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POLICY PAPER

Modelling the Medium- to Long-Term Potential Macroeconomic Impact of Brexit on Ireland

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Abstract: There is almost a complete consensus in the international literature that Brexit will have a negative effect on the UK economy both in the short and long run. The UK is one of Ireland's closest economic partners and little is known about the potential macroeconomic impact that Brexit could have on the Irish economy. In this paper, we use the new COre Structural MOdel of the Irish economy (COSMO) to attempt to quantify the medium- to long-run impact of Brexit on the Irish economy under a series of alternative scenarios. These scenarios are intended to cover a range of potential agreements between the UK and the EU. We find that the level of Irish output is permanently below what it otherwise would have been in the absence of Brexit.

I INTRODUCTION

On 23 June 2016 the UK electorate voted to leave the EU. While the referendum is non-binding, the UK Prime Minister has made it clear that her government intends to leave the EU. The relationship between the UK and the EU and thus

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Ireland is therefore likely to change. The timing and nature of the changes will depend on the outcome of the Article 50 negotiations and the negotiations on the future relationship between the UK and the EU which the EU will negotiate under Article 218(3).

The details of the agreement on the future relationship between the EU and the UK that needs to be negotiated will determine the nature and scale of any economic impacts that may arise. A number of different possible outcomes of the negotiation process have been considered in previous research (e.g. Barrett *et al*., 2015; Ebel and Warren, 2016). These range from a relatively benign scenario where the agreement is similar to that between Norway and the EU, which would have more limited impacts, to the more extreme scenario where trade between the EU and the UK is conducted under the World Trade Organisation (WTO) tariff regime and worker mobility between the EU and the UK is curtailed.

The UK is the world's fifth largest economy and the second largest in the EU with imports from the EU and exports to the EU amounting to €400 billion and €300 billion respectively in 2015.[1] The scale of the UK economy and its strong inter-linkages with the European and wider world economy suggest the impact of any changes in these economic relationships could be substantial. While Ireland has significantly diversified its economic relationships away from the UK over the last forty years, the UK is still one of its most important individual trading partners (see Barrett *et al*., 2015; Department of Finance, 2016). Furthermore, as Ireland is the only country sharing a land border with the UK, and given the close cultural ties that have enabled considerable movement of people between the UK and Ireland over many decades, the impact of a changed relationship between the UK and the EU is likely to affect the Irish economy, at least over the short- to medium-term. The impact may arise through various economic channels and might affect trade, financial flows, investment and the movement of labour.[2] In fact, some studies have suggested that Ireland would be hit more relative to other EU countries as a result of Brexit (see, for example, Schoof *et al*., 2015).

Previous research on the potential impacts of Brexit on Ireland has focused on individual channels such as trade or FDI, or on sectors (e.g. Morgenroth, 2015; Barrett *et al*., 2015; Ibec, 2016; Davy Research, 2016; Central Bank of Ireland, 2015; Donnellan and Hanrahan, 2016; Department of Finance, 2016). Barrett *et al*. (2015) also estimated the impact of a 1 per cent reduction in the level of UK GDP on the Irish economy but that analysis did not specify the nature of the shock to the

[1] Data from the UK Office for National Statistics (ONS) are converted into Euro using the annual average exchange rate from the Central Bank of Ireland.

[2] The UK had also historically been successful in shaping the EU agenda and willing to take contrary positions and its exit could change the diplomatic balance in future economic policy formation (see Morillas, 2016).

UK economy and its wider implications on other trading partners.[3] The result from this generic simulation examining how sensitive Ireland is to the UK economy was combined with estimated impacts of Brexit on the UK economy to provide an initial assessment of the macroeconomic impact on Ireland due to a potential UK vote to exit the EU (Department of Finance, 2016). This analysis suggested that there might be a possible fall in Irish GDP relative to baseline in the range of 0.5 to 1.2 per cent based on HM Treasury and UK National Institute of Economic and Social Research (NIESR) estimates. Estimates also suggested that if Euro Area GDP were to also fall by 1 per cent, a level estimated in the Treasury's 'severe scenario', Irish GDP would fall by a further 0.4 per cent relative to baseline. In the aftermath of the UK referendum vote, the Central Bank of Ireland also published an estimate of the impact of a UK exit of the EU on the Ireland economy, based on a Bayesian Vector Autoregression approach (Central Bank, 2016). They considered an adverse WTO scenario and their results suggest that the level of Irish GDP will be over 3 per cent below a no-Brexit baseline after ten years. In the short term the CBI reduced their forecasts for Irish GDP growth by 0.6 per cent in 2017, compared with a no-Brexit baseline.

