

Economic effects of materials policies:

Combining an applied general equilibrium model with materials flows

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Abstract

This study aims at integrating a materials flow model into an economic model, such that the economic effects of policies on the use materials and products can be analysed. Methods for studying materials and product flows do not properly take into account economic, behavioural or policy aspects. But most economic models do not consider material flows explicitly.

To analyse the economic effects an applied general equilibrium (AGE) model is used. The main advantage is that full direct and indirect effects of policies can be analysed. A disaggregated model is used to examine the effects of materials and product policies on various production sectors, households groups, employment and the use of materials.

The model is applied to metal flows in the Netherlands. The results show that the effects of a regulating levy on materials may be large for some production sectors, depending on where in the production process the levy is imposed. The basic metal industry and large metal using production sectors may be negatively affected by metal levies. Positive effects of the levies occur for other production sectors, for example the basic chemical industries and the petroleum refineries. In most scenarios, the labour income households can improve their real income, whilst the households of transfer recipients observe a fall in real income. However, for most production sectors and household groups the effects are small. No 'double dividend' is found in the various scenarios.

Key words: Materials policies, materials flow analysis, applied general equilibrium (AGE), empirical modelling.

1. Introduction

The extraction, production and waste treatment of materials cause problems that may call for policies. Several countries have imposed materials-related policies, mainly charges and deposit-refund systems on specific materials and products (see, OECD, 1994). In the Netherlands regulatory policies on the use of materials and products are not widespread, partly because governmental policies are focused on the self-regulatory capacity of the industry, based on covenants.

The flows of materials through the economy are mainly studied from a physical or environmental point of view, but the economic and policy side of these physical flows has not been given much attention. Methods for studying materials and product flows are, for example, materials flow analysis and life cycle assessment (see for an overview, Kandelaars *et al.*, 1996). These methods do generally not take into account economic, behavioural or policy aspects, although these evidently are important factors behind the flows of products and materials. But most economic models do not consider materials aspects explicitly.

This study tries to take a first empirical step in filling the gap between physical and economic models, by combining a materials flow model and a disaggregated applied general equilibrium (AGE) model. In the late 1960s and beginning of the 1970s, other studies have addressed materials flows in economic models analytically (e.g. Ayres and Kneese, 1969; Kneese *et al.*, 1970). Also more recently the interactions between economy, materials flows and the materials balance principle have been studied theoretically (e.g. Perrings, 1986; van den Bergh and Nijkamp, 1994).¹

A materials flow model describes the physical flows of materials and products through the various sectors of an economy, such that materials balance is satisfied for each sector in the model. To change the use of materials in an economy a materials policy may be imposed on specific materials in sectors. Such a policy may depend on materials flows that are measured in physical units.

With a disaggregated AGE model the sectoral and distributional effects of policies can be analysed for various production sectors and household groups. Moreover, the effects of various policies on trade and employment may be examined.

The primary goal of this study is to assess the empirical effects of economic and environmental policies. Furthermore, major enhancements of the integrated model that are needed for a more realistic and accurate analysis are identified.

In this study a number of scenarios are designed to study the effects of a materials policy on metals, in particular zinc and lead. These metals have been selected because of the environmental and health risks they may cause (see Gorter, 1994; Annema *et al.*, 1995). The data on the zinc and lead flows in the materials flow model are used to determine the height of the levies that are imposed on the various sectors in the AGE model for the Netherlands. Thus,

¹ The materials balance principle states that materials can be transformed or transported within a closed system, but they cannot be made or destroyed. This principle is also called the 'law of conservation of matter'.

the materials flow model is exogenously incorporated in the AGE model. The goal of the model is to examine the effects of a materials policy on the economy and on the environment. This may result in a ‘double dividend’, which is a positive effect on both employment and the environment (here, the use of materials).

The organisation of this paper is as follows. Section 2 gives a short description of the AGE model, the materials flow model and the way the latter is used in the AGE model. Section 3 discusses various materials and product policies that will be studied in the scenarios. Results of the scenario analysis are given in Section 4. The last section draws conclusions and presents suggestions for further research.

2. Model description

The AGE model used in this study is the Taxinc-model (Taxinc stands for tax incidence). The model was originally developed to analyse the effects of changes in the tax structure in the Netherlands (see Keller, 1980; Cornielje, 1990; CBS, 1991). The model has recently been applied and adapted to study the effects of energy levies (Dellink and Jansen, 1995). This section briefly discusses the AGE model and the way it is combined with the materials flow model.

The Taxinc model is a comparative static equilibrium model, which means that two equilibria are compared (i.e. the equilibrium before and after the introduction of a policy), and that the adjustment process and the time path are not considered. Structural characteristics of the model, such as household preferences, production structure, production capacity and technology are exogenous in the model. For the production sectors and the household groups, the demand and supply equations are derived from neo-classical economic theory, implying that all agents behave rationally, firms optimise their profit (given prices and capacity) and households their utility (given prices and transfers).

Market prices are determined so that all markets clear. The price paid by buyers/consumers for a good equals the market price plus taxes levied on the demand side of the market. Suppliers face a price equal to the market price minus supply-side taxes.

The model consists of 61 production sectors and 44 household groups (see Appendix), allowing the analysis of sectoral and distributional consequences of policies. Each production sector is assumed to produce a single, unique good, and represents individual firms that are assumed to be identical. Each household group represents individual households with identical marginal shares, i.e. every household within the sector is assumed to spend extra income exactly the same. Households own the production factors labour and capital.

The government is divided into three parts: (i) a household group that consumes public goods, called public sector; (ii) a production sector, called public services, that produces public goods; and, (iii) a fiscal agent that deals with tax payments and transfers (lump-sum payments to households, e.g. social security benefits).

Demand from foreign firms and households (exports) are specified as the demand by a single representative utility maximising household group, called ‘Rest of the world’ (see Woodland,

1980). Using the small open economy assumption, implying exogenous world market prices, all imports can be aggregated into a single good.²

For the calibration of the AGE model the base year is 1988 and for the materials flow model 1990. It is assumed that the ‘materials intensities’ have not changed during these years. The materials intensity is defined as the materials input (in kg) per guilder of output. From the data of the base year (1988) an initial equilibrium is calibrated. The data for the initial equilibrium include the current policies in the Netherlands in the base year. A change in the tax structure results in a new equilibrium that is determined by the initial equilibrium and the marginal reactions of producers and households. The tax impulse causes relative prices to shift, inducing a change in the demand for and supply of all goods and services. These demand and supply changes in effect cause a change in market prices and hence another change in relative prices. After an iterative procedure, a new equilibrium results, where all markets clear again. In this new equilibrium, relative prices and demand for and supply of all goods and services may differ from the initial equilibrium.

The materials flow model that is used in the AGE model is a model called Flux (see Boelens and Olsthoorn, 1996). This model describes the physical flows of materials and products through the Dutch economy. The model is an input-output model in physical units, that describes the input and the output of materials flows of various sectors so that materials balance conditions hold for each sector of the model. The materials flow model consists of domestic and foreign economic sectors and an environmental ‘sector’ (that is divided in various parts such as air, soil and water). The inflow of materials into the domestic economic system originates from the foreign economic sector (i.e. imports) and the environmental sector. The domestic economic sectors of Flux are linked to the production sectors in the AGE model. In this way the data on the materials flows are used to implement materials policies in the AGE model. The outcomes of the AGE model are used to assess the effects of a policy on the materials flows. This feedback between the AGE model and Flux is exogenous. With the model various scenarios can be constructed for materials policies to examine the economic and environmental (here, materials) effects of such policies.

Within the current model set-up it is impossible to accurately calculate the effects of the policies on the physical use of materials. However, if the assumption is made that the materials intensity of production will not change, the changes in output levels of production sectors can be translated into materials use changes. Clearly, the thus calculated materials effects will differ from the ‘true’ effects, amongst others because changes in the materials content of inputs cannot be accounted for. However, substitution from one material to another is accounted for if the supplying production sector is different for both materials. For example, if more wooden window frames are used in houses instead of metal window frames, the construction sector will substitute its inputs from the metal industry to the wood products sector. The ‘true’ materials effects will be larger than calculated here.

² In the Taxinc model, imports are actually differentiated in competitive imports for natural gas, crude petroleum and other goods and services. Non-competitive imports, for which there are no domestic substitutes go directly from the ‘Rest of the world’ to the other household groups (see for further details, CBS, 1991).

It is necessary to develop a dynamic model to analyse the impacts over time and the role of technological development. For the materials flow model, a dynamic formulation implies that the technological coefficients need not to be fixed anymore. In other words, the materials content of the economic products may change over time. In the short run, the possibilities to reduce the use of materials will be limited. In the long run, these possibilities may be substantially higher.

In the integrated dynamic model delayed effects of a policy on the economy and on materials flows may be analysed. The outflows of materials over time may also be analysed, taking into account the possibility of (temporary) accumulation of materials in the economy caused by, for instance, a delay between the purchasing and the disposal of a product.

The materials policies may invoke endogenous changes in technology, for example in recycling, more materials-efficient production techniques and new substitution possibilities. In this way, technological development is a major source for reducing the use of materials.

3. Materials and product policies

Materials policies may be imposed to reduce the use of specific materials and products. Such a policy on a materials flow generates revenues for the government. The policies used in this study are 'regulating policies' implying that the revenues are redistributed to the tax payers. Therefore, a scenario for a policy implementation consists of two parts: (1) the materials or product policy; and, (2) the destination of the revenues generated by the materials policy. In practice, policy makers need to make choices about both. In this section the policies will be described in general terms, while in Section 4 the specific policies in each scenario are given.

The first part of a scenario is to decide which materials flows will be levied and the height of the levy. The height of the levy for the production sectors and household groups depends on their materials use. For materials policies, the levy depends on the 'materials intensity' of the production sector which is the materials input (in kilograms, obtained from the materials flow model) divided by the output (in Dutch guilders, obtained from the AGE model). This materials intensity connects the materials flows with the monetary flows. The materials intensity of a sector determines the relative tax weight. Thus, the absolute tax payments per guilder of output by a sector equals the relative tax weight multiplied by the overall tax rate. The overall tax rate of the levy is arbitrarily chosen such that the total tax revenue will be 0.1% of national income. Thus, if the materials intensity of a sector is 2 kilograms per guilder of output, and the overall tax rate is α , the total tax payment by the sector is equal to 2 times α times output.

