

Bergin, Adele; Garcia-Rodriguez, Abian; McInerney, Niall; Morgenroth, Edgar L. W.;
Smith, Donal

Working Paper

Modelling the medium to long term potential macroeconomic impact of Brexit on Ireland

ESRI Working Paper, No. 548

Provided in Cooperation with:

The Economic and Social Research Institute (ESRI), Dublin

Suggested Citation: Bergin, Adele; Garcia-Rodriguez, Abian; McInerney, Niall; Morgenroth, Edgar L. W.; Smith, Donal (2016) : Modelling the medium to long term potential macroeconomic impact of Brexit on Ireland, ESRI Working Paper, No. 548, The Economic and Social Research Institute (ESRI), Dublin

This Version is available at:

<https://hdl.handle.net/10419/174281>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

Working Paper No. 548

November 2016

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

Adele Bergin^{ab}, Abian Garcia-Rodriguez^a,
Niall McInerney^a, Edgar Morgenroth^{ab*} and
Donal Smith^c

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 macro-economic 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.

**Corresponding Author: Edgar Morgenroth*

Keyword(s): Brexit, macroeconomic impacts

JEL Codes: E17, E65, E66, C553

Acknowledgements: This research was conducted under the joint Department of Finance and ESRI Research Programme on The Macroeconomy and Taxation. The authors would also like to thank Mike Fahy of the Department of Finance for assistance.

a Trinity College Dublin

b Economic and Social Research Institute (ESRI)

c Department of Finance

Modelling the Medium to Long Term Potential Macroeconomic Impact of Brexit on Ireland[^]

Adele Bergin^{a,b}, Abian Garcia-Rodriguez^a, Niall McInerney^a, Edgar Morgenroth^{a,b*} and Donal Smith^c

^a Economic and Social Research institute (ESRI), Whitaker Square, Sir John Rogerson's Quay, Dublin 2, Ireland

^b Department of Economics, Trinity College Dublin (TCD)

^c Department of Finance

*Corresponding author, Economic and Social Research Institute, Whitaker Square, Sir John Rogerson's Quay Dublin, Ireland. E-mail: edgar.morgenroth@esri.ie

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 macro-economic 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.

Key Words: Brexit, macroeconomic impacts,

JEL Classification: E17, E65, E66, C553

[^]This research was conducted under the joint Department of Finance and ESRI Research Programme on *The Macroeconomy and Taxation*. The authors would also like to thank Mike Fahy of the Department of Finance for assistance.

1. Introduction

On the 23rd of 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 Ireland is therefore likely to change. The timing and nature of the changes will depend on the date on which Article 50 of the Lisbon treaty is triggered¹ and the subsequent negotiations between the EU and the UK.

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 the 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 €400bn and €300bn respectively in 2015.² 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 labour³. In fact, some studies have suggested that Ireland would be hit particularly 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 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 UK economy and its wider implications on other trading

¹ The UK Prime Minister has recently stated that she will notify the EU of the UK's intention to leave between January and March 2017.

² Data from the UK Office for National Statistics (ONS), is converted into € using the annual average exchange rate from the Central Bank of Ireland.

³ The UK had also historically been successful in shaping the EU agenda and willing to take contrary positions, its exit could change the diplomatic balance in future economic policy formation (see Morillas, 2016).

partners.⁴ 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 suggests 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 percent below a no-Brexit baseline after ten years and 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 methodology employed in these studies ignores 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 new 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, and 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 IMF and the 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.

The remainder of the report will be structured as follows. In section 2, 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 3 describes the modelling approach and provides estimates of the medium to long term impact of Brexit on the Irish economy.

⁴ 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.

2. 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 National Institute of Economic and Social Research (NIESR), the European Commission (EC), the Organisation for Economic Cooperation and Development (OECD), International Monetary Fund (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 macroeconomic models (NIESR, HM Treasury, OECD, Oxford Economics), Bayesian estimated model (IMF), CGE models (LSE/CEPPWC), 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,b) 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.⁵

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.

