# Jobs and Fiction: Identifying the Effect of Corporate Tax Avoidance Inflating Export Measures in Ireland

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**Abstract**

Ireland's emergence as a European hub for multinationals in the information and communication technology (ICT) and pharmaceutical industries highlighted the growing tension between spatially dispersed, globalised economic activity and the nation-centred measures used to monitor it. Although 'big tech' and 'big pharma' are often praised as export powerhouses, their real contribution to Irish economic performance is unclear, as corporate tax avoidance artificially inflates national statistics. By moving around intellectual property assets, inverting corporate headquarters or engaging in factoryless manufacturing, firms go out of their way to book their profits in low-tax jurisdictions. Their products and services show up as Irish exports, often without employing any Irish labour or capital in the production process. This article uses a novel empirical approach to distinguish job-sustaining economic activity from accounting fiction. By contrasting traditional measures of export growth with export sector employment and earnings, it identifies sectors with sudden, unexplained discrepancies between the two, that are indicative signs for fictitious activity. Supporting the hypothesised pattern, discrepancies cluster in ICT and pharmaceutical industries, that are dominated by multinationals from the United States. The investigation also finds that controlling for distortions, external demand and the Transatlantic trade link remain key drivers of Irish growth. But the paper's findings should caution analysts to extrapolate from the success of 'big tech' and 'big pharma' to national economic performance – a lesson particularly relevant in the light of the COVID-19 shock, which left these specific industries largely unscathed.

**keywords:** international political economy; tax avoidance; exports

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# 1 Introduction

In the euro crisis of the early 2010s, Ireland outperformed crisis-hit peers with a faster recovery, largely attributed to sturdier export performance. A decade later, in the face of the COVID-19 shock, forecasts tapped the Irish economy to be on track to repeat this, 'boosted by exports from multinational companies specialising in medical equipment, pharmaceuticals and computer services' (European Commission, 2021, p. 25). Ireland's emergence as a European hub for multinationals is undoubtedly key to understanding its recent economic trajectory, but assessing the contribution of 'big tech' and 'big pharma' to the Irish economy is far from straightforward Regan and Brazys (2017). Large corporations' aggressive tax avoidance obscures trade and economic dynamics (Klein and Pettis, 2020; Kneafsey and Regan, 2020; Lane, 2017; Seabrooke and Wigan, 2014; Setser, 2019, 2020*a*). Multinationals go out of their way to book their profits in low-tax jurisdictions like Ireland, often without moving actual production there, and by doing so, they artificially inflate measures of national economic activity. On paper, a product shows up in the Irish GDP figure, even though no Irish labour or capital was employed in its creation – from the Irish economy's point of view, it is an accounting fiction. In 2015, the sudden surge in Irish GDP was so implausible, it was famously labelled 'leprechaun economics' by Paul Krugman. We have ample anecdotal evidence on multinationals' profit shifting and the distortions it causes in Irish export statistics, but more systematic empirical investigations have been largely absent in political economy research. The Irish economy is a critical case of a broader phenomenon: the growing detachment of globalised, spatially fluid economic activity from the statistical measures used to monitor it, especially since national economies remain the most common unit of analysis (Bryan, Rafferty and Wigan, 2017; Linsi and Mügge, 2019; Avdjiev et al., 2018). Ambiguity and misalignment are not only technical matters. They strain the fiscal apparatus and regulatory capacity of states (Seabrooke and Wigan, 2016; Saez and Zucman, 2019) and blur the boundaries between the national interest and the often non-congruent interest of a global corporation in the eyes of the electorate (Kneafsey and Regan, 2020).

Consequently, the question emerges: in light of inflated trade statistics, was Ireland's recent growth trajectory at all export-led? Assessments of Ireland's statistical problems often go as far as to claim that 'profit shifting by multinational corporations doesn't distort Ireland's balance of payments; it constitutes Ireland's balance of payments' (Frank and Setser, 2018). In contrast, works in Comparative Political Economy (CPE) engaged in the classification of discrete national economies as varieties of capitalism (Hall and Soskice, 2001) or growth models (Baccaro and Pontusson, 2016) generally view recent (post euro crisis) Irish growth as export-led (Hall, 2017), and many in policymaking circles agree. That is not to say statistical distortions go unacknowledged, but they do not prompt most observers to substantially question exports as a key growth engine in Ireland. This paper aims to deepen our understanding about a national economy's 'export orientation' or 'export-led growth' by integrating insights from International Political Economy research, that has long been occupied with the spatial dispersion of economic activity

in the era of global value chains and production networks (Gereffi, Humphrey and Sturgeon, 2005; Henderson et al., 2002; Palan, 1988; Ponte and Sturgeon, 2014).

The empirical strategy rests on contrasting sectoral export growth measured in a traditional value added perspective derived from the headline GDP figure (and expected to include fictitious activity) to the dynamics of export sector employment and wages (expected to include job-sustaining economic activity only). It leverages a simple insight: if increases in exports are driven by fictitious activity, we should not see corresponding growth in export sector jobs and earnings; and conversely: if jobs and earnings grow, it is evidence for economic activity beyond accounting fiction. A systematic sectoral mapping allows us to identify the industries where traditional and employment-based measures show large, sudden disconnects. The analysis does find substantial and unexplained discrepancies and finds them along the hypothesised pattern: in sectors dominated by multinational corporations and US ownership, specifically the chemical manufacturing (pharmaceutical) and information and communication (ICT) industries. In chemical manufacturing, there was a 200 per cent jump in activity from 2014 to 2015 that cannot be accounted for by other measures, as both employment and earnings stagnated; in ICT, value added grew four times the rate of the sectoral wage bill between 2016 and 2019 – a trend that could only be explained by a sudden, radical power-shift between capital and labour, even though labour's share of income is understood to be relatively stable over time and such an unusual shift is absent in other countries' ICT sectors. Findings are linked to brief qualitative case studies that fit the temporal patterns of the quantitative analysis.

As a subsequent question, the paper asks: controlling for the above outlined distortions, is it still justified to describe Ireland's growth performance as export-driven? It finds that it is. Controlling for the effects of inflated exports, the analysis of employment-corrected measures shows that compared to other crisis-hit peers, foreign final demand did fuel the country's superior jobs recovery from the euro crisis. However, the gross overestimation of pharmaceutical and ICT giants' contribution to Ireland's growth have several far-reaching implications for research and policy going forward.

## 2 Export-orientation: a common thread in Ireland's recent growth trajectory

Famously labelled 'the Celtic Tiger,' Ireland enjoyed a period of remarkable economic growth in the 1990s (Ó Riain, 2014). The boom was rooted in the country's success in attracting large shares of Foreign Direct Investment (FDI) from the late 1980s onwards. This FDI-inflow laid the foundations for an economy geared towards exports, as multinationals – mainly computer manufacturing and pharmaceutical firms from the United States – used the Irish economy as an export platform. What were the drivers of Ireland attracting a larger share of export-platform FDI than competitors? Empirical accounts highlight the favourable corporate tax regime, Ire-

land's geographical proximity to the US and the effectiveness of the Industrial Development Agency (IDA) (Barry, 2004; Brazys and Regan, 2017; Hardiman, 2017). The IDA is often credited for being ahead of the curve, courting companies like Apple, Microsoft, Intel or Dell into Ireland's now-famous ICT cluster often before their international breakout (Bohle and Regan, 2021). This export-orientation was also underpinned by labour market policy: centralised wage setting institutions established in the late 1980s delivered wage restraint (Johnston and Regan, 2016, p. 324).

For a period in the 2000s, Ireland's export-driven growth shifted towards domestic spending, financed by rapid credit expansion, mainly in the construction sector (Dellepiane-Avellaneda, Hardiman and Heras, 2021). A trigger for this was a slowdown in ICT investments prompted by the dotcom crash in the United States (Bohle and Regan, 2021). This sharp turnaround demonstrates why Ireland has been a difficult case to pin down by the Varieties of Capitalism framework (Hall and Soskice, 2001). While export-orientation and centralised bargaining would be markers of Coordinated Market Economies (CME), this period period would firmly put the economy in the Liberal Market Economy (LME) camp characterised by financial dominance, and an overheated, inflation-prone economy. The global financial crisis turned the Irish expansion into a boom-bust cycle. After the asset price bubble burst and the Irish housing market crashed in 2007, Ireland reached the verge of a financial sector collapse. A sharp decline in fiscal revenues and costs associated with bank rescues culminated in a sovereign debt crisis and the Irish government had to request external financial assistance. The programme consisted of reforms and spending cuts (Hardiman and Regan, 2013). Savings rates, therefore, were forced up, improving Ireland's current account balance and pushing the economy towards export-reliant growth automatically. In 2013, Ireland exited the programme as first among the crisis countries. Mainly driven by a steady growth of net exports, which helped to offset contractionary effects of fiscal policy, GDP started growing in 2013 and by 2014-15, Ireland has become the fastest growing economy in the EU. In a comparative perspective, Ireland's more successful recovery is well demonstrated by its faster employment growth: job numbers have been steeply improving from 2012 onwards, making Ireland the only programme country to reach its 2007 employment levels in 10 years.

A strong driver of the successful Irish recovery was the unique geographic and sectoral composition of Irish trade (Barry and Bergin, 2012, 2017; Polyak, n.d.). A whopping 40% of Ireland's export goods and services are bought by two countries – the United States (24%) and the United Kingdom (16%). Faster recovery in these non-euro area trading partners boosted Irish growth. IMF Article IV reports and European Semester documents from the 2010-2015 period highlight this channel as well. The fact that most euro area economies are integrated in the European trade area (led by the German economy, the world's biggest saver) limited inward-trading members' room for export-led growth, but gave a unique opportunity to Ireland to exploit its existing Transatlantic ties and grow faster than the rest of the continent. Ireland's highly open economy (trade amounted to 188% of GDP in 2011) had a substantial advantage in this respect.

