428
Petroleum and Gas	1.782	1.553	1.625	1.713	1.803	1.9	1.997	2.097	2.21	2.33	2.46
Paper Products	41.892	44.35	46.329	48.549	50.887	53.197	55.537	58.037	60.977	64.208	67.664
Refined Petroleum	65.706	64.921	67.743	70.999	74.336	77.785	81.306	85.108	89.633	94.621	99.975
Cement	6.976	7.314	7.665	8.058	8.465	8.87	9.281	9.718	10.23	10.792	11.393
Iron and Steel	6.483	7.515	7.929	8.34	8.736	9.077	9.442	9.869	10.447	11.109	11.821
Electricity	19.207	16.91	17.64	18.477	19.351	20.238	21.139	22.104	23.239	24.487	25.825
Transportation	36.511	38.13	39.572	41.255	43.122	44.992	46.878	48.874	51.148	53.637	56.295
Other Economy	19.181	20.127	21.096	22.226	23.391	24.61	25.826	27.085	28.507	30.043	31.688
Environmental tax revenue		2.27	2.379	2.507	2.635	2.771	2.908	3.053	3.22	3.403	3.599
Environmental tax revenue (%total tax revenue)		0.01937	0.01943	0.01948	0.01950	0.01950	0.01951	0.01953	0.01957	0.01962	0.01966

Table C. 24: Simulation Results of a 10% Energy Tax and a 1% Consumption Tax Levy with a 3 point payroll tax reduction

	PERIODS									
	2002	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
GDP	276.002	289.844	303.388	319.206	335.565	352.739	369.715	387.212	406.776	427.638	449.681
GDP growth rate		5.015	4.673	5.214	5.125	5.118	4.813	4.732	5.053	5.128	5.155
Sectoral Output											
Agriculture	43.514	44.334	45.94	47.684	49.908	52.183	54.321	56.609	59.074	61.574	64.292
Coal	1.81	1.875	1.914	1.954	2.017	2.065	2.114	2.168	2.231	2.301	2.374
Petroleum and Gas	0.699	0.591	0.617	0.651	0.685	0.724	0.762	0.8	0.84	0.881	0.925
Paper Products	5.047	5.435	5.713	6.029	6.337	6.655	6.976	7.316	7.72	8.16	8.626
Refined Petroleum	7.644	7.446	7.829	8.27	8.686	9.131	9.584	10.07	10.658	11.303	11.988
Cement	9.678	10.256	10.798	11.425	12.036	12.675	13.318	13.989	14.77	15.617	16.511
Iron and Steel	14.087	16.635	17.651	18.673	19.593	20.415	21.29	22.307	23.703	25.29	26.98
Electricity	17.509	14.459	15.161	15.968	16.753	17.575	18.408	19.296	20.355	21.512	22.738
Transportation	63.832	67.074	69.718	72.862	76.243	79.71	83.171	86.756	90.76	95.077	99.608
Other Economy	419.573	439.925	461.545	486.982	512.734	540.015	567.034	594.665	625.498	658.411	693.129
Unemployment rate	10.342	9.181	9.353	9.415	9.041	9.43	9.525	9.594	9.303	8.905	8.478
Private investment	41.302	52.358	55.968	59.144	62.563	64.894	67.022	69.098	71.531	74.096	76.717
Private investment (%GDP)	0.150	0.181	0.184	0.185	0.186	0.184	0.181	0.178	0.176	0.173	0.171
Private Consumption	187.34	187.083	194.304	203.727	213.329	224.563	235.832	247.562	260.63	274.634	289.53
Agriculture	16.047	15.943	16.46	17.088	17.844	18.69	19.505	20.376	21.325	22.305	23.366
Coal	1.353	1.376	1.417	1.468	1.527	1.589	1.652	1.719	1.794	1.876	1.963
Paper Products	0.791	0.802	0.834	0.875	0.916	0.963	1.011	1.061	1.118	1.18	1.247
Refined Petroleum	2.505	2.462	2.562	2.69	2.816	2.962	3.11	3.267	3.447	3.643	3.851
Cement	0.489	0.492	0.512	0.537	0.563	0.592	0.622	0.654	0.689	0.728	0.769
Iron and Steel	0.007	0.007	0.007	0.008	0.008	0.009	0.009	0.009	0.01	0.011	0.011
Electricity	3.093	2.869	2.983	3.127	3.269	3.432	3.598	3.774	3.977	4.199	4.434
Transportation	22.96	23.263	24.087	25.163	26.286	27.564	28.85	30.191	31.685	33.296	35.001
Other Economy	140.095	139.869	145.442	152.771	160.1	168.762	177.475	186.511	196.585	207.396	218.888

Table C.24 (cont'd)

