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Profit-led in Effect or in Mere Appearance? Estimating the Irish Demand Regime Given the Influence of Multinational Enterprises

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Abstract

In the Republic of Ireland, the activities of MNEs drive real demand on one level and severely distort conventional national accounts statistics on another. This poses a problem for the valid estimation of the Irish demand regime since key variables such as the wage share of GDP are skewed and strongly correlated with omitted variables that determine some components of demand. This paper summarises the real and distortionary effects of MNEs in Ireland, and then adjusts and controls for these effects as much as possible in an econometric estimation of the underlying Irish demand regime. Both ordinary least squares and three stage least squares estimators are used, the latter as an attempt to deal with the issue of simultaneity bias that confronts all empirical attempts at demand regime estimation. The main results of this paper are twofold. Firstly, Ireland is found to be wage-led in the specifications that adjust and control for the influence of MNEs. Second, the average effective corporate tax rate (AECTR) on foreign affiliates in Ireland is found to be statistically significant in explaining investment. This, alongside indicative foreign affiliate statistics, supports the view that Ireland may be "tax competition-led", in the sense implied by Woodgate (2020), where a lower AECTR has a net positive effect on aggregate demand in Ireland (though at the expense of other nations). The implications of these findings for policy are drawn.

Keywords: Distribution, demand regime, Ireland, tax competition, profit shifting

JEL: E11, E12, E25, C22, C36

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1. Introduction

Consideration of multinational enterprises (MNEs) is becoming increasingly important for the analysis of national economies. Perhaps nowhere more so than in the Republic of Ireland, where the activities of MNEs in Ireland drive real demand on one level and, on another, severely distort conventional national accounts statistics. This paper describes how the growth of tangible investment, employment, and corporate tax revenues in Ireland is largely fuelled by foreign affiliates. At the same time, certain MNE activities, mostly related to tax planning, inflate a number of key macroeconomic indicators like GDP, net exports, and the profit share, increasingly decoupling these measures for the underlying Irish economy.

The dual nature of the effects of MNEs in Ireland presents a problem for the empirical estimation of how changes in income distribution affect aggregate demand and income in the post-Kaleckian model pioneered by Bhaduri and Marglin (1990) and Kurz (1990). Failing to adjust and control for the effects of MNEs likely leads to bias due to measurement error and omitted variables. This is best seen with a couple of examples. With the inflated profit share of GDP, it is likely that too much of the variation in consumption is ascribed to the growth of profits. Additionally, since a lower average effective corporate tax rate (AECTR) may increase green-field foreign direct investment (FDI) *and* increase the value of profits artificially booked in Ireland, failing to control for the AECTR likely means that estimates of the effect of the profit share on investment suffer from omitted variable bias. Given that the majority of studies on Ireland's demand regime find it to be profit-led (Stockhammer & Stehrer, 2011; Kinsella, 2013; Onaran & Obst, 2016; Oyvat et al., 2020) but generally do not adjust and control for the influence of MNEs, questions about the internal validity of such results naturally arise. Do pro-capital changes in distribution between Irish workers and capitalists truly fuel demand once the real and distortionary effects of MNEs are taken into account?

The demand regime of Ireland is estimated in this paper in three different ways. The first approach uses the ordinary least squares (OLS) estimator and conventional national accounts data. The second and third approaches both adjust and control for the effects of foreign MNEs. While the second specification is also estimated with OLS, the third uses three stage least squares (3SLS) in attempt to address the endogeneity problem inherent in demand regime estimation (Onaran & Obst, 2016; Blecker et al., 2020) as well as the possibility of cross-equation correlation of errors. Ireland is found to be profit-led when using the conventional data, but wage-led across the two approaches that adjust and control for the effects of MNEs.

Despite the finding that the underlying Irish economy is wage-led, pro-labour distributional changes do not seem to be the main factor behind the rapid growth seen in Ireland since the 1990s. This follows since the *modified* wage share, which is adjusted for some of the main distortions due to MNEs, has remained relatively stable over the last few decades, if not declined slightly. This paper supports the view that the phenomenal growth of Irish national income has been mostly driven by the real and tangible effects of foreign affiliates in Ireland. Since the main differentiating factor that attracts MNEs to Ireland is its AECTR on foreign affiliates, which appeared to be as low as 4.5% as early as 1982, it is argued that Ireland is "tax competition-led" in the sense described in Woodgate (2020), where a reduction in the AECTR has a net positive effect on aggregate demand. This characterisation is supported by the descriptive statistics on foreign affiliates in Ireland, as well as the finding that the AECTR has a statistically significant effect on total Irish investment adjusted for distortions of MNEs.

While the focus of this paper is on Ireland, it also sheds light on the processes of modern globalisation that affect all countries. Since tax competition is a beggar-thy-neighbour phenomenon, the gains of Ireland to be described in this paper cannot be separated from the losses accrued elsewhere. Especially by enabling the profit shifting of MNEs, Ireland's tax competition-led strategy appears to feed off the same process that leads to higher post-tax inequality in the countries where the shareholders of these foreign MNEs reside. Furthermore, while Ireland's demand regime is rather exceptional, the issues encountered in its econometric estimation may nonetheless be relevant for the estimation of the demand regimes of other countries.

The paper is structured as follows. Section 2 summarises the channels through which foreign affiliates appear to have driven Irish demand with reference to the data that are least subject to distortions. It also details what these distortions are and how they came to be. Section 3 devises a modified wage share measure that is held to better reflect the true distribution of income between Irish labourers and capitalists. A brief summary of the existing literature on the Irish demand regime is offered and the concerns around using conventional data are outlined. Section 4 describes the post-Kaleckian model used in this paper, explains how the data are adjusted and controls are devised, and details the empirical approach taken before providing the results of all regressions used in determining Ireland's demand regime. Section 5 discusses these findings and draws policy implications before section six concludes.

2. Real and Distortionary Effects of Foreign MNEs in the Irish Economy

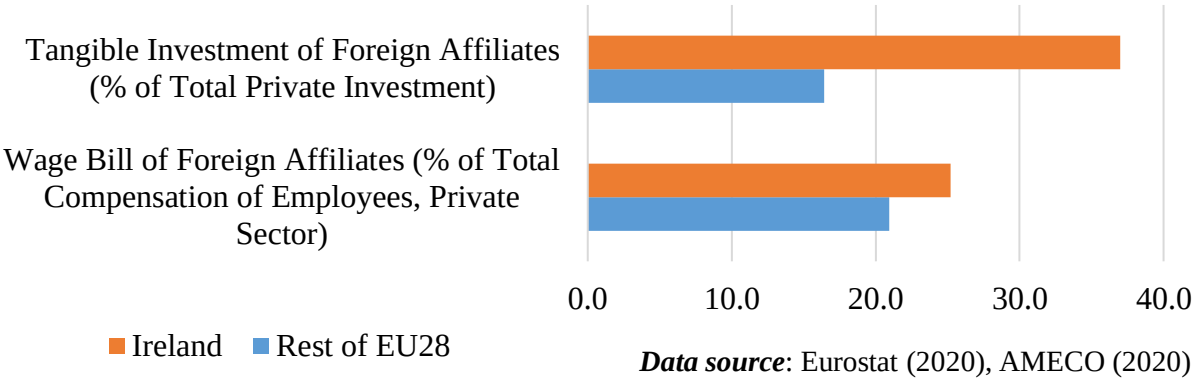
2.1 The "Celtic Tiger": How Foreign MNEs Drive Irish Aggregate Demand

Foreign MNEs in Ireland drive aggregate demand through a number of channels, the most direct of which is the green-field FDI channel. Foreign affiliate statistics (FATS) from Eurostat (2020) show that the tangible investment of non-financial foreign affiliates' accounts for a substantial 37% of total private gross fixed capital formation in Ireland. This is more than in any other European Union country, and more than double the average of the rest of the EU, as is shown in figure 1.

Likewise, the increase in size and number of foreign affiliates in Ireland has had a strong positive effect on Irish net exports. A large part of the measured increase in Irish net exports is merely distortionary in the ways to be described below, but another part reflects value added that has genuinely taken place in Ireland. While the profits resulting from these genuine MNE exports are often repatriated out of Ireland, doing little for Ireland's underlying demand regime, the input costs in the production of these exports do benefit Irish demand. In particular, the employment and wages of Irish nationals appear to be boosted by foreign MNEs that serve foreign markets from Ireland. The Eurostat data, also displayed in figure 1, suggest that 25.2% of the compensation of employees in the private sector in Ireland was paid by foreign affiliates—4.2 percentage points higher than in the rest of the EU. Though this measure is higher in a few central and eastern European counties (between 30% and 35% in Czechia, Hungary, Romania, and Slovakia), MNEs tend to locate in these countries to avail of the

relatively cheap labour. Comparing the wage bill of foreign affiliates in Ireland with that of nations with wage rates similar to those found in Ireland makes for an even starker contrast.

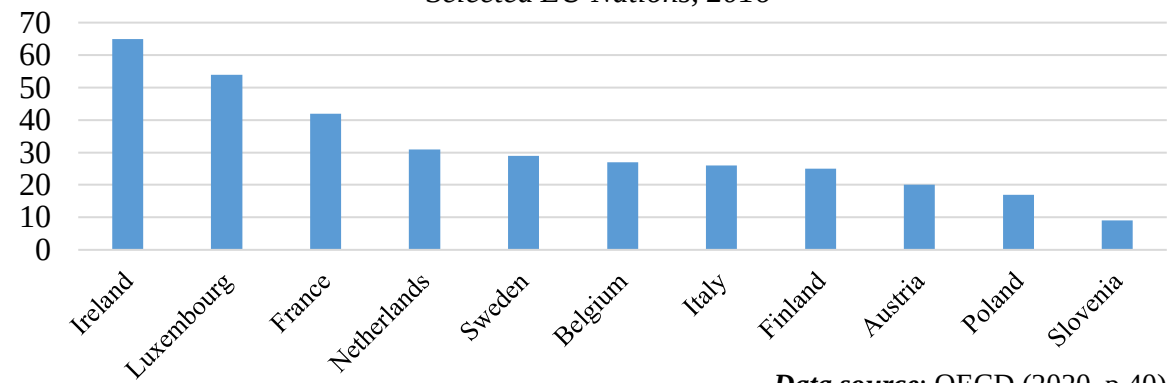
Figure 1 *Tangible Investment and Wage Bills of Non-Financial Foreign Affiliates in Ireland vs Rest of the EU, Average Values over 2014-17*



Data source: Eurostat (2020), AMECO (2020)

A third indicator of what fuels demand and thereby growth in the Irish economy is implied by the work of Torslov et al. (2018). The authors estimate that of the $616bn of profits shifted by MNEs around the world in 2015, $106bn (17.2%) ended up in Ireland, making Ireland the number one tax haven destination for MNEs. Attracting such phenomenal profits with a low effective corporate tax rate results in a much-broadened tax base in Ireland and thereby high corporate tax revenues (ibid., p.26). Related evidence for this phenomenon can be seen in figure 2, with data from the OECD (2020, p.40), where it is found that 65% of all Irish corporate tax revenues in 2016 were paid by MNEs, far exceeding the same metric in other EU countries for which data are available. Government spending of these increased tax revenues is the third way in which Ireland may enjoy real tangible benefits from the beggar-thy-neighbour strategy of tax competition.

