

Financial Scrutiny Unit Briefing

The Economic Implications of Brexit

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The Fraser of Allander Institute (FAI) were commissioned by the Scottish Parliament's European and External Relations Committee to undertake economic modelling work to explore the long-term implications of Brexit for Scotland. This briefing summarises the results of this economic modelling.



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EXECUTIVE SUMMARY

The Fraser of Allander Institute (FAI) were commissioned by the Scottish Parliament's European and External Relations Committee to undertake economic modelling work to explore the long-term implications of Brexit for Scotland, taking account of the specific structure and trading relationships of the Scottish economy. This is the first analysis of this kind for Scotland – other economic modelling studies have looked at the UK as a whole and have tended to focus on overall economic impact, without considering the impact on different sectors.

Given the uncertainties surrounding the form that Brexit will take, the FAI were asked to consider three scenarios:

- a **'Norway'** model
- a **'Switzerland'** model
- a **'World Trade Organisation (WTO)'** model

The full FAI [report](#) is published separately (Fraser of Allander, 2016a). The main results are summarised below.

- Under all modelled scenarios, Brexit is expected to have a significant negative impact on the Scottish economy, although the impact for Scotland is less severe than for the UK as a whole
- After around 10 years, a reduced level of trade with EU countries is expected to result in GDP being between 2% and 5% lower than would otherwise be the case and employment 1-3% lower
- This is equivalent to Scottish GDP being between £3bn and £8bn lower than would otherwise be the case after 10 years and employment between 30,000 and 90,000 lower after around 10 years
- The scale of impact varies depending on the scenario, with the WTO model suggesting the largest reductions in GDP and employment
- In percentage terms, the 'other primary' sector, which includes mining, refined petroleum and onshore oil and gas activities, faces the largest potential reductions in employment and output. After around 10 years, employment is expected to be 3-8% lower than would otherwise be the case and output 4-10% lower
- In absolute terms, the largest reductions are for the 'wholesale & retail trade; transportation & storage; accommodation, food services' sector – the number of jobs in this sector could be up to 25,000 lower after around 10 years than would otherwise be the case
- Depending on the details of the Brexit outcome, there could be a modest positive offsetting effect as a result of reduced EU contributions, but this effect is small in comparison to the negative effects of reduced trade
- Additional losses could result from a fall in labour productivity and an increase in tariffs for trade with EU countries

INTRODUCTION

The Fraser of Allander (FAI) were commissioned by the Scottish Parliament's European and External Relations Committee to undertake economic modelling work to explore the long-term implications of Brexit for Scotland. This is the first analysis of this kind for Scotland – other economic modelling studies have looked at the UK as a whole and have tended to focus on overall economic impact, without considering the impact on different sectors.

Given the uncertainties surrounding the form that Brexit will take, the FAI were asked to consider three scenarios:

- a **'Norway'** model:
 - member of European Economic Area (EEA);
 - full access to single market (but outside the customs union);
 - obliged to make a financial contribution to EU and accept majority of EU laws; and
 - free movement applies as it does in the EU.

- a **'Switzerland'** model:
 - member of the European Free Trade Association but not the EEA;
 - access to EU market governed by series of bilateral agreements, covering some but not all areas of trade (in particular, services are excluded);
 - makes a financial contribution to EU but smaller than Norway's;
 - no general duty to apply EU laws but has to implement some EU regulations to enable trade; and
 - free movement applies as it does in the EU.

- a **'WTO'** model:
 - WTO sets rules for international trade that apply to all members;
 - no obligation to apply EU laws although traded goods would still have to meet EU standards;
 - some tariffs would be in place on trade with the EU;
 - trade in services would be restricted;
 - no financial contribution to EU; and
 - no free movement.

This SPICe paper summarises the results of the FAI's modelling work. The FAI's full [report](#) is published separately (Fraser of Allander, 2016a).

FAI METHODOLOGY

The FAI undertook the analysis using their multiregional, multi-sectoral 'computable general equilibrium' (CGE) model for Scotland. CGE modelling is commonly used to evaluate the impact of economic and policy shocks in the economy as a whole. It attempts to reproduce the structure of the whole economy and all economic transactions between different agents (households, different sectors of the economy, the government, etc.).

The FAI's model is similar in design to economic models widely used by organisations such as HM Revenue and Customs (HMRC) and the WTO. General equilibrium modelling has underpinned analysis published by HM Treasury, the National Institute of Economic and Social Research (NIESR) and others on the impact of Brexit for the UK as a whole (HM Treasury, 2016 and Ebell and Warren, 2016). The FAI model uses a similar approach to consider the specific impacts for Scotland, taking account of Scotland's industrial composition and trade patterns. The reported results reflect:

- the sector's dependence directly (and indirectly through rUK links) on EU exports
- the scale of the sectors, in terms of value of output
- the estimated impact of tariff and non-tariff barriers on goods and services.