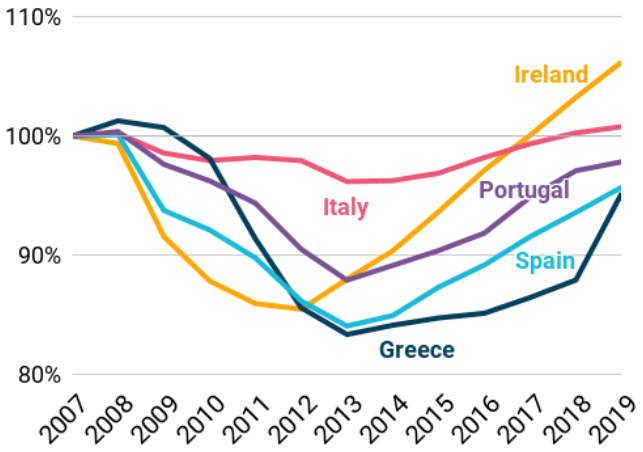


**Figure 1:** Total employment in programme countries, 2007=100% (Data: Eurostat)

Ireland was well-positioned to exploit the positive demand shock from the United States, in large part because of the existing exporting infrastructure established in the above discussed period of rapid FDI-inflows. As Regan and Brazys (2017) show, this post-crisis period was a revival of the earlier FDI-focused phase, as a new wave of largely United States-based companies in the high-tech internet services sector flocked to Ireland. Google, Facebook, Twitter, Amazon and their 'big tech' peers set up shop along Dublin's Grand Canal Docks, giving rise to the city's newest tech cluster, the 'Silicon Docks.' Similarly to the previous period, the IDA's active facilitation was an important factor, as were low corporate taxes and cash subsidies. Access to the European common market – the world's biggest consumer market – and the opportunity to tap into Europe's free-moving labour force also were significant incentives.

The surge of global demand for business sector services, mainly intermediate services inputs within these tech giants' value chains, provided an alternative to domestic demand stimulus in Ireland. Exports cushioned some of the social and economic fallout from fiscal austerity and private deleveraging, plausibly also contributing to Ireland's divergent political reception to the Troika reforms (Pappas and O'Malley, 2014).

It is visible that the literature interprets Ireland's recent economic trajectory as export-oriented; it is either an explicit or implicit assumption in most works. In short: steady inflows of export-platform FDI laid the foundations of export successes from the 1980s onwards; for a brief period in the 2000s, an overinflated domestic construction sector took over as the main jobs engine, but after the credit-fueled real estate bubble burst and painful adjustment throttled domestic sources of growth, the country could fall back on an existing trading infrastructure (particularly the Transatlantic link) to revive the export-led model. All of these narratives place exports in the heart of Ireland's growth trajectory, without deeper engagement with measurement problems rooted in foreign multinationals' profit shifting. There is an important debate whether it was successful internal devaluation that drove exports through the cost-competitiveness channel (e.g. European Commission, 2015), or whether it was a favourable foreign demand shock (e.g. Barry

and Bergin, 2017), but both sides remain in the realms of an export-driven explanation, implying that artificially inflated trade statistics do not warrant a fundamental reassessment of exports as a key driver of growth.

Regan and Brazys (2017) as well as Bohle and Regan (2021) use the term 'FDI-led growth' to describe the Irish growth model. Their approach introduces an important conceptual nuance: highlighting the role of foreign direct investment and setting up a parallel between the paths of Ireland and similarly FDI-dominated Baltic and Visegrád countries (Bohle and Greskovits, 2012). Johnston and Regan (2018) add that the promotion of an FDI-centered growth strategy has been integrated into the explicit policy agenda of the European Union. Labelling growth FDI-led, however, does not answer whether we assume growth to be export-led or not, since FDI-led and export-led growth are not mutually exclusive categories. To disentangle these factors, the causal channel linking FDI inflows and GDP growth is worth a closer look.

FDI is a financing category, while net exports is a demand component of growth (in the expenditure side approach to GDP). In period $t-1$ when the inflow arrives, FDI has a neutral effect on GDP growth. It is an investment financed by capital import, so in the national accounts equation ($Y_t = C_t + I_t + G_t + NX_t$), investment ($I_{t-1}$) goes up, net exports ($NX_{t-1}$) goes down by the same amount, resulting in a net zero effect in the initial time period. 'FDI-led growth' occurs in subsequent period $t$, when FDI-financed investment gives a boost to the economy's supply capacity. It thereby influences the economy's long-term growth potential, not only current aggregate demand. However, in $t$, that FDI will be employed to produce goods or services– and that will be either sold to foreigners (resulting in export-led growth) or to domestic residents (resulting in domestic spending-led growth).

In conclusion, deeper critical engagement with inflated export statistics is an important shortcoming of existing works engaged with export-led growth in general and Ireland's path in particular. The next section delves into the specific problem of corporate tax avoidance strategies and statistical distortions.

## 3 How multinationals' profit shifting obscures economic statistics

A growing number of commentators (Damgaard, Elkjaer and Johannesen, 2019; Klein and Pettis, 2020; Lane, 2017; Setser, 2019, 2020*b*) are ringing the alarm bell about the impact of foreign multinationals' profit shifting activities on our ability to understand and observe Ireland's actual export performance. Swings in Irish GDP and exports without underlying economic activity are large enough to distort Eurozone-wide data (Setser, 2020*a*). The case exemplifies the theoretical construct Seabrooke and Wigan (2014, 2017) call global wealth chains – created to "hide, obscure and relocate wealth to the extent that they break loose from the location of value creation" (Seabrooke and Wigan, 2014, p. 257). Multinational corporations use creative ways to book

as much profits as possible in jurisdictions with low or zero corporate tax rates. The most common distortions stem from corporations (1) transferring intangible assets like intellectual property (IP), (2) redomiciling (or inverting) group headquarters, and (3) engaging in contract manufacturing activities (Department of Finance, 2019, pp.11-14.).

How do these channels work? First, transferring so-called 'intangible' assets (assets lacking physical substance) like intellectual property to subsidiaries in low-tax jurisdictions ensures that on paper, a product is sold (exported) from an Irish-based subsidiary to a buyer, often the next country along the line in the value chain. Although no Irish labour or capital was employed in the product's creation, IP rights are owned by the Irish-based entity. An important mechanism here is transfer pricing (TP). TPs are inter-value chain prices: the company sells intermediate inputs to itself. Importantly, they are not market prices but prices set by the company, who has a vested interest in setting them in a way that they eat away a large chunk of the tax base. As Bryan, Rafferty and Wigan (2017) elaborate, intangible capital is no longer a residual category in corporate finance, it has become the dominant one for many of the world's largest corporations, magnifying such distortion channels to excessive levels.

Second, as multinationals set up group headquarters in Ireland, profits from their global operations show up in Ireland's national accounts without generating the corresponding economic activity. Retained profits (corporate savings), in turn, increase Ireland's current account surplus. Third, a phrase often popping up in discussions around inflated Irish goods exports is 'contract manufacturing' – when a foreign subcontractor produces an input on behalf of an Irish company, but never assumes legal ownership over the product; the ownership change takes place between Ireland and the purchaser, not the subcontractor and the purchaser. Analysing the United States and the United Kingdom, Coyle and Nguyen (2020) show how such 'factoryless manufacturing,' a growing phenomenon, is most prevalent in the electronics and pharmaceutical industries. The production of iPhones by Apple Inc. is perhaps the most high-profile case of contract manufacturing (Setser, 2017).

Irish authorities have acknowledged the problem and pledged to make efforts to overcome it. Ireland's Central Statistical Office (CSO) constructed an adjusted Gross National Income (GNI*) measure, better grasping Ireland's economic output than GDP, and from 2005 onwards, also a 'modified' current account balance (CA*) to remove 'globalisation-related' distortions from the headline figure. The main factors that are stripped from the adjusted figure are flows connected to R&D and intellectual property assets, aircraft leasing activities and profits of redomiciled plcs.

So do we see rebalancing (Ireland's pre-crisis CA deficit turning into a surplus) in the modified balance? Indeed, it shows that Ireland gradually switched from excessively high spending (as growth was driven by a credit-fueled construction bubble) to an excess of saving of over 6% of GNI*. The modified CA* balance decomposed to institutional sectors shows an immense private deleveraging effort by Irish households, the main driver of the CA deficit in the pre-crisis years.

The government also steeply increased its savings, switching to a net saving position in 2018.

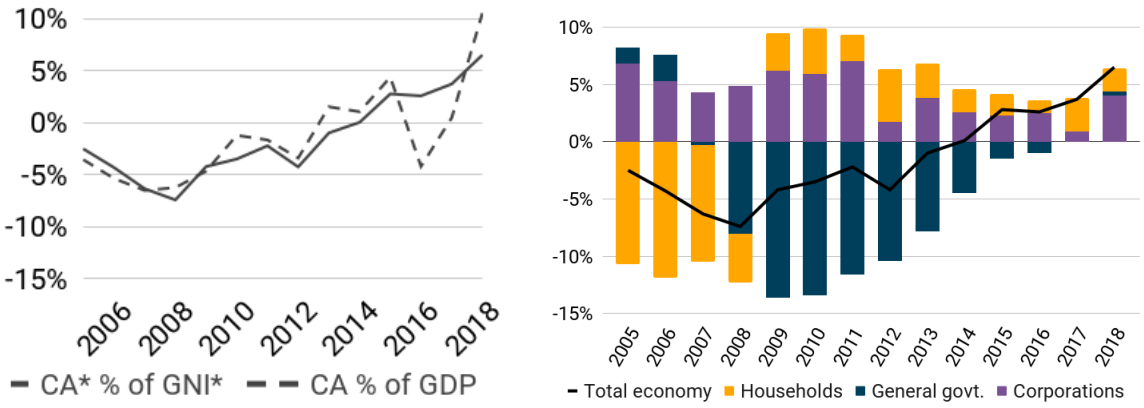


**Figure 2:** Ireland's modified $CA^*$ balance as a per cent of GNI* compared to the CA balance as per cent of GDP (L);$CA^*$ decomposed to institutional sectors (R) (Data: Department of Finance, OECD)

NACE codes (Nomenclature of Economic Activities, used by Eurostat and Irish CSO databases) are indicated throughout the paper; they are harmonised with ISIC codes (International Standard Industrial Classification of All Economic Activities, used by OECD databases)

These modified macro figures lend support to the narrative that beyond statistical distortions, Ireland did improve its CA balance quite steeply. It shows the economy squeezed domestic demand in both the public and private sectors and increasingly relied on external demand to generate strong employment growth. CA rebalancing per se is not evidence for strong export performance – the balance is a difference, and could just as well show a collapse in imports.[1] To get a more reliable picture of export performance, it is useful to project export data onto sectoral employment.