Figure 2 *Percentage of Corporate Tax Revenue Paid by MNEs in Selected EU Nations, 2016*



Data source: OECD (2020, p.40)

To examine the link between lower corporate tax rates and the growth of these components of demand, longitudinal data is needed. Unfortunately, the Eurostat (2020) FATS database extends only as far back as 2008 for Ireland (with a number of gaps in the data). The

data used in figure 2 is an outcome of the recently concluded OECD (2020) Base Erosion and Profit Shifting (BEPS) project. As of the time of writing, only data for 2016 is available.

Fortunately, survey data from the United States Bureau of Economic Analysis (BEA) on the activities of US MNEs abroad are available on a long-run basis (BEA, 2020). The survey, which is mandatory for the large and representative sample of US MNEs chosen, has been conducted on an annual basis since 1982, with further benchmark surveys conducted in 1950, 1957, 1966, 1970, and 1977. The resulting dataset offers detailed and wide-ranging information on the operations of the affiliates of US MNEs on a country-by-country basis, from which one can understand how the contributions of US MNEs toward investment, compensation of employees, and tax revenue evolved over time in Ireland. Since foreign MNEs in Ireland are mostly US-owned, the data should reasonably representative of other foreign MNEs too.

The BEA (2020) data on the tangible investment, wage and tax bills of US foreign affiliates in Ireland are expressed as a percentage of the national total gross fixed capital formation, compensation of employees, and tax revenue (AMECO, 2020) and is displayed in figure 3. These three series are plotted along the statutory corporate tax rate (OECD, 2020) using, for ease of interpretation, five-year averages over the period of 1982 until 2016. As expected, the contributions of US MNEs to Irish investment, wages, and tax revenues are all negatively correlated with the falling statutory corporate tax rate. Though figure 3 is, of course, not proof of causation, it nonetheless supports the widely held view that low corporate tax rates helped give rise to the "Celtic Tiger" period of high growth rates in the mid-1990s to mid-2000s and likely continue to drive real demand and income growth in Ireland.

Figure 3 *Falling Corporate Tax Rates (Left Axis) and Rising Corporate Tax Revenues, Wage Bill and Investment due to US MNEs in Ireland (Right Axis), Five-Year Averages between 1982 and 2016*

Data sources: BEA (2020), AMECO (2020), OECD (2020)

The rather unique Irish demand regime relates most strongly within the post-Keynesian literature to what is termed a "tax competition-led" economy in Woodgate (2020). Based on a neo-Kaleckian model with an additional tax-sensitive green-field FDI component in the investment function, a tax competition-led regime is one where a decrease in the average effective corporate tax rate (AECTR) has a net positive effect on aggregate demand. The results of the theoretical approach developed in Woodgate (2020) suggest that an economy may be tax competition-led if two conditions are met. First, the country pursuing the tax competitive strategy must be sufficiently small, so that decreases in the AECTR do not cause much of a decrease in tax revenue from domestic firms compared to the increased inflow of foreign capital.[1] Second, any decrease of the domestic AECTR must be sufficiently larger than any simultaneous fall in the foreign AECTR, otherwise the fall in the domestic rate fails to distinguish the domestic economy as a *relatively* low-tax jurisdiction. Ireland, being a small nation and early pioneer in developing the tax competitive strategy, may satisfy these two conditions.[2]

Besides offering this indicative data, one goal of this paper is to econometrically test whether reductions in the AECTR have significant and positive effects on investment in Ireland. Taken alone, an affirmative result would not be sufficient to confirm that Ireland is truly tax competition-led, since the effects on the other components of demand would also need to be considered. However, such a result would nonetheless support the hypothesis of tax competition-led demand growth. Before empirically analysing these aspects of how demand is generated in Ireland, however, one must account for the many varied distortions that plague the Irish national accounts.

2.2 "Leprechaun Economics": How Foreign MNEs Distort Irish National Accounts

In the preceding section, care was taken to ensure that all data used reflect the genuine and tangible contributions of foreign MNEs to Ireland's economy. Measures of gross value added, gross operating surplus, exports, imports, and total investment (i.e. including *intangible* capital goods) were avoided for the simple fact that they have become increasingly divorced from the economic reality of Irish nationals.[3] These distortions have become most substantial in recent years and abundantly obvious when real GDP growth was recorded as being over 25% in 2015.

Of course, it has long been known that in countries with a high degree of MNE activity, GDP overstates the true income level of the residents of such countries. Yet Irish GNI, it transpires, is also inflated by the activities of foreign MNEs. Corporate inversions and the depreciation of MNE assets, particularly intellectual property (IP) and aircraft located or registered in Ireland, has been shown to inflate GDP, GNI and other conventional statistics significantly. In response, the central statistics office (CSO) of Ireland now publishes *modified* gross national income, consumption, gross fixed capital formation, and current account balance measures (CSO, 2020). These modified measures—differentiated from the conventional metrics by an asterisk (e.g. modified GNI is denoted GNI*)—strip away the effects of re-

[1] The trade-off between higher MNE investment and higher corporate tax revenues is weakened or non-existent if, as Woodgate (2020, p. 532) details with reference to Ireland, the government manages to differentiate between domestic and foreign firms when setting AECTRs.

[2] However, the model in Woodgate (2020) does not account for profit shifting. Given that shifted profits may be taxed and spent, tax competition-led demand may be achieved in ways not fully captured by these conditions.

[3] In fact, national gross fixed capital formation was used as the denominator in figures 1 and 3, which includes some of these inflating distortions, meaning that, if anything, the contribution of foreign MNEs to Irish investment has been underestimated in these figures, especially in recent years.

domiciled corporations and these kinds of depreciation. Since 2016, data has been published by the CSO on modified GNI on an annual basis and modified domestic demand on a quarterly basis. The CSO has also since extended these series as far back as 1995. The distortions caused by the depreciation of MNE assets and re-domiciled companies appear negligible in 1995 and the years preceding it, meaning the conventional and modified series may be stitched together rather straightforwardly.

Unfortunately, however, there are further sources of distortion that are more difficult to correct. A first issue to consider is the effect of profit shifting on the Irish national accounts. Given Ireland's role as a "conduit" tax haven, MNEs find it worthwhile to establish subsidiaries in Ireland to hold and shield otherwise taxable income from the country of the parent or other affiliated company or route such income to traditional "sink" tax havens, in which corporate profits are untaxed.[4] To enable such aggressive tax planning, MNEs must first shift profits arising from sales elsewhere around the world to Ireland. They usually do so by one of three methods (see, for example, Saez and Zucman 2019, ch. 4):

1. Transfer mispricing, where intra-group imports into Ireland are at artificially low prices, whereas intra-group exports are as close to the final market price as possible.
2. Intra-group interest payments, where an Irish subsidiary charges artificially high interest rates on loans made to its parent or another affiliate. This method may have the double benefit of allowing for tax deductions in the higher tax rate country of the parent or other affiliate since interest payments are often tax deductible (though tax authorities have clamped down on this practice in some countries).
3. Intra-group royalty payments, where the parent or other affiliates pay the Irish affiliate for the right to use the MNE's intellectual property that is strategically registered in Ireland.

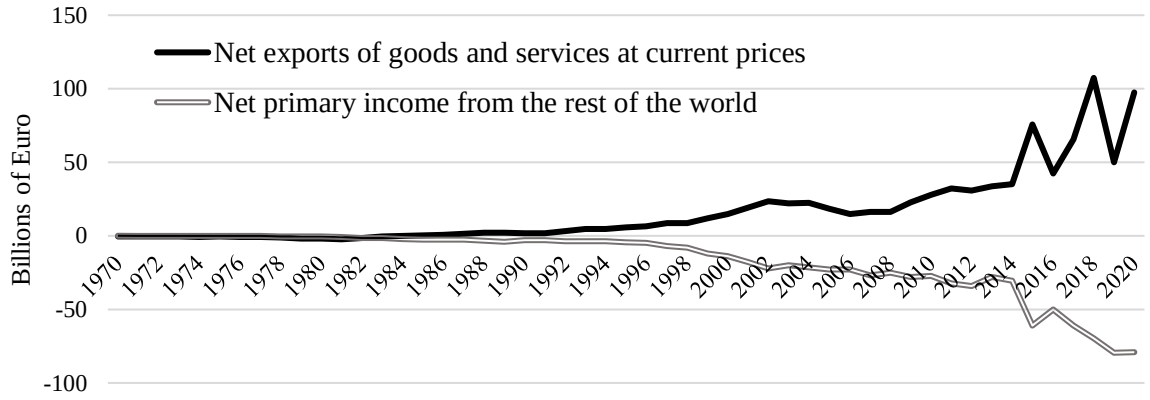
Each method allows for the means to subvert or exploit gaps in the current "pillars of international taxation", as Zucman (2014, p.122) calls them, that are woefully inadequate for the prevention of widespread profit shifting. Profit shifting essentially amounts to accounting trickery that also serves to inflate Irish GVA, profit level and net exports without a proportionate gain in the material wellbeing of ordinary Irish citizens. The only effect on Irish aggregate demand may be the aforementioned indirect effect via increased corporate tax revenues.

One last concern worth mentioning is that of contract manufacturing or "factoryless production", where corporations resident in Ireland essentially hire a third party in, say, China to perform part of the manufacturing process. A product made this way and sold to a consumer in, say, Japan may be recorded as an Irish export in the balance of payments, despite never crossing the Irish border nor worked upon by Irish labourers (Fitzgerald, 2018). In the case of foreign-owned MNEs in Ireland, the resulting profits may not accrue to an Irish capitalist either.

