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The Impact of a Reduction in Corporation Tax on the Scottish Economy   1
EXECUTIVE SUMMARY

In simulating the impact of the reduction in the corporation tax rate in Scotland, the Scottish Government has used an established general equilibrium model of the Scottish economy.

The policy simulation

This modelling work assessed the impact on the economy of a reduction in the corporation tax rate in Scotland equivalent to lowering the headline rate from 23% to 20%.

Alternatives are clearly possible. However, the specific simulation conducted here is designed to illustrate the mechanisms through which a change to the corporation tax could impact upon the Scottish economy.

Summary of the modelling

The potential impact of a more competitive corporation tax regime flows through a number of channels. In particular, reducing the rate of corporation tax could reduce the cost of capital, boost investment and reduce production costs. At the same time, a change to corporation tax may also be associated with changes to export intensity due to increased flows of Foreign Direct Investment (FDI). As a result, it is anticipated that output and employment could rise.

Alongside this, however, changes to corporation tax can also have dynamic impacts on government revenues. A lower tax rate reduces revenues from firms’ profits but by stimulating economic activity it can grow the tax base which could in turn lead to higher tax revenues. A balanced budget assumption, which equates changes in current revenues to changes in current spending, was adopted as a starting point for this modelling work.

The results – central scenario

The modelling assesses the impact of the policy over time. It is helpful therefore, to consider both the short and long-term impacts of any change to corporation tax.

In the central scenario modelled, a reduction in the corporation tax rate, as set out above, is estimated to increase Scottish GDP by 1.4% and employment by 27,000 by year 20. Investment could increase by 1.9% and the economy as a whole could become more capital intensive.

Pre-announcing any changes to corporation tax can allow households and firms to adjust their consumption and investment behaviour before the policy is implemented. As a result, and in the context of a reduction in the corporation tax rate, this can lead to the increase in output being realised earlier on.
INTRODUCTION

The aim of this paper is to outline the key mechanisms through which changes in corporation tax could affect the Scottish economy.

In order to quantify this impact, a modelling exercise has been undertaken. This exercise employed a model developed by the University of Strathclyde Business School, which allows such a policy to be simulated and results to be produced and interpreted.

The purpose of this modelling is to illustrate the potential economic impact from a more competitive corporation tax regime rather than to make the case for an exact policy change. Therefore, as a starting point, this work illustrates the potential changes in the economy from a relatively “small scale”, pre-announced change in corporation tax. Clearly other alternatives are possible, and the exact regime would be dependent upon the policy choices of the day.
1 Overview of the Model

The model used to simulate changes in the corporation tax rate is a computable general equilibrium (CGE) model of the Scottish economy. AMOS (A Macro-Micro Model of Scotland) was originally developed by the University of Strathclyde in the 1990s and has been continuously enhanced since.

The AMOS model has been regularly employed by the Fraser of Allander Institute to model various policies and economic issues. For example, the model was recently used to simulate the impact of changing the Scottish Variable Rate of Income Tax.

General equilibrium models compute how an economy could look as a consequence of a specified set of policy changes. They incorporate a snapshot of the economy’s characteristics at a certain point in time, which is then combined with a set of key behavioural assumptions about firms, households and government. The impact of policy is simulated by changing one (or several) model parameters and tracing through the resulting economic responses.

When a policy change is introduced, the economy moves out of its initial state as markets respond to the changed policy environment. The interaction of agents and markets according to set principles leads the economy to a new state, with different values for key economic variables such as output, employment and wages.

AMOS is a single region economic model, in that the rest of the UK, as well as the rest of the world are assumed to be exogenous. Changes in policy are assessed according to their impact on the Scottish economy.

AMOS is a dynamic CGE model. Dynamic models identify the transition path between old and new steady-states. This helps illustrate key issues, such as potential variations between short and long-run impacts.