## 4 An empirical strategy to distinguish jobs from fiction

To identify the discrepancy between job-sustaining economic activity and (likely) accounting fiction, an empirical strategy is to analyze growth differentials of export value added and export-sector jobs. The aim of the analysis is to pinpoint the trade links, broken down by industry, where there are large, unexplained discrepancies between the two measures, suggesting fictitious activity. Based on theoretical insights outlined above, the analysis departs from the starting hypothesis that such discrepancies will emerge in sectors dominated by foreign multinationals. Let us start by operationalising the latter concept.

According to CSO's definition, a sector dominated by foreign owned multinational enterprises

[1] Dramatic rebalancing trends in euro periphery countries in the aftermath of the euro crisis are often mistaken for strong exports– even though it was the import component that drove the effect. In Greece, for instance, exports actually decreased in the aftermath of the euro crisis, but imports dropped by an even larger amount, improving the balance (Petroulakis 2017: 5).

| | | **FOREIGN FIRMS'** | | **of which: US FIRMS'** | |
|---|---|---|---|---|---|
| | | SHARE OF SECTOR TOTAL (%) | | | |
| | | Turnover | Value Added | Turnover | Value Added |
| | TOTAL Business economy | 65.60% | 66.76% | 49.70% | 55.44% |
| B | Mining and quarrying | 36.67% | 42.06% | | |
| C | Manufacturing | **86.67%** | **90.99%** | **76.99%** | **84.39%** |
| D | Electricity, gas, steam and air conditioning supply | 21.81% | 21.81% | | |
| E | Water supply, waste management | 11.40% | 11.40% | | |
| F | Construction | 9.72% | 9.72% | | |
| G | Wholesale and retail trade | 45.42% | 45.42% | 18.96% | 18.21% |
| H | Transportation and storage | 23.72% | 23.72% | | |
| I | Accommodation and food service activities | 14.63% | 12.58% | 3.27% | 3.51% |
| J | Information and communication | **91.78%** | **88.35%** | **83.43%** | **76.52%** |
| L | Real estate activities | 12.53% | 12.53% | | 4.24% |
| M | Professional, scientific and technical activities | 25.64% | 25.64% | 18.95% | 5.94% |
| N | Administrative and support service activities | 37.62% | 37.62% | | 29.88% |

**Table 1:** Foreign owned and US owned enterprises in Ireland: their share of each sector's total turnover and value added (Author's calculations based on: Eurostat structural business statistics; year 2018)

(MNEs) is defined as a sector 'where MNE turnover on average exceeds 85% of the sector total.' Based on this, the major sectors classified as MNE dominated are 'Chemicals and chemical products' (NACE 20-21, 'Computers, electronic and electrical equipment' (NACE 26-27)[2] and 'Information and Communication' (NACE 58-63).[3]

This classification is supported by data from Eurostat's structural business statistics database, mapping foreign control of enterprises. As Table 1 shows, manufacturing visibly stands out as a sector dominated by foreign owned firms in general, and US firms in particular. In 2018, 90.1 per cent of the sector's total value added was produced by foreign owned firms, and a whopping 84.4 per cent by US owned firms. The ICT sector is the other sector above the 85 per cent cutoff, showing similar patterns. It is striking to see that about half of total turnover and value added in the Irish business economy is attributed to US owned firms.

The analysis of discrepancies in export measures is based on three complementary databases. The OECD's Trade in Value Added (TiVA) data is a valuable source, since it deals with an important problem of trade statistics in the world of globally integrated value chains: it tracks value-added based on the source of its final demand, integrating the insight that in GVCs, intermediate goods and services cross borders multiple times. The data is disaggregated by sectors and trading partners. Based on TiVA data, OECD researchers also estimate the effects of GVC trade on labour markets (Horvát, Webb and Yamano, 2020). Their employment-based

[2]both subcategories within 'Manufacturing'

[3]CSO also adds two small manufacturing subcategories: 'Reproduction of recorded media' (NACE/ISIC 18.2) and 'Medical and dental instruments and supplies' (NACE/ISIC 32.5). Unfortunately, the datasets used for the analysis do not cover such detailed disaggregation levels and small sectors. This also underscores that treating 'Manufacturing' as a whole as an MNE-dominated sector is a good proxy.

measures in the Trade in Employment (TiM) database show the share of jobs and the share of earnings that are sustained by foreign final demand (FFD) as opposed to domestic final demand (DFD). Since the OECD TiVA and TiM databases only cover the period between 2005 and 2015, as a robustness test, they are augmented by an analysis of sectoral value added and employment trends from the Eurostat database. Since the latter dataset does not distinguish between the whole economy and the FFD-led portion, it provides a more conservative estimate and a further robustness check for the discrepancy.

The concrete measure for exports from the value-added perspective is the 'domestic value-added embodied in foreign final demand' variable ($FFD\_DVA$; millions of USD) from TiVA, that is deflated by the export deflators from CSO/Eurostat and exchanged to EUR. The employment-based perspective can be grasped by the 'domestic employment embodied in FFD' variable ($FFD\_DEM$; thousands of persons) and the 'compensation of employees embodied in FFD' ($FFD\_DCE$; millions of USD) from TiM, it is deflated in the same way. Growth rates are plotted with the year 2005 (=1) as a base.

# 5 Which sectors drive the discrepancy between value-added versus employment-based measures of Irish exports?

If there are differences between the growth dynamics of exports and export sector employment, they can be explained by two factors. First, if the labour intensity in the sector changes over time (from one year to the next, productivity improves and fewer jobs are needed for the same product or service). In this case, slopes of export growth and export-sustained employment growth will diverge (jobs will grow slower than exports). Some degree of change in labour intensity is reasonable to assume, so we do not expect trendlines to go in perfect lockstep. But large discrepancies may emerge if export numbers are inflated: they are not generating actual job-sustaining activity. If we find significant discrepancies and sudden, large swings in some years, we can pinpoint the industries where the fictitious activity is likely to be most prevalent.

It is clear from the analysis of differentials presented in Figure 3. that in most sectors, the differentials are stable over time (trendlines are more or less on top of each other). In some sectors, however, employment-based export measures yield very different patterns than the GDP-based (value added) figures. The significant, 15.9 per cent jump in the year-on-year growth of exports from 2014 to 2015 is especially striking. Employment does not show an even remotely similar path (even though exporting jobs grew by quite a respectable 9 per cent that year). The biggest disconnect is found in the manufacturing sector. Zooming in on the contributions of this highly irregular jump in Irish manufacturing exports from 2014 to 2015, the visible dominance of pharmaceutical manufacturing stands out.

This finding is in line with existing analyses and anecdotal evidence. Irish pharmaceutical exports are dominated by US multinationals (final demand from the US accounted for 33.18 per

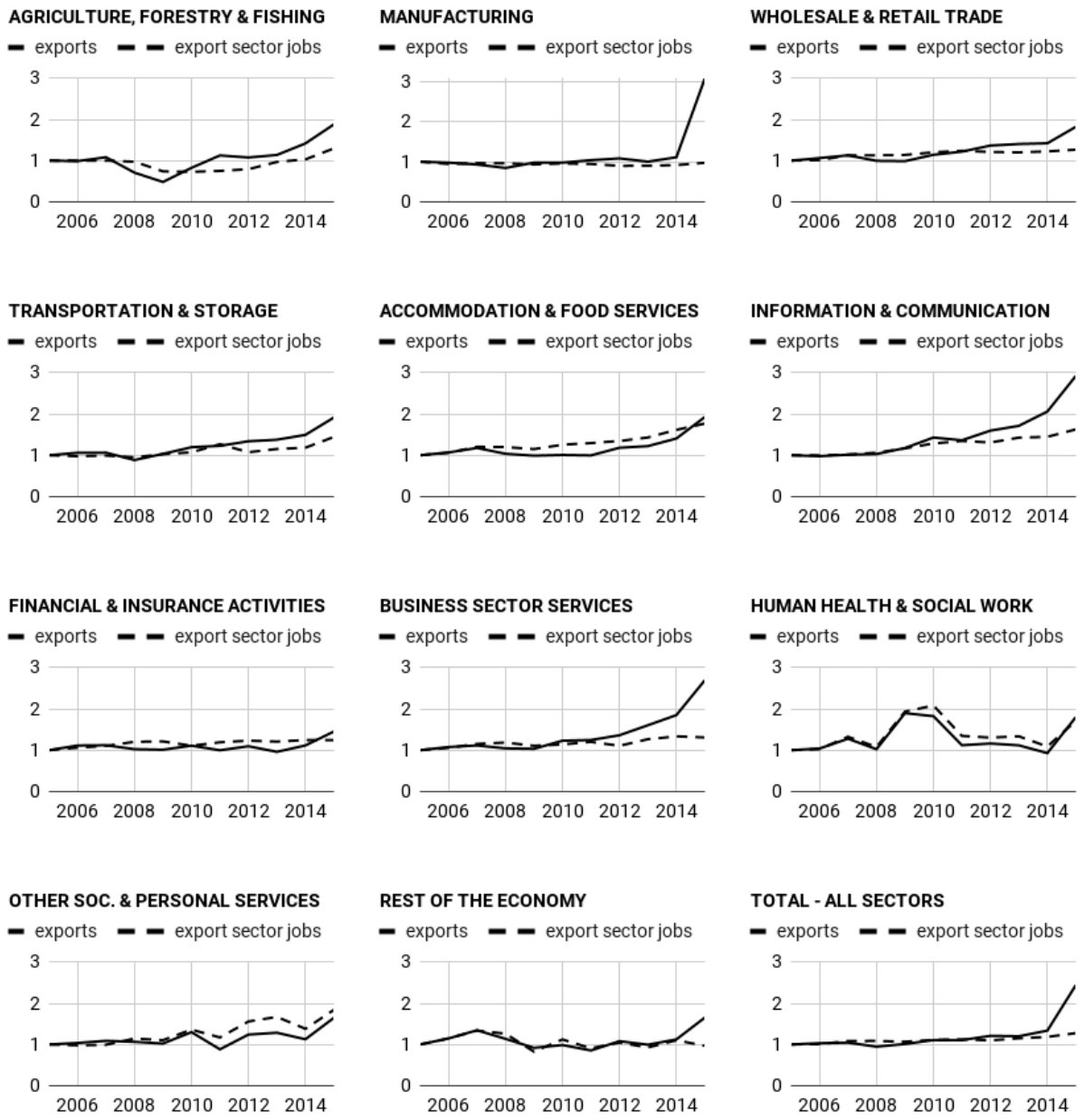


**Figure 3:** Growth of domestic value-added sustained by foreign final demand $\frac{\alpha_t Y_t}{\alpha_0 Y_0}$ ('exports') and domestic employment sustained by foreign final demand $\frac{\alpha_t N_t}{\alpha_0 N_0}$ ('exporting jobs') in the top 10 exporting industries and the rest of the economy, 2005=1, as derived in (A.12) (Author's calculations based on: OECD TiVA and OECD TiM)