If all shifted profits or profits arising from contract manufacturing were repatriated by foreign affiliates out of Ireland in the form of net primary income payments, modified gross national income would not suffer. Indeed, by some indicators it appears that some part of the profits generated in or shifted to Ireland are later routed out of Ireland, as is suggested by the strongly negative correlation between net exports and net primary income in Ireland, displayed in figure 4 (data from AMECO 2020). However, the short-term lag between profits accumulating in foreign affiliates in Ireland (through profit shifting or genuine production) may,

[4] For more on the nature and classification of conduit and sink tax havens, see Garcia-Bernardo et al. (2017).

Figure 4 *Net Exports and Net Primary Income Payments in Ireland 1970 - 2020*



Data source: AMECO (2020)

in principle, be long enough to affect annual modified measures of national income. Furthermore, the lag between booking and repatriating profits may not be so short-term at all. It may be deemed more advantageous for an MNE to accumulate a cash pile in Ireland than to transfer it out. As the case of Apple shows, such a cash pile can be used as collateral to ensure historically low interest rates on loans used to pay out dividends to shareholders and only repatriated when a tax holiday is signed into law (Fernandez & Henrikse, 2015).

The distortions to the Irish national accounts stem from various activities, though all linked to MNEs, and affect some measures (like trade) much more than others (like consumption). The modified measures introduced by the CSO are a vast improvement, but are likely still subject to distortion. Initial estimates devised by Torslov et al. (2018) seem to suggest that profit shifting, for which the modified measures of the CSO are not adjusted, skews even the modified statistics. Importantly for the purpose of this paper, the authors find that the Irish wage share is 58% when correcting for profit shifting using data for the year 2015, in contrast to the official, uncorrected value of 38% (ibid., appendix table C5). The authors also estimate that Ireland's remarkably strong trade surplus in 2015 of 31% of GDP turns into a trade deficit of 5.8% after correcting for profit shifting (ibid. appendix table C5b). Such a stark difference supports the conclusion of Frank (2018), who writes that "at this point, profit shifting by multinational corporations doesn't distort Ireland's balance of payments; it constitutes Ireland's balance of payments."

3. Income Distribution and Growth in Ireland

An unbiased measure of the adjusted wage share is crucial for understanding how changes in the functional income distribution in Ireland affect aggregate demand. Unfortunately, the measure most frequently used in demand regime estimation and other areas of macroeconomic analysis of Ireland is severely distorted, namely the wage share of GDP (whether at current market prices or at factor cost). While there is no reason to suspect that the compensation of employees is greatly skewed, total gross operating surplus is most certainly inflated, meaning the conventional wage share of GDP is biased downward. Instead, a wage share measure denominated by modified GNI* and further adjusted for profit shifting in particular would be

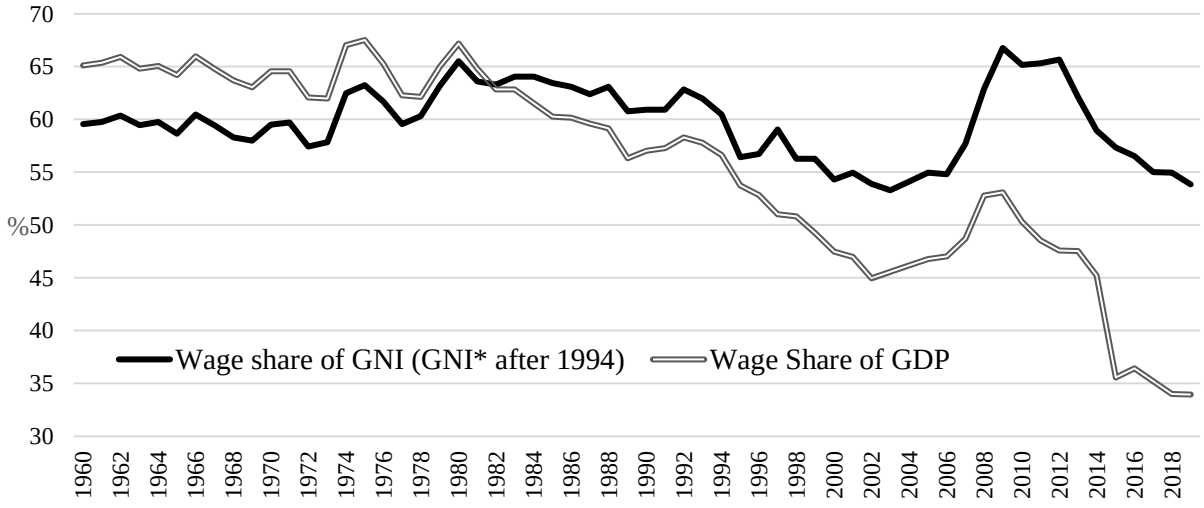
ideal. Such an ideal measure, however, is difficult to estimate, especially on the longitudinal basis needed for demand regime estimation.

While imperfect since it may still be skewed, what is here termed the *modified wage share* can nonetheless be proposed as an improvement upon the conventional wage share of GDP. As seen in equation (1), this measure is defined by the ratio of the compensation of employees in Ireland to GNI*, adjusted as usual to account for self-employed labour.

$$Modified\ Wage\ Share\ (\omega^*) = \frac{Compensation\ of\ Employees}{Modified\ GNI} * \frac{Number\ of\ persons\ employed}{Number\ of\ Employees} \quad (1)$$

This new measure is displayed alongside the adjusted wage share of GDP (taken from the AMECO database) in figure 5. For years prior to 1995, for which no data on GNI* is available, conventional GNI is used instead, as there is little difference between the two series at this point anyway. Whereas the trend in the wage share of GDP across these sixty years is clearly and strongly downward, the trend in the wage share of GNI and GNI* is relatively flat. The former falls by more than 30 percentage points over the course of the sample, while the latter rarely deviates from its sample average of 60% by more than 5 percentage points. Clearly, the two measures paint two starkly different pictures.

Figure 5 *The Modified Wage Share vs the Wage Share of GDP in Ireland (1960 - 2019)*



Data sources: CSO (2020), AMECO (2020)

3.1 Previous Estimates of the Irish Demand Regime

To date there have been at least five studies that have estimated the demand regime of Ireland. As summarised in table 1, these studies tend to find that Ireland is profit-led. The first of these papers, Stockhammer and Stehrer (2011), finds Ireland to be profit-led in models with few lags, but wage-led in models with a longer lag length. However, the authors consider the effect of changes in functional income distribution on private domestic demand alone. Since the effects of decreasing labour costs on net exports tends to be positive, the inclusion of such effects

would likely push the total Irish demand regime towards being profit-led. The rest of the listed papers estimate the effect of changes in functional distribution on the total demand regime.

Kinsella (2013) is the only work dedicated to estimating the demand regime of Ireland exclusively rather than a list of countries including Ireland. It is, however, fraught with a number of econometric issues. Firstly, the main period of analysis is of only 12 observations, which likely introduces small sample bias. Second, changes in investment are specified as a function of both changes in the profit share *and* the wage share, prompting concerns of multicolinearity. Third, changes in exports are regressed on one predictor variable alone, namely changes in exports over GNI. Besides issues of simultaneity and omitted variable bias, the economic logic for this specification is unclear. One can also take issue with how the t-statistics and significance levels are reported, or question where the estimates of the propensity to save out of wages and profits come from. For completeness, it is included in the summary of the empirical literature of the demand regime of Ireland in table 1, despite these outstanding issues.

Table 1 *Summary of previous empirical work on the demand regime of Ireland*

	Main Period	**Result**	**Caveats**	**Denominator of wage/profit share**
Stockhammer & Stehrer (2011)	1970 Q1 - 2007 Q2	Mixed findings	Domestic demand regime	GDP
Kinsella (2013)	1990 - 2002	Profit-led	Major econometric issues	GVA
Onaran & Obst (2016)	1960 - 2013	Profit-led	Only marginally profit-led	GDP
Oyvat et al. (2020)	1962 - 2011	Profit-led	Only marginally profit-led	GDP
Obst et al. (2020)	1960 - 2013	Wage-led	Includes government sector	GDP

Employing different estimation techniques, Onaran and Obst (2016) as well as Oyvat *et al.* (2020) both find that Ireland is profit-led. Using a vector error correction model, the latter estimate that the long-run effect of an increase in the wage share of one percentage point is a small decrease in private total demand of 0.05%. Onaran and Obst (2016), on the other hand, employ a single-equations, ordinary least squares approach, and find the size of this effect to be of an even smaller size (0.005%).

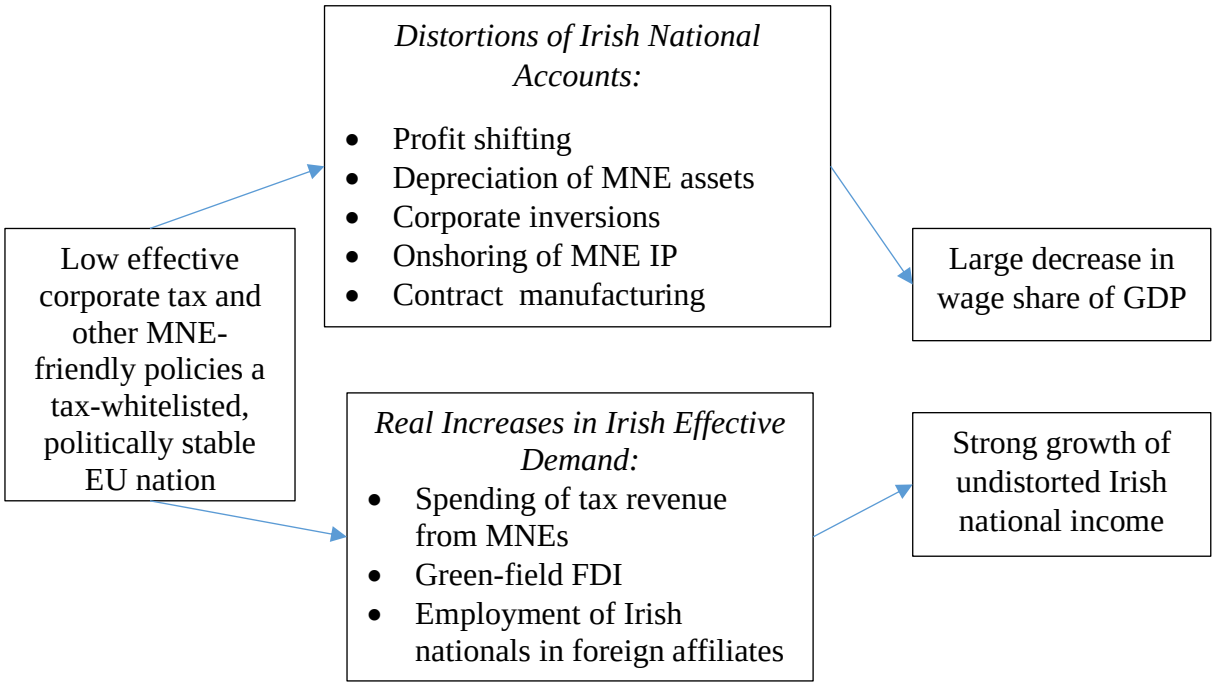
The last study listed in table 1, Obst *et al.* (2020), differs to those prior in both its approach and its result. A focus of this work is the effect of increases in government spending and taxes on demand and the primary budget balance in selected EU countries. As such, it is the only paper here to include a government sector, which taxes labour, capital and consumption at effective rates, and increases its expenditure as national income rises. Perhaps because of this difference in approach, the authors reach the opposite result, namely that the total Irish demand regime is wage-led.