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. 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).

⁵ 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.

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. To date the UK has not triggered Article 50 of the Lisbon treaty which will initiate the negotiations between the EU and the UK about the withdrawal of the UK from the EU⁶. These 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 States⁷. 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,b) the OECD (Kierzenkowski et al., 2016), IMF (IMF, 2016) and the European Commission (European Commission, 2016). The projected short-term impacts on 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 and averages 2.3 per cent.

⁶ In a speech the UK Prime Minister announced that the UK intends to trigger Article 50 in the first quarter of 2017.

⁷ 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.

Table 1: UK and International Institutions Scenario 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 | -2.7% |
| | | -5.1% |
| | | -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 on the impact of Brexit have been produced by HM Treasury (HM Treasury, 2016b), NIESR (Ebell and Warren, 2016 and 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 (EFTA) where merchandise trade would be free but where EU financial services markets are not accessible to UK based institutions, and a WTO scenario⁸. 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, EFTA 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.

3. 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.⁹ 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 NIESER 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.

⁸ They also report results for an additional WTO+ scenario where in addition to the WTO scenario the UK economy is subject to a 5% reduction in labour augmenting technical progress.

⁹ We are very grateful to the team at NIESR for making the results of their detailed scenarios available to us.

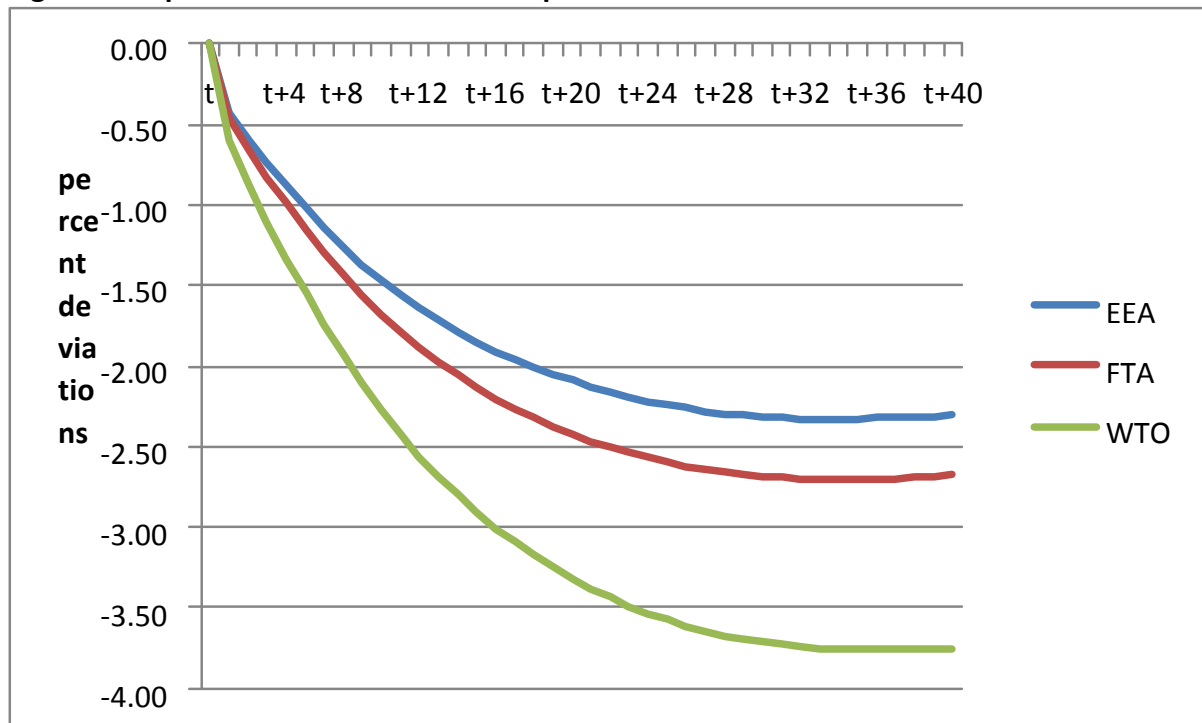
The approach adopted is first to prepare a baseline scenario that describes the evolution of the Irish economy were BREXIT not to occur. To generate the baseline, we use out-of-sample projections from COSMO out to 2030 (t+40 quarters in Figure 1). However, experience has shown that the results obtained 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.¹⁰ Then, the 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 10 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 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.¹¹

¹⁰ 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.