cent of the sector's exports in 2015) widely known for their aggressive profit shifting activity (Setser, 2019, 2020*a*,*b*). And as for this particular snapshot in time – there are two concrete cases of corporate tax inversion deals which could plausibly explain part of the discrepancy visible in the data. As many observers reported in 2015, two large medical technology firms, Covidien and former competitor Medtronic merged and shifted their headquarters to Ireland, in a 48 billion USD deal (Taylor, 2016). A similar merger took place between US pharmaceutical giant Allergan and Actavis, a 66 billion USD deal (Frank and Setser, 2018). The smaller deal already qualified as the biggest corporate tax inversion in history (to illustrate the scale – total

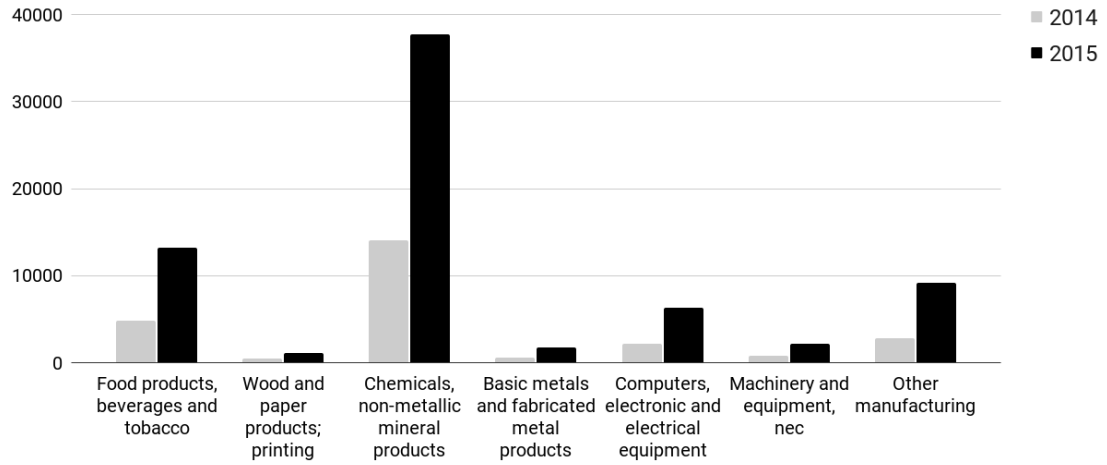


**Figure 4:** Export value added in manufacturing by subsectors, 2014 and 2015 (million EUR, constant prices) (Author's calculations based on: OECD TiVA)

Irish export value added was 180 billion in 2015). The merger resulted in the post-inversion companies' manufacturing activity (that was already taking place elsewhere) to show up in Irish GDP – with presumably little or no shift in production.

As expected, there is a visible and growing disconnect in the information and communication sector: export value added shows a 200 per cent increase in ten years, while employment grew by 50 per cent. The case behind this discrepancy in the ICT sector is well documented: much of it is fictitious exports from Apple (Bowers, 2017; Coffey, 2018). Investigative journalists relying on the 'Paradise Paper' leaks detailed how Apple's 2015 corporate restructuring contributed to inexplicable jumps in Irish national account statistics. In 2015, bowing to international pressure, the Irish state closed a tax loophole called the 'Double Irish,' an offshoring scheme for companies to triangulate their tax residencies in a way that allowed them to be a 'tax resident of nowhere' (Seabrooke and Wigan, 2014, p. 260.). Prompted by this regulatory change, Apple Inc. carried out a corporate reorganisation and moved ('onshored') intellectual property assets to Ireland effective from January 1, 2015, resulting in Apple exports showing up as Irish exports, without actual production ever changing locations. As Apple's high-yielding IP assets are based in Ireland, the distortion permanently moved to Irish GDP, creating distortions year after year.

An almost identical trend is visible in the sector labelled 'business sector services', denoting various miscellaneous services like research and development, business consultancy, legal work, accounting, leasing services etc. (Professional, scientific and technical activities [NACE M] and Administrative and support service activities [NACE N].)

To check for the robustness of these findings – keeping in mind that a jump in productivity could also explain the difference between growth rates of exports and employment – it is worth examining whether other countries also saw a similar discrepancy in the sectors where the discrepancy is the biggest (chemical manufacturing, information and communication, other business sector

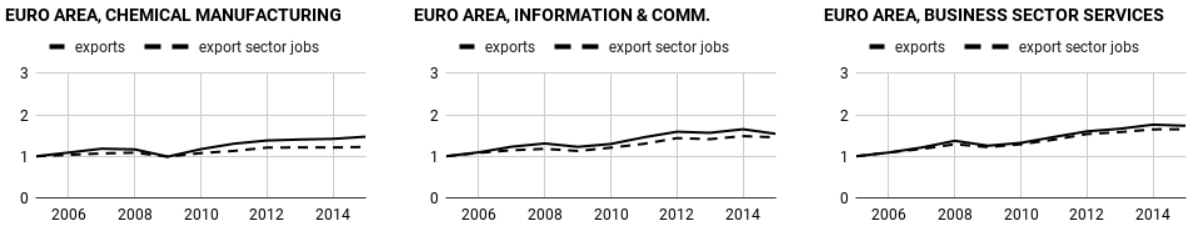


**Figure 5:** Euro area: Growth of domestic value-added sustained by foreign final demand $\frac{\alpha_t Y_t}{\alpha_0 Y_0}$ and domestic employment sustained by foreign final demand $\frac{\alpha_t N_t}{\alpha_0 N_0}$ in various sectors, 2005=1, as derived in (A.12) (Author's calculations based on: OECD TiVA and OECD TiM; 'Euro area' denotes EA19, without Ireland)

services.) Compared to the rest of the Euro area (EA19 less IE), Ireland clearly is an outlier. Whereas in the rest of the Euro area, the two measures – domestic value added sustained by foreign final demand and employment sustained by foreign final demand – grew in an almost identical lockstep, in Ireland, there is a visible discrepancy between the two. In business sector services' and ICT, the trends start to diverge in 2011, while in chemical manufacturing, the year 2015 saw a striking, three-fold jump in exports measured in value added terms, while the employment-based measure grew only slightly. The comparison to the rest of the Euro area underscores the implausibility of a sudden productivity improvement behind the discrepancy – Ireland could hardly engineer such immense productivity gains that were absent in the rest of the currency area.

A limitation of the OECD's TiVA and TiM databases is that they only cover the period until 2015, making it difficult to draw more timely lessons. However, we can track the discrepancy between value added and employment by widening the scope of the inquiry to the whole economy (beyond the export sector.) This gives a conservative estimate for the discrepancy – that is expected to be higher in the export-oriented part of the economy dominated by foreign multinationals than in the domestically oriented part. If the discrepancy remains, it builds a stronger case for the argument. Using national account data from Eurostat, we thus compare the growth trends of gross value added to growth trends of employment in the same sectors.

The inquiry is limited to the sectors with the largest visible discrepancy: manufacturing, ICT and business services. The exercise yields the same patterns seen above – the three sectors show significant discrepancies not visible in the rest of the economy. In manufacturing, recent data points confirm that the 2015 jump was not a one-off error; the presumably inflated measurement keeps showing up in Irish GDP and export figures. From 2015 onwards, the data does not show strong further divergence. A progressively widening trend is found in the ICT sector, however.There is an accelerating divergence between measures of value added and employment. Gross value added shows a whopping four-fold increase in a ten year period, with a visibly slower corresponding growth rate in jobs.

Again, it is possible that the disconnect is the result of sudden surges of productivity growth. A

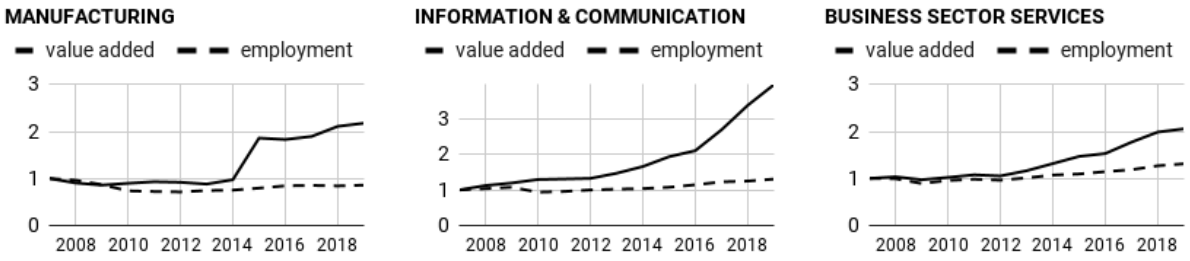


**Figure 6:** Growth of gross value added $\frac{Y_t}{Y_0}$ compared to growth of employment $\frac{N_t}{N_0}$ in the whole economy (beyond the export sector), 2007=1, as derived in (A.12) but adjusted as in (A.20) (Author's calculations based on: Eurostat)

way to control for that is to compare growth dynamics of gross value added with that of wages (using the 'compensation of employees' variable from Eurostat's national accounts database.) Similarly to employment headcounts, wages are expected to show job-sustaining economic activity, but the wage-based measure also controls for potential productivity increases, to the extent they show up in higher wages. The ratio of these two variables is the labour income share of value added, that is expected to show less movement than productivity, unless there are structural changes in market power between labour and capital. The wage-based analysis strengthens the claim that the large spike in manufacturing sector activity cannot be accounted for by employment-based measures. In ICT, wage growth does make up for some of the gap, but the 200 per cent increase in value added is significantly larger than warranted by wage dynamics. From 2016 onwards, value added shows a 186.45 per cent growth, a dramatic contrast with a 51.42 per cent growth of the sectoral wage bill, which would be a sturdy increase in its own right. The trend is visibly widening.