Common to all these studies is the use of GDP or GVA in the denominator of the measure of Irish functional income distribution. Moreover, none of these studies control for the effects or distortions caused by MNEs in Ireland except arguably Obst et al. (2020), which, in modelling public finances, includes a measure of the implicit tax rate on capital which may pick up some of the effects of tax competition. Of course, four of these studies estimate the demand regime not just of Ireland but of a dozen or more countries at once, making it quite understandable why Ireland does not receive the special attention it requires. Nonetheless, improved data are available and additional control variables can be devised, so there is no reason not to attempt to tackle the issues inherent in the estimation of the Irish demand regime.

3.2 Profit-led or tax competition-led?

The central hypothesis of this paper is that Ireland's tax competitive strategies give it the mere appearance of being profit-led. Instead, it is possible that the underlying Irish economy is wage-led in principle, but, in practice, is primarily driven by MNEs attracted to Ireland primarily by its low AECTR. In essence, the argument is that Ireland may be both wage-led and tax competition-led, rather than profit-led when the effects of MNEs are taken into account. The line of reasoning is summarised in figure 6. From an econometric perspective, the issue is one of bias due to measurement error and omitted variables. Unadjusted data are likely to ascribe too much of the variation in consumption to increases in profits. Falling effective corporate tax rates may lead to both higher investment and a higher profit share, thereby confounding estimates of the effect of the profit share on investment when not included in investment regressions. Profit shifting may inflate net exports and attenuate the wage share or unit labour costs, creating similar issues. Each case strongly suggests that more robust data and additional controls are needed to ensure internal validity in the econometric estimation of Ireland's demand regime.

Figure 6 *True Irish national income growth may be correlated with, but not caused by, an decreasing wage share of GDP*



4. Estimating the underlying Irish demand regime

4.1 Data

Three main sources are used in the compiling of data needed for the econometric analysis of the demand regime of Ireland. First, the conventional Irish macroeconomic data without adjustments for the effects of MNEs is taken from the AMECO (2020) database for the years between 1960 and 2019. Second, CSO (2020) is used for the modified data series described above. Third, data from the BEA (2020) are used to construct two important MNE-related control variables, the average effective corporate tax rate (AECTR) and the ratio of pre-tax profits to labour compensation of foreign affiliates in Ireland. For detailed information on data definitions and sources, the interested reader is referred to the appendix.

The approach taken to minimise the distortions due to MNEs is as follows. As a measure of Irish national income, real GNI (1960-1994) and GNI* (1995-2019), described above, replaces GDP.[5] These measures of income serve as the denominators in the modified wage share, as defined in equation (1). For the investment of firms, quarterly nominal data on modified gross domestic fixed capital formation (GFCF*) is converted to an annual basis for the years of 1995 until 2019, combined with conventional nominal GFCF for the years prior to 1995, and expressed in 2015 real terms using the GFCF price deflator.

CSO Ireland offers two series on the trade of goods. One series is measured in accordance with the latest European System of National Accounts standards, which uses the principle of "change of ownership" to define trade. As Fitzgerald (2018) explains, this definition implies that subsidiaries in Ireland that contract out manufacturing to another country—often China—will increase the value of Irish trade, even if the produced goods never cross the Irish border. Naturally, this is a less useful definition of trade for the purposes of understanding how increases in the Irish unit labour costs may affect international price competitiveness of producers based in Ireland. Hence, the second series, which measures the trade of goods on a "crossing of the border" principle, is preferred in this study. Combined with the trade in services series to create a measure of total exports and total imports, a few final adjustments are made based on those made by the CSO in their derivation of their modified current account measure. These adjustments are the subtraction of R&D related IP exports and imports (2014-19), R&D service imports and net aircraft imports related to leasing (2007-19).

The last modification concerns unit labour costs, which is conventionally defined as the ratio of the compensation of employees to real output. In its denominator, the adjusted measure uses real GDP minus the income of re-domiciled companies and depreciation on aircraft leasing, R&D service imports, and trade in IP.

The modified measures employed go some way to reducing the degree of distortion in the Irish national accounts, but are by no means perfect. For example, subsidiaries in Ireland that facilitate profit shifting likely still distort the modified trade indicators. To this end, a measure of the profitability of foreign affiliates in Ireland would be useful as a control variable to separate out the effect of profit shifting as much as possible in export and import regressions. Similarly, a measure of the AECTR of foreign affiliates is necessary to control for the real

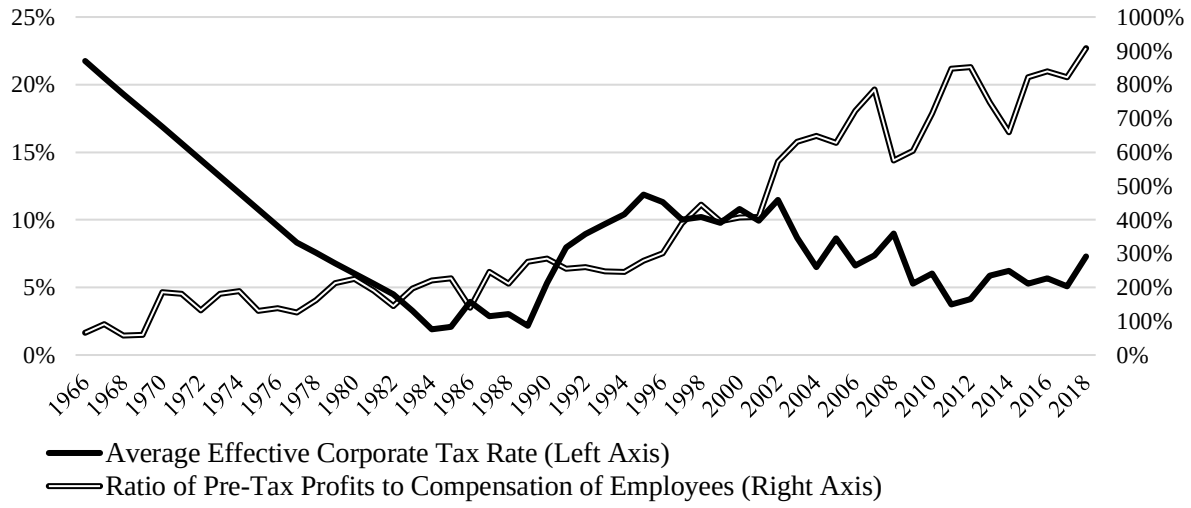
[5] Note that the conventional and modified series (such as GNI and GNI*) are at very similar levels in 1995, when the globalisation effects were still relatively insignificant. Hence, the conventional and modified series may combined in a straightforward manner.

effects of tax competition and see whether it has a significant effect on investment, as would be expected in a tax competition-led regime.

For the purpose of constructing these profitability and AECTR variables, the BEA survey data described in section two is key. On both measures, the definitions and data of Wright and Zucman (2018) are used, which spans from 1966 until 2016. The authors use data from the US Internal Revenue Service to provide estimates of the data missing in the BEA dataset in certain years prior to 1982. To expand the authors' dataset until 2018, the relevant data is added to the readymade Wright and Zucman (2018) dataset from the most recent releases of the BEA survey. The profitability measure employed is the ratio of pre-tax profits to total compensation of employees of all majority-owned affiliates of US MNEs in Ireland. The AECTR of foreign affiliates in Ireland is defined as the percentage of corporate income tax paid by US foreign affiliates to the Irish government out of their total pre-tax profits registered in Ireland. Pre-tax profits, it should be noted, are net of capital depreciation and net interest payments, since, as Wright and Zucman (2018) point out, depreciation and interest payments are typically tax deductible.

These indicators of the profitability of and taxes paid by foreign affiliates in Ireland are graphed in figure 4 for the years between 1966 and 2018. As explained above, for the years of 1967 until 1976 and 1978 until 1981, estimates are used by the authors. Profit shifting is strongly implied by the increase in the pre-tax profits to wage bill ratio from 66% in 1966 to 908% in 2018, a phenomenal rise characteristic of tax havens around the world (Wright & Zucman, 2018; Torslov et al., 2018).

Figure 4 *Falling Corporate Tax Rates and Soaring Pre-Tax Profits of Foreign Affiliates in Ireland (1966-2018)*



Data sources: Wright & Zucman (2018), BEA (2020)

In summary, and before laying out the exact model to be estimated, it should be emphasised that the model will be applied to two different datasets, as indicated in table 2. For the purposes of comparison and robustness, these two datasets are to be used in three econometric specifications. The first is the benchmark specification, which makes use of the conventional data and does not include any special MNE-related control variables. It is estimated by OLS. The second and third specifications employ the modified data and include the AECTR and PWFA control variables described above. They differ by how they are estimated: The second is estimated by OLS and the third by 3SLS.