The methodologies employed in these studies do not account for the combined effect of all channels as well as feedback and indirect effects via other trading partners, which means that they cannot assess the overall macroeconomic consequences of Brexit. Such comprehensive macroeconomic impacts can only be analysed using a full model of the Irish economy. This paper seeks to provide such an analysis of the complete macroeconomic impact of Brexit on Ireland under three alternative scenarios over the medium term. Specifically, the ESRI's new macroeconomic model, the COre Structural MOdel of the Irish Economy (COSMO, see Bergin *et al*., 2016), is used to assess the macroeconomic impact under the three scenarios developed by NIESR (Ebel and Warren, 2016; Ebel *et al*., 2016) to assess the likely impact of Brexit on the UK. The NIESR modelling provides alternative evolutions to a range of external variables under their Brexit scenarios which are used in COSMO to model the effect on the Irish economy. This includes the impacts on other countries due to Brexit, which is important as the analysis by NIESR and others such as the International Monetary Fund (IMF) and the Organisation for Economic Cooperation and Development (OECD) shows that Brexit could have substantial impacts on Ireland's trading partners, which would impact on Ireland in addition to the impact on the UK. The scenarios comprise an EEA arrangement such as that between Norway and the EU, free merchandise trade only such as that between Switzerland and the EU, and a WTO outcome.

[3] This type of simulation where UK GDP is exogenously shocked is very generic in nature; in reality, the exact source and nature of a shock can be crucial for determining its impact on Ireland. Furthermore, this simulation assumed that all other international variables that affect Ireland are unchanged relative to their baseline values.

The remainder of the paper is structured as follows. In Section II, the results of previous modelling analysis of the impact of Brexit are briefly outlined. The section focuses particularly on the impacts on the UK economy for which a number of studies have been published. The section also briefly reviews the limited previous analysis on the possible macroeconomic impacts of Brexit on Ireland. Section III describes the modelling approach and provides estimates of the medium- to long-term impact of Brexit on the Irish economy. Section IV concludes.

II PREVIOUS SCENARIO MODELLING OF THE IMPACT OF BREXIT

Prior to the referendum, a number of UK and international agencies attempted to model scenarios on the economic consequences of the UK voting to leave the EU. These include the UK Treasury, the UK NIESR, the European Commission (EC), OECD, IMF, The Centre for Economic Performance at the London School of Economics (LSE-CEP), Oxford Economics, PwC and the Bertelsmann Foundation.

A number of different modelling approaches were used, including macro-econometric models (NIESR, HM Treasury, OECD, Oxford Economics), Bayesian estimated models (IMF), CGE models (LSE/CEP, PwC), DSGE models (EC's Quest III model), and econometric trade models (Bertelsmann Foundation). In particular, the NIESR NiGEM model was used by NIESR, HM Treasury and OECD, and it is thus not surprising that the simulation results share many features but they differ in terms of the assumptions around the nature of the Brexit impact.

While some analysis only considered the short-term impacts of Brexit (e.g. HM Treasury, 2016a; Baker *et al*., 2016a; Baker *et al*., 2016b), for example through increased uncertainty and exchange rate fluctuations, most of the existing analysis has focused on the medium- to long-term impacts, for example through reduced trade, FDI, UK budget contribution to the EU, migration, and reduced productivity due to lower trade and FDI.[4]

The modelling of the short-run impacts is inherently difficult, as the impacts of Brexit in the short run largely arise out of uncertainty, which is difficult to incorporate into models as unforeseen events can change the degree of uncertainty and volatility. The impacts over the medium- to long-term are more readily assessed in models as they arise out of real changes in the relationship between the UK and the EU which can be quantified. However, there is still a lot of uncertainty about what path the future relationship between the UK and the EU will take, especially regarding trade, financial flows, and the movement of labour.

