

# Measuring Economic Activity in the Presence of Superstar MNEs\*

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November 6, 2022

## Abstract

In 2015, changes to Irish tax legislation, known as the “2015 Finance Act”, coincided with a 26% annual increase in real gross domestic product. We show evidence confirming the conclusions of existing literature, which suggests that the presence of large multinational enterprises (MNEs) is likely to have distorted Irish GDP – a measure previously considered to be a reliable proxy of domestic economic activity. Furthermore, we provide an alternative method of statistically isolating the variation in GDP growth attributable solely to domestic activity growth to infer the prevailing state of the Irish economy. Our findings imply a 21% lower level of GDP relative to the official measure recorded for 2020. We suggest that our methodology may be applied by policymakers in small open economies to improve the accuracy of growth and business cycle monitoring.

**JEL Classifications:** F23; C38; E01; H26; O34

**Keywords:** Tax havens; multinational firms; national accounting; dynamic factor models

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\*We are grateful for comments from Jeremy Piger, Bruce Blonigen, Jose Carreno, Shankha Chakraborty, Mark Colas, Anca Cristea, David Evans, George Evans, Woan Foong Wong, and other members of the University of Oregon Macro and Trade Groups. Additionally, we are grateful for comments from Adele Bergin, Paul Egan, Kieran McQuinn, and Wendy Disch from the Macroeconomic Division of the Economic and Social Research Institute (ESRI) for their helpful insights into the current national accounting needs of key Irish stakeholders. All remaining errors are our own.

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# 1 Introduction

This study considers the presence of large multinational enterprises (MNEs) in a small open economy and the unanticipated influence that the international tax planning strategies of these firms can have on the economic interpretability of national accounting measures. We focus on the case of the Republic of Ireland, in which MNEs’ strategic relocation of intangible assets has introduced difficulties in interpreting key aggregate economic measures. Ireland’s introduction of a Capital Allowances for Intangible Assets (CAIA) tool, in tandem with adjustments to tax legislation, resulted in ‘stateless’ tax entities switching in status to Irish residency.<sup>1</sup> This coincided with a 26.3% increase in Ireland’s real GDP in 2015. These changes largely stem from the emergence of digital commerce, which enables major tech firms to shift profits into low tax countries, regardless of where income was originally earned (Fitzgerald, 2018). While these issues are not unique to Ireland, this case is particularly pronounced (Avdjiev et al., 2018).

Moulton and van de Ven (2018) find that the effects of globalization can make national data difficult to interpret, and may even be considered a distorting influence on the data. In Ireland’s case, it is argued that these tax-optimization strategies of a select few superstar MNEs has led to a ‘distortion’ in GDP as a measure of domestic activity. When assessing the factors that contributed to the extreme growth of Irish GDP in 2015, the majority appear to be largely uncorrelated with the state of the domestic economy (Fitzgerald, 2015; Lane, 2017; Fitzgerald, 2018; Honohan, 2021). For example, contract manufacturing has now become a far greater aspect of the quarterly national accounts measure of exports.<sup>2</sup> While these manufactured goods never once interact with the Irish border, they continue to contribute to GDP. For policymakers in Ireland, conventional models used to predict short to medium term growth are notably less accurate when forecasting GDP. This makes correctly adjusting fiscal budgets, and motivating those adjustments, more difficult.

Our study verifies claims that these unorthodox aspects of GDP growth do not reflect variation in domestic economic activity. Additionally, we present an alternative measure of GDP that excludes the influence of foreign MNE tax-restructuring activity from existing measures of aggregate output using a dynamic factor modeling (DFM) framework. Upon as-

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<sup>1</sup>This tool allows firms to access tax allowances for any intellectual property (IP) relocated to Ireland as well as accrue tax benefits based on the depreciation of these assets.

<sup>2</sup>This process consists of contracting a firm based outside of Ireland to manufacture particular goods, the final products being owned by the contractor, i.e. the foreign-owned Irish resident firm. These goods are subsequently sold and exported by the third party on behalf of the Irish-based subsidiary, which results in the goods being registered as an Irish export due to the ownership status of the goods.

sessing this impact on the national accounts, we find that excluding distortionary IP-related MNE activity reduced the effective GDP measure by an average of 18% between 2015Q1 and 2020Q4. This implies a 12.9 percentage point higher debt-to-GDP ratio and greatly improves Ireland’s position as a contributor to the EU-27 fiscal budget. This evidence of overstated GDP aligns strongly with Guvenen et al. (2022), which highlights that IP-related tax restructuring and profit shifting by large MNEs has contributed to an understatement of US GDP. Furthermore, we find that there is no evidence of significant spillover effects between shocks to our domestic and foreign MNE factors, respectively.

