Historic paths and future expectations: the macroeconomic impacts of the offshore wind technologies in the UK

Marcello Graziano, Department of Geography, Central Michigan University, +1-989-774-1627, grazi1m@cmich.edu
Marta Musso, European University Institute, +39-055-4685-425, marta.musso@eui.eu
Patrizio Lecca, Joint Research Centre - Seville, +34-9544-88756, Patrizio.LECCA@ec.europa.eu

Overview

Offshore wind power (OSW) plays a key role within the UK strategy for a transition towards a low-carbon economy, offering vast potential for establishing a high-tech manufacturing industry. Previous experiences in the onshore sector (OWP) suggest the UK might fail in fully capturing these macroeconomic benefits. In this work, we investigate the history of UK renewable policies, comparing its national strategy to those of other major OSW-export countries. In the UK, the adoption of this technology is driven by three main objectives: lowering the overall carbon emissions of the country, increasing energy security through the exploitation of a domestic resource, and providing new manufacturing jobs (Dawley et al. 2015; HM Government 2013; McNeil et al. 2013; The Scottish Government 2010; The Scottish Government 2011). Although the first two objectives can be achieved by simply increasing the installed capacity and the electricity output produced using OSW and other renewables, the third objective depends on 'where' the supply chain of OSW is located. Understanding the economic impact of OSW is one of the major focuses in the recent stream of literature in the UK and its sub-regions, particularly Scotland, where most of the OSW potential is located.

Methods

Our work utilizes two approaches. First, we present a historic policy analysis based on recent literature, to identify the major characteristics of the OSW industry and support policies in the UK in relation to both the OWP sector (as a 'close' sector, see e.g. Gernaat et al., 2014), and other major European OSW exporters (Germany, Spain, and Denmark). Second, we utilize existing deployment projections for OSW, and the unstable character of past UK energy support policies to inform the UKENVI General Equilibrium Model (CGE) for performing a series of experiments (Allan et al., 2007; Lecca et al., 2014; Lecca et al., 2017). Under myopic expectations, consumption is simply determined as a fixed share of current income while investments follow a simple adjustment rule, according to which the additional level of investment is determined by the gap between the desired level of capital and the actual level of capital. This is a typical accelerator model developed originally by Jorgenson (1963) and consistent with the capital adjustment rules of Uzawa (1969). Capital stock is immobile across sectors, and updated at each new period through investments adjusted for depreciation. Equilibrium in the commodity markets is sufficient to guarantee equilibrium also in the payments account, since we are not considering money as a commodity. As for the capital market, capital demand equals the capital stock, and the labour market is balanced through endogenous changes in the unemployment rates. The model calibration employs the data derived from the UK Social Accounting Matrix for the year 2010 (Lecca et al., 2017). These scenario experments include: a baseline, which relies on previous estimates and foresee limited local content; a 'contamination' scenario, where the UK content reaches the same levels of OWP; and a 'non-myopic' scenario, where investors expect governmental support to decrease or disappear, replicating a common path of past renewable policies.

Results

From the our historic policy analysis, we identify the UK as a foreign direct investment (FDI)-oriented country. The country's policies, which focus on sustaianing deployment of OSW rather than the development of a national supply-chain, combined with a vast endowment of OSW resources, have attracted several foreign-based investors. This strategy contrasts with the strategies implemented by the other comparable countries. Further, these policies may hamper the efforts to fulfil national and devolved objectives in terms of job creation and economic growth in conjunction with low-carbon transtition. Our simulations show several interesting results. The 'contamination' scenario results are shown in Figure 6. The non-myopic' scenario show that the unstable character of UK policies for supporting OSW can greatly reduce the economic benefits of OSW deployments (Figure 7).

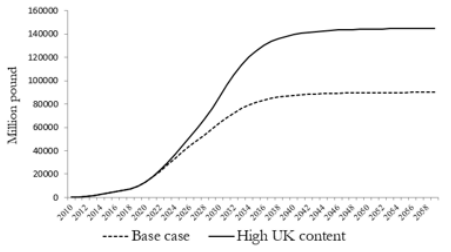

Figure 6 GDP cumulative deviations from base year values, Millions under two different assumptions about UK content