[4] The degree to which all of these factors are incorporated into model scenarios depends on the model and scenario selected. For example, migration impacts are rarely considered while trade impacts are incorporated in all model simulations.

To deal with this uncertainty about the nature of the eventual agreement between the EU and the UK most studies consider a number of scenarios that cover the range of possible outcomes to the Brexit process. In particular three scenarios have been considered frequently. These scenarios are (i) a Norwegian-type solution whereby the UK becomes a member of the European Economic Area (EEA), with free trade and movement of workers; (ii) a scenario based on the UK agreeing a bilateral trade agreement with the EU along the lines of the EU/Swiss trade agreements, where trade in services is not free; and, (iii) a third scenario, whereby the UK and EU do not conclude a bilateral trade agreement and instead, the UK exercises its rights under the Most Favoured Nation (MFN) clause of the World Trade Organisation (WTO). In the light of statements by the UK Prime Minister Theresa May and some ministers, the most likely scenario at this point is a relatively hard Brexit where the UK leaves both the Single Market and the Customs Union, and seeks to negotiate a bespoke trade deal. This implies a likely outcome that is somewhere between the FTA scenario and the WTO scenario.

A further issue is that, at this point, it is difficult to predict the date at which the UK will leave the EU, so that selecting a starting point for the changed relationship between the EU and the UK for model simulations is difficult.[5] While the UK has triggered Article 50 of the Lisbon treaty at the time of writing, there have been no substantive outcomes from the negotiations. These negotiations will deal with a range of issues including liabilities and payments, and can only be extended beyond a two-year period by unanimous agreement among EU Member States.[6] The relationship between the EU and the UK may be negotiated simultaneously, but an agreement on this cannot be signed until the UK has officially left the EU. This process is thus likely to take at least two years. In the meantime the decision by the UK electorate has created significant uncertainty about the future relationship between the EU and the UK, which has resulted in significant market volatility.

The results of the simulations of the impact of Brexit on UK GDP under different scenarios is summarised in Table 1. Short-term impacts were estimated by the Treasury (HM Treasury, 2016a), NIESR (Baker *et al.*, 2016a; Baker *et al*., 2016b), the OECD (Kierzenkowski *et al*., 2016), IMF (IMF, 2016) and the European Commission (European Commission, 2016). The projected short-term impacts on

[5] While Article 50 was triggered on 29 March 2017, which means that negotiations should be completed and the UK will leave the EU on 29 March 2019, it is possible to extend the negotiations by unanimous agreement and of course it is also possible that the UK might leave the EU before that date.

[6] Under Article 50 a Member State needs to simply notify the European Council of its intent to leave the EU. The EU treaties shall cease to apply to the Member State two years after the date of notification, unless a different date is agreed to before that date by unanimous agreement. During the period between notification and exit, the EU is required to negotiate and agree (by qualified majority and obtaining the consent of the European Parliament) with the Member State the arrangements for its withdrawal.

the level of UK GDP range from a contraction by 0.9 per cent relative to a no-Brexit base, to a reduction of 3.6 per cent relative to base, with an average impact of 2.3 per cent.

Table 1: Scenario Results by UK and International Institutions on the Impacts of a Vote to Leave the EU on the UK

Study	*Scenario*	*GDP % Change Relative to Base*
NIESR	WTO (short-term)	–2.3
HM Treasury	(short-term)	–3.6
OECD	(short-term)	–3.3
IMF	Downside (short-term)	–0.9
European Commission	Mild (short-term)	–1.0
	Severe (short-term)	–2.7
NIESR	EEA	–1.8
	FTA	–2.1
	WTO	–3.2
	WTO+	–7.8
HM Treasury	EEA	–3.8
	FTA	–6.2
	WTO	–7.5
OECD	WTO/FTA (Optimistic)	–2.7
	WTO/FTA (Central)	–5.1
	WTO/FTA (Pessimistic)	–7.7
LSE/CEP	EEA/FTA	–7.9
PwC	FTA	–3.0
	WTO	–5.5
Oxford Economics	Liberal Customs Union	–0.1
	FTA	–2.8
	WTO	–3.9
Bertelsmann Foundation	EEA	–0.6
	WTO	–3.0

