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The Potential Role for Carbon Pricing in Reducing European Deficits

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Abstract

This paper considers the possibility of using carbon fiscal measures to help to reduce budget deficits in Europe while at the same time curbing greenhouse gas emissions. National reforms are assessed for three European countries and ETS reform is assessed at European level. A scenario-based analysis using the macroeconometric E3ME model suggests that the costs to society of raising revenues from energy or carbon taxation, in terms of lost production and jobs, are no worse, and in some cases better, than alternative tax-raising policies.

Policy Implications

- National governments should consider developing energy and carbon taxation as a means of broadening the tax base and reducing fiscal deficits, while simultaneously acting on carbon emissions.
- The European ETS will provide governments with revenues from 2013 onwards; these revenues could be increased by setting a higher target for emissions reductions or auctioning a larger share of allowances.

Introduction

The overriding challenge for many European governments today is to reduce major fiscal deficits while causing the least collateral damage to jobs and growth. This paper shows that carbon fiscal measures could raise significant revenues while having a macroeconomic impact that is less detrimental or at least no worse than other tax options. Carbon fiscal measures could therefore make an important contribution to reducing fiscal deficits, quite apart from the usual environmental arguments in their favour – namely that they are cost-effective instruments to reduce Europe's greenhouse gas emissions.

Specifically, this paper considers two types of opportunity to raise revenues through carbon pricing mechanisms:

- the rebalancing of national tax structures to place greater emphasis on the taxation of energy and carbon
- reform of the EU ETS to increase its potential for raising significant revenues

Three European countries (Hungary, Poland and Spain) are used as examples for demonstrating the potential of national reforms.

The next section describes the current policy situation and the need for fiscal reform in Europe. This is followed by a description of the scenarios that were assessed and the macroeconomic model that was used in that assessment. The final sections present the results from the analysis and conclusions.

The key issues and the current policy position

The European fiscal position

According to Eurostat, 24 of the 27 EU Member States ran a fiscal deficit in 2011. The average deficit for the EU as a whole was 4.5% of GDP, and four Member States (Ireland, Greece, Spain and the UK) had rates of over 8%. The economic crisis and subsequent recession has also caused a large increase in the stock of government debt, which in 2011 stood at 82.5% of GDP for the EU as a whole, up from 62.9% in 2005. Again this average hides important variation, with four Member States in the eurozone (Greece, Italy, Ireland and Portugal) having gross debts above 100% of GDP, and Belgium looking likely to join them in 2012. The difficulties countries have faced in selling new debt to the bond markets have shown that balancing government budgets has become an urgent priority.

In response, most European countries have enacted a package of "austerity" measures that combines tax increases and spending cuts. There is much discussion about the pros and cons of these packages, but the evidence suggests that the short-term impact has involved considerable damage to national economies, for example lower GDP growth and higher unemployment (see e.g. Guajardo et al, 2011). The choice of policy has been driven by administrative and political practicality (for example, cutting new investment projects) rather than a careful assessment of the economic impact of the available alternatives. Indeed, sometimes the argument is made that, in the current economic climate, any move to raise carbon taxes should be postponed; since the corollary is that other deficit-cutting measures will be introduced instead, the question that should be

asked is whether the impact of raising carbon taxes is less damaging than the alternative ways of cutting the deficit.

EU climate policy

At the same time as it is responding to the impact of the recession, the EU continues to strive to meet its targets for reducing greenhouse gas emissions. Market-based approaches to environmental policy generally, and reducing carbon emissions specifically, have become increasingly common since the early 1990s (Andersen and Ekins, 2009). They work by establishing a price signal to influence individual behaviour (Ekins and Speck, 2011, Milne and Andersen, 2012). Although there are market failures that can limit the effectiveness of these price signals, it is now widely believed that large reductions in carbon emissions will not be possible without a sufficiently high and stable carbon price signal.

The EU's flagship emissions reduction policy is the EU Emissions Trading Scheme (EU ETS), which puts a cap on emission levels from the power and heavy industrial sectors. The EU ETS provides a single carbon price for these sectors but currently suffers from the following shortcomings:

- the current allowance price is often too low to influence behaviour
- the price has been quite unstable which may inhibit low-carbon investment
- the potential to raise significant revenues for government is only partly realised as around half of allowances (almost all pre-2013) are given to the firms involved for free, rather than sold by auction

For the sectors not covered by the EU ETS, there are also price signals in the form of tax rates1, but the variation in the tax rates between sectors and countries can lead to a rather inefficient allocation of resources. Table 1 illustrates this for a selection of EU countries.

Table 1. Carbon-energy tax rates at market exchange rates, 2011, €/tCO2

Country	Mean	Rank	Residential	Transport	Industry, public and commerce
France	66	=4	12	149	15
Germany	66	=4	34	199	23
Greece	58	5	5	213	5
Hungary	44	7	(4)	144	13
Italy	78	1	70	179	24
Poland	35	8	9	126	18
Portugal	72	2	10	151	15
Spain	56	6	20	115	17

[1] Often these taxes also apply to sectors covered by the EU ETS. These have no net emission reduction impact, as total emissions for sectors under the EU ETS is determined by the EU ETS cap.

UK	71	3	(31)	248	26

Note: (x) indicates a negative number.

Source: Vivid Economics

The proposed revisions to the Energy Taxation Directive (European Commission, 2011) attempt to reduce some of this variation, but progress here remains slow.

There is, therefore, substantial scope in most European countries for both increasing the role of carbon pricing and improving economic efficiency. This paper explores these possibilities and compares them to other forms of deficit reduction measures.

The policy scenarios that were assessed

Introduction

We have assessed possible future reform packages using a scenario-based approach. First of all a baseline case was constructed, representing the continuation of current policies in the period up to 2030. Various fiscal reform scenarios were then compared to this baseline to estimate the impacts of the suggested packages.

Scenarios of national tax reform packages

Three case studies were developed to illustrate the potential for energy tax reform in Hungary, Poland and Spain. The three countries all require varying degrees of fiscal tightening, and they also vary in size, location and economic structure.