Table 2 *Summary of the three econometric specifications used in this paper*

Specification	Dataset	Extra MNE Variables?	Estimator
1 (Benchmark)	Conventional	No	OLS
2	Modified	Yes: AECTR and PWFA	OLS
3	Modified	Yes: AECTR and PWFA	3SLS
See appendix for sources and definitions of all variables in the two datasets			

4.2 Model and its Empirical Specification

The model offered here is a "structural" post-Kaleckian model, where equations for the price level and each private component of demand are formulated and estimated separately, rather than an "aggregative" model, where GDP or capacity utilisation is regressed directly on the wage or profit share (Blecker, 2016). The structural model is preferred here simply so that the effects on each component of demand can be estimated. A detailed comparative evaluation of the two empirical approaches to demand regime estimation can be found in Blecker (2016).

For the price level and each component of private demand, the baseline theoretical relationship is first outlined before its exact empirical specification is shown. A few general notes relevant for the empirical specifications employed are in order. Firstly, natural logarithms of most of the series are used to address the exponential growth that many exhibit. This has a number of benefits, chief among which is the reduction of the degree of heteroscedasticity in the error terms. Second, two unit root tests conducted, namely the Kwiatkowski–Phillips–Schmidt–Shin (KPSS) and augmented Dickey-Fuller (ADF) tests. Both test suggest most series are integrated of order one (I(1)). All of the empirical specification are therefore in first differences, as indicated by the difference operator (Δ). Third, the lag length of dependent variables is determined by the Bayesian Information Criterion (BIC). Lags of independent variables are also added if they are found to be significant or otherwise relevant for the point estimate of other variables. Note, however, than the lag length may differ depending on the dataset being used.

For concreteness, in this paper the Irish economy will be defined as wage-led if $\delta AD/\delta ULC > 0$ and profit-led if $\delta AD/\delta ULC < 0$, where *AD* refers to total private aggregate demand and *ULC* is nominal unit labour costs. Although much of the literature defines the demand regime in terms of changes in the wage/profit share rather than changes in *ULC*, the latter is preferred here. After all, theory suggests that exports and imports are not a function of the wage share but rather the determinants of the wage share that also affect international price competitiveness, such as *ULC*, the mark-up, and nominal exchange rates (Blecker, 1989). Furthermore, since $ULC = w * a$, where *w* is the nominal wage rate determined by exogenous social factors and a is the labour-output ratio considered exogenously determined by technical factors, unit labour costs as a whole are more likely to be exogenous to the system than the wage share, which depends on the endogenously determined price level (p), since $\omega = ULC/p$.[6]

[6] In order to view the demand regime as a function of the wage/profit share, some authors (e.g. Onaran & Obst 2016, p.1522) appear to express exports and imports as a composite function of a kind, where, for example, $X = p(ULC(\omega))$ and apply the chain rule to get $\delta X/\delta\omega$. The issue with this approach lies with the inner most function, which appears to reverse the line of causation: The wage share is (partly) determined by *ULC*, but it does not follow that *ULC* are determined by the wage share as is implied by this composite function. Mathematically, the derivative of the inverse function may be found, but it is hard to ascribe any causal, economic meaning to a value found for $\delta ULC/\delta\omega$.

The approach taken here is more in line with Blecker et al. (2020), who define the demand regime with respect to changes in labour cost competitiveness, $z = E * P^f/ULC$, rather than the wage/profit share, where *E* is the nominal exchange rate and P^f represents the foreign price level.[7] In sum, the marginal effect of an increase in unit labour costs on private total demand in proportion to the average income level ($\bar{Y}$) is calculated using equation (2).

$$\frac{1}{\bar{Y}}\frac{\partial AD}{\partial ULC} = \left[\left(\frac{\partial C}{\partial \omega} + \frac{\partial I}{\partial \omega}\right)\frac{\partial \omega}{\partial ULC} + \left(\frac{\partial X}{\partial ULC} - \frac{\partial M}{\partial ULC}\right)\right]\frac{1}{\bar{Y}} \tag{2}$$

4.2.1 Consumption

The baseline consumption function is

$$C = C_A + [\omega(c_w - c_\pi) + c_\pi]Y \tag{3}$$

where C_A is real autonomous consumption and the overall marginal propensity to consume is an average of the marginal propensity to consume out of wages, c_w, and out of profits, c_π, weighted by the wage share, ω. Differentiating with respect to the wage share gives

$$\frac{\partial C}{\partial \omega} = (c_w - c_\pi)Y\ . \tag{4}$$

Hence, so long as the propensity to consume out of wages exceeds that out of profits, the effect of an increase in the wage share on consumption is positive. Since, as implied by equation (2), all effects on the components of demand are to be expressed as a proportion of the sample mean, $\bar{Y}$, one notes that the desired estimate is

$$\frac{1}{\bar{Y}} * \frac{\partial C}{\partial \omega}\Big|_{\bar{Y}} = c_w - c_\pi, \tag{5}$$

which is equivalent to the derivative of the average propensity to consume (*C/Y*) with respect to the wage share:

$$\frac{\partial (C/Y)}{\partial \omega} = \frac{\partial}{\partial \omega}\left[\frac{C_0}{Y} + \omega(c_w - c_\pi) + c_\pi\right] = c_w - c_\pi. \tag{6}$$

Hence, in this paper, the marginal effect of an increase in the wage share evaluated at the average income level will be estimated by regressing the average propensity to consume (APC) on the wage share. This differs to the approach most often taken in related literature, where consumption is modelled as a function of the wage bill and the profit level, and the coefficients on these variables are then used to find the desired difference in propensities to consume ($c_w - c_\pi$).[8] While the point estimates of the two approaches should be equivalent, the approach offered here is deemed preferable for two reasons. First, it offers a convenient way of directly estimating the standard error and thus statistical significance of the wage share in a consumption function. Second, it will be easier to handle when addressing the endogeneity issues in the three-stage-least-squares approach later.

[7] This *z* ratio was used in preliminary versions of this paper, but ultimately decided against due to the sensitivity of the variable and the results to the definition of the numerator ($E * P^f$).

[8] The approach taken here is not without precedent, however. For example, Bowles and Boyer (1995) employ a similar setup, though with the average propensity to save rather than the average propensity to consume.

$$\Delta \ln (C/Y)_t = c_0 + c_1 \Delta \ln Y_t + c_2 \Delta \ln \omega_t + c_3 \Delta \ln SB_t + c_4 d08 \quad (7)$$

As equation (7) shows, the empirical specification of the APC function includes a measure of social benefits (*SB*) and, in some specifications, a dummy variable (d08) representing the great recession period of 2008 until 2012 as control variables. Tax and debt variables were also considered as additional controls, but were found to be irrelevant or unavailable for a long enough period to allow a meaningful inclusion. As long as $c_w > c_\pi$, the coefficient on the wage share (c_2) is expected to be positive, as is the coefficient on the social benefits variable (c_3). Lastly, since the APC is expected to fall with higher levels of national income, c_1 is likely to be negative.

4.2.2 Investment

Following the standard post-Kaleckian investment function, real investment is modelled as a function of autonomous investment (I_A) capacity utilisation, and the wage share (Bhaduri & Marglin, 1990). However, as usual a proxy for capacity utilisation is used, namely real GDP or modified GNI, as is shown in equation (8).

$$I = I_A + i_Y Y + i_\omega \omega \quad (8)$$

A rising wage share implies a decreasing means of internal finance (i.e. retained earnings), external finance (to the extent retained earnings are used as collateral for a loan), as well as a larger risk of illiquidity or insolvency in the event of the failure of outstanding investment projects (Kalecki, 1937). As such, the effect of an increase in the wage share on business investment, i_ω, is thought to be negative.

From the econometric perspective, included in the investment function as controls are the long-run real interest rate (IR_t) and, in specifications 2 and 3, the average effective corporate tax rate on foreign affiliates based in Ireland ($AECTR_t$). This is shown in equation (9). The coefficients on both variables are expected to be negative, as is, for the reasons given above, the coefficient on the wage share. On the other hand, a higher level of demand, proxied by *Y*, should positively affect investment. All variables are in expressed in natural logarithms except the interest rate and AECTR.

$$\Delta \ln I_t = i_0 + i_1 \Delta \ln Y_t + i_2 \Delta \ln \omega_t + i_3 \Delta IR_t + i_4 \Delta AECTR_t \quad (9)$$

4.2.3 Prices

Following standard Kaleckian mark-up pricing theory, the domestic price level is thought of as being determined by a mark-up (*m*) on nominal unit labour costs (ULC) and unit material costs (UMC), as in equation (10).

$$p = (1 + m)(ULC + UMC) \quad (10)$$

Note that $\delta\omega/\delta ULC$ is needed, by equation (2), for estimation of the overall demand regime. Given how the wage share is defined, it follows that $\ln \omega = \ln ULC - \ln p$, and so

$$\frac{\delta \ln \omega}{\delta \ln ULC} = 1 - \frac{\delta \ln P}{\delta \ln ULC}. \quad (11)$$

Econometrically, the price level regression is specified as in equation (12). The domestic price level (*P*), reflected in the CPI, is modelled as a function of unit labour costs, the price of oil (*OIL*), the nominal exchange rate (*E*), and foreign price level (P^f). Unfortunately, data on or proxies of the average mark-up imposed by firms in Ireland are hard to come by. The average mark-up estimated by De Loecker and Eeckhout (2020) is used in a preliminary regression, but found to be insignificant and with negligible impact on the estimation of the effect of the variable of interest, unit labour costs. Since the estimated mark-up series goes from only 1980-2016, it is ultimately omitted so as to not limit the number of observations unnecessarily. The domestic output level is used as another control variable. This can be justified by appeal to more mainstream demand-pull theories of inflation or via the more post-Keynesian conflict theory of inflation, where a higher output level corresponds to a higher employment rate, which bolsters labour power in the negotiation of wages. Lastly, in order to try to capture the effects of globalisation on domestic inflation, the total number of regional trade agreements (RTA) around the world is also included. Globalisation tends to lead to lower prices through cheaper imports from abroad and the increased threat of relocating production abroad, which may serve to dampen domestic wage demands (see, for example, Milberg & Winkler, 2010).

$$\Delta \ln P_t = p_0 + p_1 \Delta \ln ULC_t + p_2 \Delta \ln OIL_t + p_3 \Delta \ln E_t + p_4 \Delta \ln P_t^f + p_5 \Delta \ln Y_t + p_6 \Delta \mathrm{RTA}_t \quad (12)$$