Short-run and long-run impacts

In reporting the results, each period is taken as an approximation to a year. This is a plausible assumption as all of the data employed in the calibration of the model (i.e. assigning values to parameters based on available data) are annual.

Short-run results refer to period (or year) 1 and are characterised by fixed factors of production. In the short-run, capital stock in individual sectors is also fixed. Activity can still vary as a result of changes in aggregate employment through movements from and into unemployment and changes in the allocation of workers between sectors. However, any reallocation of labour between sectors takes place within the constraints of a fixed endowment.

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In the longer term this assumption is relaxed. Beyond period 1, both labour and capital supply can vary. The capital supply can be altered through changes in net investment and the labour supply varies with migration. These assumptions are consistent with the small open nature of the Scottish economy. The behaviour of the labour supply is determined by the chosen labour market and migration setting.

**Labour Market in the model**

A key issue in modelling a small open economy concerns the behaviour of the labour market, and in particular the degree of ‘in’ or ‘out’ migration and the framework for wage setting.

Without migration, the labour market would effectively be fixed in size even in the long-term. Whilst employment levels can change – i.e. people can flow in and out of work – the labour capacity of the economy would stay the same. This is a useful scenario to consider from an academic point of view, but in an integrated market and open economy – such as Scotland - it is not realistic.

Alternatively, it is possible to simulate a free flow of labour in and out of a country. In this scenario, any flows are governed by the differentials between unemployment and real wages in Scotland compared to the rest of the UK. In effect, changes to unemployment levels and wages motivate inward or outward flows of labour, such that in the long-run a new steady state is reached where there is no further incentive to migrate, i.e. real wage and the unemployment rate return to their original levels.

Alongside this, the real wage rate is assumed to be inversely related to the unemployment rate, which affects workers’ bargaining power. Other alternatives, such as fixed real wage and fixed nominal wage assumptions are also possible.

**Assumptions about firm and household behaviour**

The time dimension of the modelling framework offers an important opportunity to consider the way in which households and firms respond to the expectations of future developments.

Agents can be assumed to act myopically, which means that they base their decisions on the state of the economy at that particular period and do not have (or do not consider) the information about the future.

The simulation results presented here are, however, based on the assumption of forward looking behaviour, which reflects the belief that firms and households have an awareness of future policies and their impact on the economy. For example, households may maximise their consumption based on their future ‘expected’ income (“consumption smoothing”). This means that consumption and income may not always move in the same direction at any given point in time. This could be considered as a more realistic assumption.

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6 The Impact of a Reduction in Corporation Tax on the Scottish Economy
2 Approach to Policy Simulations

The analysis models the policy change based on a reduction in the corporation tax rate deemed to be equivalent to a cut in the headline rate in Scotland from 23 to 20%. The modelling work examines the potential short-term impacts of pre-announcing such a policy. As the model applies an effective corporation tax rate, which takes into account the fact that some companies pay reduced rates of tax, the reduction affects all companies in Scotland, regardless of their size. More detail on how the reduction in the corporation tax rate has been modelled is included in Annex A.

Reducing the rate of corporation tax is likely to have several effects on the economy, which filter through a number of avenues. Three main channels are explored here. The general equilibrium nature of this modelling captures all the direct effects and subsequent inter-linkages employed in the final result.

The first key avenue stems from the actual change in the tax rate which lowers the cost of capital. Second, the reduction in the tax rate is thought to generate an increase in the gross flow of Foreign Direct Investment (FDI). An inflow of export-oriented firms from abroad in the form of FDI could be expected to increase exports in the relevant sectors. This effect is modelled as a series of export shocks. Assuming that the FDI stock, expected to generate these exports, depreciates in the same way as other types of investment, these shocks imply an ultimately stable higher stock of FDI and therefore, improved exports performance. The export shocks are discussed in more detail in Annex B.