The design of the tax reforms reflected a combination of:

- moving towards resolution of the discrepancy in carbon tax rates (within countries) shown in the previous section
- the main principles in the proposed revision to the Energy Taxation Directive with, in particular, a focus on taxing emissions outside of the EU ETS
- consultation with national stakeholders

The packages that were assessed were designed to show the potential impacts of energy tax reform. Their main components were increases in the rates of duty paid on diesel and heating fuels other than electricity, phased in over time. Specific details of the three packages are provided in the annex. Each national package raised revenues in the region of 1 to 1.5% of GDP by 2020. The expected impacts of these reforms are compared to alternative tax raising packages that raise similar sums of revenue in each year: changes in direct rates (including personal and corporate income) and indirect (VAT) tax rates.

Scenarios of ETS reform

A second set of scenarios considered how revenues could be raised from the 50% of CO2 emissions that are covered by the EU ETS. There are two main aspects to this:

- auctioning a larger share of allowances
- tightening the cap on emissions

The first of these provides additional revenue to government by selling at auction the allowances that are currently provided to companies for free. The second element reduces the supply of allowances and therefore increases the price at which they may be sold.

Both of these aspects are already under discussion. With respect to auctioning, in Phase III of the ETS (2013-20) the power generation sector will be required to buy its allowances2, although further changes to the proportion of allowances allocated for free versus auctioned are perhaps most likely after 2020. With respect to tightening the cap, the European Commission has published communications (European Commission, 2010 and 2012) regarding the possibility of setting a more ambitious target for emissions reduction, including a substantially increased contribution from ETS sectors.

Our scenario focuses mainly on tightening the cap, but we include additional discussion on allocation mechanisms. Again the scenario is compared to an alternative where the equivalent revenues are raised with increases in direct tax rates.

Summary of scenarios

Table 2 summarises the scenarios.

Table 2. Summary of Modelling Scenarios

Scenario	Countries	Main Sectors Affected	Other Sectors Affected
Spanish ETR	Spain only	Land transport (diesel)	Non-ETS industry (gas) Buildings (gas)
Hungarian ETR	Hungary only	Land transport (diesel)	Non-ETS industry (oil, gas, coal) Buildings (gas)
Polish ETR	Poland only	Land transport (diesel)	Non-ETS industry (oil, gas, coal) Buildings (gas, coal)
ETS reform	EU27	Power generation Industry covered by ETS	All fossil fuels

Note: Some minor tax increases are excluded from table; see annex for further details.

Source: Vivid Economics, Cambridge Econometrics

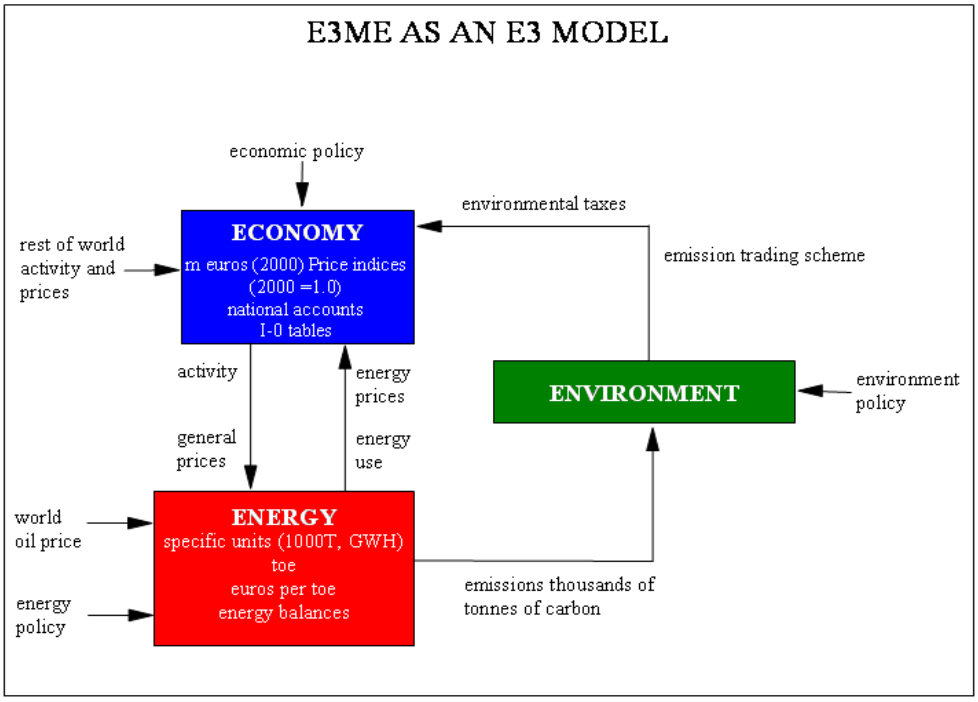
The model used to construct the policy scenarios

[2] Some other industrial sectors, those deemed not to be at risk of carbon leakage, will also be required to purchase between 20% and 70% of a benchmark level of emissions.

The scenarios were assessed using a macroeconomic model, E3ME3. E3ME is a computer-based model of Europe's economies, energy systems, and the environment (hence three Es). It was originally developed through the European Commission's research framework programmes and is now widely used in Europe for policy assessment, forecasting and research purposes.

The model structure is summarised in Figure 1.

Figure 1. The E3ME model consists of three main modules, and their various interactions



Source: Cambridge Econometrics

The economic structure of E3ME is based on the system of national accounts, as defined by ESA95 (European Commission 1996), with further linkages to energy demand and environmental emissions. The economic model includes a full set of macroeconomic feedbacks at the sectoral level that capture supply chain impacts and multiplier effects. In total the model comprises 33 sets of econometrically estimated equations, covering the individual components of GDP (consumption, investment, and international trade), prices, the labour market, energy demand, and materials demand. Each equation set is disaggregated by country and by sector.

The main dimensions of the version of the model used for this analysis are:

- 33 countries (EU27 member states, Norway, Switzerland and four candidate countries)
- 42 economic sectors, including a disaggregation of the energy sectors and 16 service sectors
- 43 categories of household expenditure
- 19 different users of 12 fuel types

[3] See www.e3me.com and Cambridge Econometrics (2011).

- 14 types of air-borne emissions including the six greenhouse gases monitored under the Kyoto protocol.
- 13 types of household, including income quintiles and specific socio-economic groups

E3ME is similar in many ways to a Computable General Equilibrium (CGE) model and produces a similar set of outputs. However, E3ME does not impose the assumptions about the nature of the economy that are typically incorporated in CGE models. Instead E3ME follows a more empirical approach, with behavioural parameters estimated using historical data sets rather than imposed or calibrated to conform with neoclassical economic theory. This means the model's empirical validity does not depend on the validity of the assumptions common to CGE models, such as perfect competition or rational expectations, but it does mean that the model's validity depends on the quality of the data that are used to estimate the parameters.