Long-run estimates of the impact of Brexit have been produced by HM Treasury (HM Treasury, 2016b), NIESR (Ebell and Warren, 2016; Ebell *et al*., 2016), OECD (Kierzenkowski *et al*., 2016), LSE/CEP (Ottaviano *et al*., 2014), Bertelsmann Foundation (Schoof *et al*., 2015), Oxford Economics (2016) and PwC (2016). The estimated long-run impacts range between –0.1 per cent and –7.9 per cent and average –4.15 per cent relative to base. The wider range of projected impacts compared to the short-run impacts is explained by the heterogeneity of the scenarios and the longer time horizon.

As the model of the Irish economy used in the analysis of the impact of Brexit on Ireland, COSMO, utilises projections of key external variables from the NIESR NiGEM model, the model scenarios on Brexit produced by the NIESR can be readily utilised in COSMO to model the impact of Brexit in Ireland. It is therefore useful to consider the NIESR long-term projections of the impact of Brexit in more detail. The scenarios in Ebell and Warren (2016) comprise an EEA style agreement, a Switzerland/EU style of agreement (FTA) where merchandise trade would be free but where EU financial services markets are not accessible to UK-based institutions, and a WTO scenario.[7] The magnitudes of the impacts on trade, FDI and tariffs are derived by NIESR with reference to the international literature (see Ebel and Warren, 2016), while the UK contribution to the EU budget is taken from HM Treasury and the EU. Under the EEA, FTA and WTO scenarios, trade between the UK and the EU is assumed to be reduced by 23 per cent, 31 per cent and 50 per cent respectively. FDI inflows into the UK are also expected to be down by 9.7 per cent, 17.1 per cent and 23.7 per cent respectively. The simulations also assume that expenditure in the UK by the EU is replaced by direct expenditure from UK sources, and the reduced or eliminated fiscal contribution to the EU budget would amount to 0 per cent, 0.3 per cent and 0.3 per cent of UK GDP respectively. The results show that depending on the scenario, the level of long-run UK GDP would be reduced by between 1.8 per cent and 3.2 per cent and the level of wages would be reduced by between 2.7 per cent and 5.5 per cent.

III MODELLING THE IMPACT OF BREXIT ON IRELAND

In order to gauge the potential impact of Brexit on Ireland, we consider a range of alternative scenarios to cover the broad spectrum of possible outcomes. Specifically, we use the three medium-to-long term counterfactual scenarios developed by NIESR, described in the previous section, which we label 'EEA', 'FTA' and 'WTO' for convenience.[8] Each of these scenarios combines a range of assumptions on trade, FDI and lower contributions to the EU budget to generate alternative paths for the UK economy and also for the wider international economy. The results from the international scenarios are compared by NIESR to its counterfactual baseline, which projects the path for the UK economy on the basis of it remaining in the EU. The alternative international scenarios are used as an input for COSMO to estimate the impact of Brexit on the Irish economy.

[7] They also report results for an additional WTO+ scenario where in addition to the WTO scenario the UK economy is subject to a 5 per cent reduction in labour augmenting technical progress.

[8] We are very grateful to the team at NIESR for making the results of their detailed scenarios available to us.