Third, the modelling work is based upon a ‘balanced budget’ analysis, which means that changes in current government expenditure are fully aligned to changes in current tax revenues. Government revenues adjust as tax receipts are influenced by the lower rate of corporation tax. However, the revenues also depend on what happens to the corporation tax base, as well as the other tax bases, such as that for income tax. This is the third channel through which the policy can impact the economy.

Figure 1 summarises the links between corporation tax and the wider economy. It shows the three main channels described above: the cost of capital, the size of government consumption (dependent on tax revenues) and the shift in export intensity from FDI inflows.
The diagram shows that the rate of corporation tax is exogenous, i.e. it is determined “outside” of the model. Cost of capital and tax revenues are endogenous and respond to the policy shock. As the FDI sector is not specified explicitly in the model, a demand-side export shock is introduced to simulate what in practice would be expected to be an endogenous response.
This section reports on the results of modelling a reduction in the rate of corporation tax within the general framework set out in the previous sections. The changes in key economic variables are summarised in Table 1 on page 12 and the dynamic effects are captured in a series of charts that trace the transition paths of selected economic variables.

It should be noted that the policy is pre-announced in period 1 and is introduced in period 3. For illustration purposes, the charts compare this to the case without the pre-announcement of the policy, when the corporation tax reduction is introduced in period 1. Export shocks lag the reduction in the tax rate by one period in both scenarios.

Long term impacts of policy

As highlighted above, in the general equilibrium framework employed, the effect of the policy is likely to feed through the economy via a number of channels.

As the corporation tax applies to firms’ profits and capital expenditure (with the exception of capital allowances), reducing its rate would technically reduce the cost of capital with an immediate effect. When agents are forward-looking, investment in the model is governed by the expected future income from capital and the cost of capital. Reducing the rate of corporation tax rate would thus be expected to create favourable conditions for investment, which has been estimated to increase by 1.9% after 20 years and by 2.0% in the long-run, when the economy settles into a new equilibrium (i.e. the effect of the policy has fully fed through the whole of the economy). Investment would be expected to respond to the policy immediately after its introduction (and even before - as the policy is pre-announced) and then settle at a new increased level. Increases in investment provide a continuous boost to aggregate demand, as well as expanding the supply side by adding to the capital stock.

As the capital stocks rise, the existing capital stock depreciates. This prevents the stock of capital from growing indefinitely as a result of investment. The steady-state is reached when the level of investment flow exactly offsets the depreciated stock in a given period.
The increase in exports modelled as a demand-side shock is likely to have an additional expansionary effect. Although export shocks are introduced to the traded sectors only, other sectors can benefit from the inter-linkages throughout the wider economy. As this modelling is of general equilibrium nature, the induced impacts from income growth are captured and non-traded sectors can also benefit from that effect.

As capacity grows through increased investment and in-migration, a fall in the cost of capital reduces the cost of production and therefore, the prices of both final and intermediate goods and services. Lower prices could make Scottish goods and services more competitive in UK and global markets, which means that exports to both the rest of the UK and rest of the World could increase. Thus exports could rise even in isolation from the impact of FDI inflows (as shown in the chart below), although an increase in export capacity associated with the latter would amplify that effect.

Under the assumption of a balanced budget, government consumption is dependent on the tax revenues raised within Scotland, which in turn depends on the various tax rates and the size of the tax base. Lowering the corporation tax rate means that generally less revenue would be raised per pound of firms’ profits. However, a reduction in the corporation tax rate can also increase the tax base in Scotland leading to a boost to revenues.
The results of the modelling suggest that although the reduction in the rate of corporation tax could have an immediate negative impact on the revenues collected by that tax, as output and employment increase, the tax base could expand.

The modelling results suggest that the combined impact of the above dynamics mean that Gross Domestic Product at basic prices (Gross Value Added) could expand gradually. Output could increase by 1.0% by year 10 and by 1.3% by year 20. In the long-run, GDP could expand by 1.5%. Output increases across all sectors of the economy, although those that are capital intensive or attract the largest shares of investment and FDI inflows are likely to benefit the most.