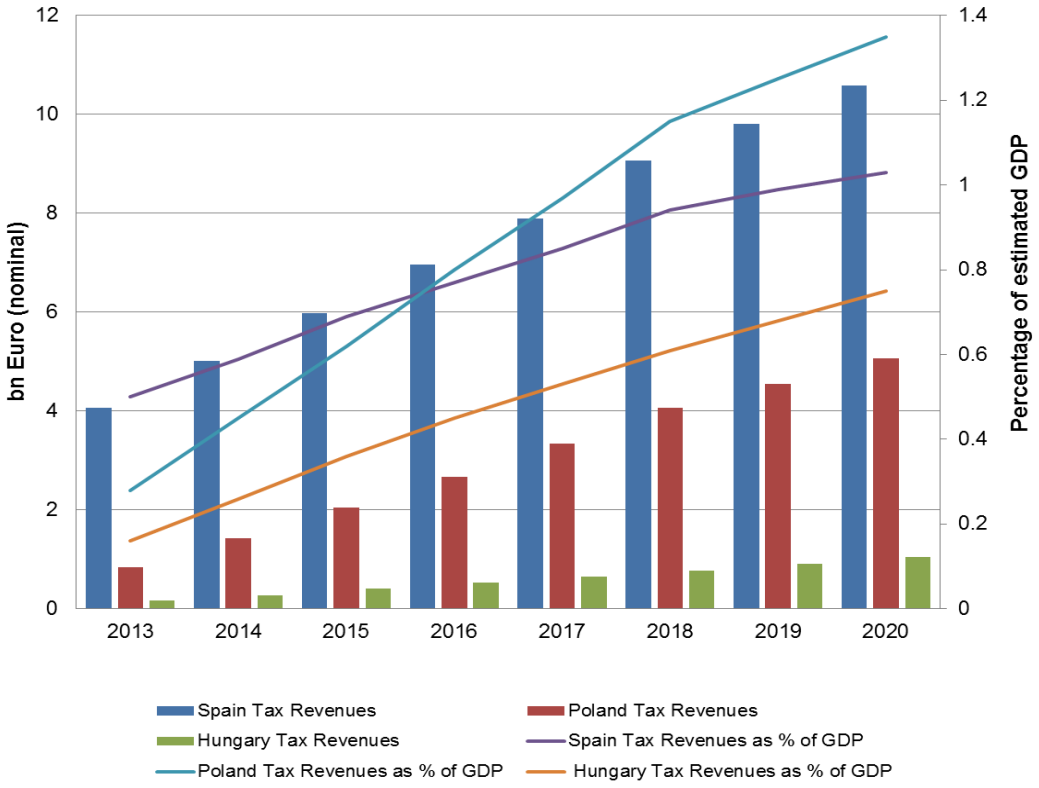
Further information about the E3ME model is available in Cambridge Econometrics (2011).

Results: National Energy Reform Scenarios

Revenues

Figure 2 shows the revenues raised in each of the three national energy reform packages. The immediate effects are quite small because we assume that the reforms are phased in gradually, but increase up to 2020. By 2020 the revenues generated from the reforms will amount to 1 to 1.5% of GDP (and 15-50% of current budget deficits), so that they could play an important role in cutting long-term public deficits in all three countries.

Figure 2. Tax revenues raised from the energy tax packages



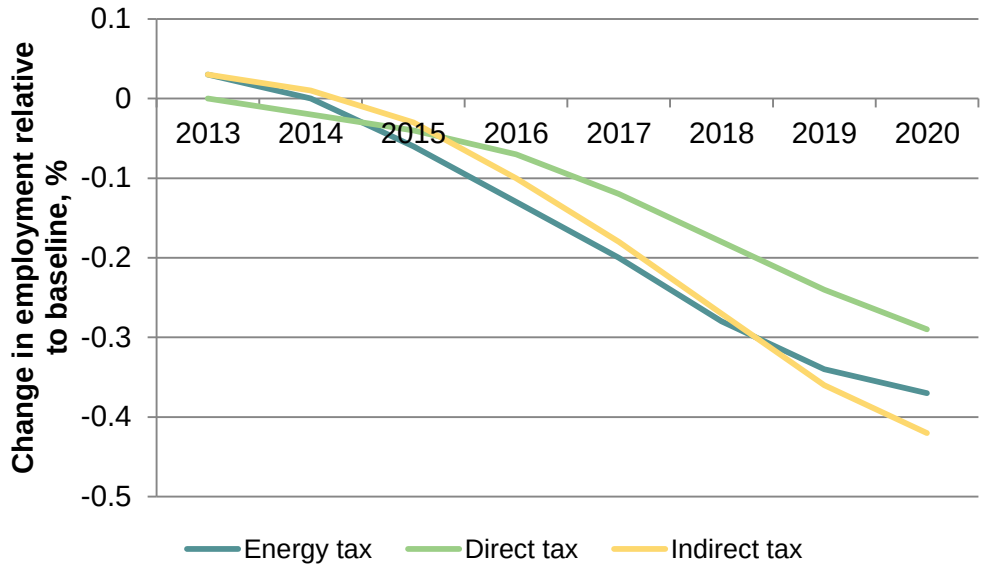
Source Cambridge Econometrics E3ME model

Impacts on GDP and other macroeconomic indicators

Figures 3, 4 and 5 present the impacts on GDP of the energy tax reform packages and compare these with the impact of changes to direct and indirect tax rates that raise the same revenues (compared to the baseline). In all cases the energy tax reform package leads to a small reduction in GDP as energy prices reduce households' real incomes and manufacturing companies' competitiveness.