This analysis offers a much more in-depth account of sectoral impact than other studies published to date on the impact of Brexit. However, the analysis still relies on a fairly broad sectoral analysis which means that overall results for particular sectors will not reflect the specific circumstances of all sub-sectors or companies within those sectors. Although this does not affect the overall picture presented, it does mean that some caution should be used in interpreting the results, particularly for those sectors with the greatest complexities in trading and ownership models. For example, both 'financial services' and 'other primary'¹ sectors are particularly complex and subject to some data limitations. This is particularly true in the case of financial services. Despite these limitations, this study offers the first opportunity to examine the relative impact of Brexit on sectors of the Scottish economy and provides a useful starting point for further analysis of impact.

BASIC ASSUMPTIONS

The economic modelling requires some initial assumptions to be made about the nature of the economic shock faced by Scotland as a result of Brexit. The FAI based their initial assumptions on research published by NIESR which presented estimates of the impact on UK exports of various scenarios (Ebell and Warren, 2016). These initial assumptions, which in turn were based on a range of academic research, were the basis for the modelling undertaken by the FAI and the results set out in this briefing reflect these initial assumptions. The assumed reduction in Scotland's exports under each scenario is set out in Table 1.

Table 1: Impact of various post-Brexit scenarios on Scotland's exports

	Estimated reduction in total exports	
	Goods	Services
Norway scenario		
Optimistic	-12%	-8%
Pessimistic	-18%	-11%
Switzerland scenario		
Optimistic	-12%	-18%
Pessimistic	-18%	-22%
WTO scenario	-26%	-25%

Source: Fraser of Allander (2016a)

The FAI modelling also assumes that the Scottish Government is required to maintain a balanced budget, so that any reduction in its budget must be matched by reduced expenditure. In addition, the UK Government is assumed to fully pass on the impact of any reduction in its own budget to the Scottish Government i.e. a given reduction in UK expenditure results in a proportionate reduction in the Scottish budget. In reality, the UK Government might not pass on the full impact of any reduction in its own budget, which could act to reduce the severity of the impact on Scotland (but would increase the impact on rUK).

It should be noted that this modelling considers potential impact once the UK has left the EU. The modelling results are not a reflection of the current position, where changes (both positive

¹ 'Other primary' includes mining, refined petroleum and associated chemicals and onshore oil and gas activities

and negative) might reflect uncertainty prior to and immediately after the EU referendum and other factors, such as exchange rate movements.

The results are set against a baseline position which assumes that nothing else changes, so as to isolate the effects that result from Brexit. In reality, there will be changes in UK and Scottish Government policy as well as other economic factors that will influence outcomes over the same period. These other changes could act to partially offset the changes resulting from Brexit that are set out in this paper. For example, where a fall in employment is shown, if this is set against rising employment in a given sector, then the overall trend in employment could remain positive. Similarly, reductions in real wages would be set against other movements in real wages, which could act to offset the negative effects anticipated as a result of Brexit.

SUMMARY OF RESULTS

This briefing focuses on the long-run impacts of Brexit for the Scottish economy, which is defined as around 10 years post-Brexit. 'Optimistic' and 'pessimistic' refer to the assumptions set out in Table 1 above.

All the modelling results set out here assume that there is no change in policy as a result of Brexit i.e. the profile of public spending is assumed to continue as at present. Also, as noted above, the model assumes that Scotland maintains a balanced budget. Given that public sector revenues will fall in response to the post-Brexit economic shock, this implies falling government expenditure. In reality, there would most likely be a policy response to the economic shock. The devolution of powers presents broader options for the Scottish Government in this respect, but this is beyond the scope of this study. The nature of any policy response by either the UK or Scottish Government is unclear at this stage and so this modelling highlights what would happen in the baseline scenario where there is no policy response. As such, the modelling isolates the impact of Brexit, without taking account of any policy response to Brexit.

Throughout all scenarios the impact of Brexit on the rest of the UK (rUK) is worse than it is on Scotland, in terms of GDP, employment and other measures. This reflects the fact that the rest of the UK has greater exposure to EU trade than Scotland. While this report focuses on the Scottish results, rUK results are summarised later in this paper.