![Percentage change in Gross Domestic Product (compared to base level)](chart)

The expected rebalancing in the economy should not be confused with “crowding-in” effects (i.e. when changes to the size of the public sector are compensated fully by changes in the size of the private sector). The dynamics of the expansion in output and employment described here refer to the impact of the corporation tax rate reduction as a specific policy and in the long-run, both the public and private sectors grow.

Despite labour becoming more expensive relative to capital, as a result of a reduction in the cost of capital, the increase in output due to savings in production costs are sufficient to offset the downward pressure on employment due to a shift to a more capital intensive production. In other words, the impact of the cut in the corporation tax rate on the demand for labour is a balance of two effects – substitution and output, of which the latter is greater.

In the end, it is estimated that employment could rise by 27,000 (1.1%) over 20 years and by 30,000 (1.3%) in the long-run. A large part of growth in employment could be expected to take place over the first 10 year period, with employment rising by 19,000 (0.8%).
The modelling suggests that in the long-run a reduction in the rate of corporation tax may have a positive impact on the Scottish economy. The reduction in the cost of capital leads to a long-run increase in capital intensity of production, which stimulates economic activity through increased exports and investment. This increases output and, in this particular case, employment. In the long-run, all elements of the final demand are expected to rise. Domestic production could become more competitive and export orientated.

As the model is neo-classical in nature, the economy eventually returns to a trend rate of growth, albeit at a higher level of output. This point is discussed in more detail in Section 4.

Table 1 Percentage changes in key variables as a result of a reduction in the corporation tax rate (compared to base levels)

<table>
<thead>
<tr>
<th></th>
<th>Long-term impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Period 20</td>
</tr>
<tr>
<td>GDP</td>
<td>1.4%</td>
</tr>
<tr>
<td>Employment</td>
<td>1.1%</td>
</tr>
<tr>
<td>CPI</td>
<td>-0.2 to 0.3%</td>
</tr>
<tr>
<td>Unemployment rate</td>
<td>-0.3%</td>
</tr>
<tr>
<td>Nominal Wage</td>
<td>-0.2%</td>
</tr>
<tr>
<td>Real Wage</td>
<td>0.0%</td>
</tr>
<tr>
<td>Household Consumption</td>
<td>0.7%</td>
</tr>
<tr>
<td>Government Consumption</td>
<td>0.1%</td>
</tr>
<tr>
<td>Investment</td>
<td>1.9%</td>
</tr>
<tr>
<td>Capital Stock</td>
<td>1.8%</td>
</tr>
<tr>
<td>Export RUK</td>
<td>1.4%</td>
</tr>
<tr>
<td>Export ROW</td>
<td>1.3%</td>
</tr>
<tr>
<td>Indirect Tax revenues</td>
<td>0.8%</td>
</tr>
<tr>
<td>Income Tax revenues</td>
<td>0.9%</td>
</tr>
</tbody>
</table>
Another key feature of the results is that a fall in the unemployment rate and a rise in the real wage in Scotland during the transition period triggers in-migration, which allows the supply of labour to expand. The free flow of migration continues until the real wage and the unemployment rate return to their base levels.

**Short term impacts**

Regardless of whether the pre-announcement of the policy is considered or not, the long-run impacts reported in the previous section are identical. In the short-run, however, pre-announcing policy allows firms and households to build in the effects of the policy into their behaviour prior to the policy being put in place.

In the case with pre-announcement, in period 1 and 2 there are no changes in the rate of corporation tax, however, firms and consumers are aware of the forthcoming policy and its impacts on the economy and adjust their behaviour accordingly. Such dynamics imply that the potential positive impacts of the policy described above could occur earlier on.