The second part is to choose the destination of the revenues generated by the materials policy. The levies imposed on physical flows are formulated as regulating policies, implying that the revenues are redistributed to the tax payers. This stands in contrast to a revenue-raising tax that is used to generate public income. The revenues are redistributed by lowering the labour taxes paid by the production sectors, which may be interpreted as a reduction in the

contributions of employers to social security.³ In model terms, this is achieved by introducing a subsidy on the demand for labour.

This regulating levy can be seen as a ‘green tax reform’; though the explicit objective is to reduce the materials use, stimulating employment may be an implicit goal. If both goals are satisfied, i.e. a positive effect on employment and environment is achieved, then a ‘double dividend’ is reaped. In the discussion of the results in Section 4 the possibility of a double dividend will be addressed.

Some characteristics are common for all scenarios. Every scenario consists of a sector-specific levy on the use of materials. Only the domestic demand for materials or products is levied; hence, exports are exempt from levies. Imports are levied in the same way as domestic goods and services. Implicitly, the materials content of the imported products is assumed equal to the domestic substitutes.⁴

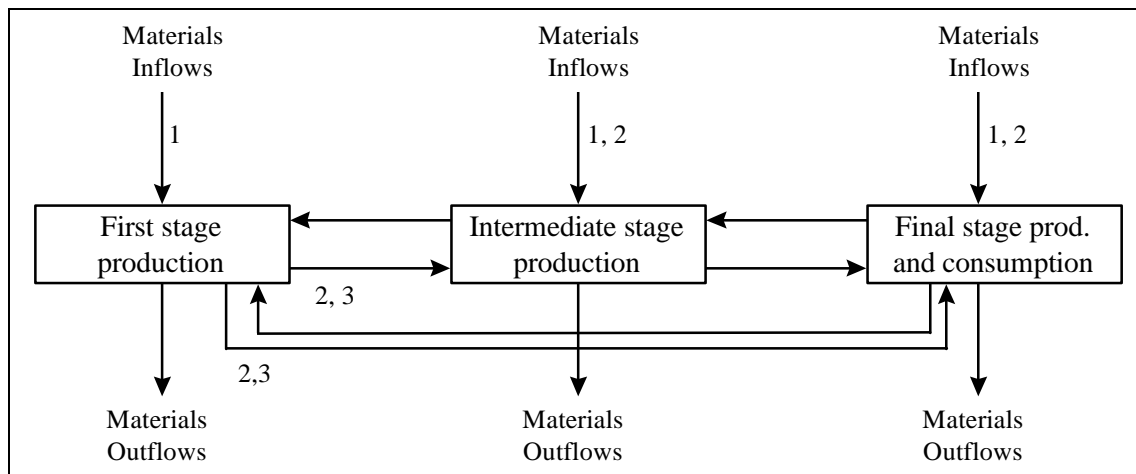
The regulating levy will not only affect the sectors that are subjected to the levy, but indirectly also other production sectors and household groups. The levied sectors will change their demand for inputs as their costs rise. This leads to a ‘backward effect’ through the economy: the suppliers of these inputs are confronted with a lower demand, and consequently their production and their demand for inputs decreases. Next, the supplier of these inputs see their demand lowered and will react to that, and so on. Furthermore, there is a ‘forward effect’ through the economy: as the demand for some goods and services goes down, the price for these goods and services will also go down. This has an effect on all demanders of the good or service. These will also react to the changes in relative prices, which in turn again triggers a reaction of other agents. In total, all relative prices will change, and consequently all production sectors and household groups are affected by the levy.

Figure 1 illustrates graphically the production and consumption stages where materials or product policies may be imposed. In Figure 1 three steps in the economic process are identified (first, intermediate and final stages). In the first production stage, raw materials are converted into (intermediate) products. Between the first and final production (and consumption) stages there may be several intermediate stages of production. All production sectors require inputs from, and supply products to, other economic sectors. Moreover, the production stages require environmental inputs which include ‘inflows’ of materials (extraction of raw materials, mainly in the first stage production, and imports). All stages have ‘outflows’ of materials to the environment and to foreign economies (exports). An example of the three stages is the following: the first stage is the basic metal industry producing zinc plates; the intermediate stage is the metal product industry that produces rain gutters; and, the final production stage is the construction sector placing the rain gutters on new houses.

³ Other possibilities to redistribute the revenues to the tax payers are to give a subsidy on the use of an environmentally less damaging input, a subsidy on R&D, or a lump-sum transfer to the production sectors or households.

⁴ As imports in the materials flow model are not distinguished by origin, these imports cannot be linked to the imports in the AGE model. Therefore, the assumption is necessary that the materials intensity of foreign production is equal to that of domestic production.

Figure 1. Stages in production and consumption where materials policies may be imposed.



Note: arrows indicate materials and product flows; numbers are explained in the text.

A regulating levy on primary materials input

A regulating levy on primary materials input is imposed on the inflow of materials into the Dutch economy, either from imports from foreign economic sectors or the environment (see arrows 1 in Figure 1). This means that the production sectors are levied according to the materials intensity of the sector. The intermediate flows of materials between sectors are not levied to avoid double-counting. In other words, the materials are taxed at the moment they enter the domestic economy. Hence, the materials intensities that are calculated from the inflows do not reflect the actual materials content of the produced goods and services in the sector. It only reflects how much materials are added during the production.

A regulating levy on materials throughput

With a regulating levy on primary materials input the first stage production sectors will be affected severely. Therefore, an alternative materials policy is to levy the throughput of materials in the economy. This is simulated by levying the inflow of all sectors (like in the primary materials input levy), except for first stage production sectors (see arrows 2 in Figure 1). The flows of materials from these sectors to the other sectors are subjected to the levy. The total materials flow that is levied is smaller than in the base scenario, because the outflows from the first stage production sectors are not levied. This is compensated by a higher overall tax rate, such that the total tax revenue is equal to the base scenario. This scenario does not directly affect the first stage production sectors; However, it may influence these sectors indirectly, for example by a reduced demand for metals by the other sectors.⁵

⁵ Unfortunately, in this version of the model it was impossible to include a link between the throughput of materials between the sectors and the source of this throughput (the first stage production sectors). In a later version of the model, this link will be included through the introduction of materials as an explicit 'sector' in the AGE model. The 'materials sector' can then be highly complementary to the first stage production sectors.

A regulating levy on products

The product policy is directed at products that contain certain materials. The consumers of these products, that may be either production sectors or households groups, are subjected to the levy (see arrows 3 in Figure 1). The goal of this policy is to encourage consumers to switch to other products with a lower metals content. The main difference with the regulating materials levies is that the products are levied, not their materials content. Hence, the relative tax weights are equal across all sectors. The total tax paid by a sector depends on the value of the products bought from the first stage production sectors.

In the scenario analysis the materials policies will be simulated for two specific heavy metals: zinc and lead. As indicated before, for a materials policy the height of the levy depends on the materials intensity of the sector. Table 1 presents the zinc and lead intensities for selected production sectors that is the use of metal per unit of output, measured in kg/guilders. For illustrative purposes, the share of the sector in the total use of the metal is presented (measured as a % of the use in kg).

Table 1. Metal intensities of selected production sectors.

Production sector	Zinc		Lead	
	Zinc intensity (kg/guilder)	Share (%)	Lead intensity (kg/guilder)	Share (%)
1 Agriculture	0.01	0.2	0.00	0.0
9 Grain mills	0.06	0.3	0.00	0.0
26 Petroleum refineries	0.01	0.1	0.02	0.2
27 Basic chemical industry	0.44	6.3	0.31	6.5
31 Basic metal industry	12.30	81.4	4.78	46.0
32 Fabricated metal products	0.42	3.7	1.08	13.8
38 Electricity supply	0.03	0.1	0.02	0.1
41 Construction	0.04	0.8	0.24	6.8
42 Wholesale and retail trade	0.20	5.7	0.60	24.1
46 Other transport	0.00	0.0	0.03	0.4
52 Civil government	0.00	0.0	0.00	0.1
58 Other services	0.44	1.4	0.42	2.0

Source: based on Boelens and Olsthoorn (1996).

Note: The production sectors are numbered to facilitate the comparison with the Appendix.

Table 1 shows that the share of the basic metal industry in the total inflow of zinc is overwhelming (more than 80% of the total zinc use). Other large users of zinc are the basic chemical industry, metal products manufacturing and trade (through imports). For lead, the intensity of the basic metal industry is much lower. Apart from these production sectors, the construction sector has a high lead intensity.

At first glance, the large metal intensity of the other services may seem surprising. However, this sector encompasses the waste treatment and processing firms that account for a large use of metals (see Boelens and Olsthoorn, 1996).

It should be noted that a high (low) metals intensity of a production sector does not necessarily imply a high (low) metals intensity of the goods and services produced in the sector. The

reported intensities are based on where the materials enters the economic process. For example, a final stage production sector may produce goods and services with a high materials content, but add few materials in the production process itself (small inflow). However, the materials embodied in the economic inputs are already accounted for in previous production stages.

4. Scenario analysis: results

The results of the policies in the various scenarios are discussed for the production sectors, the household groups, employment and trade. In all scenarios the revenues are redistributed by means of lowering the labour tax that employers pay, i.e. a subsidy on the demand for labour by the production sectors.

The following policies as described in Section 3 are imposed in Scenarios 1 to 5.

1. A regulating levy on the primary use of zinc (base scenario).
2. A regulating levy on the throughput of zinc.
3. A regulating levy on products that contain zinc.
4. A regulating levy on the primary use of lead.
5. A regulating levy on the primary use of zinc and lead.

The first three scenarios are imposed on the use of zinc to analyse the difference in the effects of an input, a throughput or a product levy. These three levies will have the same labour tax effects, because the revenues are equal (see Section 3) and redistributed in the same way. The effects of the metal levy will be different and therefore also the total effect, that is the combined effect of the metals levy and the labour tax, will differ.⁶ For policy making it is important to analyse the effects of various policies in order to implement a policy that is acceptable, effective, measurable, implementable and checkable. A concise analysis of these characteristics of the policies is beyond the scope of this paper. Scenarios 4 and 5 are examined to compare the effects of a levy on zinc with a levy on lead and on both these metals. The scenarios are comparable because the revenues of each materials policy are set at the same level (see Section 2).

The results of the scenarios are presented as real quantity changes from the initial equilibrium (without materials policies). Tables 2 to 4 give the main results of the scenarios for selected production sectors, household groups, employment and trade. The total results, including the partial effects, are presented in the Appendix. Only for Scenario 1 the partial effects of the

⁶ In the AGE model that is used, it is not relevant on what side of the market, i.e. the demand or the supply side, is levied, because the market price will adjust. However, due to the existence of sector specific taxes, it is important on which market a levy is imposed. Hence, differences may result from the various materials and product policies.

metal levy and the labour tax are discussed, because these are analogous for the other scenarios (see Appendix).