THE 'NORWAY' MODEL

Table 2 summarises the long-term changes from the current position that would be implied if the UK adopted a position similar to that of Norway. In summary, after around 10 years:

- Scottish GDP is expected to be 2-3 percent lower than would otherwise be the case; on the basis of Scottish GDP in 2015-16,² this would be equivalent to GDP being £3bn-£5bn lower after around 10 years.
- Real wages (adjusted for inflation) are expected to be 3-4 percent lower than would otherwise be the case; on the basis of current full-time earnings in Scotland, this is equivalent to average earnings being £800-£1,200 per year lower than they would otherwise be.³ (Note that other factors could still act to push real wages up and could offset the negative impact of Brexit; this analysis only shows that, with Brexit, real wages would be lower than would otherwise be the case, but not necessarily falling.)

² Scottish GDP excluding North Sea oil (£147,072m); Source: [GERS 2015-16](#)

³ Based on 2015 Annual Survey of Hours and Earnings (median, gross full-time earnings of £27,710 in Scotland)

- The Scottish population is expected to grow by around 1% more than would otherwise be the case, as a result of inward migration from the rest of the UK (the impact on Scotland is expected to be less severe than the impact on rUK).
- A 1-2% reduction in the employment level is expected; in the pessimistic scenario, this is equivalent to 50,000 fewer jobs than would otherwise be the case.⁴

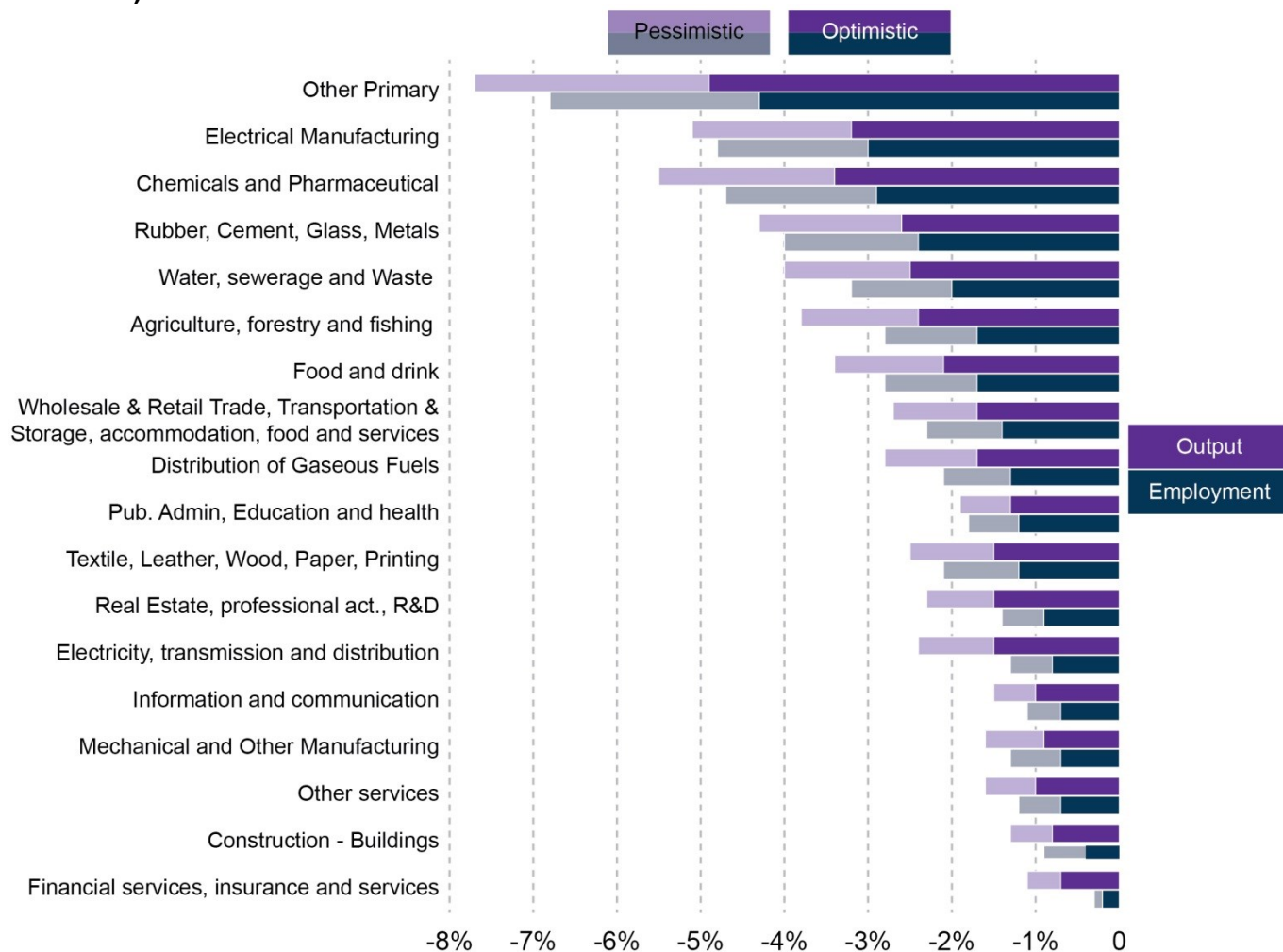
Table 2: Norway model: long-term changes relative to baseline