4.2.4 Trade

Real exports, *X*, are taken to be positively dependent on both foreign income (Y^f) and the real exchange rate, where the latter is the ratio of the foreign price level expressed in the domestic currency by the nominal exchange rate to the domestic price level, $e^R = EP^f/P$ (Blecker, 1989; Bhaduri & Marglin, 1990). In turn, the domestic price level is determined by a mark-up on unit costs, as in equation (10). Therefore, the baseline export function to be modelled is given by equation (13). Real exports that are independent of foreign income and price competitiveness are reflected in X_A. For the reasons given above, the coefficients on the real exchange rate (x_e) and foreign income (x_Y) are expected to be positive.

$$X = X_A + x_e\left(\frac{ep^f}{(1+m)(ULC+UMC)}\right) + x_Y Y^f \quad (13)$$

Likewise, real imports, *M*, are also dependent on the degree of price competitiveness of domestic firms relative to foreign firms, reflected in the real exchange rate, as well the level of domestic income. Real autonomous imports are denoted M_A and the coefficients on the real exchange rate (m_e) and domestic income (m_Y) are expected to be negative and positive respectively.

$$M = M_A + m_e\left(\frac{ep^f}{(1+m)(ULC+UMC)}\right) + m_Y Y \quad (14)$$

The econometric specification used for equations (13) and (14) are offered in equations (15) and (16) respectively. For the purposes here, foreign income is defined as the combined GDP of the UK, US, and the 12 countries of the Euro Area bar Ireland. As in the pricing equation, unit labour costs, nominal exchange rate, and the foreign price level feature in both

trade specifications, and the estimated mark-up data of De Loecker and Eeckhout (2020), while used in preliminary regressions, was ultimately omitted for the reasons given above. In specifications 2 and 3, the profit to wage ratio of foreign affiliates (PWFA) is included. The dummy variable for the great recession was often found to have a significant effect on exports, and so is included.

$$\Delta \ln X_t = x_0 + x_1 \Delta \ln Y_t^f + x_2 \Delta \ln ULC_t + x_3 \Delta \ln E_t + x_4 \Delta \ln P_t^f + x_5 \Delta \ln PWFA_t + x_6 d08 \quad (15)$$

$$\Delta \ln M_t = m_0 + m_1 \Delta \ln Y_t + m_2 \Delta \ln ULC_t + m_3 \Delta \ln E_t + m_4 \Delta \ln P_t^f + m_5 \Delta \ln PWFA_t \quad (16)$$

4.2.5 Marginal effects

Since the regressions are run in logarithms, the necessary marginal effects needed in equation (2) to estimate the sign of $\partial AD/\partial ULC$ can be backed out by multiplying and dividing by the required sample averages, as denoted by bars in equation (2').[9]

$$\frac{1}{\bar{Y}}\frac{\partial AD}{\partial ULC} = \left[\frac{\partial \ln(C/Y)}{\partial \ln \omega}\frac{\overline{(C/Y)}}{\bar{\omega}} + \frac{\partial \ln I}{\partial \ln \omega}\frac{\bar{I}}{\bar{\omega}\bar{Y}}\right]\frac{\bar{\omega}}{\overline{ULC}}\left(1 - \frac{\partial \ln P}{\partial \ln ULC}\right) + \left[\frac{\partial \ln X}{\partial \ln ULC}\frac{\bar{X}}{\overline{ULC}} - \frac{\partial \ln M}{\partial \ln ULC}\frac{\bar{M}}{\overline{ULC}}\right]\frac{1}{\bar{Y}} \quad (2')$$

These sample averages are displayed in table 3 for the conventional and modified data.

Table 3 *Sample averages used in deriving marginal effects*

Dataset	$\overline{(C/Y)}$	$\bar{\omega}$	$\bar{I}$	$\bar{Y}$	$\overline{ULC}$	$\bar{X}$	$\bar{M}$
Conventional	0.510	0.557	24.9	106.7	0.763	87.0	75.0
Modified	0.617	0.598	18.4	87.6	0.667	79.1	67.5

4.3 Estimation method

Two estimation techniques are used in this paper: Ordinary least squares (OLS) and three stage least squares (3SLS). OLS has the advantage of being easy to implement and interpret. Although OLS estimation is rendered inefficient by the presence of heteroscedasticity and autocorrelation (HAC), it is relatively straightforward to implement HAC-robust standard errors to deal with the threats to usual statistical inference. All OLS estimated coefficients given in this paper are thus HAC-robust.

The main problem of using OLS to estimate demand regimes is the inherent threat of simultaneity bias. This is most obvious in the case where GDP, GNI, or GNI* is used as an independent variable in consumption, investment or import regressions, though one can reasonably make the case for the endogeneity of the wage share as well as other variables (Blecker, 2016; Barrales & von Arnim, 2017; Blecker et al., 2020). Some authors have tried to eschew this endogeneity issue, by using lags of the simultaneously determined independent variable instead of contemporaneous values (e.g. Stockhammer & Stehrer, 2011). However,

[9] A number of authors undertaking the same task of backing out marginal effects from elasticities often appear to suggest that terms like $\bar{\omega} * \bar{Y}$ can be simplified (to, in this example, $\bar{W}$, the sample average compensation of employees). However, this is not technically correct, and so the practice is avoided here.

Reed (2015) shows that this practice does not allow one to avoid the threat of simultaneity bias. Other authors acknowledge and discuss the issue but proceed with OLS regardless, citing the lack of preferable alternatives such as valid instruments for an instrumental variables approach (e.g. Onaran & Obst, 2016).

As pointed out by Reed (2015), lags of endogenous variables may serve as valid instruments, but only as long as those lags fulfil the usual relevance and exogeneity criteria. Though it is relatively easy to show that lagged instruments are relevant and not over-identified, the possibility that a given lag truly belong in the equation of interest is difficult to rule out. Therefore, as in Blecker et al. (2020), lags of the endogenous variables serve as instruments in the 3SLS approach essentially on the assumption of exogeneity. Though one cannot say definitively whether estimates given by 3SLS are an improvement upon those given by OLS, it is nonetheless maintained that, at the very least, they are a worthwhile robustness check.

While the simpler two stage least squares (2SLS) would suffice to deal with the endogeneity problem, 3SLS is preferred as it a systems, rather than single-equation, approach that allows for the correlation of cross-equation errors. Since unobserved factors that affect one component of demand likely affect another, accounting for the correlation of cross-equation errors means 3SLS likely estimates coefficients more efficiently than 2SLS.[10] A Hausman test supports suspicions that 3SLS outperforms 2SLS, and is hence is preferred here.

Since the lag length of endogenous variables differs between equations, different sets of instruments are used for the different equations.[11] Without adjusting the conventional 3SLS estimator based on Zellner and Theil (1962), Schmidt (1990) shows that the use of different instruments for different equations may lead to inconsistent results. Therefore, the generalised method of moments variant of the 3SLS estimator suggested by Schmidt (1990), denoted "3SLS-GMM", is used. For the reasons summarised in Henningsen and Hamann (2007), the 3SLS-GMM approach is more robust than the original 3SLS approach in a number of ways.

While it is a straightforward matter to make the standard errors estimated by OLS robust to the presence of any heteroscedasticity and autocorrelation, doing so those given by the 3SLS-GMM estimator is not. Therefore, Breusch-Pagan and Breusch-Godfrey tests for heteroscedasticity and serial correlation are performed on the differenced and logged data. Both tests fail to reject the null hypotheses of homoscedastic and non-serially correlated errors.

4.4 Results

For the regressions corresponding to the price level and each component of private demand, the results for each of the three specifications are shown in the columns of tables 4 to 8. Table 4 begins with the results of the APC regressions. A one percent increase in the conventional adjusted wage share of GDP is shown to lead to a 0.46% increase in the APC (significant at the 5% level), whereas a one percent increase in the modified wage share increases the APC by around 0.6% (significant at 1% level). The effects of the control variables that are significant

[10] Indeed, Zellner and Theil (1962), the originators of the 3SLS method, use the approach to estimate a similar simultaneous system of consumption, investment, and output in their seminal paper (see pp. 71-77).

[11] Modified national income, wage share, and unit labour costs are all treated as endogenous in the 3SLS analysis, and are instrumented by the preceding four lags of these variables. The first lag of some these endogenous variables were deemed necessary in the desired, second stage regressions. For example, the first lag of the wage share was necessary for the investment function, but not the average propensity to consume. Hence, it could serve as an instrument in the latter but not in the former, and therefore the list of instruments needed to vary on an equation-by-equation basis.

have the expected signs, though in the case of social benefits this is only true of the cumulative effect over two periods. While increases in income are expected to decrease the APC, it is not too surprising that this variable is not significant in some specifications since its coefficient is directly related to autonomous consumption by equation (6). Given the lack of data on consumption when income is close to zero, it is difficult to estimate autonomous consumption efficiently.

Table 4 *Regression results - Dependent Variable:* $\Delta\, ln(C/Y)_t$

	Unadjusted data	**Data adjusted for distortions due to MNEs**	
	Spec. 1 *(OLS)*	Spec. 2 *(OLS)*	Spec. 3 *(3SLS-GMM)*
Constant	0.009	-0.017	0.021
	(0.008)	(0.011)	(0.022)
$\Delta\, ln\, \omega_t$	0.464**	0.589***	0.626***
	(0.180)	(0.138)	(0.217)
$\Delta\, ln\, SB_t$	-0.140	-0.156*	-0.161**
	(0.125)	(0.086)	(0.071)
$\Delta\, ln\, SB_{t-1}$	0.073	0.222***	0.234**
	(0.115)	(0.049)	(0.090)
$\Delta\, ln\, Y_t$	-0.288*	0.133	0.222
	(0.152)	(0.153)	(0.432)
$\Delta d08$		0.037**	0.044
		(0.015)	(0.035)
$\Delta\, ln(C/Y)_{t-1}$		0.095	-0.095
		(0.138)	(0.129)
Adjusted R^2	0.554	0.512	0.510
Observations	48	48	48
DF	43	41	41

***p < 0.01, **p < 0.05, *p < 0.1. Standard errors in parentheses.

As table 5 shows, the wage share is found to have a statistically significant negative effect on total investment after one lag. Specifications 2 and 3 suggest the unadjusted data largely overestimates how strongly negative this effect is. When estimated by OLS, total investment falls by 1.25% given a rise in the wage share of GDP by 1%, but by around only 0.79% given an equal rise in the modified wage share. The control variables have the expected sign, most interesting among which is that of the AECTR. A one percent fall in the AECTR is found to lead to an approximate rise in total investment of 1.5% after one period, supporting the hypothesis that the beggar-thy-neighbour policy of tax competition has had tangible effects on the Irish economy distinct from the mere conduit of paper profits. The effect of the AECTR is significant in both the second specification (at the 1% level) and the third specification (at the 5% level).