These findings suggest that GDP in Ireland is heavily distorted, if used to gauge the performance of the domestic economy by conventional standards. These results validate the expressed concerns of Irish policymakers and statisticians alike and add to support for continued progress in modernizing international national accounting practices in response to increased digitization and globalization of MNE activity. The remainder of the paper is organized as follows. Section 2 details our methodology. Section 3 provides a brief discussion of our raw data and the necessary transformations. Section 4 details our results and section 5 concludes the paper.

## 2 Methodology

We build a dynamic factor model and use it to generate historical estimates of a factor that represents the state of domestic economic growth in Ireland, along with a factor that represents the state of foreign activity growth associated with large MNEs actions. We then decompose the growth rate of Irish GDP as a linear combination of domestic and foreign factors to generate an adjusted GDP measure that partials out foreign distortions by projecting onto the domestic factor.

We first combine a large number of disaggregated macroeconomic series into a single dataset of quarterly frequency. We then partition the data into two groups: the first group contains series that have significant variation associated with the overall growth of domestic activity in Ireland, while the second group contains series that we claim reflect variation in the growth of IP-related foreign MNE activity. Next, we specify a dynamic factor model with two factors, such that each factor corresponds with only one of the above-mentioned groups of series – these will be referred to as the domestic and foreign factors, respectively. Both factors are specified as being generated by a VAR( $p$ ) process. To estimate our factors, we

carry out a procedure similar to the two-step DFM estimator most notably used by Giannone et al. (2008) and asymptotically analysed by Doz et al. (2011). We use the factor estimates to generate an adjusted GDP growth rate measure that rids the original GDP growth rate measure of the distortion caused by foreign activity. Given the exceptional circumstances which have brought into question the ability of Irish GDP to reflect the state of the domestic economy, we estimate the following model:

$$\% \Delta GDP_t = \alpha + \beta_1 f_t^d + \beta_2 f_t^f + \gamma D_t + \beta_3 (f_t^d D_t) + \beta_4 (f_t^f D_t) + \varepsilon_t, \quad (1)$$

where  $t$  ranges from 1998Q1 to 2020Q4,  $\% \Delta GDP$  denotes Ireland's quarter-on-quarter real GDP growth rate,  $f^d$  is the domestic factor,  $f^f$  is the foreign factor, a post-2015 IP movement dummy variable,  $D_t$ , is equal to 1 for periods from Q1 2015 onward, and  $\varepsilon$  is a disturbance term. The inclusion of the dummy interaction terms allows us to eliminate any contribution of the structural break in the relationship between GDP growth and domestic factor variation. The pre-2015 subsample provides a reliable estimate of the relationship between the domestic activity factor and the GDP growth rate, whereas the post-2015 period is subject to potential bias due to the sudden and enlarged repositioning of intellectual property into Irish national accounts. The following expression yields our adjusted GDP growth rate measure based on the parameters estimated using the regression model specified in Eq. (1):

$$\% \Delta GDP_t^a = \hat{\alpha} + \hat{\beta}_1 f_t^d + \varepsilon_t. \quad (2)$$

The data can be grouped into two subsets: monthly domestic and quarterly foreign MNE activity data. Monthly data is aggregated to a quarterly set of series in order to maintain a consistent frequency between both factors. A list of the specific series used for both factors is provided in the Appendix. In selecting the appropriate set of domestic data for estimating our domestic activity factor, we refer to the common practices of Stock and Watson (1989) and Stock and Watson (2016). Both studies focus on measures of industrial production, personal income, retail sales and employment when estimating a domestic activity factor. We measure the logged first difference of each seasonally adjusted series to obtain a stationary set of growth rates, unless otherwise stated. The set of variables used to estimate the foreign MNE factor is informed by our knowledge of the 2015 level shift in GDP and aforementioned types of MNE activities. The relocation of IP ownership to subsidiaries based in Ireland led to a significant increase in intangible assets and a rise in associated income flows.