In the forward looking case, investment responds according to the expected future value of firms’ profits, based on future capital income, rather than capital income at that particular point in time. This means that in expectation of an increase in the return on capital, firms may increase their investment in both periods 1 and 2 – before the large rise in investment in period 3. Household may also shift their consumption forward in line with expected future increases in income. These expectations of an improvement in economic conditions are already built into the dynamic path of the economy. If the policy is pre-announced in period 1, before being implemented in period 3, output and employment levels are maintained above their base in both the short-run and throughout the transition period.

**Long-run impacts across sectors**

In the short-run (period 1), capital and labour are fixed in supply (and capital is fixed in individual sectors). Therefore, the reduction in the cost of capital can only have the effect of a reallocation of activity to certain sectors as a result of movement of labour both between sectors and in and out of unemployment.

The modelling results show that in the long run, the reduction in the corporation tax could have the effect of increasing output across all sectors. If production costs fall and export intensity increases, increased demand for intermediate inputs, as well as induced demand from greater income would be expected to feed through to the whole of the economy. The sectors that attract high levels of investment and the sectors which see an inflow of FDI again expand proportionally more. In absolute terms, output rises are the greatest in Construction as well as in Business and Financial Services sectors. Sectors such as Construction are most likely to benefit from the demand-side effects of increased investment, whilst other sectors may benefit from the supply-side effect of increased availability of capital.

The results suggest that the tax base could expand over the longer term, as a result of the increase in both output and employment, eventually leading to an expansion in government consumption. Such increases may translate into greater output in sectors such as Public Administration and Education (by 0.4%), Higher Education Institutions (by 0.5%) and Other
Services (by 0.7%), i.e. those in the public sector or those closely linked to it. A full breakdown of the sectors in the model is provided in Annex C.

The results of the modelling show that in absolute numbers, the greatest increase in employment is in Business Services – a rise of 5,400. This compares to a rise of 3,600 in the construction sector. However, the greatest percentage change in employment may occur in the ‘Other Manufacturing’ sector, where employment increases by 5.6%. This is due to the large (relative to its size) volume of exports, expected to be generated by this sector from the inflow of FDI (see Annex B).
4 Further Considerations

The Scottish Government has plans to expand its economic modelling function and the work undertaken on exploring the potential impacts of changing the rate corporation tax is the first major output.

The modelling undertaken so far provides a sophisticated framework for modelling policy impacts on Scotland, capturing the economy dynamics in a way that is consistent with sound economic theory.

As part of the planned technical work, it is expected that some of the modelling scenarios that underpin these results could be explored in greater detail. Such work could include, modelling different government behaviour and productivity, as well as examining the possibilities of incorporating changes in the growth rate of the economy. This section provides some more detail around how this analysis may be enhanced as part of future projects.

Inflows of Foreign Direct Investment

Evidence suggests that a lower rate of corporation tax can attract investment from the rest of the world (see Annex B). Therefore, as the corporation tax rate is lowered, an economy could experience an investment shock, as firms relocate in order to take advantage of the lower cost of capital. Whilst in the AMOS model investment responds to the cost of capital, the model does not allow for the FDI to be specified explicitly and assumes that all investment – domestic and foreign – responds to the change in corporation tax rate in the same way. However, it may be that foreign investment responds to the rate of corporation tax differently.

As the rate of corporation tax falls, a share of existing global FDI stock could relocate to the country shortly after the policy is introduced. The introduction of the export shock generates investment, which may account for some of the FDI effect. However, it is possible that the model may underestimate the initial increase in investment. For example, it may not capture fully the initial capital investment from the location, construction and expansion of foreign business. A small open economy like Scotland could have access to a large pool of global FDI and modelling this could form part of future work that the Scottish Government undertakes in relation to corporation tax policy.

Changes in the long-term growth rate of the economy

The economic model employed for these simulations operates within a neoclassical growth framework, which does not take into account the ability of policy to change the underlying growth rate of the economy. Neoclassical growth assumes that growth is generated externally – principally through improvements in technology - and apart from the transition period between the two equilibria, growth returns to its previous trend.