Scenario 1: A regulating levy on primary use of zinc

The regulating levy on the primary use of zinc has a considerable impact on the basic metal industry: Table 2 shows that the real output level decreases with 10.5%. The basic metal industry accounts for over 80% of the total primary use of zinc (see Table 1). If this industry could transfer the tax burden to other sectors the total effect would not have been so large. Therefore, it may be concluded that the basic metal industry has only limited opportunities to transfer the tax to its buyers. This is in line with the empirical observation that international competition in this sector is severe. Table 2 also shows that the main sectors effected by the policy are the metal products, electricity and tobacco products.⁷

For most sectors the effects of the regulating materials levy are small, because most products and services have only a minor metal content and the reduction in labour taxes has no major impact on the competitive position of the sectors.

Table 2. Results for selected production sectors; Scenarios 1 to 5.

Real output change (in %)	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Production sector					
1 Agriculture	0.01	0.12	0.02	0.04	0.02
15 Tobacco products	0.43	1.61	0.49	0.42	0.42
26 Petroleum refineries	0.18	0.37	0.25	0.12	0.16
27 Basic chemical industry	-0.09	-1.62	0.46	-0.13	-0.10
31 Basic metal industry	-10.51	-0.07	-13.15	-7.01	-9.24
32 Fabricated metal products	-0.56	-3.41	-0.54	-0.95	-0.71
38 Electricity supply	-0.46	-0.41	-0.55	-0.37	-0.43
41 Construction	-0.01	-2.99	-0.01	-0.33	-0.13
42 Wholesale and retail trade	-0.10	-0.11	-0.07	-0.29	-0.17
49 Insurance	0.06	0.11	0.07	0.05	0.05
52 Civil government	0.12	0.40	0.13	0.15	0.13

Note: The production sectors are numbered to facilitate the comparison with the results in the Appendix.

The partial effect of the levy on zinc (excluding the effect of the labour tax reduction) is generally negative and small for the labour income households and positive for the self-employed, the pensioners and the transfer recipients (see Appendix, Table A1). Interesting is that the higher income households (for labour income households, pensioners and transfer recipients) are more negatively (or less positively) affected by a levy on zinc than lower income households. This implies that a levy on zinc leads to a slightly more equal income

⁷ The result for the tobacco industry is surprising and occurs in most scenarios. Apparently, the result for the tobacco industry is positively influenced by a number of factors, each of which are of minor importance. These include a low price elasticity for basic metals, a falling market price and a relative large increase in exports of tobacco products.

distribution. This result suggests that the (implicit) consumption of metal products increases more than proportionally with income.

The effect of the labour tax reduction is positive for the ‘workers’, i.e. the labour income households and the self-employed, and negative for the ‘non-workers’, i.e. the pensioners and the transfer recipients (see Appendix, Table A1). The difference between workers’ and non-workers’ households arises because workers will claim part of the labour tax reduction to increase their disposable income. The labour tax reform has a more positive effect on the high-income than on the low income households. Therefore, this part of the scenario results in an increase in income inequality.

Table 3 shows the total effect of the scenario. It appears that the policy has a positive impact on the workers and the transfer recipients. The positive impact is only significant (around 0.25% of the net income) for the self-employed household groups: both the partial effects of the metal levy and the labour tax are positive for these groups. On pensioners the scenario has a negative, but minor impact. For most households the effects of the metal levy and the labour tax reduction are opposite, which implies that the policy effects balance each other to a large extent. Only for the self-employed both effects are positive. The total effect of the scenario shows a decrease in income inequality, i.e. the low-income groups benefit more from this scenario than the high-income groups.

Table 3. Results for selected household groups; Scenarios 1 to 5.

Household group	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
1 Public sector	0.14	0.57	0.15	0.19	0.16
3 Labour Income; 1 person; 1st income quartile	0.11	-0.20	0.10	0.07	0.09
4 Labour Income; 1 person; 2nd income quartile	0.10	-0.43	0.08	0.04	0.08
5 Labour Income; 1 person; 3rd income quartile	0.05	-0.46	0.03	0.01	0.04
6 Labour Income; 1 person; 4th income quartile	0.03	-0.53	0.02	-0.01	0.02
8 Labour Income; more persons; no kids; 2nd income quartile	0.09	-0.34	0.08	0.04	0.07
12 Labour Income; more persons; with kids; 2nd income quartile	0.10	-0.30	0.08	0.05	0.08
17 Self-employed; services	0.24	0.17	0.30	0.12	0.19
20 Pensioners; 1 person; 2nd income quartile	-0.03	-0.20	-0.03	-0.05	-0.04
24 Pensioners; more persons; 2nd income quartile	-0.01	-0.10	-0.01	-0.02	-0.02
28 Transfer recipients; 1 person; 2nd income quartile	0.02	-0.06	0.02	0.01	0.01
32 Transfer recipients; more persons; 2nd income quartile	0.01	-0.06	0.01	-0.00	0.01

Note: The household groups are numbered to facilitate the comparison with the results in the Appendix.

Table 4 shows that the demand for labour decreases slightly in this scenario, which indicates that there is no double dividend. The labour tax reform has a positive effect on the import of primary inputs, but the zinc levy mitigates this. Imports decrease, while the export (the demand of the ‘rest of the world’) is affected slightly negatively by the regulating materials levy (see Table 4). Thus, the effects of the regulating materials levy on the trade balance are small and inconclusive.

Table 4. Selected results for employment and trade; Scenarios 1 to 5.

Changes in demand (in %)	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Primary inputs					
67 Medium-paid labour supply	-0.0043	-0.0085	-0.0038	-0.0043	-0.0043
64 Competitive imports	-0.58	-1.13	-0.54	-0.52	-0.56
Exports	-0.09	0.17	-0.10	-0.05	-0.08

Note: The competitive imports do not include the import of crude petroleum and natural gas; Exports are the demand of the ‘Rest of the World’.

Using the crude measure for the materials effects (see Section 2), the total use of zinc in Scenario 1 will decrease from 270 to 247 kilotons. This is a decrease of 8.5%. Comparing this to the overall decrease in output (-0.2%), it is clear that the policy invokes a (zinc) dematerialisation of the economy.

Scenario 2: A regulating levy on the throughput of zinc

A levy on the throughput of zinc negatively influences the output of most production sectors. The associated labour tax cut has a slightly positive effect while the total effect is negative for these sectors. Table 2 shows that this scenario has a negative effect of more than 1% of the output of some sectors, for instance the metal products, construction, and the wood and furniture industry. Compared to Scenario 1 the main differences are that the basic metal industry is hardly affected and that most other production sectors are affected more severely than in the first scenario. The reason is that in this scenario the tax burden is more spread over the production sectors.

For the households with a labour income, the effects of the regulating zinc levy are much more negative than in the base scenario. The reason may be that now more labour intensive sectors carry the tax burden, instead of the more capital intensive basic metal industry. For the other household groups there is only a small, but negative change. The total effect is not only negative for the pensioners as in the base scenario, but also for the households with a labour income and most transfer recipients.

This scenario has a negative effect on the demand for medium-paid labour (see Table 4). Therefore, a double dividend is not be reaped. The effect of this regulating levy is negative for imports and positive for the exports (see Table 4). Hence, the trade balance improves.

Comparing Scenarios 1 and 2 it is remarkable that the sectoral and distributional effects of both policies differ considerably. For the production sectors, the difference is to a large extent related to the demand for inputs from the basic metal industry. In the base scenario, the basic metal sector is levied severely, and subsequently a part of the levy is transferred to the demanders of their products. In this way, the ‘down-stream’ producers are levied indirectly. In Scenario 2, the down-stream producers are levied directly based on their metal intensity. Consequently, the metal-intensive sectors (mostly the industrial sectors) are affected negatively, while the less metal-intensive sectors (like basic industries and services) can increase their output. This substantiates the conclusion that the basic metal industry is not very

capable of transferring its imposed extra costs to the other sectors. In the base scenario, most metal intensive sectors (see Table 1) can even increase their output, while in the second scenario their outputs decrease.

In the base scenario the effects on households were negligible, but in Scenario 2 this is no longer the case. A reason may be that the materials levy is now more spread among the metal using production sectors, the opportunities of transferring the costs to final consumers are larger compared with the first scenario. Moreover, in this scenario the more labour intensive sectors are levied.

The total reduction in the use of materials in the production process is smaller than in the base scenario. A reason for this may be that the basic metal industry is much less affected, and hence its materials use is much less decreased. Moreover, in this scenario the substitution effects that are not accounted for will presumably be larger (see also footnote 5).

Scenario 3: A regulating product levy on zinc

The results of a product levy on the production sectors in Table 2 show that the basic metal industry is strongly affected with an output reduction of 13%. This reduction is larger than in Scenario 1; it may be concluded that a product levy is worse for the basic metal industry than a levy on the primary use of zinc which had a negative effect of 10.5%. The reason is that in this scenario only the input from the basic metal industry is levied. Although this levy is imposed on the buyers/consumers of the products of the basic metal industry, these buyers may substitute their demand to other products which affects the basic metal industry negatively. Other production sectors that are negatively affected are the metal products and the electricity sectors. A reason may be that their possibilities of using other materials/products is limited. The tobacco industry and the basic chemical industry, however, are positively influenced sectors. The basic chemical industry, which has a high zinc intensity, was negatively affected by the policy of Scenario 1 but in this scenario the effect is positive. This may be due to the fact that the basic chemical industry imports and extracts relatively much materials (high inflow, see Table 1) and this inflow is not levied here. Another reason may be that the intermediate production sectors are substituting zinc for plastics, so that the demand for products of the basic chemical increases due to the levy on zinc. Apart from the basic metal industry and the basic chemical industry the results are comparable to those of the base scenario. In both scenarios, the results are to a large extent dominated by the negative impact on the basic metal industry.

For most household groups this scenario and the base scenario have similar results (see Table 3). This similarity is interesting because a product levy affects the household groups directly in contrast to the base scenario. This shows a 'normal' mechanism of AGE models, namely that it is irrelevant on what side of the market a tax is implemented, because the market price will adjust so that markets clear and a new equilibrium results.

Table 4 shows the effects of this scenario on the trade balance and they are again inconclusive. Imports of crude petroleum increase, but the other imports decrease. These effects are of the same sign as in the base scenario, but they are larger. The employment effects are negative, but insignificant, just as in the base scenario.

