

# Natural Geography, Firm Location and the Corporation Tax Debate

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## Abstract

In this article we describe our ongoing research to investigate the impact of geography on firms' location decisions. This work allows us to comment on a key current policy debate, by assessing whether independent control over corporation tax offers an effective lever for a nation (e.g. Scotland) to offset aspects of geographic disadvantage when competing against other nations within Europe to attract foreign direct inward investment.

## 1. Introduction

In this article we summarise some key findings from our ongoing research into how natural geography influences the success of nations competing to attract firms into a supranational region.

Our analysis is based on a stylised model designed to capture two key features of natural geography: the relative size and centrality of nations. We initially assume that corporation tax is the same in each nation and gain insights on how these key features of natural geography impact on firms' location decisions. We then review the UK Government's recent changes in corporation tax, which it views as a key element of its growth strategy. We also review the motivation for the Scottish Government's desire to reduce the rate of corporation tax in Scotland to below the unified UK rate.

Within the context of our model we then explain how we can assess whether independent control over corporation tax offers an effective lever for a nation to offset aspects of geographic disadvantage when competing to attract inward foreign direct investment to a supra-national region. We show that lower corporation taxes do have the potential to attract additional inward investment and mitigate the geographic disadvantage of being a relatively small nation on the periphery of a large multi-state region. In addition, even if the governments of other nations respond to such a tax cut, their responses do not fully match the initial cut, thereby limiting the 'race to the bottom' effect.

In section 2 we explain the key features of our stylised model and characterise how firms' location decisions are made. Section 3 summarises our findings on how natural geography impacts on the distribution of firms across nations. In section 4 we contrast recent UK policy on corporation tax with the Scottish Government's desire to take control of, and reduce, the rate of corporation tax in Scotland. In section 5 we explain how we use the model to gain insights on whether independent control over corporation tax offers an effective lever for a nation to offset aspects of geographic disadvantage when competing to attract inward foreign direct investment. Section 6 concludes.

## 2. Key features of our stylised model

Our stylised model involves just three nations that together comprise a supranational free trade region.

### *Natural geography:*

The first aspect of natural geography incorporated into the model is the size of each nation. From the perspective of the firms coming into the region and setting up a production plant, the size of the nation they choose matters since that nation's consumers constitute their local market; a larger nation has more consumers, so providing a larger local market for the firms' production.

### *Centrality and the costs of exporting:*

The second aspect of natural geography incorporated into our model is the centrality of each nation. Centrality matters because firms incur additional costs when they export goods to the other nations within the free trade region. These additional costs incurred when exporting involve shipping costs as well as any associated administrative costs, but we assume that they are not prohibitive, so that each firm choosing to locate within a given nation will still choose to sell both in the market of its host nation and export to the other nations throughout the free trade region. However, it is reasonable to assume that the costs of exporting will be higher the greater the number of national borders crossed by the firm's exports en-route to their final destination.

We capture these features within our model through characterising one of the three nations as a 'hub' with the other two nations located in spoke positions. The additional costs incurred through exporting will be lowest for firms choosing to locate in the hub nation, since these firms' exports can reach their destination by crossing just one national border. The exports of firms choosing to locate in the spoke nations can reach the hub nation by crossing one border, but when the two spoke nations trade with each other their exports first cross the border to the hub then travel onwards and cross a second border, that between the hub and their final destination. The costs incurred by firms that export from one spoke nation to the other are therefore higher than the costs incurred by firms exporting from hub to spoke or spoke to hub. Note that even if it is in principle possible for firms located in either of the spokes to ship goods directly to the other without going through the hub, our logic holds provided the costs incurred through shipping direct exceed those of going through the hub.

This model seems justified, since it is consistent with available evidence. For example, Scottish Government (2009) reports that oil exports "are piped to England (or via England to Continental Europe)" (p46) while "much of the whisky destined for European consumption is transported by road to cross the Channel at Dover" (p52), and in the case of fish "significant road freight movement (...) is to the south of England before being transported to mainland Europe for distribution around the World"(p55).

A visual representation of these features of size, centrality and trade costs for a stylised three nation region is provided in Figure 1 below. From the perspective of Scotland and the rest of the EU, England is a central hub through which all shipments of goods must pass. Scotland and the rest of the EU respectively are spoke locations of very different sizes.

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**Figure 1:** Natural Geography



*Firms' location decisions*

We consider the location decisions of a fixed number of companies, currently located outside the supranational free trade region, each of which has decided to set up a firm (a production facility) within the region. We assume that each firm faces identical fixed costs of setting up a production facility whichever nation it chooses. We further assume that these fixed costs are sufficiently large to ensure that each company will set up, at most, one production facility within the region<sup>1</sup>.

We assume that firms are able to segment the national markets, choosing how much to sell in each. The greater the number of firms attracted to produce within a nation, the more intense the competition. Greater competition drives down consumer prices. There are likely to be broader benefits of attracting inward foreign direct investment in the form of net new jobs (reduced involuntary unemployment), wage premia relative to indigenous firms and technological spillovers to local firms.

Firms make the location choice that maximises their total after-tax operating profits. That is, they compare the profits they would expect to achieve if they were to locate in each individual nation, then choose the most profitable location. The equilibrium allocation of firms across nations will satisfy the condition that post-tax profits of all firms within the region are equalised.