New growth theory, often referred to as endogenous growth theory, relaxes the assumption of growth being determined outside the model. New growth models vary in factors that they
assign to be the most important in driving growth, but they have in common the fact that policy can introduce changes to the rate at which the economy is growing.

In principle, a reduction in the rate of corporation tax in Scotland could lead to a change in the economic growth rate. There are a number of reasons why this may occur, for example from "learning by doing", which relates the rate of growth to the stock of capital in the economy. As the cost of capital is reduced and the capital stock grows, under this reasoning the economy could move to a higher growth path, rather than simply moving to a higher output level.
5 Conclusions

This paper summarises the potential impacts that could arise from a reduction in the corporation tax rate in Scotland, equivalent to the change in the headline rate from 23% to 20%. The policy change was modelled using a general equilibrium framework of the Scottish economy.

The results of the simulations showed that the policy could increase the total value of output and the level of employment in Scotland over the long-term. As capital stocks are built up through increased investment, the economy could move to a new equilibrium of higher, more capital-intensive, production with goods and services produced at a lower cost. Domestic production could become more competitive and export orientated. The modelling suggests that all elements of final demand would rise in the long-run.

These simulations could be extended further, for example by looking into options for fully capturing the impact of the FDI and considering the potential impacts of the policy on the long-term growth rate.
A Corporation Tax in the Model

In the AMOS model, the corporation tax rate is applied to the cost of capital as an effective rather than as an actual rate. The effective rate is derived as a ratio of corporation tax revenue in a given year, over the tax base. Gross operation surplus from the Scottish Input-Output tables is taken as a proxy for the tax base.

As the AMOS model is calibrated on 2006 Social Accounting Matrix data. The corporation tax revenues for 2006/07 for Scotland were taken from Government Expenditure & Revenue Scotland (GERS). In that year the headline corporation tax rate was set at 30%. Any proposed changes to the corporation tax rate in Scotland would be introduced no earlier than 2014/15, when the headline corporation tax rate is expected to be 23%, in line with the UK Government’s 2011 Budget policy.

A reduction from 23% to 20% in 2014/15 is the same proportionally as a reduction from 30% to 26.1% in 2006. Direct, non-behavioural revenue changes (to exclude any “double counting” when running simulations) associated with a 3.9 percentage point reduction in the corporation tax rate, have been estimated using HM Treasury’s static costing, provided in the analysis of 2011 Budget policies. The percentage of Scottish corporation tax revenues to the total UK corporation tax revenues (8.7%) estimated in GERS was applied to the UK figure to derive revenues for Scotland and subtracted from the corporation tax revenues collected in Scotland in 2006/07.

This approach is consistent with the fact that the purpose of this exercise is to assess the impact of a certain scale of change in corporation tax rather than simply what the economy would look like under a specific level of corporation tax. Because the reduction is modelled using an effective tax rate all companies would be expected to be affected by the lower rate, regardless of the actual corporation tax rate they are liable to.

The total corporation tax revenue figure for the new rates of tax is used to derive the new effective tax rate by dividing the revenue by the tax base. As shown in Table 2, the effective tax rate is reduced from 10.3% to 9.1%.

<table>
<thead>
<tr>
<th>Corporation Tax Rate Policy</th>
<th>Implied Corresponding Tax Rate in AMOS</th>
<th>Corporation Tax Revenues Lost Compared to Base Case (£m)</th>
<th>Revenues Raised (£m) (without Dynamic Effects)</th>
<th>Effective Tax Rate in AMOS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Base</strong></td>
<td>23%</td>
<td>-</td>
<td>3255.0</td>
<td>10.3%</td>
</tr>
<tr>
<td><strong>Simulation</strong></td>
<td>20%</td>
<td>26.1%</td>
<td>384.7</td>
<td>9.1%</td>
</tr>
</tbody>
</table>

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6 Government Expenditure and Revenue Scotland, 2011, the Scottish Government

B The Export Shocks

A review of existing evidence suggests that a more competitive corporation tax regime may attract investment from other countries, as capital is usually found to be mobile across country borders. The simulations in this report build on this evidence in attempting to capture an expected increase in export intensity of Scottish industries, resulting from the inflow of the FDI.