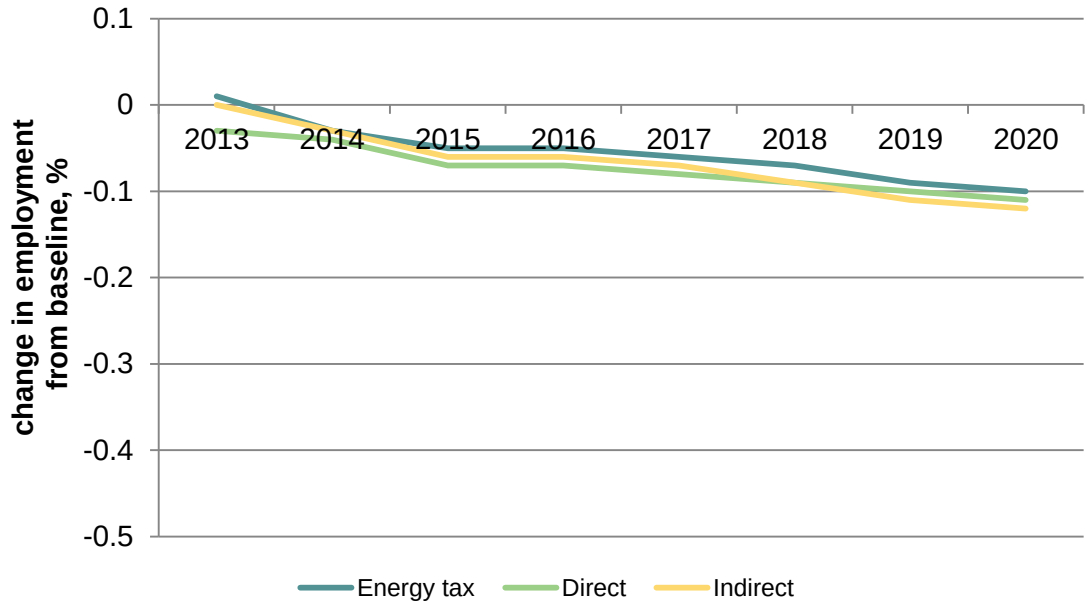
However, in all cases the reduction in GDP from the energy tax reform package is similar to or less than the reduction that results from an increase in indirect tax rates, and it is always less than the reduction that results from an increase in direct tax rates.

Figure 3. Spain: in 2020, the decline in employment from the indirect tax rise is expected to be the greatest



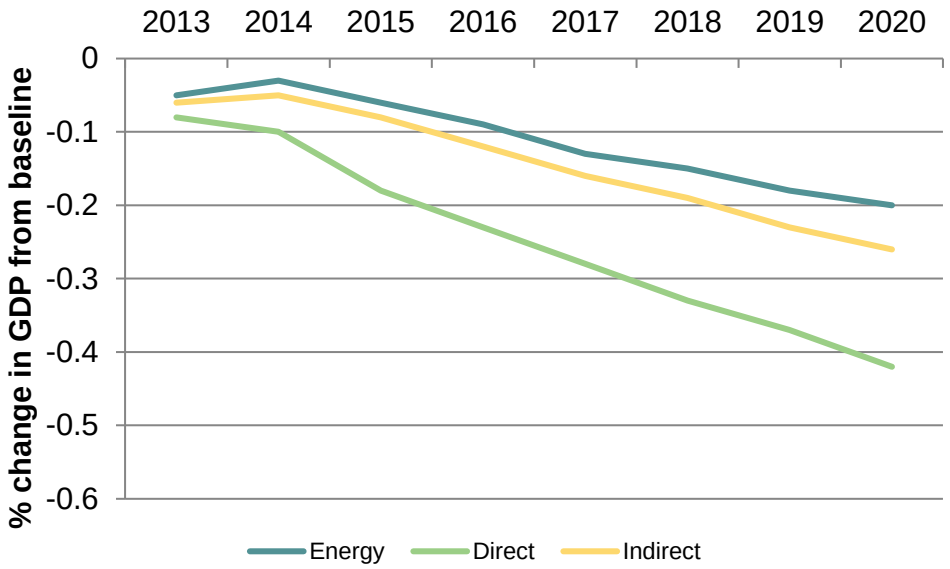
Source Cambridge Econometrics E3ME model

Figure 4. Poland: all of the tax packages are expected to lead to similar declines in employment



Source Cambridge Econometrics E3ME model

Figure 5. Hungary: the model suggests that the energy tax package in Hungary would have a less detrimental impact on GDP than either direct or indirect taxes



Source: Cambridge Econometrics E3ME model

Table 3 summarises the impact on other macroeconomic indicators, including employment, in 2020. The pattern of impacts across the scenarios is generally similar in each case study country.

Table 3. Impact on Macroeconomic variables in 2020, percentage differences from baseline

Variable	Spain			Poland			Hungary		
	Energy	Direct	Indirect	Energy	Direct	Indirect	Energy	Direct	Indirect
GDP	-0.34	-0.56	-0.38	-0.26	-0.46	-0.28	-0.2	-0.42	-0.26
Employment	-0.37	-0.29	-0.42	-0.1	-0.11	-0.12	-0.07	-0.07	-0.11
Consumption	-0.64	-1.14	-0.76	-0.34	-0.74	-0.42	-0.46	-0.98	-0.57
Investment	-0.11	-0.38	-0.11	-0.21	-0.41	-0.24	-0.16	-0.4	-0.26
Exports	-0.16	-0.1	-0.05	-0.01	0	-0.01	-0.01	0	-0.01
Imports	-0.26	-0.57	-0.25	-0.04	-0.25	-0.11	-0.08	-0.17	-0.1

CO2 emissions	-2.83	-0.37	-0.21	-1.32	-0.04	0.02	-1.74	-0.05	0.02
Total fuel consumption for energy use	-3.29	-0.58	-0.43	-1.62	-0.15	-0.06	-1.64	-0.1	-0.07
Tax revenues(% of 2020 GDP)	1	0.6	0.6	1.35	1.21	1.19	1.3	0.75	0.75

Source: Cambridge Econometrics E3ME model

Although the energy, direct and indirect tax packages raise broadly the same revenues, their economic impact differs, for several reasons.

First, both energy and indirect tax increases push up prices, causing a reduction in real incomes and household spending. In most European countries, reliance on imports is greater for energy than for other goods/services. When energy taxes are increased and consumption of energy declines, a substantial proportion of the drop in spending is borne by imports (i.e. by energy producers in other countries). When other indirect taxes are increased, more of the impact is borne by domestic producers. Consequently, raising energy taxes has a smaller direct impact on GDP.