	PERIODS										
	2002	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
Public investment	17.221	18.386	19.152	20.101	21.062	22.131	23.199	24.307	25.555	26.895	28.316
Public consumption	34.826	36.964	38.591	40.545	42.534	44.68	46.816	49.026	51.516	54.187	57.015
Public investment (%GDP)	0.06239	0.06343	0.06313	0.06297	0.06277	0.06274	0.06275	0.06277	0.06282	0.06289	0.06297
Public consumption (%GDP)	0.12618	0.12753	0.12720	0.12702	0.12675	0.12667	0.12663	0.12661	0.12664	0.12671	0.12679
Payroll tax revenue	10.722	10.436	10.897	11.439	11.998	12.588	13.175	13.785	14.476	15.218	16.004
Payroll tax revenue (%total tax revenue)	0.09636	0.08907	0.08909	0.08902	0.08901	0.08891	0.08883	0.08876	0.08871	0.08867	0.08863
Tax burden (Total tax rev. /GDP)	0.40316	0.40422	0.40318	0.40255	0.40171	0.40136	0.40117	0.40108	0.40114	0.40133	0.40154
ENVIRONMENTAL INDICATORS											
Total CO2 emissions	216.444	218.98	228.182	238.711	249.754	260.886	272.089	283.988	297.855	312.941	328.888
Energy use related emissions	177.333	179.059	186.616	195.151	204.132	213.034	222.006	231.573	242.799	255.041	267.974
Industrial process related emissions	19.107	19.914	20.859	21.96	23.089	24.274	25.447	26.659	28.022	29.48	31.021
Sectoral CO2 emissions											
Agriculture	6.067	6.219	6.45	6.713	7.022	7.34	7.647	7.973	8.33	8.704	9.104
Coal	12.636	12.785	13.163	13.633	14.172	14.733	15.298	15.901	16.584	17.323	18.105
Petroleum and Gas	1.782	1.551	1.622	1.708	1.795	1.891	1.985	2.081	2.187	2.302	2.422
Paper Products	41.892	44.156	46.093	48.262	50.537	52.773	55.02	57.404	60.191	63.225	66.426
Refined Petroleum	65.706	64.651	67.415	70.601	73.85	77.198	80.593	84.233	88.548	93.264	98.265
Cement	6.976	7.287	7.63	8.015	8.411	8.804	9.199	9.616	10.102	10.63	11.188
Iron and Steel	6.483	7.454	7.857	8.258	8.64	8.968	9.314	9.719	10.266	10.888	11.548
Electricity	19.207	16.84	17.555	18.373	19.223	20.083	20.95	21.872	22.952	24.128	25.372
Transportation	36.511	37.946	39.353	40.995	42.81	44.62	46.431	48.332	50.488	52.822	55.28
Other Economy	19.181	20.092	21.044	22.153	23.292	24.476	25.65	26.856	28.208	29.655	31.18
Environmental tax revenue		2.266	2.373	2.498	2.623	2.756	2.889	3.027	3.187	3.359	3.542
Environmental tax revenue (%total tax revenue)		0.01934	0.01940	0.01944	0.01946	0.01947	0.01948	0.01949	0.01953	0.01957	0.01962

Table C. 25: Simulation Results of a 10% Energy Tax and a 1% Consumption Tax Levy with a 2 point payroll tax reduction

	PERIODS									
	2002	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
GDP	276.002	289.34	302.639	318.149	334.127	350.829	367.214	383.961	402.552	422.145	442.53
GDP growth rate		4.833	4.596	5.125	5.022	4.999	4.67	4.561	4.842	4.867	4.829
Sectoral Output											
Agriculture	43.514	44.156	45.724	47.422	49.586	51.791	53.843	56.025	58.353	60.682	63.178
Coal	1.81	1.855	1.892	1.93	1.991	2.036	2.081	2.131	2.189	2.252	2.317
Petroleum and Gas	0.699	0.591	0.617	0.65	0.684	0.721	0.758	0.795	0.833	0.872	0.913
Paper Products	5.047	5.421	5.694	6.004	6.304	6.613	6.923	7.248	7.633	8.048	8.481
Refined Petroleum,	7.644	7.429	7.806	8.238	8.645	9.078	9.516	9.984	10.547	11.158	11.8
Cement	9.678	10.237	10.771	11.386	11.983	12.604	13.226	13.869	14.613	15.413	16.244
Iron and Steel	14.087	16.518	17.512	18.508	19.4	20.19	21.025	21.992	23.316	24.81	26.381
Electricity	17.509	14.417	15.106	15.897	16.664	17.462	18.265	19.116	20.127	21.22	22.363
Transportation	63.832	66.822	69.406	72.478	75.769	79.129	82.457	85.878	89.671	93.716	97.895
Other Economy	419.573	439.51	460.77	485.749	510.931	537.495	563.611	590.089	619.417	650.361	682.491
Unemployment rate	10.342	10.045	10.283	10.421	10.142	10.629	10.846	11.063	10.958	10.792	10.65
Private investment	41.302	52.228	55.77	58.86	62.171	64.364	66.318	68.17	70.309	72.489	74.603
Private investment (%GDP)	0.150	0.181	0.184	0.185	0.186	0.183	0.181	0.178	0.175	0.172	0.169
Private Consumption	187.34	186.8	193.888	203.149	212.549	223.533	234.493	245.832	258.397	271.745	285.786
Agriculture	16.047	15.888	16.393	17.006	17.744	18.567	19.355	20.193	21.098	22.024	23.016
Coal	1.353	1.369	1.409	1.459	1.516	1.576	1.637	1.701	1.772	1.85	1.93
Paper Products	0.791	0.801	0.832	0.872	0.912	0.958	1.004	1.053	1.108	1.167	1.23
Refined Petroleum	2.505	2.458	2.556	2.682	2.805	2.948	3.092	3.244	3.417	3.604	3.801
Cement	0.489	0.491	0.511	0.536	0.561	0.59	0.619	0.649	0.684	0.72	0.759
Iron and Steel	0.007	0.007	0.007	0.008	0.008	0.009	0.009	0.009	0.01	0.01	0.011
Electricity	3.093	2.862	2.973	3.115	3.254	3.413	3.574	3.743	3.939	4.15	4.372
Transportation	22.96	23.198	24.005	25.06	26.157	27.402	28.649	29.94	31.372	32.902	34.501
Other Economy	140.095	139.726	145.202	152.411	159.592	168.07	176.554	185.3	194.997	205.318	216.166