The large decrease in output of the basic metal industry is reflected in a relatively large decrease in the total use of materials. However, the crude assumption that there is no inter-sectoral substitution is of importance here. After all, if the use of zinc itself is taxed, the producers may substitute other metals for zinc, inducing a reduction of zinc use at a constant input from the basic metal industry. If the input from the basic metal industry itself is taxed, regardless of the zinc content of that input, there will be no incentive for the producers to substitute to other metals. Hence, the difference between the calculated materials reduction and the 'real' reduction is much smaller in this scenario than it is in the base scenario. This again stresses the importance of capturing these effects.

Scenario 4: A regulating levy on the primary use of lead

This scenario differs from the base scenario (Scenario 1) in that the levy is imposed on lead and not on zinc. The results for the production sectors show that the output of the basic metal industry will be reduced by 7% which is less than in Scenario 1 (see Table 2), because the share of the basic metal industry in the total use is smaller for lead than for zinc (see Table 1). The impact of the levy on lead on various other sectors is around 0.3 to 0.4 percent. The lead intensities are more spread over the production sectors than the zinc intensities (see Table 1) which implies that the tax burden is more evenly distributed over the various production sectors that are using lead. This more even distribution of the tax burden implies that the policy affects more production sectors negatively. Therefore, for a large number of production sectors, the effects are more negative or less positive than in the base scenario.

The impact of a levy on lead on household groups is roughly the same as in the base scenario (see Table 3), with the exception that the income improvement of labour income households is smaller than in the base scenario. A reason for this may be that a lead levy is more spread and more labour intensive production sectors are subjected to the levy. Here, the positive impact of the labour tax reform is completely mitigated by the negative impact of the levy on lead.

The effects on the imports are negative (see Table 4). For the competitive imports, the decrease in imports is slightly larger than in the base scenario (see footnote 2). The decrease of non-competitive imports is slightly smaller than in the base scenario. The employment effects are similar to those in the base scenario. Again, there is no double dividend.

Total use of lead will decrease by 3.5%. The total use of lead will decrease by 3.5%. This decrease is smaller than the decrease of zinc in the base scenario. A reason for this is that the total tax burden is spread more evenly over the production sectors. This may be clarified by looking at the demand and the input substitution effects of a policy. The demand substitution effect is the effect caused by the buyer of products from a production sector that is levied. The input substitution effect occurs when a production sector that is levied seeks possibilities for substituting the input that is levied. In this scenario, both substitution effects may be smaller than when the levy is imposed more heavily on one sector (like in Scenario 1), because the total tax burden is spread more evenly over the various sectors. As indicated before, substitution possibilities were rather small for the basic metal industry.

Scenario 5: A regulatory levy on the primary use of zinc and lead

This scenario is studied in order to obtain an idea about the combined effect of levies on both zinc and lead. This combined levy can give an insight in the economic effects of a ‘more complete’ metals policy. Policy makers who are thinking about implementing a materials policy may want to impose it on several materials simultaneously. They may, for example, choose to levy more harmful materials stronger. To analyse such a policy in this scenario a combined policy on zinc and lead is implemented. This scenario may be compared to Scenarios 1 and 4 where a policy is imposed on one metal.

Table 2 shows that the effects of this scenario are between those of Scenarios 1 and 4. If in Scenario 1 (4) zinc (lead) was substituted by lead (zinc), it would be expected that in a scenario where both metals are levied the costs of substitution and the output effects would be higher as some of these substitution possibilities are no longer available. This effect does not occur and therefore it may be concluded that here is not much substitution between zinc and lead. Also for the household groups, employment, trade and total materials use the effects of this scenario are between those of Scenarios 1 and 4 (see Tables 3 and 4).

5. Final remarks

This study presents the results of a first empirical step in filling the gap between physical and economic models by using a materials flow model and an applied general equilibrium model. In this way, the effects of materials policies may be analysed from environmental and economic perspectives. The model is applied to study the impact of policies to reduce the use of zinc and lead in the Netherlands.

The current formulation of the integrated model is far from perfect. There are no endogenous feedback mechanisms from the economic model to the materials flow model and a significant part of the substitution between materials cannot be accounted for. However, even from the current analysis some qualitative conclusions can be drawn.

First, a regulating levy on the use of materials will have only minor effects on most production sectors and households. The macro-economic effects are likely to be small. The main economic effects are the output losses of those sectors where most materials enter the economy (the so-called first stage production sectors). On the other hand, the environmental gains are clear: total materials use will decrease significantly.

Specifying an alternative scenario where the first stage production sectors are exempt of the levy will have a more dispersed effect on the economy. More production sectors are hurt by the regulating levy, but none to the extent of the first stage production sectors in the base scenario. However, the environmental gains will also be smaller.

Finally, the economic effects of a product levy (irrespective of the materials use) will be similar to those of a materials levy. Unfortunately, the environmental differences between a materials and a product levy cannot be assessed accurately in this version of the model.

From this illustration of materials policies in an economic model it may be concluded that the combination of an AGE model and a materials flow model opens up the road for analysing

sectoral, distributional, and environmental effects of economic or materials policies. Consistent analysis of the interactions of these effects is important for environmental-economic policy making.

More research is needed to accurately assess the environmental and economic impacts of policies in an integrated physical and economic model. Two further steps towards this integration that are of utmost importance are the inclusion of an endogenous feedback from the AGE model to the materials flow model and the modelling of the dynamic effects. The endogenous feedback might be implemented by means of the calibration of the AGE model, using a new economic sector (perhaps called 'environment') that supplies the materials to the production sectors. In this way, the materials flow model will essentially become a part of the AGE model. This way of modelling also opens up many new possibilities, as other environmental themes can be included in the same manner. A dynamic integrated model may be developed to analyse impacts over time and analyse the role of technological progress as a major source for reducing materials use. Currently, the possibilities are explored to combine both extensions to the model through the formulation of an environmental technology supplying sector.

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Appendix: Results of the simulations

This appendix shows the results of the production sectors, the household groups and the primary inputs in detail. Tables A1 to A15 present the total and partial effects resulting from a levy on metals and the labour tax reform. The total effect is the sum of the two partial effects.

Table A.1: Real income changes of household groups (in % of net income): Scenario 1

Household group	Metal Tax	Labour Tax	Total
1 Public Sector	0.3391	-0.1969	0.1422
2 Rest of the World	-0.0876	-0.0055	-0.0931
3 Labour income; 1 person; 1st income quartile	-0.0187	0.1247	0.106
4 Labour income; 1 person; 2nd income quartile	-0.1103	0.2062	0.0959
5 Labour income; 1 person; 3rd income quartile	-0.1393	0.1907	0.0514
6 Labour income; 1 person; 4th income quartile	-0.1476	0.1824	0.0348
7 Lab. inc.; more pers.; no children; 1st income quartile	0.007	0.0994	0.1064
8 Lab. inc.; more pers.; no children; 2nd income quartile	-0.0547	0.1432	0.0885
9 Lab. inc.; more pers.; no children; 3rd income quartile	-0.0776	0.1614	0.0838
10 Lab. inc.; more pers.; no children; 4th income quartile	-0.0971	0.1641	0.067
11 Lab. inc.; more pers.; with children; 1st income quartile	0.0429	0.0388	0.0817
12 Lab. inc.; more pers.; with children; 2nd income quartile	-0.0535	0.1495	0.096
13 Lab. inc.; more pers.; with children; 3rd income quartile	-0.0866	0.1636	0.077
14 Lab. inc.; more pers.; with children; 4th income quartile	-0.1025	0.1757	0.0732
15 Self-employed; agriculture.	0.1571	0.1055	0.2626
16 Self-employed; trade	0.1362	0.1195	0.2557
17 Self-employed; service	0.1185	0.1206	0.2391
18 Self-employed; other	0.1669	0.1267	0.2936
19 Pensioners; 1 person; 1st income quartile	0.2194	-0.2295	-0.0101
20 Pensioners; 1 person; 2nd income quartile	0.1485	-0.1822	-0.0337
21 Pensioners; 1 person; 3rd income quartile	0.0895	-0.126	-0.0365
22 Pensioners; 1 person; 4th income quartile	-0.0616	-0.0035	-0.0651
23 Pensioners; more persons; 1st income quartile	0.2392	-0.2467	-0.0075
24 Pensioners; more persons; 2nd income quartile	0.1994	-0.2139	-0.0145
25 Pensioners; more persons; 3rd income quartile	0.1545	-0.1766	-0.0221
26 Pensioners; more persons; 4th income quartile	0.0963	-0.1208	-0.0245
27 Transfer recipients; 1 person; 1st income quartile	0.2105	-0.1836	0.0269
28 Transfer recipients; 1 person; 2nd income quartile	0.1934	-0.1784	0.015
29 Transfer recipients; 1 person; 3rd income quartile	0.1549	-0.1486	0.0063
30 Transfer recipients; 1 person; 4th income quartile	0.1885	-0.1533	0.0352
31 Tr. rec.; more pers.; no children; 1st income quartile	0.219	-0.212	0.007
32 Tr. rec.; more pers.; no children; 2nd income quartile	0.2093	-0.2025	0.0068
33 Tr. rec.; more pers.; no children; 3rd income quartile	0.1729	-0.1688	0.0041
34 Tr. rec.; more pers.; no children; 4th income quartile	0.1198	-0.1063	0.0135
35 Tr. rec.; more pers.; with children; 1st income quartile	0.2307	-0.2305	0.0002
36 Tr. rec.; more pers.; with children; 2nd income quartile	0.2262	-0.2209	0.0053
37 Tr. rec.; more pers.; with children; 3rd income quartile	0.1763	-0.1463	0.03
38 Tr. rec.; more pers.; with children; 4th income quartile	0.1635	-0.1412	0.0223
39 People living in institutions; younger than 65 years	0.1655	-0.0983	0.0672
40 People living in institutions; 65 years and older	0.263	-0.204	0.0095
41 Care	0.1429	-0.0077	-0.2107
42 Non Profit Organisations	-0.5186	0.2319	-0.2867
43 Collective Wealth Fund	0.2188	-0.2093	0.0095
44 Pension Insurance	-0.2038	-0.0069	-0.2107