In business sector services, however, the discrepancy narrows when corrected for wage growth. This insight suggests that various business sector service activities generally associated with foreign multinationals such as legal and business consultancy, market research or accounting were indeed a prominent growth engine in the recovery phase (from 2012 onwards), showing strong growth in the sectoral wage bill, although less so in the employment headcount (suggesting a composition shift towards higher-paying jobs.) These sectors are dominated by Irish owned firms (see Table 1 above) and show a much smaller disconnect than ICT or pharmaceuticals. It is quite plausible, however, that they are linked to the presence of these tech and pharma giants, feeding into the bigger ecosystem these firms create. This claim is also supported by OECD regional employment data, which shows that similarly to ICT and pharma, job growth in these sectors are concentrated in the Dublin area. This finding suggests that to understand Ireland's growth performance, it is advisable to look beyond 'big pharma' and 'big tech' — to the burgeoning operation of business service firms catering for their needs.

Finally, a growth decomposition exercise is useful to demonstrate how much each sector contributes to the distortions and assign numerical values to them to estimate their scale. The growth of value added and wages in the whole economy is disaggregated to show each sector's

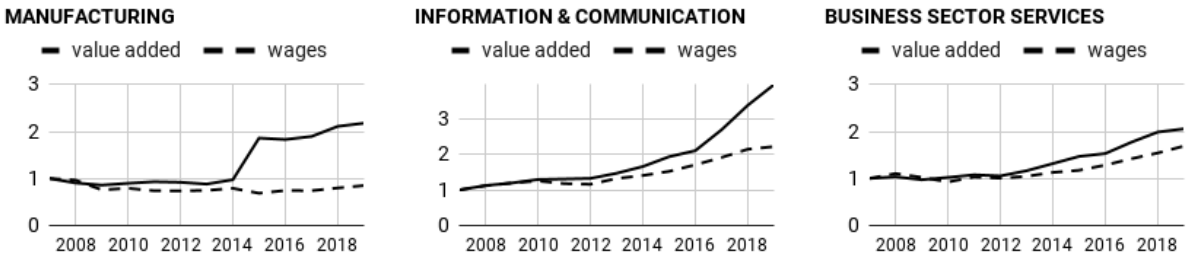


**Figure 7:** Growth of gross value added $\frac{Y_t}{Y_0}$ compared to growth of wages $\frac{w_t N_t}{w_0 N_0}$, 2007=1, as derived in (A.15) but adjusted as in (A.21) (Author's calculations based on: Eurostat)

contribution. It is immediately visible that there are substantial discrepancies in the case of manufacturing and ICT – the manufacturing sector's 30.4 per cent contribution to total value added growth (that was 73 per cent in the recovery phase) stands in stark contrast to its 0.8 per cent contribution to the growth of the total wage bill in the same period (which grew by 8.7 per cent). ICT contributed 19 percent to the overall value added growth, and only 2.3 per cent to the overall growth in earnings. Discrepancies are strongly correlated with the share of foreign owned firms in each sector (the correlation coefficient is 0.89).

| | | **CONTRIBUTION TO 2012-2019 GROWTH** | | **DISCREPANCY** | **FOREIGN OWNERSHIP** |
|---|---|---|---|---|---|
| **NACE code** | **Sector** | **value added** $\hat{\eta}^i$ | **wages** $\hat{\omega}^i$ | $-\hat{\delta}^i = \hat{\eta}^i - \hat{\omega}^i$ | |
| A | Agriculture, forestry and fishing | 0.80% | 0.18% | 0.62% | |
| B, D, E | Industry (ex Manufacturing) | 0.77% | 0.41% | 0.36% | 22.61% |
| C | Manufacturing | 30.43% | 1.85% | 28.58% | 90.99% |
| F | Construction | 1.15% | 0.45% | 0.70% | 9.72% |
| G-I | Trade, transport and hospitality | 6.05% | 6.43% | -0.38% | 36.38% |
| J | Information and communication | 19.01% | 5.30% | 13.71% | 88.35% |
| K | Financial and insurance services | 0.86% | 0.16% | 0.69% | |
| L | Real estate activities | 0.86% | 0.09% | 0.76% | 12.53% |
| M-N | Business sector services | 9.08% | 6.37% | 2.71% | 31.63% |
| O-Q | Public administration, etc. | 3.40% | 5.62% | -2.22% | |
| R-U | Rest of the economy | 0.67% | -6.84% | 7.51% | |
| **TOTAL** | **All NACE activities** | **73.07%** | **20.03%** | **53.04%** | |

**Table 2:** Sectoral decomposition of value added and wage bill growth between 2012-2019, and of the discrepancy between them.

Note: The contribution of each sector $i$ to value added growth in the whole economy is captured by $\hat{\eta}^i$, and is calculated as in (A.17). The contributions to wage bill growth are denoted by $\hat{\omega}^i$, and are calculated as in (A.16). The discrepancy between these two, for each sector, is defined as $-\hat{\delta}^i = \hat{\eta}^i - \hat{\omega}^i$, and its decomposition is calculated as in (A.19). Relative to these equations (which use OECD data), the Eurostat data used here refers to the whole economy (as opposed to the export sector only), so the proper expressions should contain a scaling factor as shown in (A.22). Foreign ownership refers to foreign owned firms' share of the total value added by sector (% of sector total, only available for the 'business sector' [NACE B-N ex K]) (Author's calculations; data: Eurostat)

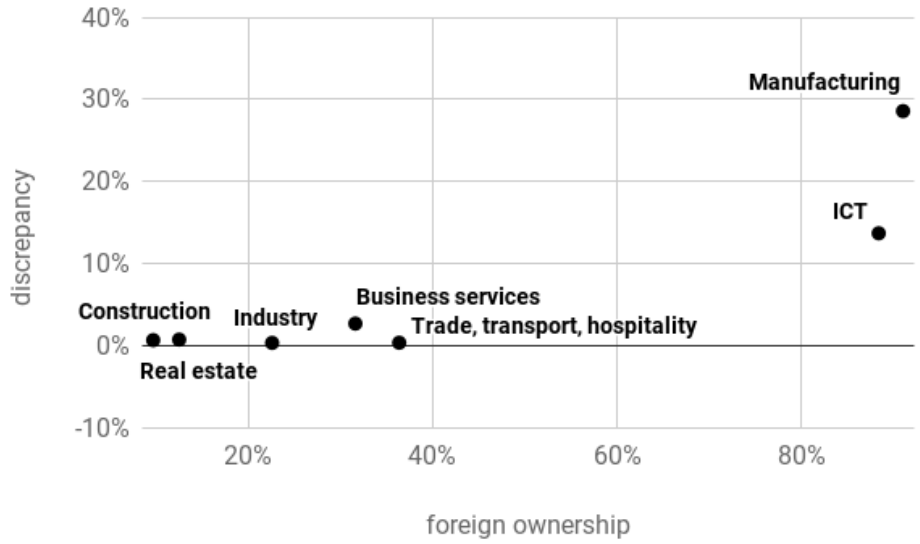


**Figure 8:** Discrepancy by sector (defined as the difference between contribution to value added growth and contribution to wage growth, %); and foreign owned firms' share of the total value added by sector (% of sector total) (Author's calculations based on: Eurostat)

# 6 What do results imply for Ireland's export-led growth?

The employment-based approach can also be used to control for distortions when it comes to our assessment of Ireland's recent growth performance and allows us to formulate more precise lessons going forward. The following section contrasts Ireland to three other programme countries hit hard by the euro crisis of the early 2010s – Portugal, Spain and Greece – focusing on the employment recovery.

First of all, how do Ireland and other deficit countries fare in terms of the share of employment sustained by foreign demand (FFD) and who are the trading partners contributing most? As expected, Ireland stands out in the share of jobs sustained by foreign demand. 50 per cent of Irish employment relies on FFD – this is a significantly larger share than that of Portugal (30), Spain (24) or Greece (22). It is another measure of the extreme openness of the island's economy. The role of US demand also stands out when compared to the others. Based on TiM estimates, 8.2 per cent of all Irish jobs are supported by final demand from the United States, while this number is below 2 per cent for the other three programme countries.

The Irish labour market's reliance on foreign markets has far reaching implications. Assessing the contribution of foreign or domestic demand sources to jobs recoveries in the four countries (plotting change over the period covered by the OECD TiM database, 2007-2015), it is visible that superior employment performance of Ireland was driven by a relatively smaller decline in jobs sustained by domestic demand, and a bigger increase in jobs sustained by foreign demand. Suppressing domestic spending – the policy prescription to all euro crisis countries – is not so costly for an economy that is less reliant on domestic spending in the first place Polyak (n.d.).