Table C.25 (cont'd)

	PERIODS										
	2002	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
Public investment	17.221	18.358	19.11	20.041	20.981	22.023	23.058	24.124	25.317	26.585	27.913
Public consumption	34.826	36.904	38.501	40.418	42.362	44.451	46.517	48.637	51.009	53.528	56.155
Public investment (%GDP)	0.06239	0.06345	0.06314	0.06299	0.06279	0.06277	0.06279	0.06283	0.06289	0.06298	0.06308
Public consumption (%GDP)	0.12618	0.12755	0.12722	0.12704	0.12678	0.12670	0.12668	0.12667	0.12671	0.12680	0.12690
Payroll tax revenue	10.722	10.647	11.11	11.653	12.211	12.798	13.376	13.974	14.646	15.36	16.104
Payroll tax revenue (%total tax revenue)	0.09636	0.09089	0.09090	0.09083	0.09082	0.09073	0.09063	0.09056	0.09051	0.09047	0.09042
Tax burden (Total tax rev. /GDP)	0.40316	0.40488	0.40385	0.40324	0.40241	0.40208	0.40192	0.40186	0.40197	0.40220	0.40247
ENVIRONMENTAL INDICATORS											
Total CO2 emissions	216.444	218.051	227.057	237.348	248.095	258.876	269.647	281.001	294.16	308.328	323.086
Energy use related emissions	177.333	178.234	185.627	193.963	202.697	211.308	219.923	229.038	239.677	251.159	263.109
Industrial process related emissions	19.107	19.879	20.807	21.886	22.99	24.142	25.274	26.434	27.73	29.101	30.526
Sectoral CO2 emissions											
Agriculture	6.067	6.195	6.421	6.676	6.978	7.286	7.581	7.892	8.23	8.579	8.948
Coal	12.636	12.714	13.082	13.538	14.062	14.605	15.148	15.723	16.371	17.065	17.791
Petroleum and Gas	1.782	1.549	1.618	1.703	1.788	1.881	1.972	2.065	2.166	2.274	2.386
Paper Products	41.892	43.965	45.861	47.981	50.192	52.356	54.512	56.781	59.42	62.262	65.213
Refined Petroleum,	65.706	64.384	67.092	70.209	73.374	76.62	79.891	83.374	87.484	91.934	96.588
Cement	6.976	7.259	7.596	7.973	8.358	8.739	9.119	9.516	9.977	10.473	10.987
Iron and Steel	6.483	7.393	7.788	8.176	8.546	8.86	9.191	9.572	10.09	10.673	11.282
Electricity	19.207	16.77	17.47	18.27	19.098	19.931	20.764	21.644	22.669	23.775	24.926
Transportation	36.511	37.763	39.138	40.74	42.504	44.254	45.992	47.802	49.839	52.022	54.286
Other Economy	19.181	20.059	20.994	22.081	23.193	24.345	25.478	26.631	27.915	29.271	30.679
Environmental tax revenue		2.262	2.367	2.49	2.612	2.741	2.869	3.002	3.154	3.316	3.486
Environmental tax revenue (%total tax revenue)		0.01931	0.01937	0.01941	0.01943	0.01943	0.01944	0.01946	0.01949	0.01953	0.01957

Table C. 26: Simulation Results of a 10% Energy Tax and a 1% Consumption Tax Levy with a 1 point payroll tax reduction