Further, in the case of the energy tax package, some of the money previously spent on imported energy is diverted to other products which are more likely to be produced domestically, including investment goods, further offsetting the decline in GDP.

These factors more than offset the fact that the energy tax is expected to lead to a larger fall in exports (through competitiveness effects) than the indirect tax increase.

The model also has different effects on the labour market arising from energy and indirect taxes on the one hand and direct taxes on the other. Specifically, based on estimated relationships, the changes in consumer prices that follow from increases in indirect or energy taxes are quickly matched by increases in nominal wages, leaving real wages largely unchanged. Consumption, therefore, falls only modestly. By contrast, and in line with empirical estimates of the impact of an increase in direct taxes on wages (Azémar and Desbordes 2010), only around 50% of the initial decline in post-tax wages is offset by higher pre-tax wages, although this proportion can rise over time. So in the direct tax case, real after tax wages are lower and household consumption is lower.

Finally, it is worth noting that all the tax reforms have distributional effects, but the higher energy taxes fall disproportionately on the poorer households. However, the model results show that it would only require a small fraction of the revenue accrued to offset this impact.

Environmental impacts

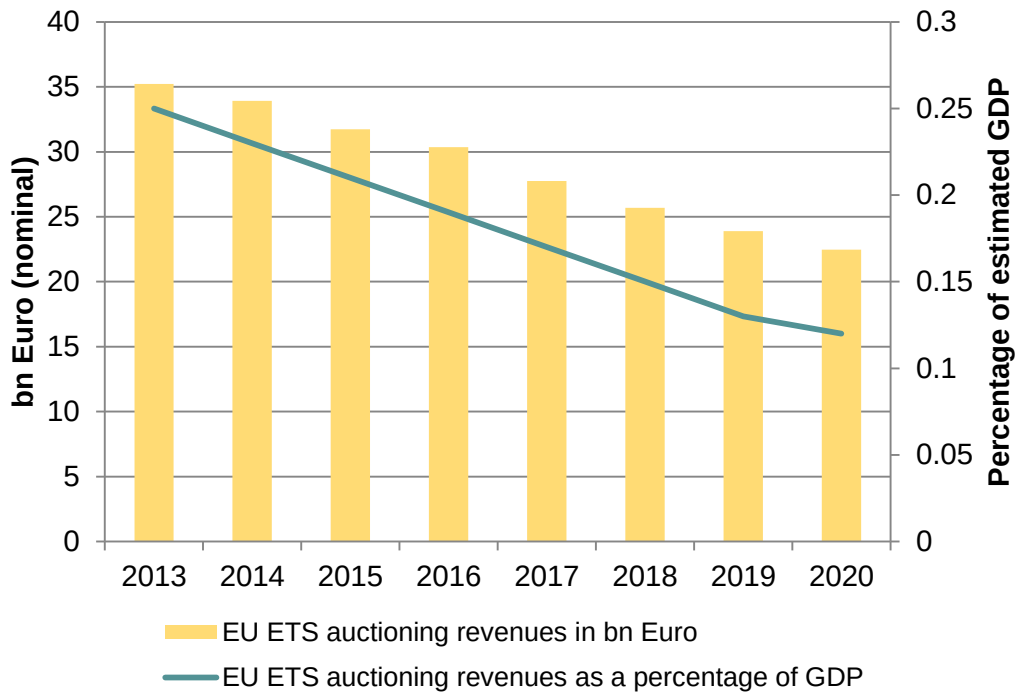
The energy tax reform packages reduce annual CO2 emissions by between 1 and 2% in Hungary and Poland, and nearly 3% in Spain, by 2020 (compared to baseline). In the other scenarios there are also small falls in emissions because output and consumption are lower, but these are much lower (not more than around 0.2%).

Results: ETS Scenarios

Revenues

If the ETS cap is auctioned in line with the EU's ambitious 30% GHG reduction target, the model predicts an increase in the allowance price4. The value of the allowances auctioned increases by up to €35bn in 2013, or 0.25% of GDP, compared to the baseline (see Figure 6). Over time this additional revenue decreases as the number of allowances auctioned each year falls, but it still amounts to an additional 0.1% of GDP in 2020.

Figure 6. EU ETS: a reform could result in more than €30 billion per annum of additional revenues in Europe before 2015



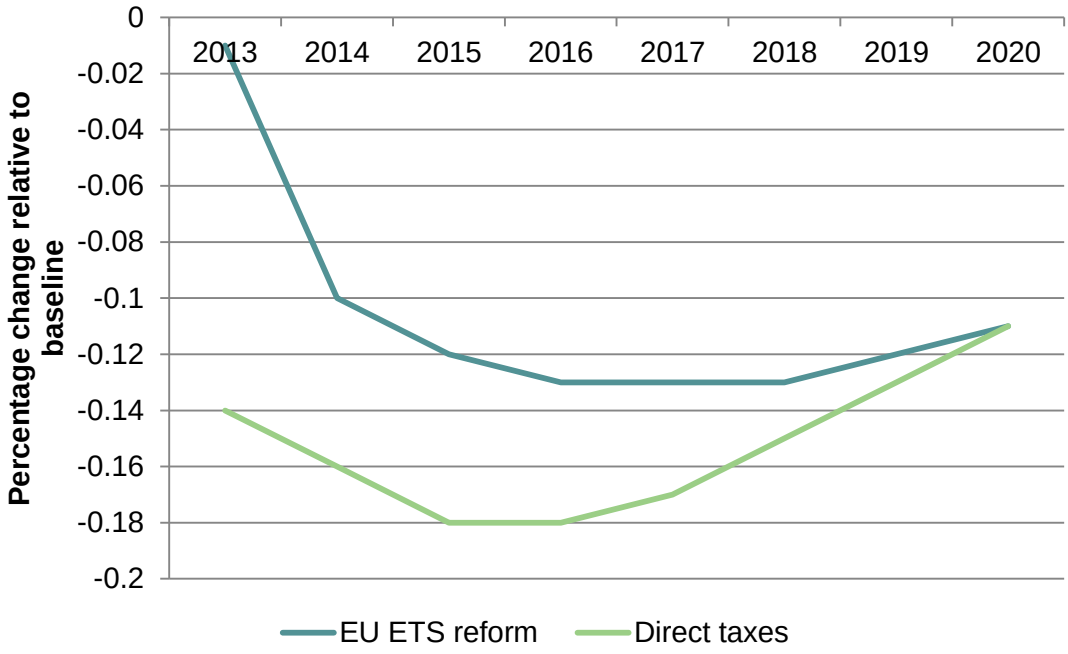
Source: Cambridge Econometics E3ME model

Impacts on GDP

Figure 7 shows the impact of tightening the cap on European GDP, alongside a scenario that raises a comparable sum through an increase in direct taxes. The cost of ETS reform is in the range of 0.1 to 0.15% of annual GDP. The cost of increasing direct taxes is around 0.05 percentage points higher, although the two become similar by 2020 as wage rates adjust.