The modelled increase in export intensity rests on the assumption that new Foreign Direct Investment (FDI) firms are more likely to produce their goods and services for the foreign market compared to local Scottish firms. Given the nature of FDI and the multinational nature of most companies, this is believed to be a reasonable assumption to make. The export shocks simulate an increase in exports associated with the additional capacity brought in by the FDI. There are three key assumptions that underpin the modelling of the export shocks:

1) The relationship between the inflow of FDI jobs and the rate of corporation tax is characterised by a 6% semi-elasticity;
2) Of the additional output resulting from the inflow of FDI, 75% is exported; and,
3) Stock of FDI, which generates the exports, increases in each period at a decreasing rate, being subject to a depreciation rate of 15% year on year. The stock stops growing when depreciation fully offsets gross inflow of FDI.

1) Inflow of FDI jobs

It has been estimated that the number of FDI jobs created in Scotland could increase by 720 per year, as a result of the reduction in corporation tax rate equivalent to a cut in the headline rate from 23% to 20%. This is based on a semi-elasticity of around 6% (i.e. a 1 percentage point reduction in the corporation tax rate resulting in a 6 percentage point increase in the number of FDI jobs). This value was found to be approximately the mid-point of the range of estimates provided by reviewed academic studies and empirical evidence. The assumption is also broadly consistent with HM Treasury analysis which uses a semi-elasticity for changes to the effective average tax rate of 5.9%. The semi-elasticity was then applied to the current flow of FDI jobs into Scotland, which averages at 4,000 per year. The increase in output from the additional investment is assumed to be proportional to the increase in the number of FDI jobs.

The size of FDI is assumed to vary by sector, based on trends over the five years to 2010 and the breakdown is shown in Table 3. As the table outlines, the majority of the employment effect (61%) is divided between four sectors (Machinery, Other Manufacturing,  

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8 OECD Tax Policy Studies, Tax Effects on Foreign Direct Investment, Tax Policy Study No. 17, 2007/08
9 Rebalancing the Northern Ireland economy, HM Treasury, March 2011
http://www.hm-treasury.gov.uk/consult_rebalancing_ni_economy.htm
10 Ernst and Young, European Investment Monitor Data
11 The distribution of the export shock across sectors is based on the European Investment Monitor (http://www.ayeim.com/) data, which reports annual FDI employment by sector and activity.
Financial Services and Business Services). The remainder of the FDI employment is presumed to be split evenly across another 8 sectors.

