IS THERE A NEED FOR POLICY INTERVENTION TO OFFSET COSTLY CAPITAL REQUIREMENTS TO SUPPORT INDUSTRIAL DECARBONISATION IN PURSUING A JUST TRANSITION TO NET ZERO?

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Overview

Much focus in industrial decarbonisation research to date has been on the development and deployment of technologies, and on cost reduction where solutions, such as carbon capture and storage (CCS), involve large capital investment and operational expenditures. Our research shifts focus to the need to investigate how deployment and uptake of such solutions may impact across all sectors of the wider economy through a range of prince, income and market effects, particularly direct and indirect effects on competitiveneness and supply chain activity. Thus, outcomes can have important implications for government and political decision making, household earning capacity and real incomes. Capturing all of this requires analysis that incorporates a multi-sector economy-wide perspective in order to understand how impacts in different time frames may be affected under a range of scenarios encompassing different ways of funding costly additional capital requirements (from 'polluter pays' to full socialisation through taxation) under different circumstances affecting the public sector budget (whether Government requires a balanced budget in any time period) and how labour, capital and good/services markets and supply chains function.

We focus here on the case of the UK, which legislated for a 2050 'net zero' target in 2019 in line with the more ambitious 1.5 degree celcius ambitions of the Paris Agreement. In this context, it is crucial that attention is not limited to the technical 'how', but that research focus on the real political economy challenges that arise in balancing the timing and extent of the UK's contribution to limiting global warming against the need for a sustainable and equitable evolution of the nation's economy. A key context is the UK Government's Industrial Strategy and the role identified for CCS in decarbonising the nation's industrial clusters. This is set against the backdrop of a history of problematic transitions (e.g. out of coal mining and much heavy manufacturing) and the economic value and jobs currently generated through the oil and gas industry.

In this presentation, we focus attention on the challenge of decarbonising the UK Chemicals industry, much of which is located in two or three of the UK's six high point source emission 'industrial clusters' targeted by UK Government for deep decarbonisation, but which plays an important role in supporting both high value and significant numbers of jobs across the UK, and in contributing to the nation's GDP. Previous analyses have shown that, between direct industry and supply chain jobs, the UK Chemicals industries support wage levels markedly above the Scottish average wage. However, there is policy concern that this value may be at risk if the need to pay for firms to pay additional capital that delivers reduced CO_2 emissions without additional output (thereby reducing capital productivity/efficiency) negatively impacts competitiveness. Here we consider how outcomes are impacted if the polluter is reqired to pay set against the potential for additional capital costs associated with delivering deep decarbonisation can be socialised through the tax system. We find that, where there is a risk of negative competitiveness effects (e.g. unilateral action), socialising costs could help reduce impacts GDP and high value chemicals industry and supply chain jobs. But there is a trade-off in terms of other jobs economic activity driven and supported by household spending. On the other hand, given the transformative nature of the net zero transition, such outcomes should be set in the context of how other elements of the transition (e.g. residential energy efficiency gains) could offset negative impacts arising from household real income effects.

Methods

We use a dynamic CGE model of the UK economy, UKENVI. It is calibrated using a 2016 UK Social Accounting Matrix (SAM), which includes 33 industrial sectors, including an aggregated Chemicals industry. We identify final domestic public and private consumers (UK Government and households). We also identify income and trade flows with the rest of the World (ROW), with UK and ROW products being imperfect substitutes (Armington assumption) and exports responding to changes in relative prices. We assume that the labour market is characgterised by a bargaining set up where the real wage is negatively related to the unemployment rate (so that wages are determined in an imperfect competition setting). Total national labour supply is constrained. Changes in returns to capital at the sectoral level influence investment activity, with an intertemporal adjustment process that allows the capital stock to adjust over time. We also vary assumptions regarding the public budget, from a case where a deficit can build up to

ones where Government balances the budget either by reducing expenditure or increasing income taxes. Here we headline results from a case (informed by discussions with the one of the largest Chemicals firms operating in the UK, INEOS, around carbon capture as an example of a decarbonisation solution with significant capital costs) where increased capital requirements reduce capital efficiency by 30%. We consider two scenarios where industry operators bear all the additional capital costs or Government fully socialises the costs through the income tax system. We extend to consider how outcomes may be impacted if (a) the UK Government acts to offset cost differentials through import tariffs, (b) international competitors bear similar costs, (c) the UK gains an early mover advantage in deploying carbon capture.