[4] The model results suggest it could be in the region of €40/tCO2, although this figure is highly sensitive to assumptions about use of offsets and CDMs, and about baseline economic growth rates.

Figure 7. ETS: the E3ME model suggests that using direct taxes to raise the same revenue as provided by EU ETS reform would result in greater losses in GDP



Source: Cambridge Econometrics E3ME model

The pattern of employment impacts is similar to those for GDP, although the impact in percentage terms is less (i.e. around -0.05% in 2020). For other macroeconomic indicators the pattern of results is similar to the national energy reform scenarios, with higher energy prices leading to reductions in real incomes and household spending, but lower imports of fossil fuels.

Environmental impact

Finally, as we expect, reform to the EU ETS results in lower EU carbon emissions. The reduction is between 2.5 and 3% by 2020. The equivalent direct tax scenario has a reduction of 0.1%.

Increasing the share of auctioned allowances

The other way to increase revenues from the ETS is to raise the share of allowances that is auctioned rather than provided freely to companies. Under current proposals a share of allowances is allocated freely and a share is auctioned; the results reported above assume that the reduction in the total number of allowances (required to meet the tighter target) comes entirely from the auctioned share, following the approach used in the European Commission's analysis (European Commission, 2012). If instead the burden of a tighter cap was shared equally between auctioned and freely allocated allowances, this could raise an estimated €20bn across Europe in the period 2013-20, on top of the annual revenues shown in Figure 7.

The cost of this to GDP is unclear. Microeconomic theory suggests that the level of output and prices is set to equate marginal costs and marginal revenues (increasing production beyond this point implying that costs increase more than revenues and hence profits fall). As the number of allowances provided are determined independently of production levels, the profit maximising level of output is not changed. This means that

removing the freely-allocated allowances reduces company profits rather than product prices, which has a much more limited impact on GDP.

The way that prices and output are determined in practice is disputed by the companies involved and there is no conclusive evidence either way. De Bruyn et al (2010) conducts an analysis of several energy-intensive sectors and finds some evidence that energy intensive industries have been making their production decisions independently of the level of free allowance allocation.

Conclusions

Many European countries are still running large deficits and have mounting levels of public debts. Cutting deficit levels has become a short-term priority and it would be sensible for Member States to consider the full range of tax options.

Recognising that raising tax revenues typically reduces GDP, the tax portfolio ought to be weighted towards tax bases associated with the lowest macroeconomic costs. This paper has shown that, at both national and European level, energy and carbon taxes (ETS at EU level) perform well in comparison to direct and indirect taxes, when assessing their impacts on GDP and employment. This is due to a combination of factors, but notably the opportunity to reduce the bill for fossil fuel imports as well as different labour market dynamics. The findings for the three case study countries should hold for all countries with a large dependency on imported fuel.

The evidence collected in this study suggests that energy and carbon taxes currently play too small a role in the tax portfolio of many European countries. This evidence is not widely known, and perhaps this is why these taxes do not fulfil their potential role in fiscal strategy. Road transport fuels, which already make a large contribution to revenues, and whose economic effects are perhaps more widely understood, are an exception to this; they already play a substantial role though there is also still some potential left unused.

Energy/carbon tax and ETS reform are also important instruments in reducing CO2 emissions, and helping to meet the international commitments made by Europe and its Member States. Economists refer to carbon pricing as a means to “internalise the externalities” by setting the price of fuel to reflect its true costs to society, rather than merely the narrower costs of production. The results presented in this paper have shown that the measures could contribute to addressing simultaneously two of the major challenges faced by society at present: cutting public deficits and reducing CO2 emissions. Further research into the political feasibility of carbon tax reform is recommended.

Acknowledgment

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Bibliography

Andersen, MS and Ekins, P (2009) 'Carbon Energy Taxation: Lessons from Europe', Oxford University Press.

Azémar, C and Desbordes, R (2010) 'Who Ultimately Bears the Burden of Greater Non-Wage Labour costs?' In IFS/ETPF conference proceedings, 1-21, London.

Cambridge Econometrics (2011) 'E3ME Manual, Version 5.0', available online: http://www.camecon.com/AnalysisTraining/suite_economic_models/E3ME/E3MEManual.aspx

de Bruyn, S, Markowska, A, de Jong, F, and Bles, M (2010) 'Does the energy intensive industry obtain windfall profits through the EU ETS ? An econometric analysis for products from the refineries, iron and steel and chemical sectors', CE Delft publication, April 2010.

Ekins, P and Speck, S (2011) 'Environmental Tax Reform (ETR)', Oxford University Press.

European Commission (2012) 'Analysis of options beyond 20% GHG emission reductions: Member State results', SWD(2012) 5 final, Brussels. See: http://ec.europa.eu/clima/policies/package/docs/swd_2012_5_en.pdf

European Commission (2011) 'Proposal for a COUNCIL DIRECTIVE amending Directive 2003/96/EC restructuring the Community framework for the taxation of energy products and electricity', COM(2011) 169/3, Brussels. See: http://ec.europa.eu/taxation_customs/resources/documents/taxation/com_2011_169_en.pdf

European Commission (2010) 'Analysis of options to move beyond 20% greenhouse gas emission reductions and assessing the risk of carbon leakage', COM(2010) 265 final, Brussels. See: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2010:0265:FIN:EN:PDF

Guajardo, J, Leigh, D and Pescatori, A (2011) 'Expansionary Austerity: New International Evidence', IMF Working Paper, WP/11/158.

Milne, J and Andersen, MS (2012) 'Handbook of Research on Environmental Taxation', Edward Elgar.

Annex - *Full details of reform packages in Spain, Poland and Hungary*

Spain

Based on conversations with country experts as well as on an analysis of Spain's energy tax curve, we developed the following possible package of national energy tax reforms for Spain. This package, outlined below, underlies the macro-economic modelling undertaken using E3ME.