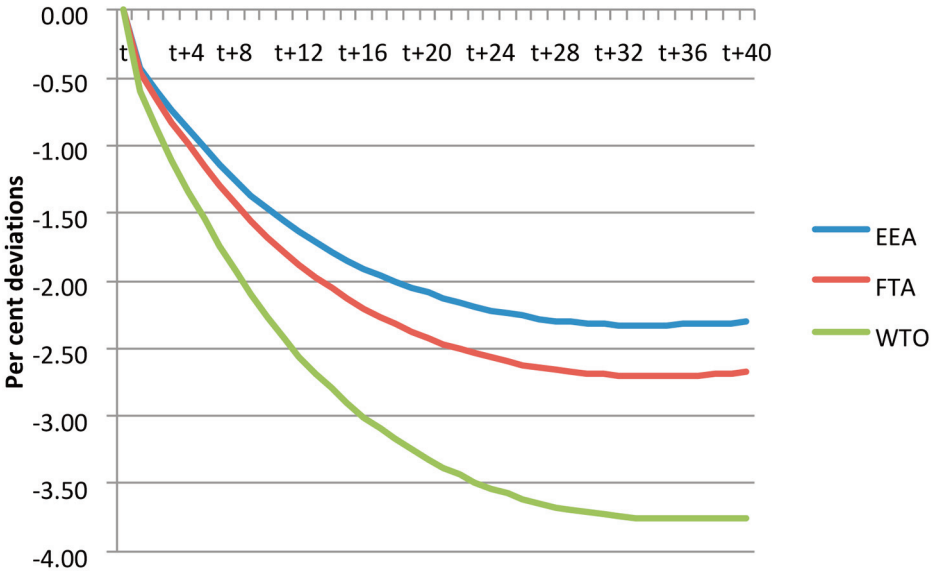
COSMO incorporates projections of key international variables from the NiGEM model. These international variables include interest rates, effective exchange rates, oil prices, competitor prices, trade-weighted world demand (for Irish exports) and conditions in alternative labour markets. The three Brexit scenarios developed by Ebell and Warren (2016) largely affect Ireland through the trade channel. In COSMO, output in the traded sector is driven by world demand and cost competitiveness and a 1 per cent increase in world demand for Irish exports leads to GVA being around 1.3 per cent above base in the long term. This strong impact reflects the highly open nature of the Irish economy. This is also the main mechanism through which the Brexit scenarios operate in the COSMO model. This also implies that the impacts estimated here do not encompass all channels through which Brexit might affect Ireland. Separate analysis of the impact of a Brexit FDI shock shows that this is expected to have a positive effect on Ireland but one that is smaller than the negative trade effect (see Lawless and Morgenroth, 2016a).

The approach adopted is first to prepare a baseline scenario that describes the evolution of the Irish economy were Brexit not to occur. To generate the baseline, we use out-of-sample projections from COSMO out to 2030 (t+40 quarters in Figure 1). However, experience has shown that the results obtained are relatively invariant with respect to the precise baseline used. We also input the international assumptions from a 'no-Brexit' scenario NIESR developed to create the baseline scenario.[9] Then the projections from these three alternative Brexit scenarios are separately incorporated into COSMO. The resulting simulation results are then compared to the baseline thereby isolating the effects on the Irish economy of Brexit. Importantly, we do not impose any balanced budget rules/solvency rules in order to identify the impact of Brexit on public finances.

Figure 1 shows the medium- to long-term impact of Brexit on the level of real output in the Irish economy over a horizon of ten years (40 quarters). In each scenario, the level of Irish output is permanently below what it otherwise would have been in the absence of Brexit. In these scenarios, we are abstracting from the short-run uncertainties associated with Brexit and only considering the potential medium- to longer-term impacts. For the simulations it is assumed that the starting date in the scenarios can be viewed as the conclusion of the Article 50 negotiations. The simulation results indicate that under the 'EEA' scenario, the level of Irish

[9] An alternative approach to developing a baseline, which is sometimes adopted, is to forecast forward all exogenous variables (including time) unchanged to generate the base. Then the changes are superimposed on this artificial base. While this approach has the advantage that the results are not affected by changing levels of key variables in the base, it raises difficulties as to how to handle inflation rates and rates of return, including interest rates. Generally in such cases interest rates and rates of return should be held fixed in real terms. Because of these problems we favour the baseline approach – superimposing shocks to the model on a baseline forecast. In that regard, past experience in using the model indicates that the results of shocks or perturbations are relatively invariant to small changes in the baseline.

Figure 1: Impact on the Level of Real Output in Ireland Across the Three Scenarios



output will be around 2.3 per cent below what it otherwise would have been over the longer term, while the longer term impacts are 2.7 per cent and 3.8 per cent in the 'FTA' and 'WTO' scenarios respectively.[10]

The simulation results suggest that the potential long-term impact of Brexit on Ireland is severe. While the three scenarios considered include a whole set of international variables that are linked to COSMO, the strongest effect is a reduction in the trade-weighted demand for Irish exports compared to what it otherwise would have been.[11] Table 2 shows the impact on key Irish macro variables after ten years (40 quarters). The table shows the deviations of variables from their baseline values. In each of the scenarios, the same mechanisms are at play but the impacts are weakest for the 'EEA' scenario and strongest in the 'WTO' scenario. While there is uncertainty around all of the estimated impacts, it is interesting to note that the simulation results suggest that the overall macro impact on Ireland is slightly more severe than the impact on the UK economy as reported by Ebell and Warren (2016), reflecting the highly open nature of the Irish economy.