Results

Table 1: Percentage changes in key macroeconomic and socio-economic indicators for the reference 'polluter pays' and 'income tax funded subsidy' cases (changes compared to base year values, CET 2 and CES K-L elasticity of substitution 0.3)

		2030		2050	
Year	Base (2016) values	Households pay subsidy directly, Import & Export price unchanged, 30% efficiency reduction	Polluter pays, Import & Export price unchanged, 30% efficiency reduction	Households pay subsidy directly, Import & Export price unchanged, 30% efficiency reduction	Polluter pays, Import & Export price unchanged, 30% efficiency reduction
GDP (£million)	1,751,690	-0.063	-0.113	-0.042	-0.118
CPI (indexed to 1)	1	-0.003	0.035	-0.014	0.047
Nominal wage pre-tax (indexed to 1)	1	-0.035	-0.062	-0.029	-0.056
Real wage pre-tax (indexed to 1)	1	-0.032	-0.097	-0.015	-0.104
Total Imports (£million)	515,335	-0.027	0.001	-0.037	0.007
Total Exports (£million)	477,563	-0.040	-0.299	0.026	-0.293
Total Employment (FTE)	29,300,731	-0.015	-0.045	-0.007	-0.049
Investment (£million)	310,036	0.206	0.072	0.171	0.065
Real Earnings - employment (£million)	967,471	-0.047	-0.160	-0.018	-0.169
Real Earnings per employee (£)	33,019	-0.032	-0.115	-0.011	-0.120
Productivity (£ GDP per FTE)	59,783	-0.048	-0.068	-0.035	-0.069
Real Household Expenditure (£million)	1,185,745	-0.096	-0.052	-0.089	-0.055
Imports of Chemicals (£million)	6,532	1.225	6.312	0.146	5.472
Chemical industry exports (£million)	12,907	-1.682	-9.327	-0.001	-8.211
Chemical industry employment (FTE)	90,445	-0.810	-5.452	0.133	-4.795
Chemical industry investment (£million)	2,047	34.187	26.350	28.526	22.161
Price of Chemical industry output (indexed to 1)	1	0.852	5.017	0.000	4.377
Chemical industry output (£million)	31,785	-1.073	-6.848	0.124	-6.026

Table 2: Percentage changes (2050) in key macroeconomic and socio-economic indicators for reference 'polluter pays' and 'income tax funded subsidy' cases - comparing outcomes with changing import/export prices and/or UK gains in comparative advantage

		Polluter pays			
Year	Households pay subsidy directly, Import & Export price unchanged	Import & Export price unchanged	Import price +6.9%	Import & Export price +6.9%	Import & Export price +6.9%
Efficiency reduction in Chemical industry	30% efficiency reduction	30% efficiency reduction	30% efficiency reduction	30% efficiency reduction	15% efficiency reduction
GDP (£million)	-0.042	-0.118	-0.167	-0.112	-0.041
CPI (indexed to 1)	-0.014	0.047	0.063	0.126	0.099
Nominal wage pre-tax (indexed to 1)	-0.029	-0.056	-0.111	0.016	0.052
Real wage pre-tax (indexed to 1)	-0.015	-0.104	-0.174	-0.110	-0.047
Total Imports (£million)	-0.037	0.007	-0.092	0.114	0.115
Total Exports (£million)	0.026	-0.293	-0.426	-0.209	-0.030
Total Employment (FTE)	-0.007	-0.049	-0.082	-0.052	-0.022
Investment (£million)	0.171	0.065	-0.004	0.078	0.042
Real Earnings - employment (£million)	-0.018	-0.169	-0.274	-0.165	-0.062
Real Earnings per employee (£)	-0.011	-0.120	-0.192	-0.113	-0.040
Productivity (£ GDP per FTE)	-0.035	-0.069	-0.085	-0.060	-0.020
Real Household Expenditure (£million)	-0.089	-0.055	-0.119	-0.040	-0.005
Imports of Chemicals (£million)	0.146	5.472	2.233	3.889	0.755
Chemical industry exports (£million)	-0.001	-8.211	-12.405	0.004	5.099
Chemical industry employment (FTE)	0.133	-4.795	-5.885	-0.215	2.719
Chemical industry investment (£million)	28.526	22.161	20.732	28.031	15.073
Price of Chemical industry output (indexed to 1)	0.000	4.377	6.847	6.898	4.274
Chemical industry output (£million)	0.124	-6.026	-7.767	-2.187	1.453

Conclusions

Our results show that the extent of losses under a polluter pays approach are very much dependent on the extent to which the impact of additional operating capital costs on industry output prices affects the competitiveness of a UK Chemicals industry engaged in carbon capture in wider global markets. Thus the implied value of subsidy action, which involves trade-offs in terms of GDP, employment and earnings losses in other parts of the UK economy very much depends on the extent to which potential trade responses can be anticipated. The critical outcome emerging from our CGE analyses is that the economy is likely to contract regardless of 'who pays', with this being a question of the extent and distribution of net losses. Thus, where the economy is likely to respond to price and income effects in the types of ways simulated here, the key policy implication emerging is the need to identify and enable solutions that allow the challenging, but likely essential, implementation of industrial carbon capture in a manner where the distribution of costs is acceptable to society. If not, there is a need to investigate how undesirable impacts could be offset, or compensated. The most direct challenge for CCS in this regard is whether the deployment of full chain CCS could potentially generate sufficient GDP, income and revenue to justify policy action to protect the competitiveness of capturing firms, in addition to a range of other likely demands on public resources in supporting infrastructure and regulatory requirements.