### 3 Results

Upon estimating the dynamic factor model, we identify a common component of domestic economic activity as well as one for foreign multinational activity in Ireland. For brevity, we refer to these two items displayed in Figure 1 as the domestic and foreign factors, respectively. Each of these factors are normalized, hence any deviation above or below zero would be considered a deviation from long-run average growth rates.

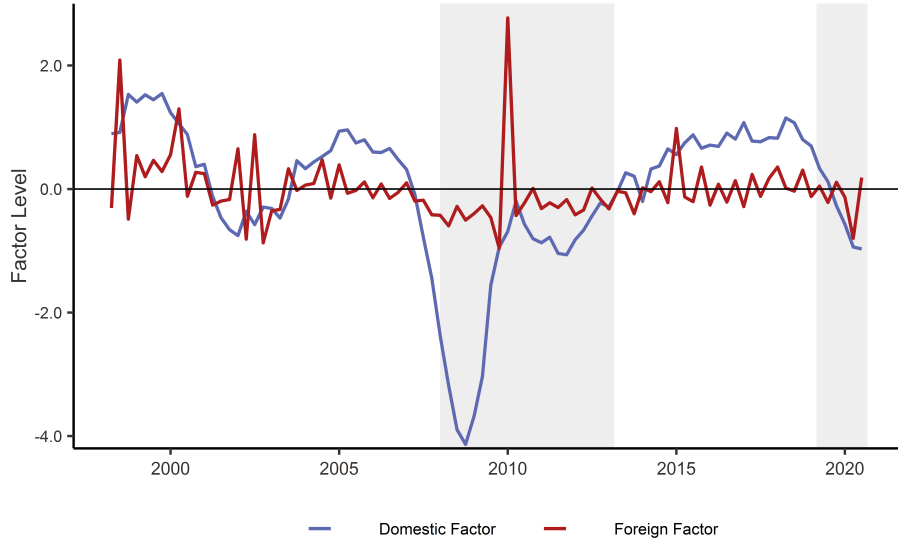


Figure 1: Domestic and foreign factor estimates

A number of events appear to be captured appropriately by the factor estimates. Notice that the domestic series accurately captures the Great Recession period. Following a prolonged recovery period, the series suggests a rather smooth and lengthy period of prosperity between 2013 and 2019. In contrast the foreign factor suggests a less intense response following the Great Recession. Furthermore, significant increases in this factor's variation overlap notably with respect to the introduction of specific profit-shifting tax tools in 2010 and 2015.<sup>3</sup> Although there is a sharp increase in MNE activity in 2015, the trend in domestic growth remains persistent relative the periods before and after – in line with our previously expressed priors.

The correlation coefficient between GDP and the domestic factor drops from 0.47 in the pre-2015 subsample to -0.09 in the post-2015 subsample, suggesting a degradation in the ability of the prevailing GDP measure to reflect the state of the domestic economy. In

<sup>3</sup>We refer to Capital Allowances for Intangible Assets (CAIA) base-erosion and profit-shifting tools, which limit the tax liability of firms with major holdings of intellectual property.

contrast, the foreign factor becomes highly correlated with GDP, rising from 0.41 in the pre-2015 subsample to 0.76 in the post-period subsample. These stylized facts support the proposition that IP-related MNE activities have distorted GDP growth in recent years.

We estimate the linear regression model expressed in Eq. (1) to generate a series of adjusted GDP growth rates based on domestic economic performance. In the post-2015 period, a unit increase in the domestic factor variable is associated with a  $-2.2$  percentage point adjustment in the real quarterly GDP growth rate whereas prior to 2015, a  $0.7$  percentage point increase is expected. Leveraging use of this pre-2015 relationship, we generate our adjusted GDP growth measure. In Figure 2 we highlight the level of GDP from 2014Q4 onward, should we exclude the influences of distortionary MNE activities and only rely on the adjusted growth rates up until 2020Q3. This highlights a substantial exaggeration of sustained domestic activity growth, which once excluded represents an average GDP level reduction of 14%.