[10] The Central Bank of Ireland, using a Bayesian Vector Autoregression approach, considered the likely long-term impact on real output in Ireland after ten years in a WTO scenario. Their estimates suggest that the level of Irish output would be 3.2 per cent below a no-Brexit baseline.

[11] The trade impacts are broadly similar to those obtained by Morgenroth (2015), Barrett *et al*. (2015) and Lawless and Morgenroth (2016b) using different methodologies to assess the potential trade impact of Brexit.

In COSMO, this shock is initially transmitted to the Irish economy through the traded sector. The shock to foreign demand would reduce the volume of output in the traded sector and exports over the medium- to long-run to below their baseline values. The fall in traded sector output leads to labour demand being below base which has knock-on effects for employment and the unemployment rate. As a result of the loosening in the labour market average wages are lower than in the base. The combination of lower employment and lower wages leads to lower personal income and consumption. As a result, activity in the non-traded sector which is driven by domestic demand is below base.

The fall in output and employment reduces government revenue from a range of taxes while the increase in the unemployment rate would increase government spending on welfare payments. The net effect is a dis-improvement in the general government balance over the long term.

Table 2: Impact of Brexit on Ireland after ten years, change from baseline

	EEA	*FTA*	*WTO*
Per cent deviation from Baseline Level:			
Gross value added at basic prices	–2.3	–2.7	–3.8
Gross value added at basic prices, traded sector	–2.6	–3.0	–4.3
Gross value added at basic prices, non-traded sector	–2.3	–2.7	–3.6
Exports of goods and services	–3.0	–3.5	–4.9
Personal consumption of goods and services	–2.2	–2.5	–3.4
Employed persons	–1.2	–1.4	–2.0
Average wage €	–2.2	–2.5	–3.6
Deviation from Baseline:			
Personal consumption deflator, %	–0.2	–0.2	–0.3
GDP deflator, %	–0.2	–0.2	–0.3
Personal savings rate, %	–0.3	–0.3	–0.5
Unemployment rate, %	1.2	1.4	1.9
General government balance, % GDP	–0.6	–0.8	–1.0

IV CONCLUSIONS

There is almost a complete consensus in the existing literature that Brexit will have a negative effect on the UK economy both in the short-term (via uncertainty) and over the medium-to-long term (via trade, FDI etc.). The UK is one of Ireland's closest economic partners and, as such, Ireland will be very exposed to the effects of the UK leaving the EU. There is considerable uncertainty surrounding the

eventual agreement between the UK and the EU. As a result, many of the existing international papers that model the effects of Brexit consider several scenarios that cover the range of potential outcomes.

To model the potential effects of Brexit on the Irish economy, we draw on the international literature and use the scenarios developed by NIESR to create alternative international scenarios for Ireland. These international scenarios are incorporated into the new COSMO model of the Irish economy in order to quantify the potential impact of Brexit. The results of the modelling exercise confirm some international analysis (e.g. Schoof *et al*., 2015) that Ireland will be particularly badly impacted by Brexit. Depending on the scenario considered, the level of Irish output ranges to between 2.3 and 3.8 per cent below what it otherwise would have been.

Given that COSMO is a three sector model where all internationally traded activities are aggregated into one sector, the analysis does not shed light on the sectoral exposures or indeed the regional exposures and distributional consequences. Clearly the impact of Brexit is unlikely to be evenly distributed across sectors, regions and the population. To investigate these aspects microeconomic approaches need to be utilised. Lawless and Morgenroth (2016b) analyse the potential impact of the imposition of WTO tariffs, which corresponds with the more severe scenario in this paper, on trade at the detailed product level. They show that agri-food products in particular are highly vulnerable to a hard Brexit.

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