- An immediate increase in 2013 of the transport diesel rate for non-commercial use to bring the excise duty rate into line with the current petrol rate.
- A more gradual increase in the excise duty rate for non-commercial diesel use between 2013 and 2018 such that, by 2018, the relationship between the diesel and petrol rate reflects the minima in the Energy Tax Directive (as required under the ETD, although the ETD only requires this by 2023).
- A phased increase in the transport diesel rate for commercial purposes such that by 2018 there is no discount for commercial diesel use, as proposed in the ETD.
- Ending of tax exemption for railway diesel and a phased increase in the rate such that by 2020 it is brought into line with prevailing transport diesel rates.
- Phasing out of the reimbursement of diesel excise tax in agriculture by 2020.
- A phased introduction of a tax on domestic consumption of gas starting at €0.15/GJ in 2013 - the minima in the existing Energy Tax Directive - and increasing to €1.27 - the rate proposed for commercial use for installations outside of the EU ETS. 2020 is the year that many other allowances and exemptions identified in the proposed revisions to the Energy Tax Directive are anticipated to expire.
- A phased introduction of a tax on domestic consumption of coal starting at €0.15/GJ in 2013 and increasing to €2.04/GJ (the rate for commercial use) by 2018.
- Compliance with all other minima in the EU Energy Tax Directive. For transport fuel use this is phased gradually over the period to 2018, for non-transport commercial fuel use, there is an immediate adjustment in 2013.
- Automatic indexation on all energy taxes.

This would result in the following profile of energy taxes for Spain, in 2011 prices.

Table 4. A possible profile of revised energy taxes in Spain

Variable	2012	2013	2014	2015	2016	2017	2018	2019	2020
Transport fuels									
Unleaded petrol (€/1,000l)	425	425	425	425	425	425	425	425	425
Transport diesel (€/1,000l)	331	425	432	440	447	451	462	462	462
Transport diesel for commercial purposes (€/1,000l)	330	352	374	396	418	440	462	462	462

Transport diesel used in railways (€/1000l)	0	58	115	173	231	289	346	404	462
Agricultural diesel net of reimbursement (€/1000l)	0	9.84	19.7	29.5	39.4	49.2	59.0	68.9	78.7
Kerosene (€/1,000l)	316	329	341	354	367	379	392	392	392
LPG (€/1,000l)	57.5	131	205	279	353	426	500	500	500
Natural gas (€/GJ)	1.15	2.74	4.33	5.93	7.52	9.11	10.7	10.7	10.7
Other fuel use									
Gas oil, all uses, €/1,000l	84.7	84.7	84.7	84.7	84.7	84.7	84.7	84.7	84.7
Heavy fuel oil, installations outside the EU ETS, €/1,000l	15.0	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8
Heavy fuel oil, installations inside the EU ETS,€/1,000l	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
Kerosene, all uses €/1,000l*	78.7	78.7	78.7	78.7	78.7	78.7	78.7	78.7	78.7
LPG, installations outside the EU ETS, €/100kg	0	64.9	64.9	64.9	64.9	64.9	64.9	64.9	64.9
LPG, installations inside the EU ETS, €/1,000kg**	0	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9
Gas, domestic heating,€/GJ	0	0.16	0.32	0.48	0.64	0.79	0.95	1.11	1.27
Gas, installations outside the EU ETS, €/GJ	0	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27
Gas installations inside the EU ETS, €/GJ***	0	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Coal, domestic, €/GJ	0	0.26	0.51	0.77	1.02	1.28	1.53	1.79	2.04
Coal, installations outside the EU ETS, €/GJ	0.15	1.89	1.89	1.89	1.89	1.89	1.89	1.89	2.04
Coal, installations inside the EU ETS, €/GJ	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Electricity, domestic, €/MWh****	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Electricity, business use, €/MWh****	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8

Note: 2011 prices. Proposal also includes indexing to account for inflation in each year.

* Kerosene for industrial/commercial use as defined under Article 8 of the Energy Tax Directive would continue to be taxed at €315.8/1000l, subject to annual indexation.

** LPG used within installation inside the EU ETS for industrial/commercial use as defined under Article 8 of the Energy Tax Directive would continue to be taxed at €57.5/1000kg, subject to annual indexation.

*** Gas used within installation inside the EU ETS for industrial/commercial use as defined under Article 8 of the Energy Tax Directive would continue to be taxed at €1.15/GJ, subject to annual indexation.

**** Tax is levied at 5.1% of electricity price before VAT, which in 2008 came on average to 5.3 €/MWh for domestic electricity use, and 3.8 €/MWh for business electricity use.

Source: Vivid Economics

Poland

Based on conversations with country experts as well as on an analysis of Poland's energy tax curve, we developed the following package of national energy tax reforms. This package, outlined below, underlies the macro-economic modelling undertaken.

- Steady increases in the excise duty rate on diesel so that Poland is on track to meet the required relationship between the minima rates in the Energy Tax Directive by 2023. This would require increases in transport diesel rates at a faster rate than needed for compliance with the minima in the Directive in 2018. Rebates not linked to energy consumption would be provided for diesel for agricultural use for distributional reasons while preserving the marginal incentive to reduce energy consumption/emissions.
- Introduction of taxes on domestic gas and coal consumption with the rates moving towards the level required by the EU Energy Tax Directive for installations outside the EU ETS.
- Compliance with all other minima rates in the EU Energy Tax Directive proposals, with steady increases between current levels and future minima where this is allowed.
- Automatic indexation on all energy taxes.

This would lead to the following profile of taxes, shown in table 5.