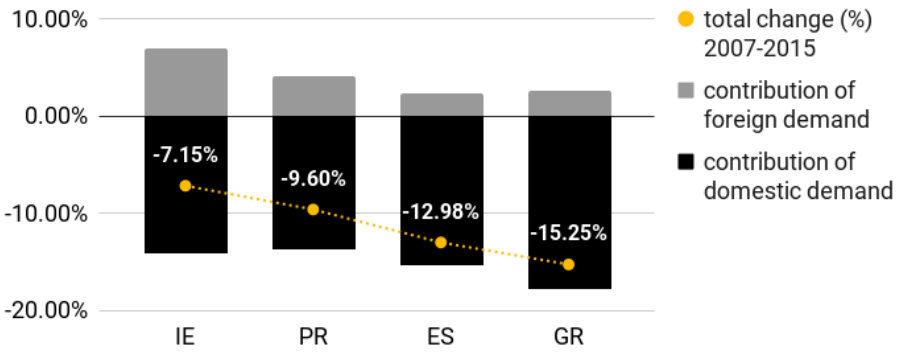


**Figure 9:** Percentage change in employment between 2007 and 2015, decomposed by sources of demand–Ireland compared to Portugal, Spain and Greece (Author's calculations. Data: OECD TiM)

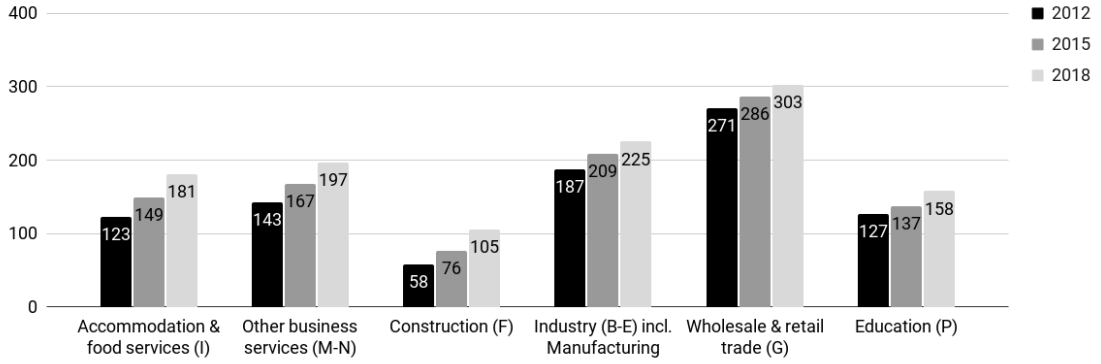


**Figure 10:** Which sectors drove Ireland's jobs recovery? Industries gaining at least 30,000 extra jobs between 2012 and 2018 (thousand persons) (Data: CSO)

| | |
|---|---|
| Accommodation & food services (I) | **40.80%** |
| Other business services (M-N) | 78.30% |
| Construction (F) | **0.70%** |
| Industry (B-E) incl. Manufacturing | **75.00%** |
| Wholesale & retail trade (G) | **77.60%** |
| Education (P) | **5.60%** |

**Table 3:** Share of domestic employment embodied in foreign final demand in sectors with the fastest employment growth between 2012 and 2018 (Data: OECD TiM, % of sector total)

Zooming in on the period of rapid employment growth in Ireland, the sectors with the biggest contributions to the expanding labour market in the post-crisis phase between 2012 and 2018 were hospitality (+58,000 jobs) and business sector services (+54,300). Construction (+47,400), industry (+37,900), trade (+32,500) and education (+30,500) also contributed significantly. Note that three of these sectors (business services, industry and trade) have an over 75 per cent share of jobs that are export driven, while in hospitality, around 40 per cent of jobs are sustained by foreign final demand. Among the biggest contributors, the slowly recovering construction sector and the education sector were the only domestically powered jobs engines. This supports

the claim that notwithstanding inflated export figures, foreign markets continue to be a meaningful driver behind Irish growth, also when measured in labour market performance, thereby controlling for fictitious activity.

Curiously missing from the top sectors driving the jobs expansion is ICT, notwithstanding its enormous contribution to Ireland's economic activity on paper. The sector expanded by 15,800 jobs (28 per cent) between 2012 and 2018, that is in stark contrast to the almost 300 per cent value added growth in the same period. ICT is different from pharmaceuticals in this sense: steady job growth in the sector labelled 'Industry' (NACE B-E, including Manufacturing) was propelled by pharmaceutical manufacturing.

These patterns of labour market recovery after the euro crisis allow us to draw some lessons for Ireland's ability to cope with the recession in the wake of the COVID-19 pandemic. First, lockdowns introduced to slow the spread of the pandemic hit domestically oriented sectors the most, so Ireland's extremely open economy and overreliance on export-driven employment is a boon. Reliance on spending by the United States, in particular, allows Ireland to take advantage of the Biden administration's large fiscal stimulus package 'leaking' abroad (Financial Times, 2021). However, statistical distortions do not bode well for Ireland when it comes to designing an own stimulus package or participating in the European Union's stimulus. Since statistical measures for economic output are used to anchor policymaking, serve as the basis for the design of stimulus packages or the allocation key for European Union recovery funds, Irish and European authorities run the risk of gross misalignments in policy responses (Noble Stairs, 2020).

As evidenced above, Ireland's export portfolio is dominated by pharmaceuticals and ICT, the two sectors that are plausibly the most shielded in this specific crisis. A public health emergency with lockdowns and social distancing measures hurts large swathes of the economy but gives a boost to both the pharma industry and the digital economy (from remote working platforms to e-commerce). However, as we saw, these are the sectors where fictitious activity is most prevalent, and the ICT sector in particular is not a strong jobs engine – so analysts should be cautious to draw inferences from these firms' strong performance and apply them to the economy at large.

Finally, it is worth taking a quick look at the hospitality sector, that is, along with construction, one of the main employers in the lower skilled segment. A rapid expansion of hospitality jobs in the post crisis period partially offset the dramatic fall in construction jobs. A plausible narrative behind this surge is that multinationals' employment and wage growth had a positive spillover effect on the sector, effectively making hospitality sort of a 'transmission belt,' through which multinationals have an impact on the wider Irish economy (this is supported by geographic concentration of these jobs: employment in hospitality surged in the regions where MNE employment did). This would impact Ireland's recovery from the COVID-19 shock. Lockdowns obviously hit hospitality more than any other sector. If this transmission belt is absent, the Irish economy and society at large are expected to benefit from strong export performance to a

lesser degree, highlighting the importance of targeted relief for these sectors.

# 7 Conclusion

This paper used a novel analytical approach to show how multinational firms' aggressive profit shifting artificially inflates trade statistics, using Ireland as an illustrative case and arguing that the Dublin-based 'Silicon Docks' cluster's contribution to Ireland's economic performance seems larger on paper than it actually is. It contributes to the literature in three important ways.

First, while terms like 'leprechaun economics' or 'phantom FDI' have gained wide traction, and US-based 'big tech' and 'big pharma' are automatically assumed to be the main culprits, more systematic empirical investigations into mismeasurement of multinationals' economic activity have been largely absent in political economy research. This inquiry contrasts traditional measures of export growth to employment and earnings dynamics to identify job-sustaining economic activity, sector by sector. It departs from a simple assumption: if export growth reflects fictitious activity, there should be no corresponding growth in export sector jobs and earnings; and conversely: if jobs and earnings grow, it is evidence for economic activity beyond accounting fiction. Although diverging growth rates are no definitive proof and can be explained by other factors – namely shifts in productivity or the labour share of income – large, sudden discrepancies between traditional and employment-based measures that are absent in other countries' sectoral data are indicative evidence for fictitious activity. Along the theoretical expectations, the analysis finds substantive discrepancies concentrated in the tech and pharmaceutical industries – two sectors dominated by US multinational firms. The findings align with a large swathe of anecdotal case evidence: in pharma, the Covidien/Medtronic and Allergan/Actavis mergers, and in ICT, the high-profile case of Apple (Taylor, 2016; Frank and Setser, 2018).

After identifying significant distortions, the paper examines whether their scale warrants a reassessment of Ireland's classification as an export-driven economy. Although some commentators dismiss Ireland's entire export performance as an illusion, results here do not support this claim. Nor do they imply that these distortions would fundamentally rewrite our assessment of Ireland's growth trajectory, that has long been viewed as export-led. Quite the contrary: the analysis of employment-corrected measures finds that even with substantial distortions in place, Ireland outperforms euro area peers on the global market. But results should caution analysts to extrapolate from the success of 'big tech' and 'big pharma' to national economic performance – a lesson particularly relevant in the light of COVID-19 shock, a crisis leaving these specific industries largely unscathed. A stronger jobs and export engine is the business services sector, denoting activities like legal and business consultancy or accounting. This sector is dominated by Irish-owned firms (foreign ownership is around 30 per cent), but supply services generally targeted at foreign multinationals. This finding suggests that paradoxically, a substantial amount of real economic activity in Ireland might feed into multinational firms faking economic activity.

Finally, results have implications to refine the notion of an 'export-led national growth model', pioneered by Baccaro and Pontusson (2016) and widely used by Comparative Political Economists. Beyond demand components of GDP and national accounts statistics, the study of national growth models could integrate alternative measures of activity such as sectoral employment sustained by foreign final demand and be attentive to the distortions caused by multinational corporations. Although export-led national growth strategies and public policies underpinning them continue to be relevant, both academics and policymakers should view them against the backdrop of globalised economic activity that is spatially dispersed and increasingly decoupled from the nation state.

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**Data availability:**

A replication file for this article is openly available at the Harvard Dataverse under https://doi.org/10.7910/DVN/A89GJL.

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# A Appendix: Overview of export statistics used in the paper

## A.1 Exports in national accounts

The expenditure side of GDP can be decomposed as:

$$\begin{aligned} Y &= \overbrace{\overbrace{C+I+G}^{\equiv D}}+NX = \\ &= \underbrace{D^D+D^M}_{D}+\underbrace{\overbrace{X^f-X^M}^{X}-D^M}_{NX} = \\ &= D^D+X \end{aligned} \tag{A.1}$$

$$Y = D^D + X^f - X^M \tag{A.2}$$

$$NX = \underbrace{(X^f - X^M)}_{X} - D^M = X - D^M \tag{A.3}$$

$$= X^f - \underbrace{(X^M + D^M)}_{M} = X^f - M \tag{A.4}$$

- where $X^f$ are the *gross total value* of final exports... (or "foreign final demand for domestic output")
  - ...as opposed to the *value added* of exports $X$ (which excludes any imported intermediate goods $X^M$ used during the production of final export goods, since these represent value not generated within the economy)
- GDP is a concept based on value added: it represents *total demand* for value added produced by domestic firms (A.1):
  - domestically generated value added used for domestic consumption $D^D$ can be called *domestic demand*
  - while exported value added $X$ can be called *external demand* [4]
- In contrast, statistical offices report the total gross value $X^f$ as "exports"
- Net exports show:
  - the difference between *value added* exports $X$, and imports *used for domestic purposes* (either directly as final consumption or as intermediate goods in production meant for domestic consumption) $D^M$ – see (A.3)

[4] Alternatively, domestic demand might refer to $D$, i.e. to demand *by domestic consumers* which includes imports, too. In this case, however, its counterpart is *net external demand*, $NX$, otherwise it will not add up to GDP.