	PERIODS										
	2002	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
GDP	276.002	288.841	301.898	317.105	332.706	348.942	364.746	380.756	398.39	416.739	435.497
GDP growth rate		4.652	4.52	5.037	4.92	4.88	4.529	4.39	4.631	4.606	4.501
Sectoral Output											
Agriculture	43.514	43.98	45.511	47.163	49.269	51.405	53.373	55.45	57.646	59.807	62.085
Coal	1.81	1.835	1.871	1.907	1.964	2.007	2.048	2.095	2.147	2.204	2.261
Petroleum and Gas	0.699	0.591	0.616	0.649	0.682	0.719	0.755	0.79	0.826	0.863	0.9
Paper Products	5.047	5.407	5.675	5.979	6.272	6.572	6.87	7.181	7.547	7.938	8.339
Refined Petroleum	7.644	7.412	7.783	8.207	8.605	9.026	9.45	9.898	10.437	11.016	11.616
Cement	9.678	10.219	10.743	11.347	11.931	12.535	13.134	13.751	14.459	15.212	15.981
Iron and Steel	14.087	16.403	17.375	18.346	19.21	19.97	20.766	21.683	22.938	24.342	25.796
Electricity	17.509	14.376	15.052	15.827	16.575	17.35	18.125	18.94	19.902	20.933	21.995
Transportation	63.832	66.572	69.099	72.098	75.302	78.556	81.755	85.013	88.6	92.379	96.216
Other Economy	419.573	439.099	460.002	484.53	509.147	535.005	560.23	585.574	613.422	642.43	672.017
Unemployment rate	10.342	10.894	11.196	11.408	11.221	11.804	12.14	12.501	12.576	12.632	12.766
Private investment	41.302	52.1	55.575	58.579	61.783	63.842	65.624	67.256	69.106	70.907	72.523
Private investment (%GDP)	0.150	0.180	0.184	0.185	0.186	0.183	0.180	0.177	0.173	0.170	0.167
Private Consumption	187.34	186.519	193.479	202.577	211.775	222.515	233.171	244.129	256.2	268.904	282.105
Agriculture	16.047	15.833	16.327	16.925	17.645	18.446	19.207	20.012	20.876	21.749	22.672
Coal	1.353	1.362	1.401	1.449	1.505	1.563	1.621	1.683	1.751	1.823	1.898
Paper Products	0.791	0.799	0.83	0.87	0.908	0.953	0.998	1.045	1.098	1.155	1.214
Refined Petroleum	2.505	2.454	2.551	2.674	2.794	2.934	3.075	3.221	3.388	3.566	3.751
Cement	0.489	0.49	0.509	0.534	0.559	0.587	0.615	0.645	0.678	0.713	0.749
Iron and Steel	0.007	0.007	0.007	0.008	0.008	0.009	0.009	0.009	0.01	0.01	0.011
Electricity	3.093	2.855	2.964	3.103	3.239	3.394	3.55	3.714	3.902	4.103	4.311
Transportation	22.96	23.135	23.925	24.958	26.028	27.242	28.451	29.694	31.064	32.514	34.01
Other Economy	140.095	139.584	144.965	152.056	159.089	167.387	175.645	184.106	193.433	203.271	213.489

Table C.26 (cont'd)

	PERIODS										
	2002	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
Public investment	17.221	18.33	19.068	19.982	20.9	21.916	22.919	23.944	25.082	26.28	27.517
Public consumption	34.826	36.845	38.413	40.293	42.192	44.225	46.221	48.253	50.51	52.878	55.31
Public investment (%GDP)	0.06239	0.06346	0.06316	0.06301	0.06282	0.06281	0.06284	0.06289	0.06296	0.06306	0.06319
Public consumption (%GDP)	0.12618	0.12756	0.12724	0.12707	0.12681	0.12674	0.12672	0.12673	0.12679	0.12689	0.12700
Payroll tax revenue	10.722	10.854	11.318	11.861	12.418	13	13.571	14.154	14.807	15.491	16.193
Payroll tax revenue (%total tax revenue)	0.09636	0.09266	0.09268	0.09260	0.09259	0.09249	0.09240	0.09232	0.09228	0.09222	0.09217
Tax burden (Total tax rev. /GDP)	0.40316	0.40553	0.40451	0.40392	0.40311	0.40280	0.40267	0.40264	0.40278	0.40306	0.40340
ENVIRONMENTAL INDICATORS											
Total CO2 emissions	216.444	217.136	225.95	236.006	246.462	256.899	267.247	278.067	290.532	303.804	317.401
Energy use related emissions	177.333	177.422	184.653	192.794	201.285	209.612	217.876	226.549	236.614	247.354	258.345
Industrial process related emissions	19.107	19.844	20.755	21.814	22.892	24.011	25.104	26.213	27.443	28.727	30.04
Sectoral CO2 emissions											
Agriculture	6.067	6.17	6.391	6.641	6.934	7.233	7.517	7.813	8.132	8.458	8.796
Coal	12.636	12.643	13.001	13.445	13.953	14.479	15	15.549	16.161	16.813	17.482
Petroleum and Gas	1.782	1.547	1.615	1.698	1.781	1.872	1.96	2.049	2.145	2.246	2.349
Paper Products	41.892	43.776	45.633	47.703	49.854	51.945	54.012	56.169	58.663	61.317	64.024
Refined Petroleum	65.706	64.121	66.773	69.823	72.905	76.053	79.201	82.53	86.441	90.63	94.946
Cement	6.976	7.233	7.562	7.932	8.307	8.675	9.039	9.417	9.854	10.317	10.789
Iron and Steel	6.483	7.334	7.718	8.097	8.455	8.755	9.068	9.429	9.917	10.462	11.023
Electricity	19.207	16.702	17.386	18.168	18.974	19.78	20.582	21.421	22.393	23.429	24.49
Transportation	36.511	37.585	38.927	40.488	42.202	43.894	45.561	47.281	49.203	51.239	53.312
Other Economy	19.181	20.025	20.943	22.01	23.095	24.215	25.307	26.408	27.624	28.894	30.187
Environmental tax revenue		2.257	2.361	2.481	2.601	2.726	2.85	2.977	3.121	3.274	3.431
Environmental tax revenue (%total tax revenue)		0.01927	0.01933	0.01937	0.01939	0.01939	0.01940	0.01942	0.01945	0.01949	0.01953