¹¹ 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.

Figure 1: Impact on the level of Real Output in Ireland across the three scenarios



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 or Irish exports compared to what it otherwise would have been¹². 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.

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 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 (GGB) over the long-term.

¹² The trade impacts are broadly similar to those obtained by Morgenroth, (2015), Barrett et al., (2015) and Lawless and Morgenroth (2016) using different methodologies to assess the potential trade impact of Brexit.

Table 2: Impact of Brexit on Ireland after 10 years, change from baseline

| | EEA | FTA | WTO |
|--|------|------|------|
| <i>Percent deviation from Baseline Level:</i> | | | |
| 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 |
| | | | |
| <i>Deviation from Baseline:</i> | | | |
| 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 |

4. 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.

References

- Baker, J., Carreras, O., Ebell, M., Hurst, I., Kirby, S., Meaning, J., Piggott, R., and J. Warren (2016a), "The short-term economic impact of leaving the EU", *National Institute Economic Review*, Vol. 236, pp.108-120.
- Baker, J., Carreras, O., Kirby, S., Meaning, J., and R. Piggott (2016b), "Modelling events: The short-term impact of leaving the EU", *Economic Modelling*, Vol. 58, pp. 339-350.
- Barrett, A., Bergin, A., FitzGerald, J., Lambert, D., McCoy, D., Morgenroth, E., Siedschlag and Z. Studnicka (2015), *Scoping the Possible Economic Implications of Brexit on Ireland*. Research Series No. 48. Dublin; Economic and Social Research Institute.
- Bergin, A., Conroy, N., Garcia Rodriguez, A., Holland, D., McInerney, N., E. Morgenroth and D. Smith (2016), COSMO: A Structural Macro-Econometric Model with Financial Market Linkages for Ireland. *ESRI Working Paper* (Forthcoming).
- Central Bank of Ireland (2015), "Box 6: Potential implications for the Irish financial sector of a UK exit from the EU", in *Central Bank Macro-Financial Review, 2015:II*. Dublin: Central Bank of Ireland.
- Central Bank of Ireland (2016), "Box B: The Impact of Brexit on the Short-term Outlook", in *Central Bank Quarterly Bulletin Q3*. Dublin: Central Bank of Ireland.
- Davy Research (2016), *The economic impact of Brexit on Ireland*. Davy Irish Economy March 31, Dublin: Davy Research
- Department of Finance (2016), *Summer Economic Statement*. Dublin: Department of Finance
- Department of Finance (2016), *UK EU Exit - An Exposure Analysis of Sectors of the Irish Economy*. Dublin: Department of Finance.
- Donnellan, T., and K. Hanrahan (2016), *Brexit: Potential Implications for the Irish Agri-Food Sector*. Athenry: Teagasc
- Ebell, M., and J. Warren (2016), "The long-run economic impact of Leaving the EU", *National Institute Economic Review*, Vol. 236, pp. 113-143.
- Ebell, M., Hurst, I., and J. Warren (2016), "Modelling the long-run economic impact of leaving the European Union", *Economic Modelling*, Vol. 59, pp. 196–209
- EC (2016), "The Economic Outlook after the UK Referendum: A First Assessment for the Euro Area and the EU". *Institutional Paper 032*. Brussels: European Commission.
- HM Treasury (2016a), *HM Treasury analysis: the immediate economic impact of leaving the EU*. London: HM Treasury.
- HM Treasury (2016b), *HM Treasury analysis: the long-term economic impact of EU membership and the alternatives*. London: HM Treasury.
- Ibec (2016), *The impact of a possible Brexit on Irish business*. Dublin: Ibec
- IMF (2016), *World Economic Outlook Update*. Washington: International Monetary Fund.
- Kierzenkowski, R., Pain, N., Rusticelli, E., and Zwart, S. (2016), *The Economic Consequences of Brexit: A Taxing Decision*. *OECD Economic Policy Paper*, No. 16. Paris: OECD.
- Lawless, M., and E. Morgenroth (2016), "The Product and Sector Level impact of a hard Brexit across the EU", mimeo.