- net exports are also equal to the difference between *total value* of exports $X^f$, and *total value* of imports $M$ (both of which include imported intermediate goods used for export production $X^M$) – see (A.4)

- Measures of export reliance, or openness can be constructed as follows:
  - based on (A.1):

$$\beta \equiv \frac{X}{Y} = \frac{X}{D^D + X} \leq 1 \qquad \text{since } D^D \geq 0 \tag{A.5}$$

  - based on (A.2):

$$\frac{X^f}{Y} = \frac{X^f}{D^D + X^f - X^M} \tag{A.6}$$

  - alternatively, based on (A.8):

$$\alpha \equiv \frac{X^f}{\mathcal{Y}} \equiv \frac{X^f}{D^D + X^f} \leq 1 \qquad \text{since } D^D \geq 0 \tag{A.7}$$

## A.2 Foreign final demand in OECD's input-output trade statistics

- using (A.2), we can express "supergross output" $\mathcal{Y}$ as total value added $Y$ (GDP) plus imported intermediate inputs $X^M$, which is used either for domestic consumption $D^D$ or sold to foreigners as final gross export $X^f$

$$\underbrace{Y + X^M}_{\mathcal{Y}} = D^D + X^f \tag{A.8}$$

- OECD's *Domestic value added embodied in foreign final demand (FFD_DVA)* measure, when aggregated across industries and trading partners[5]:

$$\begin{aligned} FFD\_DVA = \frac{P^\$ Y}{P^\$ \mathcal{Y}} P^\$ X^f = \frac{Y}{Y + X^M} P^\$ X^f = \\ = \frac{Y}{Y + X^M} P^\$ \underbrace{(X + X^M)}_{X^f} = \\ = P^\$ Y \underbrace{\frac{X + X^M}{Y + X^M}}_{\alpha} \end{aligned} \tag{A.9}$$

  where $\alpha$ is a measure of openness based on *gross* exports to *gross* output $\frac{X^f}{\mathcal{Y}}$ ratios

  - $FFD\_DVA^{i,p}_{c,t} = (P^i_{c,t})^\$ Y^{i,p}_{c,t} \ \alpha^{i,p}_{c,t}$ exists disaggregated for industries $i \in (1, n)$ and trading partners $p \in (1, k)$ (for particular countries $c$ and years $t$ of interest)
  - this is a nominal measure (at "basic prices" = in current USD) so it needs to be deflated by a deflator $P^\$_t = P^\epsilon_t E^{\$/\epsilon}_t$ (the one corresponding to $X^f$) when comparing over time: $\frac{FFD\_DVA_t}{P^\epsilon_t E^{\$/\epsilon}_t} = \alpha_t Y_t$

- OECD's *Domestic employment embodied in foreign final demand (FFD_DEM)* measure, when aggregated across industries and trading partners:

$$\begin{aligned} FFD\_DEM = \frac{N}{P^\$ \mathcal{Y}} P^\$ X^f = N \frac{X^f}{\mathcal{Y}} = \\ = N \underbrace{\frac{X + X^M}{Y + X^M}}_{\alpha} \end{aligned} \tag{A.10}$$

  - the working assumption is then that employment to (gross) output ratios are the same in total production (in a particular industry), as they are for export production

$$\frac{FFD\_DEM}{X^f} = \frac{\alpha N}{\alpha \mathcal{Y}} = \frac{N}{\mathcal{Y}}$$

[5] and $X^f$ now denoting "foreign final demand" as opposed to direct bilateral "gross export", meaning that even if the exported goods cross other transit countries first as intermediate goods, it is the destination country where the final consumption happens, to which will be assigned as relevant trading partner. The distinction should not matter when looking at the aggregate Rest of the World statistic.

– the other measure *Share of domestic employment embodied in foreign final demand (EMPN_FFDDEM)* relative to total employment, when aggregated across industries, should coincide with the openness measure $\alpha$, i.e. it is the same as the share of gross exports relative to gross output:

$$\begin{aligned} EMPN\_FFDDEM &= \frac{FFD\_DEM}{N} = \frac{\alpha\, N}{N} \\ &= \alpha = \frac{X + X^M}{Y + X^M} \end{aligned}$$

- looking at the ratio of (A.9) to (A.10)

$$\begin{aligned} P^{\$}\, A \equiv \frac{FFD\_DVA}{FFD\_DEM} &= \frac{\alpha\, P^{\$}\, Y}{\alpha\, N} = \\ &= P^{\$}\, \frac{Y}{N} \end{aligned} \tag{A.11}$$

gives a kind of labor productivity measure $A$, i.e. value added per employee

– after deflating $\frac{FFD\_DVA_t}{P_t^{\epsilon} E_t^{\$/\epsilon}} = \alpha_t\, Y_t$ we can compare over time $A_t = \frac{Y_t}{N_t}$

– unless there is growing productivity one would expect $A_t \approx A_0$ to stay roughly constant over time – in other words, the lines tracing the dynamics of value added and employment in FFD (i.e. level indices normalized to $t_0 = 1$) should be roughly on top of each other:

$$\begin{aligned} \frac{A_t}{A_0} = \frac{\alpha_t Y_t}{\alpha_t N_t}\, \frac{\alpha_0 N_0}{\alpha_0 Y_0} &\approx 1 \\ \frac{\alpha_t Y_t}{\alpha_0 Y_0} &\approx \frac{\alpha_t N_t}{\alpha_0 N_0} \end{aligned} \tag{A.12}$$

– absent productivity growth, other explanation for mismatch can be "fictive productivity growth" due to tax evasion

- a better measure for this comparison could be to use OECD's *Domestic compensation of employees content of foreign final demand (DDF_DCE)*,

$$\begin{aligned} FFD\_DCE = \frac{P^{\$} w\, N}{P^{\$} \mathcal{Y}}\, P^{\$} X^f = P^{\$} w\, N\, \frac{X^f}{\mathcal{Y}} &= \\ = P^{\$} w\, N\, \underbrace{\frac{X + X^M}{Y + X^M}}_{\alpha} & \end{aligned} \tag{A.13}$$

and then taking the ratio of (A.13) to (A.9)

$$\begin{aligned} \lambda \equiv \frac{FFD\_DCE}{FFD\_DVA} &= \frac{\alpha\, P^{\$} w\, N}{\alpha\, P^{\$} Y} = \\ &= \frac{wN}{Y} \end{aligned} \tag{A.14}$$

where $\lambda$ is the labor income share of total value added.

- looking at the ratio (A.14) thereby controls for potential productivity increases (to the extent that they show up in higher wages) as well
- it is also already a real measure so no need for to deflate it further: $\lambda_t = \frac{w_t N_t}{Y_t}$ can be readily comapred over time
- the labor share is expected to stay roughly constant over time $\lambda_t \approx \lambda_0$ unless there is some structural change in market power between labor and capital (or fictive profits for capital signalling accounting fraud)
- in other words, the lines tracing the (real or nominal) dynamics of the two measures (i.e. level indices normalized to $t_0 = 1$) should be roughly on top of each other. The nominal dynamics are $\frac{\alpha_t P_t^{\$} Y_t}{\alpha_0 P_0^{\$} Y_0} \approx \frac{\alpha_t P_t^{\$} w_t N_t}{\alpha_0 P_0^{\$} w_0 N_0}$, while after deflation the real dynamics are: $\frac{\alpha_t Y_t}{\alpha_0 Y_0} \approx \frac{\alpha_t w_t N_t}{\alpha_0 w_0 N_0}$

$$\frac{\lambda_t}{\lambda_0} = \frac{\alpha_t w_t N_t}{\alpha_t Y_t} \frac{\alpha_0 Y_0}{\alpha_0 w_0 N_0} \approx 1$$

$$\frac{\alpha_t \, w_t N_t}{\alpha_0 \, w_0 N_0} \approx \frac{\alpha_t Y_t}{\alpha_0 Y_0} \tag{A.15}$$

### A.2.1 Gross exports vs Foreign final demand

- the very same measures and comparisons as above can be done with $X^f$ denoting "Gross exports" instead of "Foreign final demand"
- the difference is whether we are interested in *direct* bilateral trade links or the final source of demand which might *indirectly* pass through other countries in the form of intermediate goods
  - e.g. a country might export some phone parts to Vietnam (gross exports to Vietnam), where it is assembled to a functioning phone and sold to American final consumers (final foreign demand from US)
  - on the World level (all industries, all trading partners) the two measures should be the same
- use $\hat{X}^f =$ for denoting gross exports, then $\gamma = \frac{\hat{X}^f}{\mathcal{Y}}$ is an openness measure based on gross exports share in gross output
  - while the openness measure above was $\alpha = \frac{X^f}{\mathcal{Y}}$ based on foreign final demand $X^f$
  - so the difference is what kind of openness measure we're using to allocate some share of value added, employment or wage bill to external demand
  - since at the World level $\hat{X}^f = X^f$, we should also have $\alpha = \gamma$
- when calculating the labor share, the distinction should not matter even at the industry/trading partner level, as the openness measures $\alpha$ or $\gamma$ would cancel out

$$EXGR\_DVA = \gamma\, P^{\$} Y \qquad FFD\_DVA = \alpha\, P^{\$} Y$$

$$EXGR\_DEM = \gamma\, N \qquad FFD\_DEM = \alpha\, N$$

$$EXGR\_DCE = \gamma\, P^{\$} w\, N \qquad FFD\_DCE = \alpha\, P^{\$} w\, N$$

$$\frac{EXGR\_DCE}{EXGR\_DVA} = \frac{\gamma\, P^{\$} w\, N}{\gamma\, P^{\$} Y} = \frac{wN}{Y} = \lambda \qquad \frac{FFD\_DCE}{FFD\_DVA} = \frac{\alpha\, P^{\$} w\, N}{\alpha\, P^{\$} Y} = \frac{wN}{Y} = \lambda$$