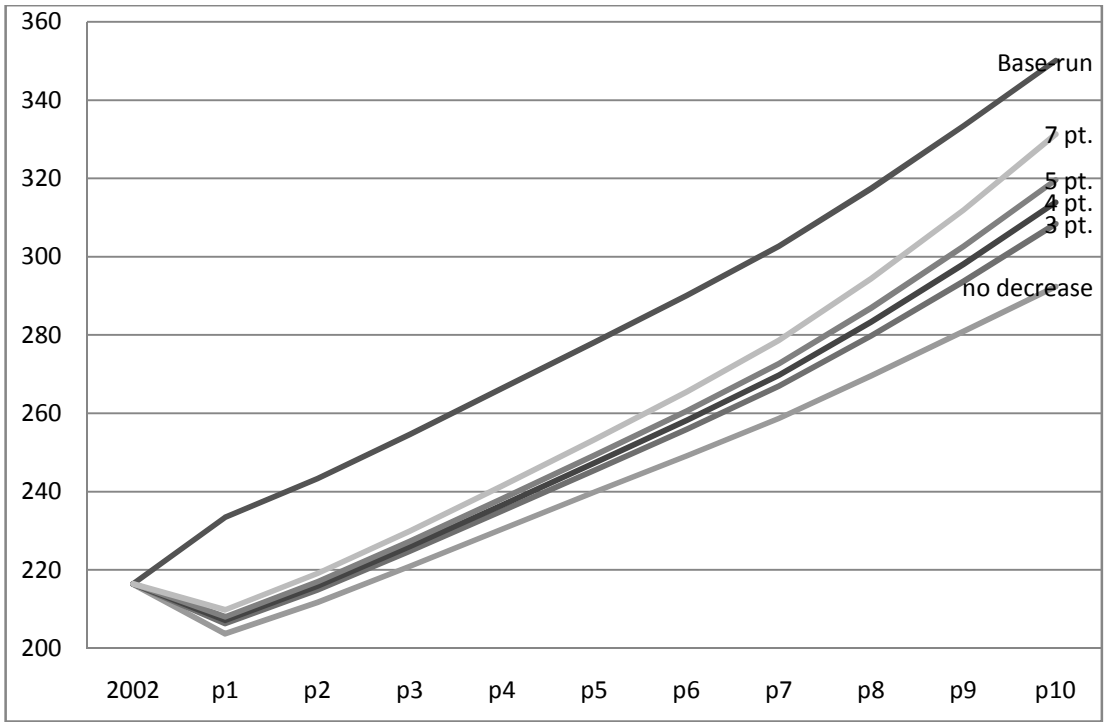

Figure D. 1: CO_2 emissions under a 20% energy tax and alternative payroll tax reductions (million tons)