	Optimistic % change	Pessimistic % change
GDP	-2.0	-3.1
Exports	-4.4	-6.7
Real wages	-2.9	-4.3
Employment	-1.2	-1.8
Population	+0.8	+1.2

Source: Fraser of Allander Institute

⁴ Based on employment level in Scotland at September 2016 (<http://www.gov.scot/Resource/0050/00504632.pdf>)

Figure 1: long-term % changes in output and employment relative to baseline (Norway scenario)



In terms of the impact on employment and output, the sectors expected to experience the largest declines in employment and output⁵ in the long run are:

- Other primary – employment 4-7% lower than would otherwise be the case; output 5-8% lower; this is equivalent to between 1,000 and 1,500 fewer jobs in this sector in the long-run than would otherwise be the case.
- Chemicals and pharmaceutical – employment and output both 3-5% lower.
- Electrical manufacturing – employment and output both 3-5% lower.
- Rubber, cement, glass and metals manufacturing – employment 2-4% lower; output 3-5% lower.

All sectors are expected to experience some decline in employment and output relative to the baseline scenario over the long run.

⁵ As measured by gross value added (GVA)

THE 'SWITZERLAND' MODEL

Table 3 summaries the long run changes from the current position that would be implied if the UK adopted a position similar to that of Switzerland. In this scenario:

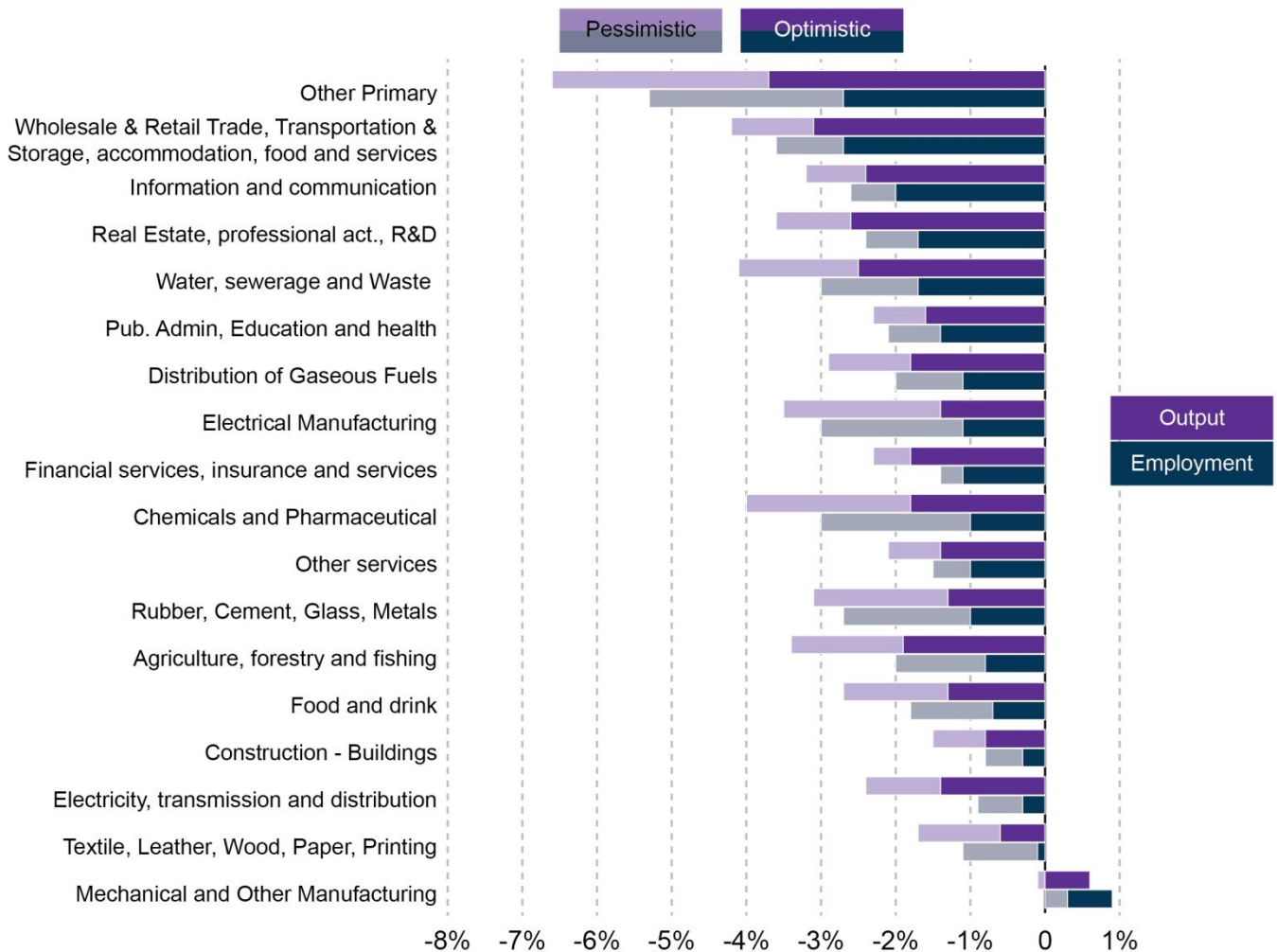
- The anticipated reduction in GDP is larger than in the Norway scenario: after around 10 years, GDP is expected to be 3-4% lower than would otherwise be the case (equivalent to £4bn-£6bn on the basis of current Scottish GDP).
- Real wages are expected to be around 5% (£1,400 per year) lower than would otherwise be the case in the long run and exports 6-8% lower.
- The population growth is stronger in this scenario (around 2% higher in the long run than would otherwise be the case), reflecting inward migration from rUK where the adverse impacts are expected to be greater.