Table A.2: Changes in output levels of firms (in % of net output): Scenario 1

Production sector	Metal Tax	Labour Tax	Total
1 Agriculture, hunting and forestry	0.0289	-0.0148	0.0141
2 Fishing	0.2017	-0.0095	0.1922
3 Crude petroleum production	0.1443	0.017	0.1613
4 Natural gas production	0.0525	0.006	0.0585
5 Other mining and quarrying	0.1226	0.032	0.1546
6 Slaughtering and meat-processing industry	0.0503	-0.0008	0.0495
7 Manufacture of dairy products	0.0252	-0.0032	0.022
8 Fish, vegetable and fruit-processing industry	0.0693	0.0113	0.0806
9 Grain-processing industry	0.0629	-0.0185	0.0444
10 Sugar manufacturing and processing industry	0.1503	-0.0054	0.1449
11 Flour processing industry	0.0416	0.0065	0.0481
12 Cocoa, chocolate and sugar products industry	0.1198	0.014	0.1338
13 Manufacture of other food products	0.0585	0.0016	0.0601
14 Manufacture of beverages	0.1394	0.0353	0.1747
15 tobacco processing industry	0.4112	0.0144	0.4256
16 Wool industry	0.1579	0.0322	0.1901
17 Cotton industry	0.0546	0.0316	0.0862
18 Knitting and hosiery industry	0.0326	0.045	0.0776
19 Textiles industry (other enterprises)	0.1034	0.0376	0.141
20 Wearing apparel industry	0.0363	0.047	0.0833
21 Manufacture of leather, footwear and other leatherware	0.0321	0.048	0.0801
22 Manufacture of wood, wood products and furniture	-0.0557	0.0786	0.0229
23 Paper and cardboard industry	0.1156	0.0135	0.1291
24 Manuf. of paper products and corrugated cardboard	0.1004	0.019	0.1194
25 Printing, publishing and related industries	-0.0002	0.0218	0.0216
26 Petroleum industry	0.159	0.0162	0.1752
27 Manufacture of chemical basic products	-0.1034	0.0142	-0.0892
28 Manufacture of chemical final products	0.067	0.0153	0.0823
29 Manufacture of rubber and plastic products	-0.0482	0.0343	-0.0139
30 Manufacture of building materials	-0.1994	0.064	-0.1354
31 Manufacture of basic metals	-10.5385	0.0327	-10.5058
32 Manufacture of metal products	-0.6087	0.0509	-0.5578
33 Manufacture of machinery	-0.0895	0.055	-0.0345
34 Electrotechnical industry	0.0175	0.043	0.0605
35 Automobile industry	-0.0752	0.0858	0.0106
36 Manufacture of transport equipment (other enterprises)	-0.0387	0.0381	-0.0006
37 Man. of instruments, optical products and industry not elsewhere specified	0.0766	0.0435	0.1201
38 Public utilities (electricity)	-0.4777	0.0133	-0.4644
39 Public utilities (gas distribution)	-0.0134	0	-0.0134
40 Public utilities (water supply)	0.0204	-0.0036	0.0168
41 Construction	-0.1052	0.0945	-0.0107
42 Wholesale and retail trade	-0.1317	0.0288	-0.1029
43 Hotels, restaurants, cafes etc.	0.0292	0.0336	0.0628
44 Repair of consumer goods	-0.048	0.0497	0.0017

Production sector	Metal Tax	Labour Tax	Total
45 Sea and air transport	0.2279	0.0129	0.2408
46 Other transport and storage	-0.1089	0.0126	-0.0963
47 Communication	-0.0118	0.0041	-0.0077
48 Credit institutions	0.1117	0.0315	0.1432
49 Insurance companies and pension funds	0.0421	0.0142	0.0563
50 Operation of real estate	0.0233	0.0235	0.0468
51 Business services	-0.1176	0.0394	-0.0782
52 Public administration and social security funds	0.2708	-0.1543	0.1165
53 Defence	0.2798	-0.1597	0.1201
54 State and subsidised education	0.2698	-0.1514	0.1184
55 Social services etc.	0.0834	-0.0133	0.0701
56 Health and veterinary services	0.0139	-0.0017	0.0122
57 Cultural, sports and recreational services	0.0646	0.0074	0.072
58 Enterprises producing services not elsewhere specified	-0.0413	-0.0231	-0.0644
59 Private households with wage-earning staff	0.016	0.0165	0.0325
60 Goods and services not elsewhere classified	-0.1962	0.0311	-0.1651
61 Capital goods	-0.0775	0.1251	0.0476

Table A.3: Changes in demand for primary inputs (in % of total output): Scenario 1

	Metal Tax	Labour Tax	Total
62 Import of crude petroleum	0.0801	0.0167	0.0968
63 Import of natural gas	-0.647	0.003	-0.644
64 Other competitive imports	-0.6139	0.0345	-0.5794
65 Non-competitive imports	-0.4769	0.0239	-0.453
66 Low-paid labour supply	-0.0055	0.0023	-0.0032
67 Medium-paid labour supply	-0.0028	-0.0015	-0.0043
68 High-paid labour supply	-0.0095	-0.0042	-0.0137
69 Supply of self-employed labour	-	-	0
70 Capital services	-0.0066	0.0036	-0.003

Table A.4: Real income changes of household groups (in % of net income): Scenario 2

Household group	Metal Tax	Labour Tax	Total
1 Public Sector	0.7705	-0.1969	0.5736
2 Rest of the World	0.179	-0.0055	0.1735
3 Labour income; 1 person; 1st income quartile	-0.3215	0.1247	-0.1968
4 Labour income; 1 person; 2nd income quartile	-0.64	0.2062	-0.4338
5 Labour income; 1 person; 3rd income quartile	-0.6553	0.1907	-0.4646
6 Labour income; 1 person; 4th income quartile	-0.7168	0.1824	-0.5344
7 Lab. inc.; more pers.; no children; 1st income quartile	-0.1112	0.0994	-0.0118
8 Lab. inc.; more pers.; no children; 2nd income quartile	-0.486	0.1432	-0.3428
9 Lab. inc.; more pers.; no children; 3rd income quartile	-0.571	0.1614	-0.4096
10 Lab. inc.; more pers.; no children; 4th income quartile	-0.6108	0.1641	-0.4467
11 Lab. inc.; more pers.; with children; 1st income quartile	0.0825	0.0388	0.1213
12 Lab. inc.; more pers.; with children; 2nd income quartile	-0.446	0.1495	-0.2965
13 Lab. inc.; more pers.; with children; 3rd income quartile	-0.5017	0.1636	-0.3381
14 Lab. inc.; more pers.; with children; 4th income quartile	-0.5727	0.1757	-0.397
15 Self-employed; agriculture.	0.1103	0.1055	0.2158
16 Self-employed; trade	0.0717	0.1195	0.1912
17 Self-employed; service	0.0464	0.1206	0.167
18 Self-employed; other	0.2454	0.1267	0.3721
19 Pensioners; 1 person; 1st income quartile	0.1484	-0.2295	-0.0811
20 Pensioners; 1 person; 2nd income quartile	-0.0201	-0.1822	-0.2023
21 Pensioners; 1 person; 3rd income quartile	-0.1669	-0.126	-0.2929
22 Pensioners; 1 person; 4th income quartile	-0.5308	-0.0035	-0.5343
23 Pensioners; more persons; 1st income quartile	0.2135	-0.2467	-0.0332
24 Pensioners; more persons; 2nd income quartile	0.1103	-0.2139	-0.1036
25 Pensioners; more persons; 3rd income quartile	-0.005	-0.1766	-0.1816
26 Pensioners; more persons; 4th income quartile	-0.1567	-0.1208	-0.2775
27 Transfer recipients; 1 person; 1st income quartile	0.2762	-0.1836	0.0926
28 Transfer recipients; 1 person; 2nd income quartile	0.1169	-0.1784	-0.0615
29 Transfer recipients; 1 person; 3rd income quartile	0.0945	-0.1486	-0.0541
30 Transfer recipients; 1 person; 4th income quartile	0.0642	-0.1533	-0.0891
31 Tr. rec.; more pers.; no children; 1st income quartile	0.2435	-0.212	0.0315
32 Tr. rec.; more pers.; no children; 2nd income quartile	0.1474	-0.2025	-0.0551
33 Tr. rec.; more pers.; no children; 3rd income quartile	0.0331	-0.1688	-0.1357
34 Tr. rec.; more pers.; no children; 4th income quartile	-0.0963	-0.1063	-0.2026
35 Tr. rec.; more pers.; with children; 1st income quartile	0.2223	-0.2305	-0.0082
36 Tr. rec.; more pers.; with children; 2nd income quartile	0.1702	-0.2209	-0.0507
37 Tr. rec.; more pers.; with children; 3rd income quartile	0.0488	-0.1463	-0.0975
38 Tr. rec.; more pers.; with children; 4th income quartile	0.0121	-0.1412	-0.1291
39 People living in institutions; younger than 65 years	0.1545	-0.0983	0.0562
40 People living in institutions; 65 years and older	0.4204	-0.204	0.2164
41 Care	0.7983	-0.0077	0.7906
42 Non Profit Organisations	-1.5812	0.2319	-1.3493
43 Collective Wealth Fund	0.1874	-0.2093	-0.0219
44 Pension Insurance	-1.0375	-0.0069	-1.0444