- Morgenroth, E., (2015), 'Economic Consequences for Ireland' in O'Ceallaigh, D., and P. Gillespie (eds.) *Britain and Europe: The Endgame*. Dublin; Institute for International and European Affairs.
- Morillas, P., (2016), "The Brexit Scenarios: Towards a new UK-EU Relationship", CIDOB Documents.
- Ottaviano, G., Pessoa, J., Sampson, T., and J. Van Reenen (2014), 'The Costs and Benefits of Leaving the EU', *Centre for Financial Studies Working Paper Series* No. 472.
- Oxford Economics (2016), *Assessing the Economic Implications of Brexit*. London: Oxford Economics.
- PWC (2016), *Leaving the EU: Implications for the UK economy*. London: PricewaterhouseCoopers LLP
- Schoof, U., Petersen, T., Aichle, R., and G. Felbermayr (2015), *Brexit – potential economic consequences if the UK exits the EU*. Gütersloh: Bertelsmann Stiftung.

| Year | Number | Title/Author(s) ESRI Authors/Affiliates <i>Italicised</i> |
|------|--------|--|
| 2016 | 547 | The student perspective on in-school personal electronic devices and online safety: A qualitative study, Bryan Coyne and <i>Selina McCoy</i> |
| | 546 | Recreational Angling Tournaments: Participants' Expenditures, <i>John Curtis, Benjamin Breen</i> and Paul O'Reilly |
| | 545 | What Drives People's Opinions of Electricity Infrastructure? Empirical Evidence from Ireland, <i>Valentin Bertsch, Marie Hyland</i> and Michael Mahony |
| | 544 | The Effects of Home Energy Efficiency Upgrades on Social Housing Tenants: Evidence from Ireland, Bryan Coyne, <i>Sean Lyons and Daire McCoy</i> |
| | 543 | Price Transparency in Residential Electricity: Experiments for Regulatory Policy <i>Pete Lunn and Marek Bohacek</i> |
| | 542 | Value for Money in Energy Efficiency Retrofits in Ireland: Grant Provider and Grant Recipients <i>Matthew Collins and John Curtis</i> |
| | 541 | Examining the Benefits of Load Shedding Strategies using a Rolling-Horizon Stochastic Mixed Complementarity Equilibrium Model <i>Mel T. Devine and Valentin Bertsch</i> |
| | 540 | How Sensitive is Irish Income Tax Revenue to Underlying Economic Activity? <i>Yota Deli, Derek Lambert, Martina Lawless, Kieran McQuinn, Edgar Morgenroth</i> |
| | 539 | The Timing and other Determinants of Gas Central Heating Adoption <i>Daire McCoy and John Curtis</i> |
| | 538 | The Efficient Frontiers and Fiscal Stability: An Ex-ante and Ex-post Application to the Irish Public Finances <i>Kieran McQuinn</i> and Maurice Roche |
| | 537 | The Impact of Taxes on the Extensive and Intensive Margins of FDI Ronald B. Davies, <i>Iulia Siedschlag and Zuzanna Studnicka</i> |
| | 536 | The Surplus Identification Task and Limits to Multi-Attribute Consumer Choice <i>Peter D. Lunn, Marek Bohacek and Féidhlim McGowan</i> |

For earlier Working Papers see <http://www.esri.ie>