Table 3: Switzerland model: long-term % changes relative to baseline

	Optimistic % change	Pessimistic % change
GDP	-2.7	-3.9
Exports	-5.9	-8.4
Real wages	-4.5	-5.8
Employment	-1.4	-2.2
Population	+1.8	+2.3

Source: Fraser of Allander Institute

Figure 2: long-term % changes in output and employment relative to baseline (Switzerland scenario)



The sectoral impact on employment and output differs in this scenario from the Norway scenario. This reflects both the larger scale of the shock and the greater impact of the shock on the service sector in the Switzerland scenario (as EFTA does not include bilateral agreements for trade in services). The sectoral impacts also reflect the larger reduction in real wages, which will have a differential impact on sectors of the economy, depending on how reliant they are on labour relative to other inputs. Over the long run:

- ‘Other primary’ activities are still the hardest hit in percentage terms although the impact is slightly lower than in the Norway scenario – employment 3-5% lower than would otherwise be the case; output 4-7% lower.
- The service sector experiences greater reductions in this scenario:
 - Wholesale & retail trade; transportation & storage; accommodation, food services are expected to see employment and output 3-4% lower than would otherwise be the case.
 - Information and communication services are expected to see employment and output 2-3% lower.
- A modest positive impact is anticipated for ‘mechanical and other manufacturing’ – this reflects the fact that, relatively speaking, it is hit less hard than other sectors and benefits from the reduction in real wages.

THE 'WTO' MODEL

The modelling of the WTO scenario shows the largest anticipated reductions in economic activity, as summarised in Table 4. After around 10 years:

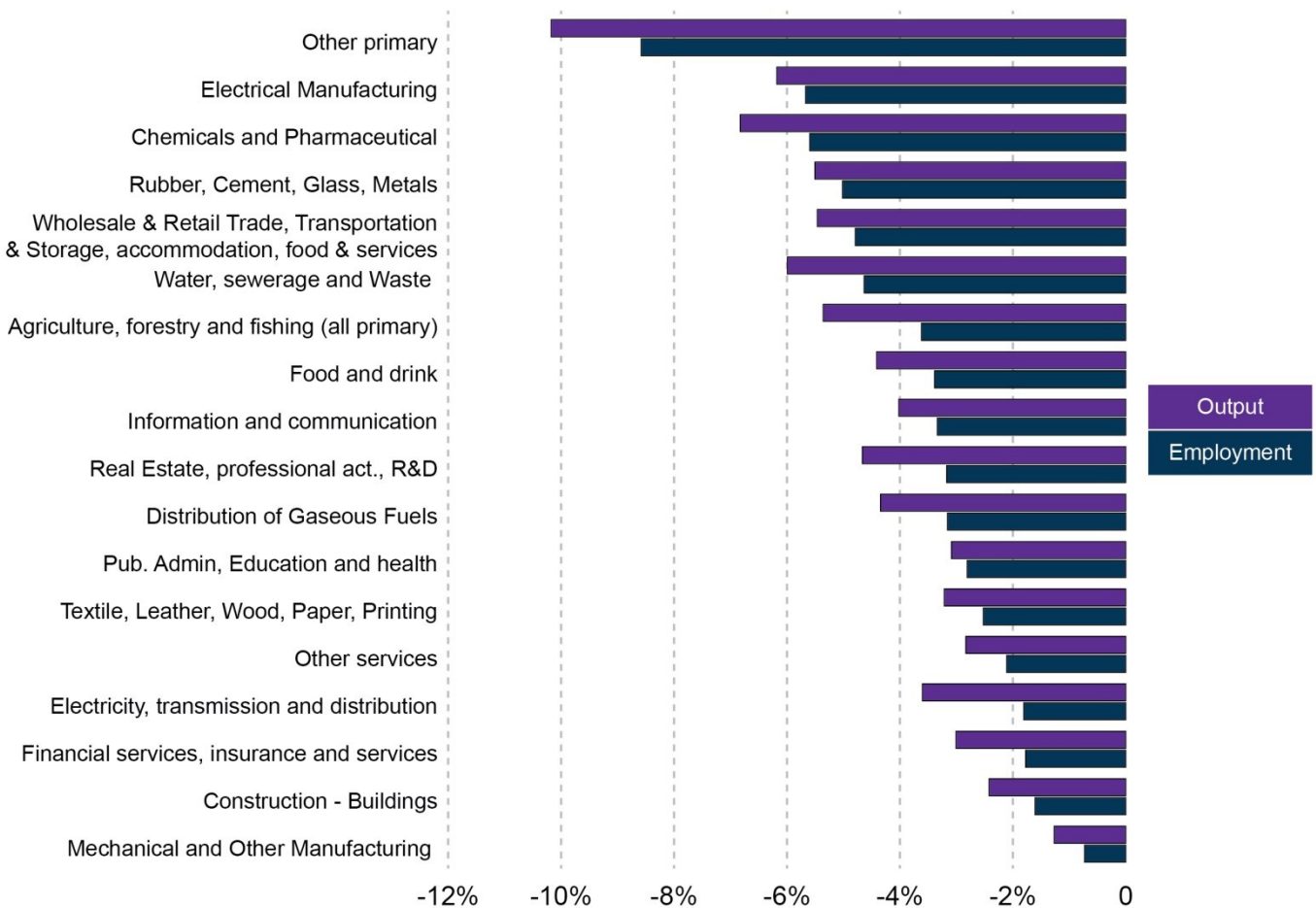
- GDP is expected to be over 5% (£8bn) lower than would otherwise be the case in the long run and exports over 11% (£4bn) lower.
- Real wages are expected to be 7% lower than would otherwise be the case, equivalent to £2,000 per year on the basis of average full-time earnings.
- After around 10 years, the number employed is expected to be 3% lower than would otherwise be the case (around 90,000 jobs).
- The population is expected to be 3% higher than would otherwise be the case.

Table 4: WTO model: long-term % changes relative to baseline

	% change
GDP	-5.3
Exports	-11.3
Real wages	-7.2
Employment	-3.2
Population	+3.0

Source: Fraser of Allander Institute

Figure 3: long-term % changes in output and employment relative to baseline (WTO scenario)



In terms of the impact on employment and output:

- 'Other primary' activities are again the hardest hit, with employment 8.6% lower and output 10.2% lower after around 10 years than would otherwise be the case.
- In percentage terms, the 'chemicals and pharmaceutical', 'electrical manufacturing' and 'rubber, cement, glass and metals manufacturing' sectors again suffer larger reductions in output and employment than other sectors.
- The impact on the 'wholesale & retail trade; transportation & storage; accommodation, food services' sector is smaller in percentage terms, but this sector is large in employment terms, so the 5% reduction in employment after around 10 years relative to the baseline equates to around 25,000 fewer jobs than would otherwise be the case.

ADDITIONAL EFFECTS

The results set out above reflect the effect of the assumed reduction in exports to the EU. Additional effects might result from:

- Fiscal effects – the positive impact of reduced contributions by the UK Government to the EU budget;
- Tariff effects – the potential negative impact resulting from the imposition of tariffs if no trade deal with the EU is agreed; and
- Labour productivity effects – the potential negative impact that might result if labour productivity reduced as a result of Brexit.

The nature and likelihood of these effects is less certain. In the case of the fiscal effects and tariff effects, much would depend on the exact form of Brexit. For example, in the case of fiscal effect, EU contributions might continue to some extent in the Norway and Switzerland scenarios. In the case of tariff effects, the extent of these will depend heavily on the nature of the deal negotiated with the EU. Meanwhile, the likelihood of a decline in labour productivity is less widely accepted.

Due to these uncertainties, these additional effects are considered for illustrative purposes below, rather than as part of the core scenarios. They are shown in relation to the WTO model only, reflecting the fact that the fiscal effects and tariff effects are more relevant to this scenario.