Table A.5: Changes in output levels of firms (in % of net output): Scenario 2

Production sector	Metal Tax	Labour Tax	Total
1 Agriculture, hunting and forestry	0.1372	-0.0148	0.1224
2 Fishing	0.7781	-0.0095	0.7686
3 Crude petroleum production	0.2408	0.017	0.2578
4 Natural gas production	0.4842	0.006	0.4902
5 Other mining and quarrying	-0.2326	0.032	-0.2006
6 Slaughtering and meat-processing industry	0.1515	-0.0008	0.1507
7 Manufacture of dairy products	0.1222	-0.0032	0.119
8 Fish, vegetable and fruit-processing industry	0.1288	0.0113	0.1401
9 Grain-processing industry	0.2752	-0.0185	0.2567
10 Sugar manufacturing and processing industry	0.5491	-0.0054	0.5437
11 Flour processing industry	0.032	0.0065	0.0385
12 Cocoa, chocolate and sugar products industry	0.3462	0.014	0.3602
13 Manufacture of other food products	0.1333	0.0016	0.1349
14 Manufacture of beverages	0.3623	0.0353	0.3976
15 tobacco processing industry	1.5933	0.0144	1.6077
16 Wool industry	0.4806	0.0322	0.5128
17 Cotton industry	0.0228	0.0316	0.0544
18 Knitting and hosiery industry	-0.1298	0.045	-0.0848
19 Textiles industry (other enterprises)	-0.0448	0.0376	-0.0072
20 Wearing apparel industry	-0.0737	0.047	-0.0267
21 Manufacture of leather, footwear and other leatherware	-0.0495	0.048	-0.0015
22 Manufacture of wood, wood products and furniture	-1.3937	0.0786	-1.3151
23 Paper and cardboard industry	0.4481	0.0135	0.4616
24 Manuf. of paper products and corrugated cardboard	0.4311	0.019	0.4501
25 Printing, publishing and related industries	-0.1272	0.0218	-0.1054
26 Petroleum industry	0.3536	0.0162	0.3698
27 Manufacture of chemical basic products	-1.6316	0.0142	-1.6174
28 Manufacture of chemical final products	0.1268	0.0153	0.1421
29 Manufacture of rubber and plastic products	-0.309	0.0343	-0.2747
30 Manufacture of building materials	-1.6408	0.064	-1.5768
31 Manufacture of basic metals	-0.1052	0.0327	-0.0725
32 Manufacture of metal products	-3.4653	0.0509	-3.4144
33 Manufacture of machinery	-1.269	0.055	-1.214
34 Electrotechnical industry	-0.6077	0.043	-0.5647
35 Automobile industry	-1.2334	0.0858	-1.1476
36 Manufacture of transport equipment (other enterprises)	-0.3655	0.0381	-0.3274
37 Man. of instruments, optical products and industry not elsewhere specified	-0.2874	0.0435	-0.2439
38 Public utilities (electricity)	-0.4272	0.0133	-0.4139
39 Public utilities (gas distribution)	-0.1497	0	-0.1497
40 Public utilities (water supply)	-0.2351	-0.0036	-0.2387
41 Construction	-3.0857	0.0945	-2.9912
42 Wholesale and retail trade	-0.1376	0.0288	-0.1088
43 Hotels, restaurants, cafes etc.	0.0129	0.0336	0.0465
44 Repair of consumer goods	-0.3376	0.0497	-0.2879

Production sector	Metal Tax	Labour Tax	Total
45 Sea and air transport	0.8351	0.0129	0.848
46 Other transport and storage	0.0983	0.0126	0.1109
47 Communication	-0.108	0.0041	-0.1039
48 Credit institutions	0.2745	0.0315	0.306
49 Insurance companies and pension funds	0.0973	0.0142	0.1115
50 Operation of real estate	-0.1348	0.0235	-0.1113
51 Business services	-0.7057	0.0394	-0.6663
52 Public administration and social security funds	0.5496	-0.1543	0.3953
53 Defence	0.6408	-0.1597	0.4811
54 State and subsidised education	0.6122	-0.1514	0.4608
55 Social services etc.	0.228	-0.0133	0.2147
56 Health and veterinary services	0.0213	-0.0017	0.0196
57 Cultural, sports and recreational services	0.0825	0.0074	0.0899
58 Enterprises producing services not elsewhere specified	-0.2621	-0.0231	-0.2852
59 Private households with wage-earning staff	-0.1861	0.0165	-0.1696
60 Goods and services not elsewhere classified	-0.7059	0.0311	-0.6748
61 Capital goods	-3.7315	0.1251	-3.6064

Table A.6: Changes in demand for primary inputs (in % of total output): Scenario 2

	Metal Tax	Labour Tax	Total
62 Import of crude petroleum	-0.0297	0.0167	-0.013
63 Import of natural gas	-2.4712	0.003	-2.4682
64 Other competitive imports	-1.1656	0.0345	-1.1311
65 Non-competitive imports	-0.2855	0.0239	-0.2616
66 Low-paid labour supply	-0.0049	0.0023	-0.0026
67 Medium-paid labour supply	-0.007	-0.0015	-0.0085
68 High-paid labour supply	0.0265	-0.0042	0.0223
69 Supply of self-employed labour	-	-	0
70 Capital services	0.035	0.0036	0.0386

Table A.7: Real income changes of household groups (in % of net income): Scenario 3

Household group	Metal Tax	Labour Tax	Total
1 Public Sector	0.3503	-0.1969	0.1534
2 Rest of the World	-0.0967	-0.0055	-0.1022
3 Labour income; 1 person; 1st income quartile	-0.0293	0.1247	0.0954
4 Labour income; 1 person; 2nd income quartile	-0.1307	0.2062	0.0755
5 Labour income; 1 person; 3rd income quartile	-0.1607	0.1907	0.03
6 Labour income; 1 person; 4th income quartile	-0.1674	0.1824	0.015
7 Lab. inc.; more pers.; no children; 1st income quartile	-0.0033	0.0994	0.0961
8 Lab. inc.; more pers.; no children; 2nd income quartile	-0.0671	0.1432	0.0761
9 Lab. inc.; more pers.; no children; 3rd income quartile	-0.0915	0.1614	0.0699
10 Lab. inc.; more pers.; no children; 4th income quartile	-0.1115	0.1641	0.0526
11 Lab. inc.; more pers.; with children; 1st income quartile	0.0372	0.0388	0.076
12 Lab. inc.; more pers.; with children; 2nd income quartile	-0.0663	0.1495	0.0832
13 Lab. inc.; more pers.; with children; 3rd income quartile	-0.1032	0.1636	0.0604
14 Lab. inc.; more pers.; with children; 4th income quartile	-0.1179	0.1757	0.0578
15 Self-employed; agriculture.	0.2326	0.1055	0.3381
16 Self-employed; trade	0.2041	0.1195	0.3236
17 Self-employed; service	0.1774	0.1206	0.298
18 Self-employed; other	0.2364	0.1267	0.3631
19 Pensioners; 1 person; 1st income quartile	0.2221	-0.2295	-0.0074
20 Pensioners; 1 person; 2nd income quartile	0.1558	-0.1822	-0.0264
21 Pensioners; 1 person; 3rd income quartile	0.1052	-0.126	-0.0208
22 Pensioners; 1 person; 4th income quartile	-0.0294	-0.0035	-0.0329
23 Pensioners; more persons; 1st income quartile	0.2404	-0.2467	-0.0063
24 Pensioners; more persons; 2nd income quartile	0.2031	-0.2139	-0.0108
25 Pensioners; more persons; 3rd income quartile	0.1596	-0.1766	-0.017
26 Pensioners; more persons; 4th income quartile	0.1084	-0.1208	-0.0124
27 Transfer recipients; 1 person; 1st income quartile	0.2106	-0.1836	0.027
28 Transfer recipients; 1 person; 2nd income quartile	0.1947	-0.1784	0.0163
29 Transfer recipients; 1 person; 3rd income quartile	0.1554	-0.1486	0.0068
30 Transfer recipients; 1 person; 4th income quartile	0.2015	-0.1533	0.0482
31 Tr. rec.; more pers.; no children; 1st income quartile	0.2171	-0.212	0.0051
32 Tr. rec.; more pers.; no children; 2nd income quartile	0.2122	-0.2025	0.0097
33 Tr. rec.; more pers.; no children; 3rd income quartile	0.1746	-0.1688	0.0058
34 Tr. rec.; more pers.; no children; 4th income quartile	0.1222	-0.1063	0.0159
35 Tr. rec.; more pers.; with children; 1st income quartile	0.2296	-0.2305	-0.0009
36 Tr. rec.; more pers.; with children; 2nd income quartile	0.2273	-0.2209	0.0064
37 Tr. rec.; more pers.; with children; 3rd income quartile	0.1794	-0.1463	0.0331
38 Tr. rec.; more pers.; with children; 4th income quartile	0.1631	-0.1412	0.0219
39 People living in institutions; younger than 65 years	0.1661	-0.0983	0.0678
40 People living in institutions; 65 years and older	0.2786	-0.204	0.0746
41 Care	0.1523	-0.0077	0.1446
42 Non Profit Organisations	-0.4588	0.2319	-0.2269
43 Collective Wealth Fund	0.2272	-0.2093	0.0179
44 Pension Insurance	-0.1798	-0.0069	-0.1867

Table A.8: Changes in output levels of firms (in % of net output): Scenario 3

Production sector	Metal Tax	Labour Tax	Total
1 Agriculture, hunting and forestry	0.0335	-0.0148	0.0187
2 Fishing	0.2385	-0.0095	0.229
3 Crude petroleum production	0.2354	0.017	0.2524
4 Natural gas production	0.0697	0.006	0.0757
5 Other mining and quarrying	0.1522	0.032	0.1842
6 Slaughtering and meat-processing industry	0.0619	-0.0008	0.0611
7 Manufacture of dairy products	0.0311	-0.0032	0.0279
8 Fish, vegetable and fruit-processing industry	0.0891	0.0113	0.1004
9 Grain-processing industry	0.0904	-0.0185	0.0719
10 Sugar manufacturing and processing industry	0.1857	-0.0054	0.1803
11 Flour processing industry	0.0482	0.0065	0.0547
12 Cocoa, chocolate and sugar products industry	0.1439	0.014	0.1579
13 Manufacture of other food products	0.0814	0.0016	0.083
14 Manufacture of beverages	0.1762	0.0353	0.2115
15 tobacco processing industry	0.4747	0.0144	0.4891
16 Wool industry	0.2146	0.0322	0.2468
17 Cotton industry	0.0807	0.0316	0.1123
18 Knitting and hosiery industry	0.0516	0.045	0.0966
19 Textiles industry (other enterprises)	0.1407	0.0376	0.1783
20 Wearing apparel industry	0.0548	0.047	0.1018
21 Manufacture of leather, footwear and other leatherware	0.0489	0.048	0.0969
22 Manufacture of wood, wood products and furniture	-0.0493	0.0786	0.0293
23 Paper and cardboard industry	0.1377	0.0135	0.1512
24 Manuf. of paper products and corrugated cardboard	0.1287	0.019	0.1477
25 Printing, publishing and related industries	0.0137	0.0218	0.0355
26 Petroleum industry	0.2367	0.0162	0.2529
27 Manufacture of chemical basic products	0.4456	0.0142	0.4598
28 Manufacture of chemical final products	0.092	0.0153	0.1073
29 Manufacture of rubber and plastic products	-0.0225	0.0343	0.0118
30 Manufacture of building materials	-0.2226	0.064	-0.1586
31 Manufacture of basic metals	-13.1849	0.0327	-13.1522
32 Manufacture of metal products	-0.5956	0.0509	-0.5447
33 Manufacture of machinery	-0.1026	0.055	-0.0476
34 Electrotechnical industry	0.0238	0.043	0.0668
35 Automobile industry	-0.0747	0.0858	0.0111
36 Manufacture of transport equipment (other enterprises)	-0.057	0.0381	-0.0189
37 Man. of instruments, optical products and industry not elsewhere specified	0.0988	0.0435	0.1423
38 Public utilities (electricity)	-0.5606	0.0133	-0.5473
39 Public utilities (gas distribution)	-0.0143	0	-0.0143
40 Public utilities (water supply)	0.041	-0.0036	0.0374
41 Construction	-0.0999	0.0945	-0.0054
42 Wholesale and retail trade	-0.0984	0.0288	-0.0696
43 Hotels, restaurants, cafes etc.	0.021	0.0336	0.0546
44 Repair of consumer goods	-0.0629	0.0497	-0.0132