Note, however, that using "Gross exports (EXGR)" $P^{\$} \hat{X}^f$ as opposed to "Value added embodied in gross exports" ($EXGR\_DVA$), when calculating the labor productivity measure similar to (A.11), would give

$$\frac{EXGR}{EXGR\_DEM} = \frac{P^{\$} \hat{X}^f}{\gamma\, N} = P^{\$}\, \frac{\hat{X}^f}{\frac{\hat{X}^f}{\mathcal{Y}} N} = P^{\$}\, \frac{\mathcal{Y}}{N} \equiv P^{\$}\, \mathcal{A}$$

$$\frac{EXGR\_DVA}{EXGR\_DEM} = \frac{\gamma\, P^{\$} Y}{\gamma\, N} = P^{\$}\, \frac{Y}{N} = P^{\$}\, A$$

- where the difference between the two labor productivity measure boils down to whether it shows gross output $\mathcal{Y}$ or value added $Y$ (GDP) per employee.
- The latter is the true measure of labor productivity as it does not include intermediate inputs.
- when looking at how these measures grow over time, they give the same growth rate only as long as the share of intermediate inputs in gross output stays unchanged. Otherwise, the discrepancy is:

$$\frac{\frac{EXGR\_DVA_t}{EXGR\_DEM_t}}{\frac{EXGR_t}{EXGR\_DEM_t}} = \frac{A_t}{\mathcal{A}_t} = \frac{Y_t}{\mathcal{Y}_t} = \frac{Y_t}{Y_t + X_t^M}$$

### A.2.2 Decomposition of labor share growth

- Denote by $W_t \equiv \frac{FFD\_DCE_t}{P_t^{\epsilon} E_t^{\$/\epsilon}} = \alpha_t \, w_t N_t$

$$
\begin{aligned}
W_t &= \sum_i W_t^i \\
\underbrace{W_t - W_0}_{\Delta W} &= \sum_i W_t^i - \sum_i W_0^i = \sum_i \underbrace{(W_t^i - W_0^i)}_{\Delta W^i} \\
\underbrace{\frac{\Delta W}{W_0}}_{\omega} &= \sum_i \underbrace{\frac{\Delta W^i}{W_0}}_{\omega^i} = \\
&= \sum_i \underbrace{\frac{W_0^i}{W_0} \underbrace{\frac{\Delta W^i}{W_0^i}}_{\%\Delta W^i}}_{\omega^i} = \sum_i \omega^i
\end{aligned}
\tag{A.16}
$$

  - where $\omega^i$ is the *contribution* of industry $i$ to the percentage change (growth rate) of the total wage bill sustained by foreign final demand $\omega$
  - ...as opposed to $\%\Delta W^i$ which is the *percentage change* of the wage bill in industry $i$. This measure would still need to be weighed by the industry shares in the base period $\frac{W_0^i}{W_0}$ to account for composition, and get the proper contribution measure

- similarly for $V_t \equiv \frac{FFD\_DVA_t}{P_t^{\epsilon} E_t^{\$/\epsilon}} = \alpha_t \, Y_t$

$$
\begin{aligned}
\underbrace{\frac{\Delta V}{V_0}}_{\eta} &= \sum_i \underbrace{\frac{\Delta V^i}{V_0}}_{\eta^i} = \\
&= \sum_i \underbrace{\frac{V_0^i}{V_0} \underbrace{\frac{\Delta V^i}{V_0^i}}_{\%\Delta V^i}}_{\eta^i} = \sum_i \eta^i
\end{aligned}
\tag{A.17}
$$

  - where $\eta^i$ is the *contribution* of industry $i$ to the percentage change (growth rate) of the total value added sustained by foreign final demand $\eta$

- then their ratio, the labor share

$$
\begin{aligned}
\lambda_t &= \frac{W_t}{V_t} \\
\frac{\lambda_t}{\lambda_0} &= \frac{W_t / W_0}{V_t / V_0} \\
\overbrace{\frac{\lambda_t - \lambda_0}{\lambda_0}}^{\Delta\lambda} &= \frac{\lambda_t}{\lambda_0} - 1 = \frac{W_t / W_0}{V_t / V_0} - 1 \approx \\
&\approx \underbrace{\frac{\Delta W}{W_0}}_{\omega} - \underbrace{\frac{\Delta V}{V_0}}_{\eta} \equiv \delta
\end{aligned}
$$

where the approximation is only accurate for relatively small percentage changes.

To get a more precise expression, multiply both sides by $\frac{V_t}{V_0} = (1+\eta)$:

$$\begin{aligned}
\frac{\Delta\lambda}{\lambda_0}\underbrace{\frac{V_t}{V_0}}_{1+\eta} &= \frac{W_t}{W_0} - \frac{V_t}{V_0} = \\
&= \left(\frac{W_t}{W_0} - 1\right) - \left(\frac{V_t}{V_0} - 1\right) = \\
&= \underbrace{\underbrace{\frac{\Delta W}{W_0}}_{\omega} - \underbrace{\frac{\Delta V}{V_0}}_{\eta}}_{\delta} = \qquad \text{(A.18)} \\
&= \underbrace{\sum_i \frac{\Delta W^i}{W_0}}_{\omega \text{ by (A.16)}} - \underbrace{\sum_i \frac{\Delta V^i}{V_0}}_{\eta \text{ by (A.17)}} = \\
&= \sum_i \underbrace{\left\{ \underbrace{\frac{\Delta W^i}{W_0}}_{\omega^i} - \underbrace{\frac{\Delta V^i}{V_0}}_{\eta^i} \right\}}_{\equiv \delta^i} = \qquad \text{(A.19)} \\
= \delta &= \sum_i \underbrace{(\omega^i - \eta^i)}_{\delta^i}
\end{aligned}$$

- $\delta^i$ (referred to as "discrepancy by sector" in the main text) is a very simple difference between the contributions of the wage bill and value added, in each industry $i$, to their respective overall percentage changes.
- But adding these differences up $\delta = \sum_i \delta^i$ will not *precisely* yield the percentage change in overall labor share $\Delta\lambda/\lambda_0$, the difference being $-\frac{\eta}{1+\eta}(\omega - \eta)$

$$\begin{aligned}
\delta = \frac{\Delta\lambda}{\lambda_0}(1+\eta) &= \omega - \eta \\
\frac{\Delta\lambda}{\lambda_0} &= \frac{1}{1+\eta}(\omega - \eta) = \\
&= \omega - \eta - \frac{\eta}{1+\eta}(\omega - \eta) = \\
&= \delta - \frac{\eta}{1+\eta}\delta = \frac{\delta}{1+\eta}
\end{aligned}$$

## A.3 Eurostat data

A limitation of the OECD's TiVA and TiM databases is that they only cover the period until 2015, making it difficult to draw more timely lessons. However, we can track the discrepancy between value added and employment (or the wage bill) by widening the scope of the inquiry

to the whole economy beyond the export sector. This gives a conservative estimate for the discrepancy – that is expected to be higher in the export-oriented part of the economy dominated by foreign multinationals than in the domestically oriented part. If the discrepancy remains, it builds a stronger case for the argument.

Using national accounts data from Eurostat in the main text, the growth trends of gross value added $Y_t$ and employment $N_t$ (or the wage bill $w_t N_t$) for the whole economy are compared within each sector. Notice that these comparisons are able to capture the same kind of discrepancies as those derived for the export sector based on the OECD data in (A.11) and (A.14), since the OECD measures just project total economy values to foreign final demand (export sector) by using the same openness measure $\alpha_t$. When comparing them against each other, this openness measure occurs in both the nominator and denominator, and therefore cancels out, yielding the same expression as if we directly compared total economy values (available in Eurostat).

$$A_t = \frac{\alpha_t\, Y_t}{\alpha_t\, N_t} = \frac{Y_t}{N_t}$$
$$\lambda_t = \frac{\alpha_t\, w_t N_t}{\alpha_t\, Y_t} = \frac{w_t N_t}{Y_t}$$

In other words, while the *level* of the Eurostat growth trends could be different from those defined by (A.12) and (A.15) (by a factor of $\frac{\alpha_t}{\alpha_0}$), the discrepancy between them should still be adequately captured.

$$\begin{aligned} &\text{OECD, (A.12):} && \frac{\alpha_t Y_t}{\alpha_0 Y_0} \approx \frac{\alpha_t N_t}{\alpha_0 N_0} \\ &\text{Eurostat:} && \frac{Y_t}{Y_0} \approx \frac{N_t}{N_0} \end{aligned} \tag{A.20}$$

and similarly, for the wage bill:

$$\begin{aligned} &\text{OECD, (A.15):} && \underbrace{\frac{\alpha_t\, w_t N_t}{\alpha_0\, w_0 N_0}}_{=\frac{W_t}{W_0}=1+\omega} \approx \underbrace{\frac{\alpha_t Y_t}{\alpha_0 Y_0}}_{=\frac{V_t}{V_0}=1+\eta} \\ &\text{Eurostat:} && \underbrace{\frac{w_t N_t}{w_0 N_0}}_{\equiv 1+\hat{\omega}} \approx \underbrace{\frac{Y_t}{Y_0}}_{\equiv 1+\hat{\eta}} \end{aligned} \tag{A.21}$$

From (A.18) we have that the discrepancy from export sector OECD data is:

$$\begin{aligned} \delta &= \omega - \eta = \\ &= (1+\omega) - (1+\eta) = \\ &= \frac{\alpha_t}{\alpha_0}(1+\hat{\omega}) - \frac{\alpha_t}{\alpha_0}(1+\hat{\eta}) = \frac{\alpha_t}{\alpha_0}\underbrace{(\hat{\omega}-\hat{\eta})}_{\hat{\delta}} \\ \hat{\delta} &= \hat{\omega} - \hat{\eta} = \frac{\alpha_0}{\alpha_t}\,\delta \end{aligned} \tag{A.22}$$

just a scaled version of that coming from the total economy Eurostat data. It can also be seen, that from $(1+\omega) = \frac{\alpha_t}{\alpha_0}(1+\hat{\omega})$ we get $\omega = \frac{\alpha_t}{\alpha_0}\hat{\omega} + \left(\frac{\alpha_t}{\alpha_0} - 1\right)$. And similarly for $\eta$.