Moving now to the sources of external demand, the estimated effects of unit labour costs on real exports are detailed in table 6, alongside those of the control variables. Interestingly, while unit labour costs have a significant negative effect in the first, unadjusted specification, no significant effect could be detected in the specifications using the adjusted data and extra control. One possible explanation for this is that the first specification is subject to omitted variable bias. Profit shifting inflates the profitability of foreign affiliates (PWFA), total exports, and GDP. Failing to include a measure like *PWFA* means the increase in exports caused by profit shifting may be falsely attributed to a fall in unit labour costs, since GDP, which is also inflated by profit shifting, enters into the denominator of *ULC*. As with investment, the additional MNE-related control increases the goodness of fit quite substantially.

Table 5 *Regression results - Dependent Variable:* $\Delta \ ln \ I_t$

	Unadjusted data, no added controls	**Adjusted data, controlling for effective corporate tax rate paid by foreign affiliates**	
	Spec. 1 *(OLS)*	Spec. 2 *(OLS)*	Spec. 3 *(3SLS-GMM)*
Constant	-0.011	-0.016	-0.030
	(0.025)	(0.011)	(0.044)
$\Delta \ ln \ \omega_t$	0.012	-0.083	0.083
	(0.473)	(0.508)	(0.586)
$\Delta \ ln \ \omega_{t-1}$	-1.253***	-0.804***	-0.783**
	(0.311)	(0.219)	(0.366)
ΔIR_t	-0.006	-0.008***	-0.008*
	(0.005)	(0.003)	(0.004)
ΔIR_{t-1}	-0.010*	-0.006	-0.006
	(0.005)	(0.004)	(0.004)
$\Delta \ln Y_t$	1.265**	1.349***	1.681*
	(0.549)	(0.289)	(0.988)
$\Delta d08$	-0.007	-0.050	-0.026
	(0.050)	(0.053)	(0.077)
$\Delta AECTR_t$		-0.434	-0.517
		(0.602)	(0.785)
$\Delta AECTR_{t-1}$		-1.531***	-1.504**
		(0.512)	(0.709)
Adjusted R^2	0.335	0.621	0.614
Observations	58	52	52
DF	51	43	43

***p < 0.01, **p < 0.05, *p < 0.1. Standard errors in parentheses.

In table 7, unit labour costs are found to be insignificant in explaining imports across all specifications.[12] Imports appear most driven by domestic income, the nominal exchange rate, and foreign price level. Again, the profitability of foreign affiliates is found to be a significant factor in the explanation of the value of total Irish imports. This, alongside the fact that the coefficient on *PWFA* in the import function is smaller than that of the same variable in the export function, fits with the hypothesis that profit shifting distorts the Irish trade balance.

Table 6 *Regression results - Dependent Variable:* $\Delta \ln X_t$

	Unadjusted data, no added controls	**Adjusted data, controlling for the profitability of foreign affiliates**	
	Spec. 1 *(OLS)*	Spec. 2 *(OLS)*	Spec. 3 *(3SLS-GMM)*
Constant	0.084***	0.096***	0.095***
	(0.013)	(0.010)	(0.017)
$\Delta \ln ULC_t$	-0.507**	-0.266	-0.253
	(0.203)	(0.178)	(0.174)
$\Delta \ln ULC_{t-1}$	0.108	-0.074	-0.074
	(0.120)	(0.213)	(0.167)
$\Delta \ln Y_t^f$	0.331**	-0.335*	-0.297
	(0.163)	(0.182)	(0.209)
$\Delta \ln Y_{t-1}^f$		0.514***	0.476***
		(0.168)	(0.162)
$\Delta \ln P^f{}_t$	-0.076	-0.101	-0.116
	(0.119)	(0.101)	(0.146)
$\Delta \ln E_t$	-0.178	-1.270***	-1.248***
	(0.246)	(0.340)	(0.346)
$\Delta\, d08$	-0.084***	0.077***	-0.076***
	(0.012)	(0.026)	(0.025)
$\Delta \ln X_{t-1}$	0.114	0.110	0.112
	(0.122)	(0.190)	(0.142)
$\Delta \ln PWFA_t$		0.137**	0.135***
		(0.054)	(0.027)
Adjusted R^2	0.428	0.512	0.511
Observations	58	52	52
DF	50	42	42

***p < 0.01, **p < 0.05, *p < 0.1. Standard errors in parentheses.

[12] Further analysis not reported in full here show that replacing *ULC* with the price level does not qualitatively change the result that price competitiveness appears as an insignificant predictor in the second and third specifications of the export and import regressions.

Table 7 *Regression results - Dependent Variable:* $\Delta \ln M_t$

	Unadjusted data, no added controls	**Adjusted data, controlling for the profitability of foreign affiliates**	
	Spec. 1 *(OLS)*	Spec. 2 *(OLS)*	Spec. 3 *(3SLS-GMM)*
Constant	0.029**	0.037***	0.053**
	(0.013)	(0.011)	(0.021)
$\Delta \ln ULC_t$	0.223	0.190	-0.124
	(0.274)	(0.137)	(0.381)
$\Delta \ln ULC_{t-1}$	-0.272	-0.182	-0.029
	(0.183)	(0.143)	(0.252)
$\Delta \ln Y_t$	0.882***	0.939***	-0.084
	(0.230)	(0.184)	(0.978)
$\Delta \ln Y_{t-1}$	0.432*	0.518**	0.862*
	(0.267)	(0.214)	(0.481)
$\Delta \ln E_t$	-1.031***	-1.570***	-1.451***
	(0.357)	(0.244)	(0.363)
$\Delta \ln P^f{}_t$	-0.517***	-0.540***	-0.436**
	(0.145)	(0.101)	(0.213)
$\Delta \ln M_{t-1}$		-0.047	0.124
		(0.125)	(0.214)
$\Delta \ln PWFA_t$		0.083**	0.078**
		(0.038)	(0.037)
Adjusted R^2	0.504	0.636	0.461
Observations	58	52	52
DF	51	43	43

***p < 0.01, **p < 0.05, *p < 0.1. Standard errors in parentheses.

The results of the regression of changes in logged CPI on its various explanatory variables is given in table 8. As expected, higher unit labour costs appear to lead to higher prices. A one percent increase in unit labour costs is associated with an increase in the price index of between 0.16% and 0.23%, depending on the specification. All other variables have the expected sign, though the income level is not found to be a significant predictor of inflation. Generally, the goodness-of-fit is high across all specifications.

Table 8 *Regression results - Dependent Variable:* $\Delta \ln P_t$

	Unadjusted data	**Data adjusted for distortions due to MNEs**	
	Spec. 1 *(OLS)*	Spec. 2 *(OLS)*	Spec. 3 *(3SLS-GMM)*
Constant	0.012	0.010	0.016
	(0.008)	(0.008)	(0.010)
$\Delta \ln ULC_t$	0.216***	0.194***	0.162**
	(0.064)	(0.069)	(0.072)
$\Delta \ln ULC_{t-1}$	0.002	0.026	0.039
	(0.005)	(0.055)	(0.059)
$\Delta \ln OIL_t$	0.033***	0.033***	0.036***
	(0.010)	(0.011)	(0.011)
$\Delta \ln Y_t$	0.082	0.124	0.046
	(0.085)	(0.077)	(0.111)
$\Delta \ln E_t$	-0.263***	-0.260***	-0.239**
	(0.083)	(0.084)	(0.096)
$\Delta \ln P^f{}_t$	0.121**	0.117**	0.135**
	(0.048)	(0.050)	(0.052)
ΔRTA_t	-0.001*	-0.001**	-0.001*
	(0.001)	(0.001)	(0.001)
$\Delta \ln P_{t-1}$	0.529***	0.545***	0.516***
	(0.076)	(0.082)	(0.089)
Adjusted R^2	0.891	0.892	0.892
Observations	55	55	51
DF	46	46	42

***p < 0.01, **p < 0.05, *p < 0.1. Standard errors in parentheses.

4.5 Marginal effects and the total private demand regime

Given the regression results of the preceding section, the total private demand regime of Ireland can now be estimated according to equation (2'). The derived marginal effects are displayed in table 9 for the three empirical specifications used in this paper. Only effects that are significant at the 1% or 5% level are reported in table 9. Dashes signify that the effect was not significant at even the 10% level.

It is clear that adjusting and controlling for the influence of MNEs has a substantial effect on the estimation of Ireland's demand regime. In the OLS approach using unadjusted data (specification 1), Ireland is found to be quite strongly profit-led. Indeed, private domestic demand (*C+I*) alone already appears to be slightly profit-led before the negative effect of higher unit labour costs on trade are considered. The marginal effect of unit labour costs on the price level is higher than in the other specifications, implying that the pass-through of an increase in unit labour costs to the wage share (reflected in $\partial\omega/\partial ULC$) is lower.

In the specifications that adjust and control for the influence of MNEs (namely 2 and 3), the marginal effect of an increase in the wage share on consumption is considerably higher. The size of the effect on investment is also much lower when using the adjusted data and OLS or 3SLS estimators. Taken together, these differences in the marginal effects on the components of demand explain the stark difference in the estimated demand regime of the MNE-robust specifications and the benchmark specification that is not robust to effects of MNEs in Ireland. These results indicate the underlying Irish economy is wage-led rather than profit-led.