Production sector	Metal Tax	Labour Tax	Total
45 Sea and air transport	0.2522	0.0129	0.2651
46 Other transport and storage	-0.1371	0.0126	-0.1245
47 Communication	-0.0044	0.0041	-0.0003
48 Credit institutions	0.1158	0.0315	0.1473
49 Insurance companies and pension funds	0.0534	0.0142	0.0676
50 Operation of real estate	0.0183	0.0235	0.0418
51 Business services	-0.123	0.0394	-0.0836
52 Public administration and social security funds	0.2801	-0.1543	0.1258
53 Defence	0.2893	-0.1597	0.1296
54 State and subsidised education	0.279	-0.1514	0.1276
55 Social services etc.	0.0935	-0.0133	0.0802
56 Health and veterinary services	0.0144	-0.0017	0.0127
57 Cultural, sports and recreational services	0.0679	0.0074	0.0753
58 Enterprises producing services not elsewhere specified	-0.0051	-0.0231	-0.0282
59 Private households with wage-earning staff	0.0161	0.0165	0.0326
60 Goods and services not elsewhere classified	-0.1738	0.0311	-0.1427
61 Capital goods	-0.0695	0.1251	0.0556

Table A.9: Changes in demand for primary inputs (in % of total output): Scenario 3

	Metal Tax	Labour Tax	Total
62 Import of crude petroleum	0.1763	0.0167	0.193
63 Import of natural gas	-0.5733	0.003	-0.5703
64 Other competitive imports	-0.6899	0.0345	-0.6554
65 Non-competitive imports	-0.5622	0.0239	-0.5383
66 Low-paid labour supply	-0.0051	0.0023	-0.0028
67 Medium-paid labour supply	-0.0023	-0.0015	-0.0038
68 High-paid labour supply	-0.0099	-0.0042	-0.0141
69 Supply of self-employed labour	-	-	0
70 Capital services	-0.0065	0.0036	-0.0029

Table A.10: Real income changes of household groups (in % of net income): Scenario 4

Household group	Metal Tax	Labour Tax	Total
1 Public Sector	0.3863	-0.1969	0.1894
2 Rest of the World	-0.0463	-0.0055	-0.0518
3 Labour income; 1 person; 1st income quartile	-0.0554	0.1247	0.0693
4 Labour income; 1 person; 2nd income quartile	-0.1618	0.2062	0.0444
5 Labour income; 1 person; 3rd income quartile	-0.182	0.1907	0.0087
6 Labour income; 1 person; 4th income quartile	-0.1966	0.1824	-0.0142
7 Lab. inc.; more pers.; no children; 1st income quartile	-0.0107	0.0994	0.0887
8 Lab. inc.; more pers.; no children; 2nd income quartile	-0.1037	0.1432	0.0395
9 Lab. inc.; more pers.; no children; 3rd income quartile	-0.1328	0.1614	0.0286
10 Lab. inc.; more pers.; no children; 4th income quartile	-0.1517	0.1641	0.0124
11 Lab. inc.; more pers.; with children; 1st income quartile	0.0413	0.0388	0.0801
12 Lab. inc.; more pers.; with children; 2nd income quartile	-0.1	0.1495	0.0495
13 Lab. inc.; more pers.; with children; 3rd income quartile	-0.1305	0.1636	0.0331
14 Lab. inc.; more pers.; with children; 4th income quartile	-0.1529	0.1757	0.0228
15 Self-employed; agriculture.	0.015	0.1055	0.1205
16 Self-employed; trade	0.0027	0.1195	0.1222
17 Self-employed; service	-0.0018	0.1206	0.1188
18 Self-employed; other	0.0417	0.1267	0.1684
19 Pensioners; 1 person; 1st income quartile	0.2155	-0.2295	-0.014
20 Pensioners; 1 person; 2nd income quartile	0.1326	-0.1822	-0.0496
21 Pensioners; 1 person; 3rd income quartile	0.0547	-0.126	-0.0713
22 Pensioners; 1 person; 4th income quartile	-0.1339	-0.0035	-0.1374
23 Pensioners; more persons; 1st income quartile	0.2385	-0.2467	-0.0082
24 Pensioners; more persons; 2nd income quartile	0.1898	-0.2139	-0.0241
25 Pensioners; more persons; 3rd income quartile	0.1365	-0.1766	-0.0401
26 Pensioners; more persons; 4th income quartile	0.0611	-0.1208	-0.0597
27 Transfer recipients; 1 person; 1st income quartile	0.2198	-0.1836	0.0362
28 Transfer recipients; 1 person; 2nd income quartile	0.1857	-0.1784	0.0073
29 Transfer recipients; 1 person; 3rd income quartile	0.1426	-0.1486	-0.006
30 Transfer recipients; 1 person; 4th income quartile	0.1539	-0.1533	0.0006
31 Tr. rec.; more pers.; no children; 1st income quartile	0.2261	-0.212	0.0141
32 Tr. rec.; more pers.; no children; 2nd income quartile	0.2	-0.2025	-0.0025
33 Tr. rec.; more pers.; no children; 3rd income quartile	0.1552	-0.1688	-0.0136
34 Tr. rec.; more pers.; no children; 4th income quartile	0.0915	-0.1063	-0.0148
35 Tr. rec.; more pers.; with children; 1st income quartile	0.2318	-0.2305	0.0013
36 Tr. rec.; more pers.; with children; 2nd income quartile	0.2175	-0.2209	-0.0034
37 Tr. rec.; more pers.; with children; 3rd income quartile	0.1521	-0.1463	0.0058
38 Tr. rec.; more pers.; with children; 4th income quartile	0.1437	-0.1412	0.0025
39 People living in institutions; younger than 65 years	0.1714	-0.0983	0.0731
40 People living in institutions; 65 years and older	0.2848	-0.204	0.0808
41 Care	0.2214	-0.0077	0.2137
42 Non Profit Organisations	-0.6347	0.2319	-0.4028
43 Collective Wealth Fund	0.2312	-0.2093	0.0219
44 Pension Insurance	-0.2838	-0.0069	-0.2907

Table A.11: Changes in output levels of firms (in % of net output): Scenario 4

Production sector	Metal Tax	Labour Tax	Total
1 Agriculture, hunting and forestry	0.056	-0.0148	0.0412
2 Fishing	0.1613	-0.0095	0.1518
3 Crude petroleum production	0.1058	0.017	0.1228
4 Natural gas production	0.128	0.006	0.134
5 Other mining and quarrying	-0.0131	0.032	0.0189
6 Slaughtering and meat-processing industry	0.0391	-0.0008	0.0391
7 Manufacture of dairy products	0.0323	-0.0032	0.0291
8 Fish, vegetable and fruit-processing industry	0.0354	0.0113	0.0467
9 Grain-processing industry	0.1238	-0.0185	0.1053
10 Sugar manufacturing and processing industry	0.1751	-0.0054	0.1697
11 Flour processing industry	0.0295	0.0065	0.036
12 Cocoa, chocolate and sugar products industry	0.088	0.014	0.102
13 Manufacture of other food products	0.0575	0.0016	0.0591
14 Manufacture of beverages	0.0886	0.0353	0.1239
15 tobacco processing industry	0.4056	0.0144	0.42
16 Wool industry	0.0799	0.0322	0.1121
17 Cotton industry	0.0014	0.0316	0.033
18 Knitting and hosiery industry	-0.0507	0.045	-0.0057
19 Textiles industry (other enterprises)	0.0202	0.0376	0.0578
20 Wearing apparel industry	-0.0377	0.047	0.0093
21 Manufacture of leather, footwear and other leatherware	-0.0394	0.048	0.0086
22 Manufacture of wood, wood products and furniture	-0.2353	0.0786	-0.1567
23 Paper and cardboard industry	0.1067	0.0135	0.1202
24 Manuf. of paper products and corrugated cardboard	0.0744	0.019	0.0934
25 Printing, publishing and related industries	-0.06	0.0218	-0.0382
26 Petroleum industry	0.1048	0.0162	0.121
27 Manufacture of chemical basic products	-0.1441	0.0142	-0.1299
28 Manufacture of chemical final products	0.0195	0.0153	0.0348
29 Manufacture of rubber and plastic products	-0.0945	0.0343	-0.0602
30 Manufacture of building materials	-0.3599	0.064	-0.2959
31 Manufacture of basic metals	-7.0443	0.0327	-7.0116
32 Manufacture of metal products	-1.0018	0.0509	-0.9509
33 Manufacture of machinery	-0.2147	0.055	-0.1597
34 Electrotechnical industry	-0.0766	0.043	-0.0336
35 Automobile industry	-0.2409	0.0858	-0.1551
36 Manufacture of transport equipment (other enterprises)	-0.0705	0.0381	-0.0324
37 Man. of instruments, optical products and industry not elsewhere specified	-0.0386	0.0435	0.0049
38 Public utilities (electricity)	-0.3794	0.0133	-0.3661
39 Public utilities (gas distribution)	-0.0241	0	-0.0241
40 Public utilities (water supply)	-0.0046	-0.0036	-0.0082
41 Construction	-0.4236	0.0945	-0.3291
42 Wholesale and retail trade	-0.3166	0.0288	-0.2878
43 Hotels, restaurants, cafes etc.	0.037	0.0336	0.0706
44 Repair of consumer goods	-0.0667	0.0497	-0.017

Production sector	Metal Tax	Labour Tax	Total
45 Sea and air transport	0.2705	0.0129	0.2834
46 Other transport and storage	-0.0551	0.0126	-0.0425
47 Communication	-0.0444	0.0041	-0.0403
48 Credit institutions	0.0887	0.0315	0.1202
49 Insurance companies and pension funds	0.0331	0.0142	0.0473
50 Operation of real estate	-0.0102	0.0235	0.0133
51 Business services	-0.1734	0.0394	-0.134
52 Public administration and social security funds	0.301	-0.1543	0.1467
53 Defence	0.3188	-0.1597	0.1591
54 State and subsidised education	0.3069	-0.1514	0.1555
55 Social services etc.	0.1026	-0.0133	0.0893
56 Health and veterinary services	0.0152	-0.0017	0.0135
57 Cultural, sports and recreational services	0.062	0.0074	0.0694
58 Enterprises producing services not elsewhere specified	-0.0591	-0.0231	-0.0822
59 Private households with wage-earning staff	-0.019	0.0165	-0.0025
60 Goods and services not elsewhere classified	-0.3242	0.0311	-0.2931
61 Capital goods	-0.4777	0.1251	-0.3526