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<sup>1</sup> Note that by assuming that each company only locates a production facility in one nation we abstract from issues that have attracted a lot of attention in relation to profit shifting and compliance costs.

### **3. Insights on the impact of natural geography on firms' location decisions**

Consistent with previous research, we show that when there are no differences in corporation taxes across nations within the supra-national region, size matters: larger nations are able to attract more firms.

The hub and spoke nature of our model, along with the costs associated with exporting, allow us to gain new insights on the influence centrality on firms' locations. Solving the model for firms' location choices under the assumption that each nation has an equal share of the region's population demonstrates that the proportion of firms that then choose to locate in the hub nation is substantially greater than the proportions locating in either spoke.

The existence of these costs incurred through exporting mean that exporting firms will sell a lower quantity in a given external nation than firms that chose to set up production within that nation.

The interaction of the influences of size and centrality can be clarified further by solving the model after reallocating a proportion of the population from the hub nation to one of the spokes. Since both spoke nations gain in size relative to the hub, they both attract more of the firms while the hub attracts fewer. As would be expected, the nation that gains in size in both relative and absolute terms attracts proportionately more investment. So, while centrality of a nation within the free trade region confers an advantage in attracting inward investment to a large hub nation, this can be offset by the size disadvantage of locating in a small hub. Furthermore, reallocating a proportion of the population from a spoke to the hub illustrates the disadvantage of being a relatively small nation on the periphery of a free trade region in attracting inward investment.

### **4. Corporation tax: and the contrasting views of the UK and Scottish Governments**

The current UK Government sees corporation tax as a key element in "creating the right environment for businesses to invest, export and grow" HM Treasury (2014) p3. Successive reductions in the rate of corporation tax are at the heart of its growth strategy. It has followed through on its five year plan, first announced in 2010, to implement year-on-year cuts in the rate of corporate tax rate from 28 percent in 2010-11 to 21 percent in April 2014. In the March 2014 budget, the Chancellor announced that the unified UK corporation tax rate will reach 20 percent, the joint lowest rate in the G20.

However, corporation tax currently remains a reserved power and successive UK governments have, so far, been opposed to setting (or indeed allowing) differential rates across the devolved nations.

Meanwhile, the current Scottish Government has long argued that it would like to set a rate of corporation tax below that in the rest of the UK and this is reflected in various Scottish Government policy documents. At least in part, its reasoning is based on the argument that hubs (such as London and the South East of England) have in-built competitive advantages that derive from their natural geography, and that reducing corporation tax in Scotland is one appropriate lever to help redress this:

*“a unified UK rate of corporate tax is neither desirable nor economically efficient. (...) Given the competitive advantages of London relative to other parts of the UK (such as London’s position as one of the largest financial centres in the world, and its transport links with major cities worldwide etc.) there is clear evidence that London (and indeed the South East of England) already has an in-built competitive advantage over not only Scotland but also other parts of the UK. Scotland needs the lever of corporate tax to consider a wider array of options than is currently the case to help address this imbalance.”*  
Scottish Government (2011), p34.

## **5. Using our model to consider whether differences in corporation taxes across nations can offset the impacts of natural geography**

The Scottish Government’s line of argument (as quoted above) seems to view Scotland’s geographical disadvantage as derived both from its smaller size *and* its peripheral location. These characteristics are captured in our model which does indeed suggest that Scotland’s natural geography means Scotland has less chance than (parts of) England in attracting foreign direct investment from firms wanting to serve consumers across Europe as a whole.

Of course there are many other factors, aside from corporation tax, that influence firms’ location choices. Our stylised model abstracts from these other factors by assuming nations have identical wage rates, skills bases, infrastructures and regulatory environments and differ only in terms of their relative size and position within the region. This means that we cannot hope to compare and contrast the use of corporation tax with other levers that governments have available to them to influence firms’ location decisions.

In order to use our stylised model to explore the incentive for an independent Scotland to deviate from the corporation tax regime of the rest of the UK we assume that each national government has as its goal maximisation of the welfare of its households. Inward foreign direct investment is then attractive because local production confers higher social benefits than imports.

We show that, relative to the location decisions made when taxes are equal, a geographically disadvantaged nation whose government reduces corporation tax will attract more firms and that this will partially offset the impact of its natural geography. Of course, any nation that follows a tax-cutting strategy such as that proposed by the Scottish Government must expect retaliation. However, our analysis demonstrates that when the tax cutting nation is sufficiently small, the retaliation does not involve matching the extent of the tax cut in full, given that the other nations retain their advantages of size and centrality. Hence, any ‘race to the bottom’ is likely to be limited, with the result that there is a net improvement in the attractiveness Scotland to inward investors. Nevertheless, there is a trade-off to be made between attracting more firms through reducing corporation tax, and accruing less corporation tax revenues.

## Conclusions

In this article we have summarised our ongoing research using a stylised model to gain a clearer understanding of the impact of natural geography on firms' location decisions. We have explained the set-up of our model and have outlined a number of insights. We then went on to describe how we have explored the incentives for national governments change corporation tax. We found that corporation tax can be an effective lever for a small nation to mitigate some impacts of geographic disadvantage, and attract more inward investment. Nonetheless there is likely to be a trade-off between attracting more firms and accruing less tax revenue.

Our research in this area is continuing. In particular, we are seeking to draw insights on how a possible future decision to allow different corporation tax regimes across devolved administrations within the UK might impact on the welfare of each nation, as well as that of the UK as a whole.

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