Table 9 *Marginal effects and the estimated demand regime of Ireland across specifications*

Specification	**Marginal effects** (as a proportion of sample mean national income, $\bar{Y}$)						**Result**
	$\frac{\partial\omega}{\partial ULC}$	$\frac{\partial C}{\partial\omega}$	$\frac{\partial I}{\partial\omega}$	$\frac{\partial X}{\partial ULC}$	$\frac{\partial M}{\partial ULC}$	$\frac{\partial AD}{\partial ULC}$	
1: OLS; Not MNE-robust	0.57	0.43	-0.53	-0.54	-	-0.60	Profit-led
2: OLS; MNE-robust	0.72	0.61	-0.28	-	-	0.24	Wage-led
3: 3SLS; MNE-robust	0.75	0.65	-0.28	-	-	0.28	Wage-led

5. Implications

The finding that higher unit labour costs have no statistically significant effect on exports and imports is clearly a large part of the ultimate result that Ireland is wage-led. A likely explanation for the lack of price relevance in Irish trade comes down to the fact that a substantial part of Irish trade is due to MNEs, who locate in Ireland not for low labour costs, but for low taxes. To achieve the lowest tax rates, MNEs in Ireland often have to prove that a certain amount of

expenditure on labour or capital took place in Ireland. For example, to be eligible for research and development tax credits and to benefit from the special low rate of 6.25% on income arising from intellectual property (IP), MNEs must prove to the Irish authorities that "relevant activities" were performed on the IP in Ireland. Qualifying expenditure includes "wages, related overheads, plant and machinery, and buildings" (IDA 2016, p. 6). Hence, MNEs often choose to locate managerial positions and/or capital-intensive production processes that require highly skilled labour in Ireland. The inherent costs would likely be similar no matter where such aspects of business activity are located but the tax bill in Ireland is lower. It seems to be for this reason that virtually all of the world's largest pharmaceutical and technology companies, which are typically capital-intensive and require high-skill labour, have a real presence in Ireland.[13] Under these circumstances, it is not surprising that higher real wages do not seem to deter investment and exports too severely. If anything, the MNEs that locate in Ireland to avail of low taxes likely bid up wages in certain industries.[14] Hence, by successfully engaging in tax competition, it may be that labour costs in Ireland are less subject to competitive downward pressure as a result.

However, this is not to say other countries should aim to emulate the Irish strategy. While it may be true that a 1% fall in the AECTR increased investment by around 1.5% in Ireland over the years analysed, such results have little to no external validity—i.e. an effect, especially of this size, is unlikely to be enjoyed by another country looking to employ the same tax competitive economic model. There are at least three reasons for this, which are developed in more detail in Woodgate (2020). Firstly, multiple countries lowering corporate tax rates *simultaneously* does little to establish any one country as relatively low-tax. Second, it is hard to see how countries like Ireland could be undercut on corporate tax when its AECTR is already close to zero and has been since the 1980s (see figure 4 above). Lastly, the cost of lower corporate taxes is higher post-tax inequality, which in and of itself slows demand growth in all wage-led economies. In sum, then, Ireland is likely not the example of, but rather the exception to, the general rules of prudent macroeconomic tax policy.

There is also no guarantee for how long Ireland will benefit from this tax competitive strategy. Since tax competition is a beggar-thy-neighbour strategy that benefits a handful of nations at the expense of all others, the majority of countries around the world have every incentive to crack down on tax competition. To do so, nations acting unilaterally or multilaterally have a number of reasonable and implementable policy proposals at their deposal (for example, see Saez and Zucman, 2019, ch. 6). Should meaningful anti-tax-competition legislation come to pass or if Ireland somehow finds itself outcompeted in the race to the bottom in corporate taxes, the Irish economy in its current form would face an existential threat. Such a conclusion is also shared by Patrick Honohan, the former governor of the Central Bank of Ireland. Honohan recently warned that the high reliance on foreign MNEs, especially for tax revenue, "is not really a sustainable system … It has generated huge tax revenues in the last few years [but] it might be like the end of one of these stars that has a supernova explosion towards the end of its life" (Hutton, 2019). Furthermore, the outcome of the OECD BEPS project, as incomplete as it may be, already appears to threaten the Irish regime, with the Irish Minister for Finance warning that up to 20% of corporate tax revenues could be lost as a result

[13] See IDA (n.d.) for an extensive list that includes information and communication technology companies such as Amazon, Apple, Facebook, Google, and Microsoft, and pharmaceutical companies such as Pfizer, Roche, Novartis, and GlaxoSmithKlein, as well as many more of the largest MNEs.

[14] Though with problematic regional and distributional disparities, as Regan and Brazys (2018) point out.

of MNEs changing their tax plans to be compliant with new BEPS rules (Burke-Kennedy, 2020). The sustainability of Irish growth is therefore likely to based on fostering domestic demand through, for example, redressing income inequality, rather than merely hoping the Irish economy can remain tax competition-led indefinitely.

6. Conclusion

This paper has argued that one cannot fully understand the Irish economy without understanding key trends in modern globalisation such as tax competition, profit shifting, and contract manufacturing. Long-running and consistent tax competitive policies have attracted numerous large MNEs to Ireland, leading to higher investment and higher tax revenues. Many MNEs are resident in Ireland but sell all across Europe and further afield, meaning that employment in Ireland has become increasingly a function of world demand rather than domestic demand. In this sense, the Irish tax competitive regime is similar to the model of export-led growth via wage restraint. It is also similar in that it is a beggar-thy-neighbour strategy with repercussions for income inequality. Unlike export-led growth via wage restraint, however, the success of Ireland's tax competitive strategy does not depend on the suppression of wage growth.

The econometric analysis conducted supports this conclusion. Using both OLS and 3SLS estimators, the effect of the modified wage share on domestic demand was found to be positive while no significance could be attributed to effect of higher unit labour costs on net exports once the effects of MNEs are taken into account. Failing to consider these effects paints a very different picture of the Irish economy. It would appear that real effects of Ireland's tax competition-led regime go hand-in-hand with large distortionary effects that bias the conventional wage share and unit labour costs metrics downward, leading to a strong semblance of profit-led demand growth. However, in light of empirical results of this paper, further evidence of profit-led growth beyond the mere appearance could not be found. Across both specifications robust to effects of MNEs, Ireland was found to be wage-led.

The limitations of the empirical approach taken relate to the data and estimators used. For example, improved and longer-running data on mark-ups and private debt could prove useful if made available in the future. For the reasons described above, the OLS estimator very likely suffers from endogeneity bias, while the 3SLS estimator alternative may still be imperfect. Future research on demand regime estimation, especially, but not exclusively, of other economies dominated by MNEs, may also benefit from the kinds of adjustments and controls seen here. Regarding Ireland specifically, further research on the question of the sustainability of Ireland's peculiar macroeconomic regime could be valuable.

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Appendix: Data definitions and sources

All data are 1960-2019, unless noted otherwise.

Conventional (unadjusted) data		
Variable	**Definition**	**Source**
GDP (Y)	Real gross domestic product (constant 2015 prices)	AMECO (2020)
Consumption (C)	Real private final consumption expenditure (constant 2015 prices)	AMECO (2020)
Investment (I)	Real gross fixed capital formation (GFCF) (constant 2015 prices)	AMECO (2020)
Exports (X)	Real exports of goods and services (constant 2015 prices)	AMECO (2020)
Imports (M)	Real imports of goods and services (constant 2015 prices)	AMECO (2020)
Price level (P)	National consumer price index	AMECO (2020)
Wage share (ω)	Adjusted wage share of GDP at current market prices	AMECO (2020)
ULC	Nominal unit labour costs	AMECO (2020)
Interest rate (IR)	Long term real interest rate, deflator GDP	AMECO (2020)
Foreign GDP (Y^f)	Sum of real GDP of EU12 bar Ireland, United States and United Kingdom	AMECO (2020)
Foreign Price Level (P^f)	Price deflator of imports of goods and services into Ireland	AMECO (2020)
Exchange rate (E)	Nominal effective exchange rate, relative to the rest of the former EU15, double export weights	AMECO (2020)
RTA	Cumulative number of regional trade agreements in force	WTO (2020)
Oil	Nominal price converted into euro per barrel of Arabian Light crude (1960-1984) and Brent crude (after 1985).	Bank of England (2020)
Social Benefits (SB)	Sum of all current transfer payments from government to households (1970-2019), deflated by GDP deflator	CSO (2020)
d08	Dummy variable, equal to one between 2008 and 2012	
Mark-up (m)	Estimated average mark-up of firms in Ireland (1980-2016)	De Loecker & Eeckhout (2018)
Modified data (adjusted for distortions due to MNEs)		
GNI* (Y*)	Real modified gross national income (1995-2019) = GNI *minus* income of redomiciled companies *minus* depreciation on R&D service imports, IP, and aircraft leasing	CSO (2020)
C*	Quarterly modified consumption expenditure converted to annual basis (1995-2019) and expressed in real terms using consumption deflator	Own estimate based on data from CSO (2020) AMECO (2020)

I*	Quarterly modified gross fixed capital formation converted to annual basis (1995-2019) and expressed in real terms using GFCF deflator I*= GFCF – R&D and IP imports – net aircraft related to leasing	Own estimate based on data from CSO (2020) AMECO (2020)
X*	Nominal merchanting exports *plus* exports of services *minus* exports of R&D and IP products (2014-2019), expressed in real terms using export deflator	Own estimate based on data from CSO (2020) AMECO (2020)
M*	Nominal merchanting imports *plus* imports of services (1960-2019) *minus* imports of R&D and IP products (2014-19) *minus* net aircraft imports (2007-19) *minus* R&D service imports (2007-19), expressed in real terms using export deflator	Own estimate based on data from CSO (2020) AMECO (2020)
ω*	Modified adjusted wage share (For definition, see equation 1)	Own estimate based on data from CSO (2020) AMECO (2020)
ULC*	Modified nominal unit labour costs = $(W_t/Y^*_t)/(W_{2015}/Y^*_{2015})$ where Y* denotes real GDP *minus* factor income of re-domiciled companies *minus* depreciation on R&D service imports, IP, and aircraft leasing. 2015 subscript implies value in the year of comparison.	Own estimate based on data from CSO (2020) AMECO (2020)
Additional MNE-related control variables		
AECTR	Average effective corporate tax rate (1966-2018), majority-owned foreign affiliates (MOFAs) of US MNEs in Ireland $AECTR = T^{FA}/\Pi^{FA}$ T^{FA}: total Irish corporation tax paid by US MOFAs Π^{FA}: Pre-tax profits of US MOFAs based in Ireland, *minus* net interest payments and depreciation	Wright & Zucman (2018) for 1966-2016, updated until 2018 based on BEA (2020)
PWFA	Ratio of pre-tax profits to total compensation of employees US MOFAs in Ireland (1966-2018) $PWFA = \Pi^{FA}/W^{FA}$ Π^{FA}: See above W^{FA}: compensation of employees, US MOFAs in Ireland	Wright & Zucman (2018) for 1966-2016, updated until 2018 based on BEA (2020)

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