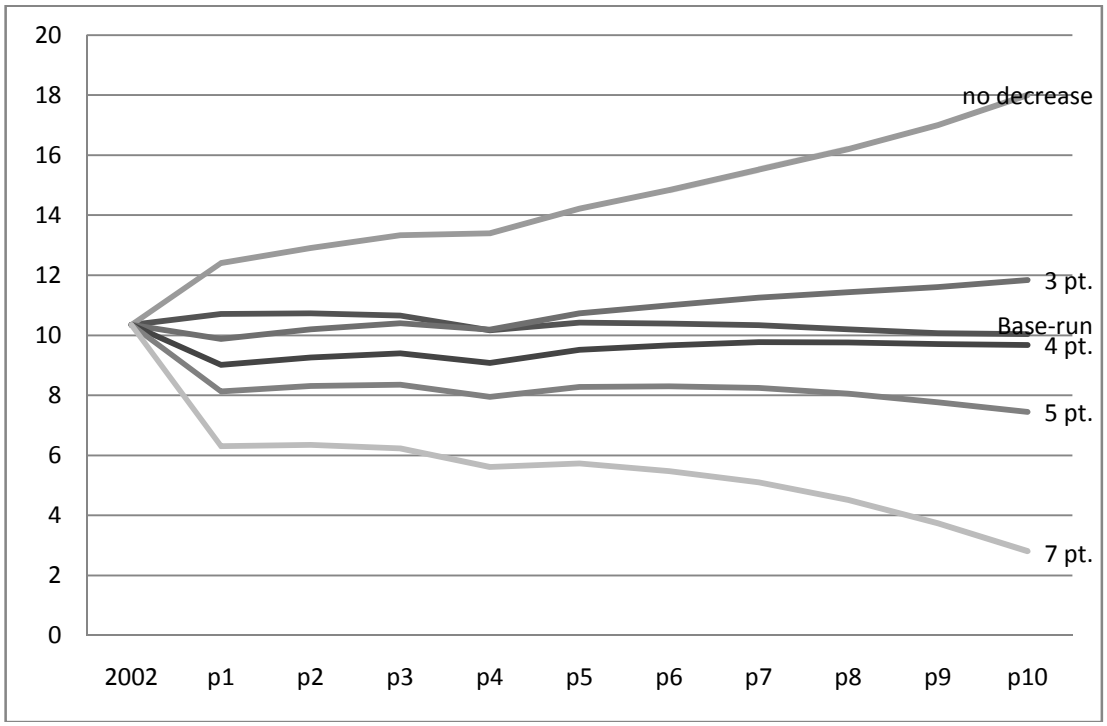

Figure D. 2: Unemployment rate under a 20% energy tax and alternative payroll tax reductions (%)

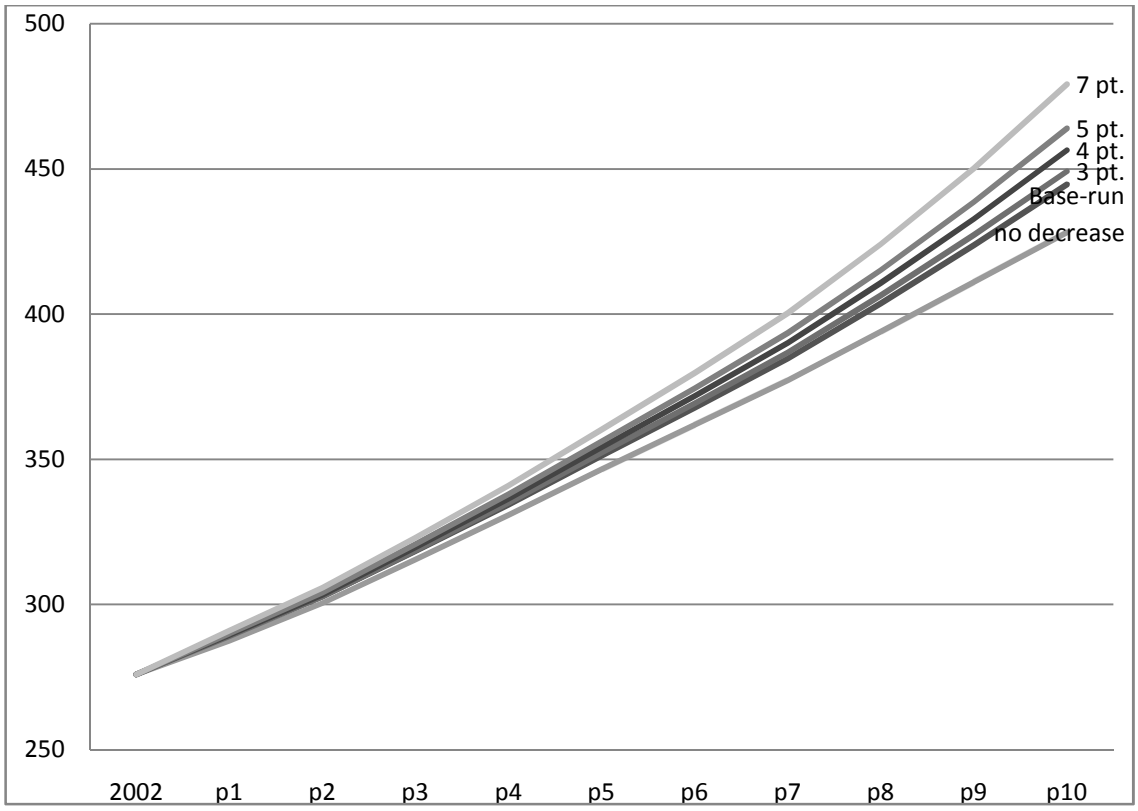

Figure D. 3: GDP under a 20% energy tax and alternative payroll tax reductions (2002 prices, billion TL)