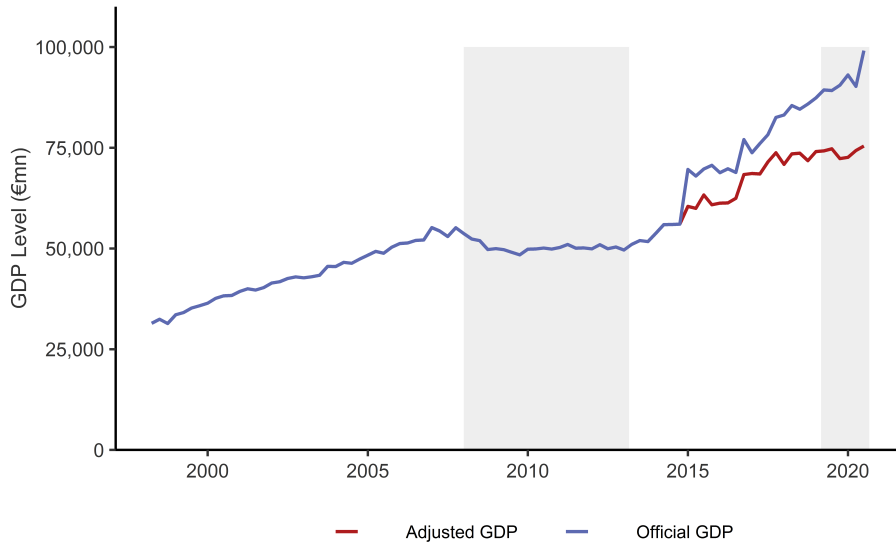


Figure 2: Imputed real GDP

We are also able to address the assertion from policymakers and national accounting practitioners alike that activities associated with the relocation of IP do not contribute to domestic economic activity in Ireland. Through a set of impulse response functions, we observe the responsiveness of the factors to orthogonal shocks in both foreign and domestic activity. As highlighted in Figure 3, the two factors are significantly separable. A shock to domestic activity in Ireland has a negligible transitory effect on the foreign factor, and likewise, any shock to the foreign factor has no significant effect on domestic activity.<sup>4</sup> Our

<sup>4</sup>We have performed an additional robustness test in which we estimated a multi-level DFM containing

results suggest that activities related to commercially sensitive intangible assets of large MNEs in Ireland did not lead to growth spillovers for the domestic economy.<sup>5</sup>

To assess our adjusted GDP measure, we compare it to existing and regularly used alternative measures of domestic economic activity in Ireland. These series consist of Modified Domestic Demand (MDD) and Modified Gross National Income (GNI\*), the former being the current preferred measure of output growth in Ireland. As displayed in Figure ??, our measure performs favourably. Firstly, while none of these series use GDP as an input, our own adjusted measure maps most closely to the prevailing real GDP level up to 2014. Additionally, the series neither predicts excessively high levels of growth from 2015 onward, nor does it imply as much of a slow recovery process following the Great Recession as the alternative measures.