Table A.12: Changes in demand for primary inputs (in % of total output): Scenario 4

	Metal Tax	Labour Tax	Total
62 Import of crude petroleum	0.0231	0.0167	0.0398
63 Import of natural gas	-0.7745	0.003	-0.7715
64 Other competitive imports	-0.5591	0.0345	-0.5246
65 Non-competitive imports	-0.3793	0.0239	-0.3554
66 Low-paid labour supply	-0.0057	0.0023	-0.0034
67 Medium-paid labour supply	-0.0028	-0.0015	-0.0043
68 High-paid labour supply	-0.0031	-0.0042	-0.0073
69 Supply of self-employed labour	-	-	0
70 Capital services	-0.002	0.0036	0.0016

Table A.13: Real income changes of household groups (in % of net income): Scenario 5

Household group	Metal Tax	Labour Tax	Total
1 Public Sector	0.3577	-0.1969	0.1608
2 Rest of the World	-0.0726	-0.0055	-0.0781
3 Labour income; 1 person; 1st income quartile	-0.0323	0.1247	0.0924
4 Labour income; 1 person; 2nd income quartile	-0.1297	0.2062	0.0765
5 Labour income; 1 person; 3rd income quartile	-0.1555	0.1907	0.0352
6 Labour income; 1 person; 4th income quartile	-0.1662	0.1824	0.0162
7 Lab. inc.; more pers.; no children; 1st income quartile	0.0005	0.0994	0.0999
8 Lab. inc.; more pers.; no children; 2nd income quartile	-0.073	0.1432	0.0702
9 Lab. inc.; more pers.; no children; 3rd income quartile	-0.0983	0.1614	0.0631
10 Lab. inc.; more pers.; no children; 4th income quartile	-0.1176	0.1641	0.0465
11 Lab. inc.; more pers.; with children; 1st income quartile	0.0424	0.0388	0.0812
12 Lab. inc.; more pers.; with children; 2nd income quartile	-0.0708	0.1495	0.0787
13 Lab. inc.; more pers.; with children; 3rd income quartile	-0.1031	0.1636	0.0605
14 Lab. inc.; more pers.; with children; 4th income quartile	-0.1214	0.1757	0.0543
15 Self-employed; agriculture.	0.1048	0.1055	0.2103
16 Self-employed; trade	0.087	0.1195	0.2065
17 Self-employed; service	0.0742	0.1206	0.1948
18 Self-employed; other	0.1209	0.1267	0.2476
19 Pensioners; 1 person; 1st income quartile	0.2187	-0.2295	-0.0108
20 Pensioners; 1 person; 2nd income quartile	0.1431	-0.1822	-0.0391
21 Pensioners; 1 person; 3rd income quartile	0.0769	-0.126	-0.0491
22 Pensioners; 1 person; 4th income quartile	-0.0886	-0.0035	-0.0921
23 Pensioners; more persons; 1st income quartile	0.2398	-0.2467	-0.0069
24 Pensioners; more persons; 2nd income quartile	0.1965	-0.2139	-0.0174
25 Pensioners; more persons; 3rd income quartile	0.1484	-0.1766	-0.0282
26 Pensioners; more persons; 4th income quartile	0.0836	-0.1208	-0.0372
27 Transfer recipients; 1 person; 1st income quartile	0.2147	-0.1836	0.0311
28 Transfer recipients; 1 person; 2nd income quartile	0.1912	-0.1784	0.0128
29 Transfer recipients; 1 person; 3rd income quartile	0.1509	-0.1486	0.0023
30 Transfer recipients; 1 person; 4th income quartile	0.1763	-0.1533	0.023
31 Tr. rec.; more pers.; no children; 1st income quartile	0.2224	-0.212	0.0104
32 Tr. rec.; more pers.; no children; 2nd income quartile	0.2065	-0.2025	0.004
33 Tr. rec.; more pers.; no children; 3rd income quartile	0.1669	-0.1688	-0.0019
34 Tr. rec.; more pers.; no children; 4th income quartile	0.1098	-0.1063	0.0035
35 Tr. rec.; more pers.; with children; 1st income quartile	0.2319	-0.2305	0.0014
36 Tr. rec.; more pers.; with children; 2nd income quartile	0.2238	-0.2209	0.0029
37 Tr. rec.; more pers.; with children; 3rd income quartile	0.1679	-0.1463	0.0216
38 Tr. rec.; more pers.; with children; 4th income quartile	0.1567	-0.1412	0.0155
39 People living in institutions; younger than 65 years	0.1682	-0.0983	0.0699
40 People living in institutions; 65 years and older	0.2719	-0.204	0.0679
41 Care	0.1724	-0.0077	0.1647
42 Non Profit Organisations	-0.5633	0.2319	-0.3314
43 Collective Wealth Fund	0.2242	-0.2093	0.0149
44 Pension Insurance	-0.2341	-0.0069	-0.241

Table A.14: Changes in output levels of firms (in % of net output): Scenario 5

Production sector	Metal Tax	Labour Tax	Total
1 Agriculture, hunting and forestry	0.039	-0.0148	0.0242
2 Fishing	0.1872	-0.0095	0.1777
3 Crude petroleum production	0.131	0.017	0.148
4 Natural gas production	0.0807	0.006	0.0867
5 Other mining and quarrying	0.0726	0.032	0.1046
6 Slaughtering and meat-processing industry	0.0463	-0.0008	0.0455
7 Manufacture of dairy products	0.0279	-0.0032	0.0247
8 Fish, vegetable and fruit-processing industry	0.0569	0.0113	0.0682
9 Grain-processing industry	0.0856	-0.0185	0.0671
10 Sugar manufacturing and processing industry	0.1599	-0.0054	0.1545
11 Flour processing industry	0.0373	0.0065	0.0438
12 Cocoa, chocolate and sugar products industry	0.1083	0.014	0.1223
13 Manufacture of other food products	0.0583	0.0016	0.0599
14 Manufacture of beverages	0.1208	0.0353	0.1561
15 tobacco processing industry	0.4102	0.0144	0.4246
16 Wool industry	0.1293	0.0322	0.1615
17 Cotton industry	0.035	0.0316	0.0666
18 Knitting and hosiery industry	0.0018	0.045	0.0468
19 Textiles industry (other enterprises)	0.0728	0.0376	0.1104
20 Wearing apparel industry	0.0089	0.047	0.0559
21 Manufacture of leather, footwear and other leatherware	0.0056	0.048	0.0536
22 Manufacture of wood, wood products and furniture	-0.1223	0.0786	-0.0437
23 Paper and cardboard industry	0.1126	0.0135	0.1261
24 Manuf. of paper products and corrugated cardboard	0.091	0.019	0.11
25 Printing, publishing and related industries	-0.0224	0.0218	-0.0006
26 Petroleum industry	0.14	0.0162	0.1562
27 Manufacture of chemical basic products	-0.1191	0.0142	-0.1049
28 Manufacture of chemical final products	0.0493	0.0153	0.0646
29 Manufacture of rubber and plastic products	-0.0656	0.0343	-0.0313
30 Manufacture of building materials	-0.2594	0.064	-0.1954
31 Manufacture of basic metals	-9.2748	0.0327	-9.2421
32 Manufacture of metal products	-0.7564	0.0509	-0.7055
33 Manufacture of machinery	-0.136	0.055	-0.081
34 Electrotechnical industry	-0.0173	0.043	0.0257
35 Automobile industry	-0.1368	0.0858	-0.051
36 Manufacture of transport equipment (other enterprises)	-0.0505	0.0381	-0.0124
37 Man. of instruments, optical products and industry not elsewhere specified	0.0341	0.0435	0.0776
38 Public utilities (electricity)	-0.4427	0.0133	-0.4294
39 Public utilities (gas distribution)	-0.0174	0	-0.0174
40 Public utilities (water supply)	0.0112	-0.0036	0.0076
41 Construction	-0.2232	0.0945	-0.1287
42 Wholesale and retail trade	-0.2009	0.0288	-0.1721
43 Hotels, restaurants, cafes etc.	0.0322	0.0336	0.0658
44 Repair of consumer goods	-0.055	0.0497	-0.0053

Production sector	Metal Tax	Labour Tax	Total
45 Sea and air transport	0.2444	0.0129	0.2573
46 Other transport and storage	-0.0893	0.0126	-0.0767
47 Communication	-0.0239	0.0041	-0.0198
48 Credit institutions	0.1035	0.0315	0.135
49 Insurance companies and pension funds	0.0389	0.0142	0.0531
50 Operation of real estate	0.011	0.0235	0.0345
51 Business services	-0.1386	0.0394	-0.0992
52 Public administration and social security funds	0.2829	-0.1543	0.1286
53 Defence	0.2951	-0.1597	0.1354
54 State and subsidised education	0.2844	-0.1514	0.133
55 Social services etc.	0.0908	-0.0133	0.0775
56 Health and veterinary services	0.0144	-0.0017	0.0127
57 Cultural, sports and recreational services	0.0639	0.0074	0.0713
58 Enterprises producing services not elsewhere specified	-0.048	-0.0231	-0.0711
59 Private households with wage-earning staff	0.003	0.0165	0.0195
60 Goods and services not elsewhere classified	-0.2444	0.0311	-0.2133
61 Capital goods	-0.2256	0.1251	-0.1005

Table A.15: Changes in demand for primary inputs (in % of total output): Scenario 5

	Metal Tax	Labour Tax	Total
62 Import of crude petroleum	0.0598	0.0167	0.0765
63 Import of natural gas	-0.6962	0.003	-0.6932
64 Other competitive imports	-0.5954	0.0345	-0.5609
65 Non-competitive imports	-0.4422	0.0239	-0.4183
66 Low-paid labour supply	-0.0056	0.0023	-0.0033
67 Medium-paid labour supply	-0.0028	-0.0015	-0.0043
68 High-paid labour supply	-0.0072	-0.0042	-0.0114
69 Supply of self-employed labour	-	-	0
70 Capital services	-0.005	0.0036	-0.0014