WTO scenario - fiscal effects

The negative effects that result from the reduction in exports to the EU following Brexit would be partially offset by positive effects resulting from higher public expenditure in the UK. This is the result of a reduced contribution to the EU budget following Brexit, allowing for increased UK Government expenditure. The extent of the positive fiscal effects will depend on the negotiated settlement, as the Norway and Switzerland scenarios are likely to involve some continued contribution to the EU budget. It is only under the WTO scenario that UK public sector expenditure would benefit from the full amount of the current net EU contribution. The modelling assumes that the additional funds available to the UK Government are applied in full to Government expenditure, distributed in line with the current profile of public sector expenditure.

The UK's net EU contribution was £8.6bn in 2014 (Ebell and Warren, 2016).⁶ This figure takes account of the UK Government's rebate and the receipts of the UK Government in respect of programmes such as CAP and EU structural funds. The FAI looked at the impact of assuming that, as a result of this positive fiscal effect on the UK Government's budget, the Scottish Government's budget was increased by £860m (10% of the UK figure). This assumes that the UK Government spends this additional resource (rather than using it, for example, to reduce the deficit). It also assumes that the Scottish Government's budget increases by 10% of this total, all of which is allocated to Scottish Government expenditure.⁷

Table 5 below sets out the long run effects of an increase to the Scottish Government's budget of this magnitude, assuming that the additional resources are applied in full to Scottish Government expenditure.

Table 5: Fiscal effects: long-term % changes relative to baseline

	% change
GDP	+1.0
Exports	-0.4
Employment	+1.1
Scottish Government expenditure	+3.9

Source: Fraser of Allander Institute

Note that these are the effects of the fiscal stimulus in isolation i.e. not taking into account the effect of the reductions in EU exports set out earlier in the paper. The combined effect is considered below.

WTO scenario – tariff effects

In the WTO scenario, the UK would cease to be covered by the EU's single market trade agreements. Until new trade agreements are in place, WTO tariffs would apply in relation to trade with EU countries. NIESR research suggests that, in the long term, there would be an average 2% increase in trade tariffs (Ebell, Warren and Hurst, 2016).

The FAI have modelled the effect of a 2% increase in trade tariffs applied to EU trade. Their results suggest that, in isolation from other effects, this would result in GDP being 0.8% lower than would otherwise be the case after around 10 years.

The sectors most affected by these tariff effects are the food and drink sector, electrical manufacturing and services. It should be noted that the actual outcome could vary between sectors as the assumption of a 2% increase across all sectors does not reflect the reality of the current position where trade tariffs vary quite widely between different sectors. In addition, the long run effects could be mitigated by the negotiation of more favourable trade agreements during that period.

WTO model – labour productivity effects

A further potential consideration is the impact that Brexit could have on labour productivity. In their [analysis](#) of the impact of Brexit, HM Treasury assumed that Brexit would have a negative impact on labour productivity, based on research suggesting that more open economies tend to experience higher labour productivity (HM Treasury, 2016). This assumption of a reduction in

⁶ Total net contribution taking account of imputed private sector receipts, which are assumed to be matched by the UK Government (table 9)

⁷ Note that if the UK Government chose to spend the additional resource on reserved areas, such as defence or reserved benefits, there would also be a positive effect for Scotland, albeit less direct

labour productivity resulted in the HMT analysis showing sharper declines in economic output and other variables than other research (which did not make the same assumptions about productivity).

As the productivity assumption has not been universally adopted in research on the implications of Brexit, the FAI did not incorporate such assumptions in their core modelling. However, for illustrative purposes the long-run effect of incorporating a direct reduction of 5% in labour productivity is set out in Table 6. Again, these results show the impact of the reduction in labour productivity in isolation from other effects.