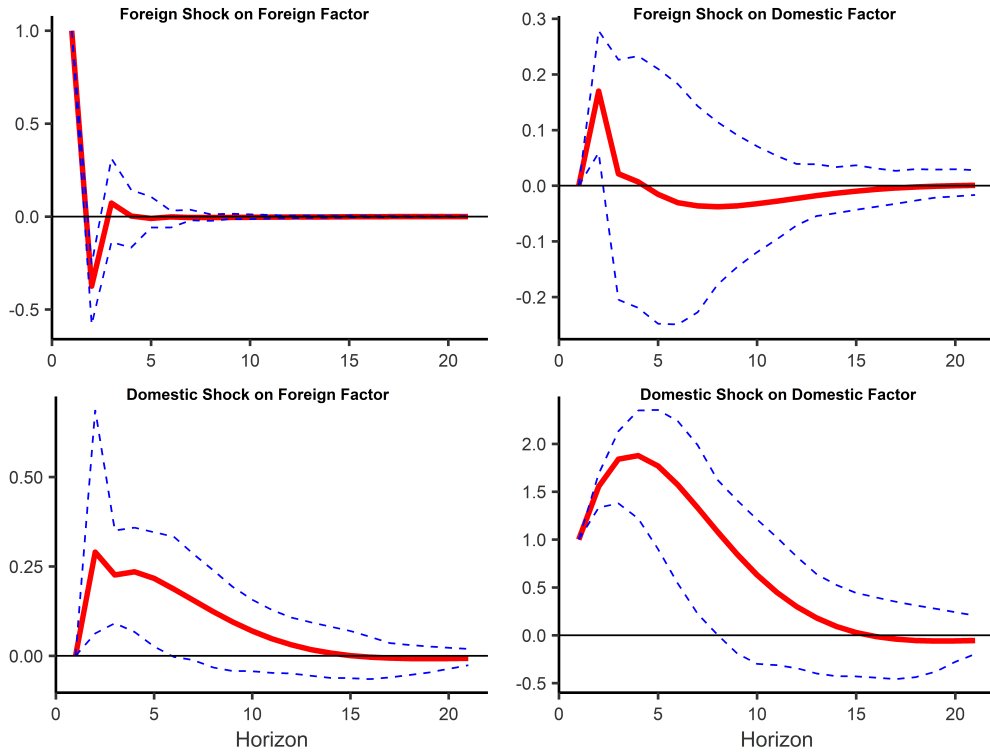


Figure 3: IRFs for reduced-form shocks to foreign and domestic factors

*Note:* The blue lines represent bootstrapped 95% confidence intervals.

an additional common factor across both data blocks. We found this ‘global’ factor to be insignificant, as it accounts for very little of the overall variation in the data. This implies a lack of common shocks affecting both data blocks, and in turn a lack of common shocks to the domestic and foreign factors.

<sup>5</sup>Although evidence of positive MNE spillovers exists, such evidence is often limited to scenarios in which the investing firms are incentivized to reduce their costs through backward supply linkages (Javorcik, 2004).

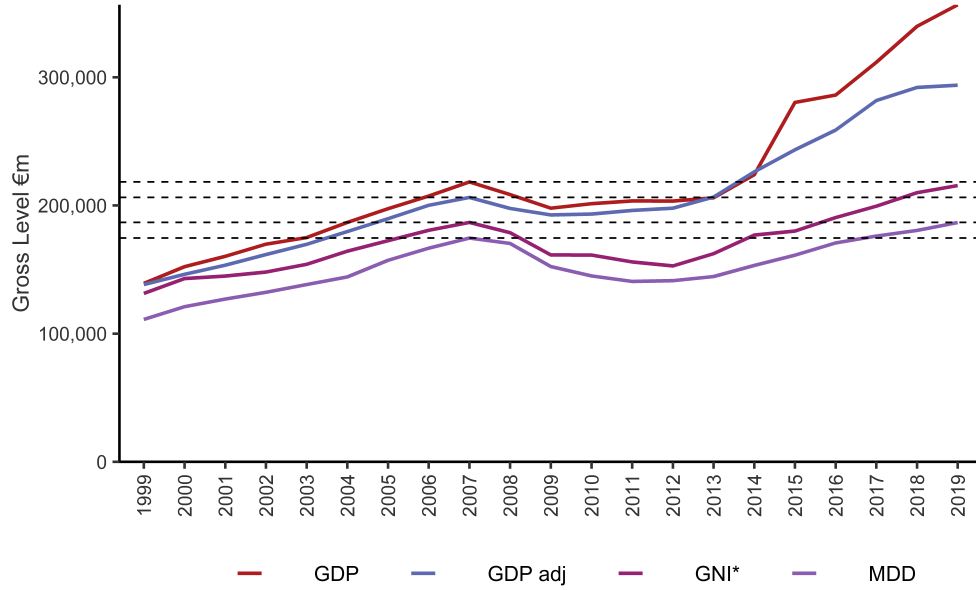


Figure 4: Comparing Annualized Domestic Measures

*Note:* Levels are compared to real GDP from 1999 to 2019. The dashed black lines indicate the period at which each series suggests the Irish economy returned to activity observed in 2007.