Table 3 FDI Impact by Sector

<table>
<thead>
<tr>
<th>Sector</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture, Forestry &amp; Fishing</td>
<td>0.0%</td>
</tr>
<tr>
<td>Mining</td>
<td>4.9%</td>
</tr>
<tr>
<td>Food</td>
<td>0.0%</td>
</tr>
<tr>
<td>Drinks &amp; Tobacco</td>
<td>0.0%</td>
</tr>
<tr>
<td>Textile</td>
<td>0.0%</td>
</tr>
<tr>
<td>Apparel, Leather &amp; Footwear</td>
<td>0.0%</td>
</tr>
<tr>
<td>Wood &amp; Paper</td>
<td>0.0%</td>
</tr>
<tr>
<td>Printing and Publishing</td>
<td>0.0%</td>
</tr>
<tr>
<td>Chemical industry</td>
<td>4.9%</td>
</tr>
<tr>
<td>Glass, Ceramics, Cement &amp; Concrete</td>
<td>0.0%</td>
</tr>
<tr>
<td>Metallurgy</td>
<td>0.0%</td>
</tr>
<tr>
<td>Machinery</td>
<td>8.0%</td>
</tr>
<tr>
<td>Other Manufacturing</td>
<td>10.0%</td>
</tr>
<tr>
<td>Electricity, Gas &amp; Water</td>
<td>0.0%</td>
</tr>
<tr>
<td>Construction</td>
<td>4.9%</td>
</tr>
<tr>
<td>Trade &amp; Distribution</td>
<td>4.9%</td>
</tr>
<tr>
<td>Hotels, Catering, Pubs, etc</td>
<td>4.9%</td>
</tr>
<tr>
<td>Transport</td>
<td>4.9%</td>
</tr>
<tr>
<td>Telecommunications</td>
<td>4.9%</td>
</tr>
<tr>
<td>Financial Services</td>
<td>16.0%</td>
</tr>
<tr>
<td>Real Estate</td>
<td>0.0%</td>
</tr>
<tr>
<td>Business Services</td>
<td>27.0%</td>
</tr>
<tr>
<td>Public Admin and Education</td>
<td>0.0%</td>
</tr>
<tr>
<td>Higher Education Institutions</td>
<td>0.0%</td>
</tr>
<tr>
<td>Other Services</td>
<td>4.9%</td>
</tr>
</tbody>
</table>

2) The scale of the increase in export intensity

The increase in export intensity is based on the value of FDI output (based on the number of additional jobs as identified above) expected to be created in Scotland per year in response to the lower corporation tax rate. However, exports are presumed to grow at a decreasing rate annually. Also, in this modelling, these shocks are introduced one period later than the change in the tax rate. This reflects the practical assumption that FDI firms would take time to set up their operations before they could export their output.

The size of the shock is based on the assumption that 75% of output produced by new FDI firms is exported. This assumption is in line with a range of evidence, for example, PACEC (Public and Corporate Economic Consultants) data on Foreign Direct Investment in UK Manufacturing stated that 76% of foreign-owned manufacturing sector output in Scotland was exported. Also, as part of the Annual Review of SDI in 2010, a survey of firms that had received some form of assistance from SDI was conducted. The survey concluded that exports account for between 60% - 70% of sales across all sectors. It also found that 77% of firms reported regular export activities.

3) Depreciation of exports

Investment in the model is assumed to depreciate by 15% in each period. It is therefore consistent to assume that any FDI that enters the Scottish economy would depreciate at the same rate. Given that the FDI inflow is not modelled explicitly but through a series of export shocks, the depreciation is applied to the additional exports. Each year exports from FDI are assumed to increase but at a decreasing rate. In each period, the value of the export shock is equal to the sum of the shock in period 1 (calculated based on increased capacity as described above) and the shock in the previous period, depreciated by 15%.

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12 Source: Scottish Government’s calculations based on European Investment Monitor data


C Sectoral Breakdown

The AMOS model uses a Social Accounting Matrix for Scotland, which is based on Scottish Input-Output tables for 2004 (rolled forward to 2006). The 123 industries in the Input-output tables are aggregated into 25 broader sectors, which are listed below:

- AGR  Agriculture, Forestry & Fishing
- MIN  Mining
- FOO  Food
- DAT  Drinks & Tobacco
- TEX  Textile
- ALF  Apparel, Leather & Footwear
- WAP  Wood & Paper
- PAP  Printing and Publishing
- CHI  Chemical industry
- GCC  Glass, Ceramics, Cement & Concrete
- MET  Metallurgy
- MAC  Machinery
- OTM  Other Manufacturing
- ENE  Electricity, Gas & Water
- CON  Construction
- TDI  Trade & Distribution
- HCP  Hotels, Catering & Pubs
- TRA  Transport
- TEL  Telecommunications
- FIN  Financial Services
- RES  Real Estate
- BSS  Business Services
- PAD  Public admin and Education
- HEI  Higher Education Institutions
- OTH  Other Services