Table 5. A possible profile of revised energy taxes in Poland, euros, 2011 prices

Variable	2012	2013	2014	2015	2016	2017	2018	2019	2020
Transport fuels									
Unleaded petrol (€/1000l)	422	422	422	422	422	422	422	422	422
Transport diesel (€/1000l)	327	339	351	363	375	387	399	411	423
Kerosene (€/1,000l)	462	462	462	462	462	462	462	462	462

LPG (€/1,000l)	208	257	305	354	403	451	500	500	500
Natural gas (€/GJ)	0	1.8	3.6	5.4	7.2	8.9	10.7	10.7	10.7
Other fuel use									
Gas oil, all uses*, €/1,000l	58.9	58.9	58.9	58.9	58.9	58.9	58.9	58.9	58.9
Heavy fuel oil, installations outside the EU ETS, €/1,000l	16.3	22.0	27.7	33.5	39.2	44.9	50.6	56.4	62.1
Heavy fuel oil, installations inside the EU ETS,€/1,000l	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3
Kerosene, all uses €/1,000l**	58.9	58.9	58.9	58.9	58.9	58.9	58.9	58.9	58.9
LPG, installations outside the EU ETS, €/1,000kg***	0	7.2	14.4	21.6	28.8	36.1	43.3	50.5	57.7
LPG, installations inside the EU ETS, €/1000kg***	0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Gas, domestic heating,€/GJ	0	0.14	0.28	0.43	0.56	0.71	0.85	0.99	1.13
Gas, installations outside the EU ETS, €/GJ	0	0.14	0.28	0.43	0.56	0.71	0.85	0.99	1.13
Gas installations inside the EU ETS, €/GJ	0	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Coal, domestic, €/GJ****	0	0.23	0.45	0.68	0.91	1.13	1.36	1.59	1.81
Coal, installations outside the EU ETS, €/GJ****	0	0.23	0.45	0.68	0.91	1.13	1.36	1.59	1.81
Coal, installations inside the EU ETS, €/GJ****	0	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Electricity, domestic, €/MWh	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1
Electricity, business use, €/MWh	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1

Note: 2011 prices. Proposal also includes indexing to account for inflation in each year.

* Gas oil used for industrial/commercial use as defined under Article 8 of the current Energy Tax Directive would continue to be taxed at €327.1/1000l subject to annual indexation.

** Kerosene used for industrial/commercial use as defined under Article 8 of the current Energy Tax Directive, as well as kerosene as defined as CN2710 1925 would continue to be taxed at €462.8/1000l subject to annual indexation.

*** LPG used for industrial/commercial use as defined under Article 8 of the current Energy Tax Directive would continue to be taxed at €207.7/1000kg subject to annual indexation.

**** This modelling was undertaken before the recent introduction of a coal tax in Poland was introduced. The 'current' coal tax rate is therefore given as 0 (as was used in the model), even though Poland is now levying a tax of €0.29/GJ on coal.

Source: Vivid Economics

Hungary

Based on conversations with country experts as well as on an analysis of Hungary's energy tax curve, we identified the following package of national energy tax reforms. This package underlies the macro-economic modelling undertaken.

- Removal of the reduced rate for commercial diesel use in 2013.
- Removal of tax exemption for railway diesel, and a phased increase in the rate such that by 2020 it is brought into line with prevailing transport diesel rates.
- A steady increase in the tax rate on transport diesel so that Hungary is on track to comply with the requirement of the EU Energy Tax Directive that the relationship between the different minima rate for petrol and diesel will be reflected in national tax rates by 2023.
- Removal of subsidies for domestic gas consumption in 2012.
- Introduction of taxes on the domestic consumption of coal and gas, steadily increasing at the same rate as taxes on the use of these fuels by installations outside the EU ETS will be required to increase in order to comply with the Energy Tax Directive.
- Removal of the lower rate for VAT for district heating in 2017 (halfway through the period during which increases in the real rates of tax on domestic coal and gas would be phased in).
- Compliance with all other minima rate set out in the EU Energy Tax Directive proposals, with steady increases between current levels and future minima where this is allowed.
- Automatic indexation on all energy taxes.

Table 6 outlines the impact of this proposal on the energy tax rates in Hungary, with tax rates given in euros.

Table 6. A possible profile of revised energy taxes in Hungary, euros, 2011 prices

Variable	2012	2013	2014	2015	2016	2017	2018	2019	2020
Transport fuels									
Unleaded petrol (€/1,000l)	438	438	438	438	438	438	438	438	438
Transport diesel (€/1,000l)	362	372	383	393	403	414	424	434	445
Transport diesel for commercial purposes (€/1,000l)	362	372	383	393	403	414	424	434	445

Transport diesel used in railways (€/1,000l)	0	56	111	167	222	278	334	389	445
Kerosene (€/1,000l)	453	453	453	453	453	453	453	453	453
LPG (€/1,000l)	175	229	283	338	392	446	500	500	500
Natural gas (€/GJ)	0	1.79	3.57	5.36	7.15	8.93	10.7	10.7	10.7
Other fuel use									
Gas oil, all uses, €/1,000l	362	362	362	362	362	362	362	362	362
Heavy fuel oil, installations outside the EU ETS, €/1,000l	16.2	21.9	27.7	33.4	39.1	44.9	50.7	56.3	62.1
Heavy fuel oil, installations inside the EU ETS,€/1,000l	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2
Kerosene, all uses €/1,000l	453	453	453	453	453	453	453	453	453
LPG, installations outside the EU ETS, €/1,000kg*	0	6.9	14.2	21.4	28.7	35.9	43.2	50.4	57.7
LPG, installations inside the EU ETS, €/1,000kg**	0	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9
Gas, domestic heating,€/GJ	0 - subsidies removed	0.14	0.28	0.42	0.56	0.71	0.85	0.99	1.13
Gas, installations outside the EU ETS, €/GJ	0.32	0.43	0.53	0.64	0.74	0.85	0.95	1.06	1.16
Gas installations inside the EU ETS, €/GJ	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32
Coal, domestic, €/GJ	0	0.51	0.7	0.89	1.08	1.28	1.47	1.66	1.85
Coal, installations outside the EU ETS, €/GJ	0.32	0.51	0.7	0.89	1.08	1.28	1.47	1.66	1.85
Coal, installations inside the EU ETS, €/GJ	0.32	0.28	0.25	0.21	0.18	0.14	0.11	0.07	0.04
Electricity, domestic, €/MWh	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08
Electricity, business use, €/MWh	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08
District heating, VAT rate, %	5%	5%	5%	5%	5%	25%	25%	25%	25%

Note: 2011 prices. Proposal also includes indexing to account for inflation in each year.

*	LPG used for commercial/industrial purposes as defined under Article 8 would continue to be taxed at €44.2/1000kg until 2019.
**	LPG used for commercial/industrial purposes as defined under Article 8 would continue to be taxed at €44.2/1000kg.
Source:	Vivid Economics