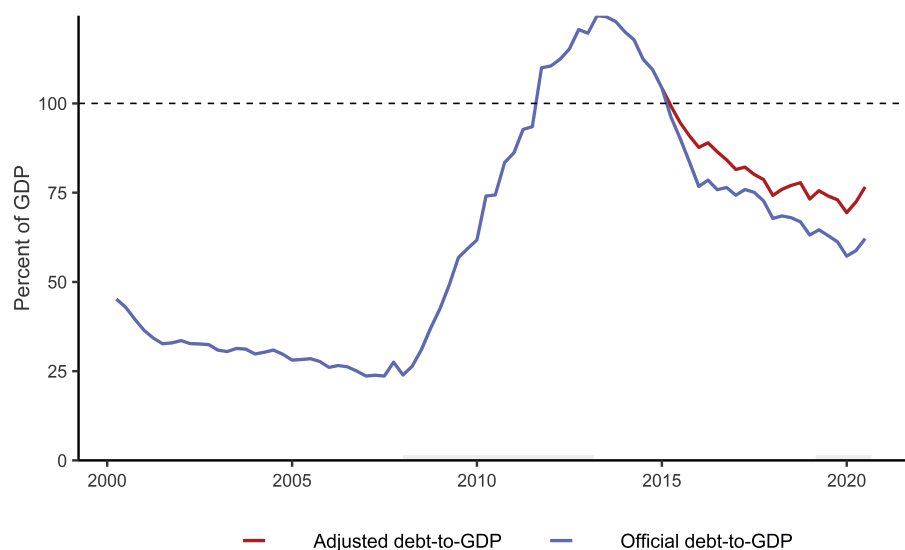
Given our quarterly measure of adjusted GDP from 2015 onward, we can reassess the fiscal position of Ireland with respect to national debt and EU budget contributions. From 2015Q1 onward, Figure 5a displays an average percentage point increase in the debt position of 12.9 percentage points. The most recent 2020Q3 difference of 16.9 percentage points implies debt represents 79.1% of adjusted GDP, which remains considerably below the EU-27 average of 90.1%. This correction for the influence of intangible asset ownership present in our adjusted GDP measure also implies Ireland has been contributing more generously to the EU budget than previously thought. As displayed in Figure 5b, Ireland ranked as the 4th lowest contributor to the 2018 EU budget as a percentage of GDP, whereas according to our adjustment Ireland ranks moderately at 15th place.

This exercise also highlights that other low ranked countries are common culprits with respect to a large MNE influence on national accounts. In the case of Luxembourg and the Netherlands, Damgaard et al. (2019) refer to a similar pattern of major FDI flows passing through empty shells recognized as foreign subsidiary firms of MNEs. As the study states, “these shells, also called special purpose entities, have no real business activities. Rather, they carry out holding activities, conduct intra-firm financing, or manage intangible



assets—often to minimize multinationals’ global tax bill.” While these countries could also see their GDP adjusted, to present a more reasonable ranking of EU countries, we leave such efforts for future research.

Panel A: Implied Debt-to-GDP ratio



Panel B: EU Budget Contributions by country in 2018

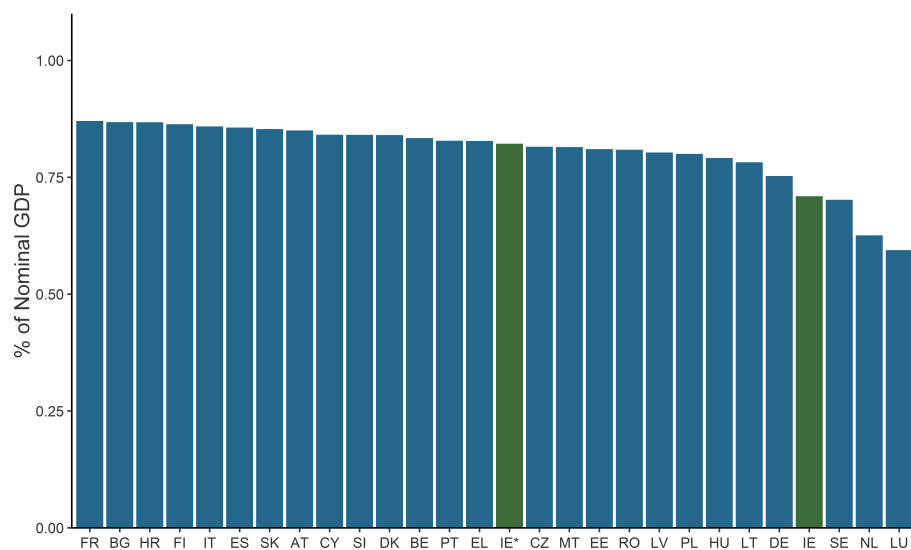


Figure 5: Corrections to Irish Fiscal Position

## 4 Conclusion

Despite our focus on the implications of such tax strategies for a given country's national accounts, there exists a wider concern with respect to GDP distortions across small open economies. Torslov et al. (2020) estimates that in 2015 more than 40% of US-parented multinational profits (\$616bn) were shifted to tax havens globally. Although Ireland maintains the highest estimated share of profit-shifting destinations (17.2%), the Netherlands (9.3%), Singapore (11.4%), Switzerland (9.4%) and the Caribbean (15.7%) also all feature prominently. While our paper focuses on the case of Ireland, our methodology is applicable to a wider set of countries exposed to similar GDP distortions. We encourage policymakers in small open economies with GDP distortion issues of the same nature as Ireland to use our approach in order to more accurately track the growth states of their domestic economies.