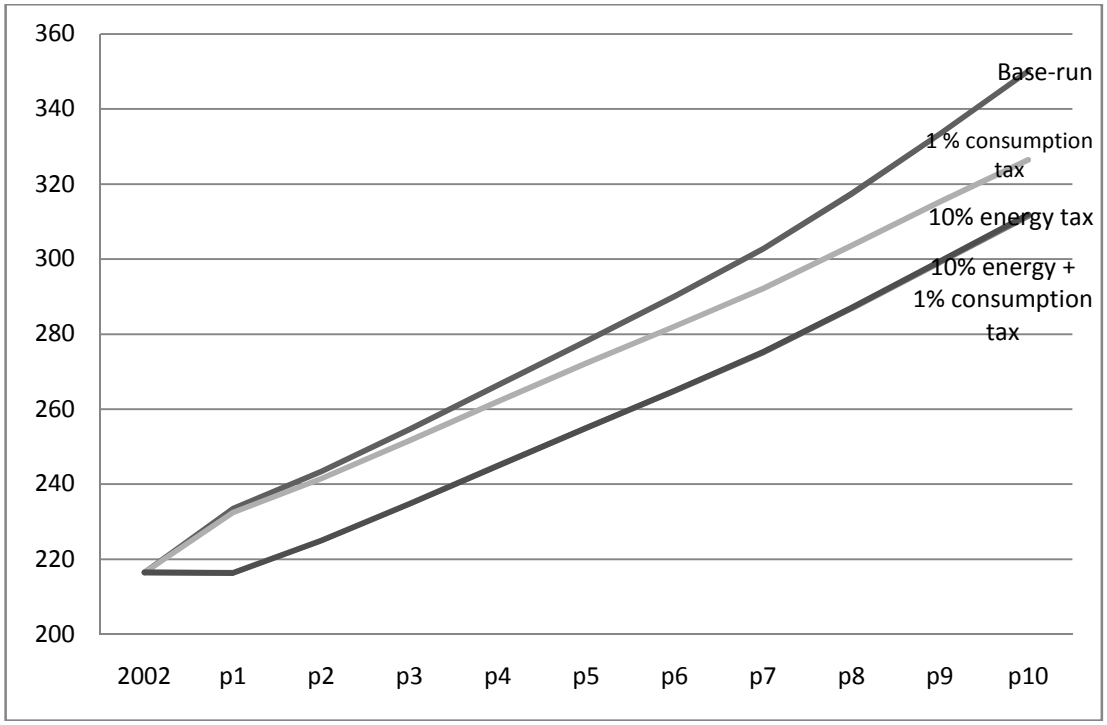

Figure D. 4: CO_2 emissions under a 10% energy tax, a 1% consumption tax and a tax mix (million tons)