Table 6: Labour productivity effects: long-term % changes relative to baseline

	% change
GDP	-4.8
Real wage	-2.3
Employment	-0.6

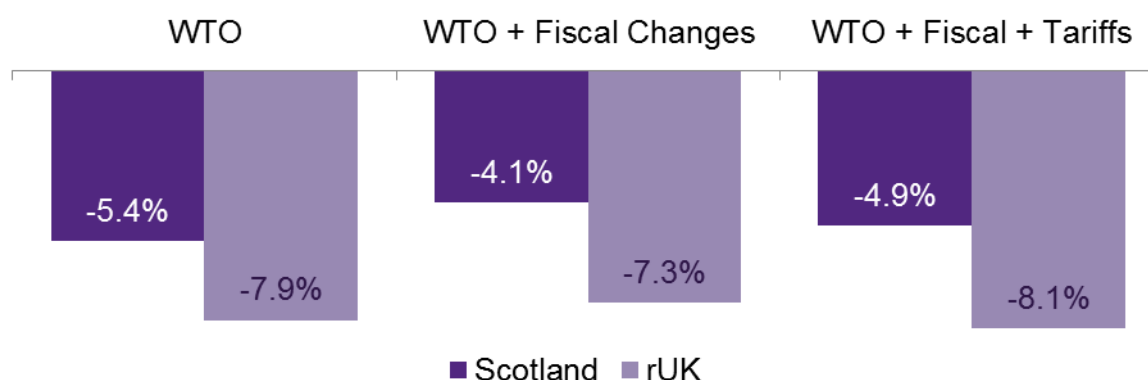
Source: Fraser of Allander Institute

WTO model – combined effect

Figure 4 sets out the long run effect on GDP under the WTO model when taking into account the additional (positive) effect of the fiscal stimulus and the additional (negative) effects of the introduction of tariffs for EU trade and a reduction in labour productivity.

This figure also shows the impact of combining the various shocks associated with Brexit under the WTO scenario for rUK. In each case, the impact on the rUK economy exceeds that for Scotland. The impacts on the rUK are larger than the effects found in aggregate macroeconomic modelling analyses of the impact of Brexit on the UK performed to date. This is likely, at least in part, to reflect the fact that the sectors that are hardest hit by the decline in exports tend to be those with the highest value-added. The FAI multisectoral model is capable of capturing this sectoral variation.

Figure 4: WTO scenario – combined long-run effects on GDP in Scotland and rUK (% change from baseline)



SECTORAL IMPACTS

‘Other primary’ activities

In all scenarios, ‘other primary’ activities are one of the hardest hit in terms of the anticipated percentage reduction in both employment and output. In the Norway and WTO scenarios, this sector could see reductions in employment of around 2,000 after around 10 years compared to the baseline. For this sector, exports are expected to be around £0.5bn lower than would

otherwise be the case after around 10 years even in the more optimistic Norway and Switzerland scenarios. In the WTO scenario, exports from the 'other primary' sector are expected to be more than £1bn lower than would otherwise be the case after around 10 years.

Other sectors that suffer larger percentage reductions in employment and output include:

- Electrical manufacturing;
- Chemicals and pharmaceuticals;
- Rubber, cement, glass and metals manufacturing; and
- Water, sewerage and waste.

Service sector

In the Switzerland scenario, the service sector takes a greater hit than in other scenarios, due to the exclusion of service sector trade agreements in EFTA. This results in larger percentage reductions for the wholesale & retail trade; transportation & storage; accommodation; food services sector.

In terms of the impact on numbers of jobs, the sectors affected by large percentage reductions are not always those expected to suffer the largest reductions in numbers employed, due to the relative scale of these sectors. The 'wholesale & retail trade; transportation & storage; accommodation; food services sector' is one of the largest sectors in employment terms, so even small percentage reductions for this sector can imply large reductions in terms of numbers employed. For this sector, the Norway scenario could imply between 8,000 and 12,000 fewer jobs than would otherwise be the case after around 10 years. In the WTO scenario, this sector could see a reduction of over 25,000 jobs relative to the baseline.

Public administration, education and health is another large sector, where small percentage changes can have a large effect on output and employment. Although this sector is less reliant on exports, it is affected by the reduction in public sector expenditure resulting from the economic slowdown and so suffers a decline in both output and employment. In the WTO scenario, this sector could face a reduction of around 15,000 jobs over the long-term, relative to the baseline. As noted earlier, this analysis takes no account of policy changes over this period, which could act to offset or mitigate these changes.

COMPARISON WITH SCOTTISH GOVERNMENT ESTIMATES

The FAI's modelling work should not be directly compared with the analysis published by the [Scottish Government](#) in August 2016 (Scottish Government, 2016). The Scottish Government analysis was not based on CGE modelling, but considered research published for the UK as a whole and applied these results to Scotland. By using CGE modelling, the FAI modelling takes account of the specific characteristics of the Scottish economy, including exports and industrial structure and so takes account of how any changes might impact differently on Scotland from the rest of the UK. The impact of Brexit on the Scottish economy, while significantly negative, is expected to be less severe than the impact on the rUK economy due to Scotland's lower exposure to international trade and the potential positive effect of inward migration to Scotland from the rest of the UK. The FAI modelling work reflects these differential impacts. The FAI have commented on the Scottish Government analysis in their [blog](#) (Fraser of Allander Institute, 2016b).

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RELATED BRIEFINGS

[SB 16-60](#) Following the EU Referendum - Frequently Asked Questions (566 KB pdf)

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