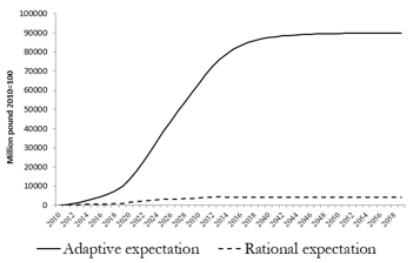

Figure 7 Cumulative GDP under myopic and forward looking agents

Conclusions

UK renewable energy policies have been crafted to include the creation of a strong, UK-based manufacturing supply-chain capable of supporting highly paid manufacturing jobs. In our work, we attempt to show that policies aimed at supporting a specific renewable energy, OSW, and whose expectation is to generate widespread and positive macroeconomic impacts, might fail to achieve this objective under certain circumstances. Specifically, we consider two important factors influencing these macroeconomic outcomes*: i) the extent to which the local supply chain is developed enough to satisfy the additional increase in demand of OSW; and ii) the response of economic agents under the uncertainty associated to governmental support*. Both these factors are influenced by the changes and uncertainties of past policies, or whose effects are powerful enough to establish a multi-sectoral influence (. Furthermore, the overall ability of governments to reduce the uncertainty linked to the support policies is necessary to guarantee significant and continuous macroeconomic benefits. Past experiences can influence agents' decisions, and history shows that uncertainty, rather than stable support, is a major actor in undermining investments in renewables (Lewis and Wiser, 2007; Ćetković and Buzogány, 2016).

Our modelling exercise suggests that the magnitude of the impact significantly increases with improvement in the local content. This difference represents the benefits of expanding the UK-based supply chain, possibly at the expense of foreign suppliers. In the model, we assumed that local content would rise to levels like those of a related and more mature sector, OWP. We have found that uncertainty can jeopardize any potential expansion of the local supply chain. Essentially, our results suggest that the behaviour of economic agents in relation to the uncertainty associated to the support scheme could be even more important than any short-term industrial policy supporting the expansion of a UK-based supply chain. We have tried to mimic such a behaviour assuming forward-looking agents in a context of temporary government support of OSW in contrast to myopic agents. Two lessons can be learned by our analysis. Firstly, the 'prize' for increasing local content can be substantial, although, in the context of the UK, an historic lack of direct industry-related interventions, and especially a lack of policies to support export-oriented advanced manufacturing, suggest these 'local content premiums' might not be attained in the short term, even after the Brexit vote, due to a lack of actor-firms capable of seizing this opportunity. Secondly, the historic uncertainty of renewable energy support policies in the UK bears a high cost in terms of reduced macroeconomic benefits. In this sense, linking the implementation of renewable energy to more than one policy domain (emission reduction and economic development) has the potential to stabilize the policy landscape, and to generate confidence in investors (Graziano et al., 2016).

References

Allan G., Hanley, N., McGregor, P., Swales, K. and Turner, K., 2007. The impact of increased efficiency in the industrial use of energy: A computable general equilibrium analysis for the United Kingdom. Energy Economics, 29(4), pages 779-798.

Ćetković, S. and Buzogány, A., 2016. Varieties of capitalism and clean energy transitions in the European Union: When renewable energy hits different economic logics. Climate Policy. 16(5); 642-657.

Dawley S., MacKinnon D., Cumbers A., Pike A., 2015. Policy activism and regional path creation: the promotion of offshore wind in North East England and Scotland. Cambridge Journal of Regions, Economy and Society, 8: 257-272.

Gernaat, D.E.H.J., van Vuuren, D.P., van Vliet, J., Sullivan, P., Arent, D.J., 2014. Global long-term cost dynamics of offshore wind electricity generation. Energy, 76: 663-672.

Graziano, M., Billing, S-L., Kenter, J., and Greenhill, L., 2016. A transformational paradigm for marine renewable energy development. Energy Research and Social Science, 23: 136-147.

HM Government, 2013. Offshore Wind Industrial Strategy - Business and Government Action.

Lecca, P., McGregor, P.G., Swales, J.K., and Turner, K., 2014. The added value from a general equilibrium analysis of increased efficiency in household energy use, Ecological Economics, 100(C): 51-62.

Lecca, P., McGregor, P. G., Swales, J. K., and Tamba M., 2017. The Importance of Learning for Achieving the UK's Targets for Offshore Wind. Ecological Economics. Vol. 135(5): 259-268.

Lewis, J., Wiser, R., 2007. Fostering a Renewable Energy Technology Industry: An International Comparison of Wind Industry Policy Support Mechanisms. Energy Policy, 35: 1844–1857.

McNeil C., Rowney, M. and Straw, W., 2013. Pump up the volume – Bringing down costs and increasing jobs in the offshore wind sector. Institute for Public Policy Research, London (UK).

Jorgenson D. W., (1963). Capital Theory and Investment Behaviour. American Economic Review, Vol. 53, No. 2, pp. 247-259.

Uzawa H., (1969). “The Preference and Penrose Effect in a Two-Class Model of Economic Growth”. The Journal of Political Economy, Vol. 77, No.4, pp. 628-652.
The Scottish Government, 2010. A Low Carbon Economic Strategy for Scotland. APS Group Scotland.

The Scottish Government, 2011. 2020 Routemap for Renewable Energy in Scotland.