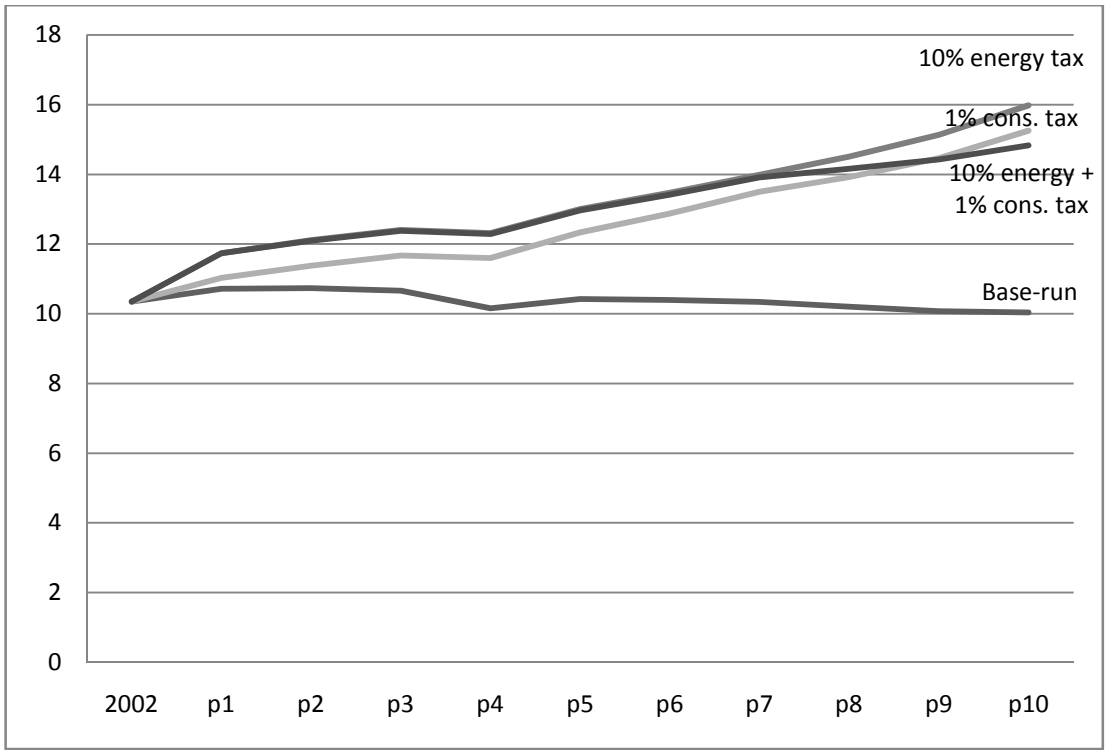

Figure D. 5: Unemployment rate under a 10% energy tax, a 1% consumption tax and a tax mix (%)

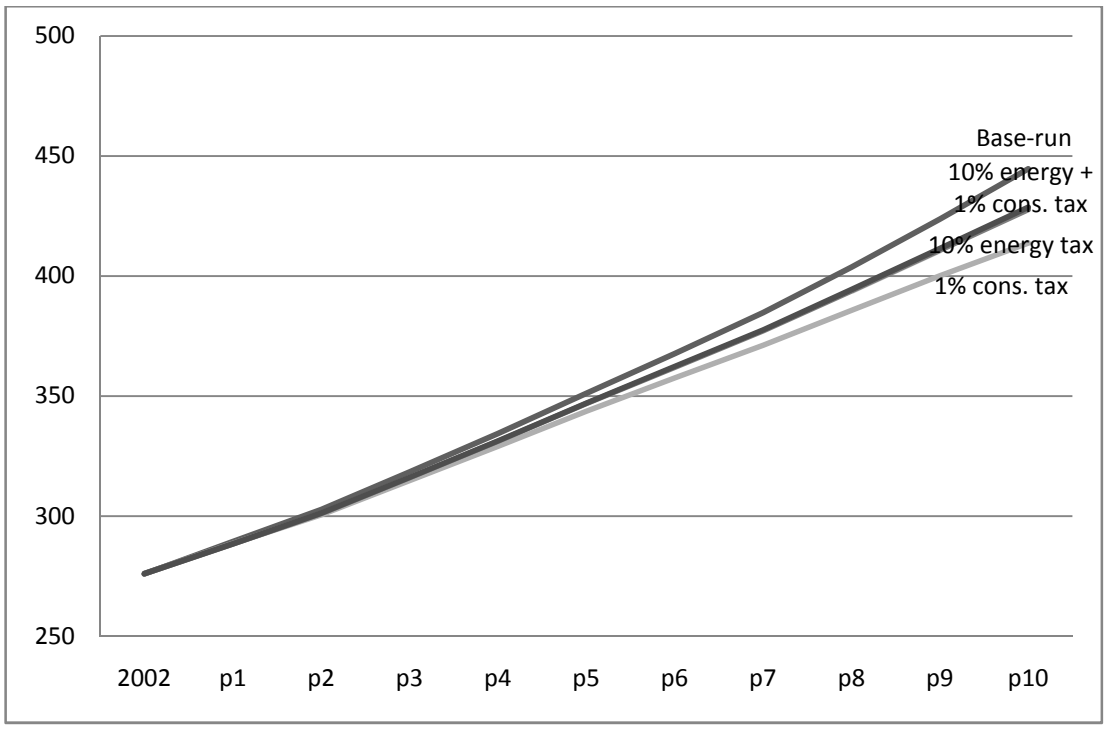

Figure D. 6: GDP under a 10% energy tax, a 1% consumption tax and a tax mix (2002 prices, billion TL)

Table E. 1: List of Environmental Policies and Measures in Turkey on GHG Abatement

Policy / Measure	Objective	GHG	Implementation date
Air Quality Control	Emission control	CO2, NOx	1986
Control of Air Pollution Arising from Heating	Emission reduction	CO2	13.01.2005
Control of Air Pollution from Industrial Plant	Emission reduction	CO2	07.10.2004 22.07.2006
Control of Air Pollution Arising from Motor Vehicles	Emission reduction	CO2	08.07.2005
Quality of Petrol and Disel Fuels Directive	Emission reduction	CO2	11.06.2008
Labelling on fuel economy and CO2 emissions in respect of the marketing of new passanger cars	Emission reduction	CO2, NOx	2007-2008
Large Combustion Plants Directive (LCP-2001/80/EC)	Emission reduction	CO2	Under Preperation
Air Quailty Framework Directive (96/62/EC)	Health and Emission control		Under Preperation
Integrated Pollution Prevention and Control Directive (IPPC 96/61/EC)	Emission control	CO2	Under Preperation

Source: First National Communication of Turkey on Climate Change, 2007.