# Appendix

Table 1: Domestic Data Series

Name	Source
<b>Industrial Production</b>	
Meat and meat products (101)	CSO: MIM02, MIM03, MIM04
Other foods (102 to 104,108)	
Dairy products (105)	
Bakery and farinaceous products (107)	
Textiles, wearing apparel and leather products (13 to 15)	
Wood and wood products, except furniture (16)	
Paper and paper products, printing and reproduction of media (17,18)	
Rubber and plastic products (22)	
Other non-metallic mineral products (23)	
Basic metals and fabricated metal products (24,25)	
Transport equipment (29,30)	
Electricity, gas, steam and air conditioning supply (35)	
<b>Unemployment</b>	
Persons on Live Register, All ages, Unadjusted	CSO: LRM01
Monthly Unemployment ('000s), 25 - 74 years, Seasonally-Adjusted	CSO: MUM01
<b>Retail Sales</b>	
Motor trades (45)	CSO: RSM03, RSM04, RSM05
Retail sale in non-specialized stores with food, beverages or tobacco	
Department stores (4719)	
Retail sale of hardware, paints and glass (4752)	
Retail sale of furniture and lighting (4759)	
Retail sale of food (4711,4721 to 4729)	
Non food products, excluding motor trades, automotive fuel and bars	
Retail sale of food, beverages and tobacco in specialized stores	
Retail sale of household equipment (4741 to 4743,4752,4754,4759)	
Retail sale of electrical goods (4741 to 4743,4754)	
Retail sale of books, newspapers, stationery and other goods	
Other retail sales (4753,4763 to 4765,4776 to 4778)	
Retail sale of pharmaceutical, medical and cosmetic articles (4773 to 4775)	
<b>Other</b>	
New Vehicles	CSO: TEM01
Secondhand Vehicles	CSO: TEM01
Tax Receipts, Income Tax	DOF: Databank
Tax Receipts, Stamp Duty	
Tax Receipts, Value-Added Tax	
Consumer confidence indicator	Eurostat: BS-CSMCI-BAL

*Note:* Central Statistics Office (CSO), Department of Finance (D.o.F). Any terms following CSO are PXtable codes.

Table 2: Foreign MNE Data Series

Name	Source
Gross Domestic Fixed Capital Formation - Intangible Assets	CSO: NQQ49
CA Inflow - Communication Services	CSO: BPCQ1,BPQ19,BPQ20
CA Inflow - Financial Services	
CA Inflow - Computer Services	
CA Inflow - Royalties & License Fees	
CA Inflow - Operational Leasing	
CA Outflow - Communication Services	
CA Outflow - Royalties & License Fees	
CA Outflow - Research & Development Services	
CA Outflow - Operational Leasing	
CA Outflow - Other Business Services	
CA Outflow - Dividends and Distribution of Branch Profits	
CA Outflow - Reinvested Earnings	
Corporation Tax Receipts	D.o.F Databank CSO: NQQ43
GVA - Information and Communication Services	
GVA - Industry	CSO: TSM10
GVA - Finance and Insurance Activities	
Imports - Organic Chemicals	
Imports - Medicinal and Pharmaceutical Products	
Imports - Machinery less Electrical Machinery	CSO: TSM10, NQQ49
Imports - Electrical Machinery	
Contract Manufacturing (author calculations)	

*Note:* Central Statistics Office (CSO), Current Account (CA), Department of Finance (D.o.F), Gross value added at basic prices (GVA). Any terms following CSO are PXtable codes. Our estimate of contract manufacturing also includes contributions by the merchanting of goods (reselling of final goods purchased and sold outside of Ireland), purchases of aviation fuel abroad by Irish resident airlines, estimates for illegal cross-border trade, transportation and insurance costs. Based on supplementary notes from the CSO, we assume these additional elements to be negligible in size.<sup>6</sup>

<sup>6</sup>See ‘Explaining Goods Exports and Imports 2012-2016’, which largely motivated this approach. Contract manufacturing represented 89.4% and 88.3% of the difference between QNA goods exports and cross-border goods exports in 2015 and 2016, respectively. Available at: [www.cso.ie/en/releasesandpublications/in/geid/explaininggoodsexportsandimports2012-2016/](http://www.cso.ie/en/releasesandpublications/in/geid/explaininggoodsexportsandimports2012-2016/)

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