

# A bottom-up sectoral assessment of the strength of income tax receipts

Analytical Note No. 16

Kevin Timoney

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# Abstract

The jump in taxes paid by employees in 2021 was surprisingly sharp. This led to an increase in the average effective tax rate in the economy — something official forecasts assume will continue. This surprising outturn suggests reasons to be cautious: there are risks that the rise in effective tax rates could reverse. In many sectors, the recovery from the pandemic is likely to lead to reduced effective tax rates: this reflects the return of low-pay and low-tax jobs. But continued growth in high-pay sectors may more than offset this decline. This offsetting force would be consistent with the overall picture for the economy set out in official forecasts in the *Stability Programme Update 2022*.

Bottom-up projections set out in this note building on the recent performance of low, middle and high pay sectors suggests these effects could yet persist, provided that growth in the real economy and incomes continues.

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The author is an economist on the Secretariat of the Irish Fiscal Advisory Council. Email: [kevin.timoney@fiscalcouncil.ie](mailto:kevin.timoney@fiscalcouncil.ie). The opinions expressed and arguments employed in this paper do not necessarily reflect the official views of the Fiscal Council. The author would like to acknowledge the helpful comments from Philip O'Rourke in the Revenue Commissioners; Brendan O'Connor, Ian Power and colleagues at the Department of Finance; and the feedback and kind assistance received from members of the Council and from the Secretariat.

# Summary

Income tax receipts were exceptionally strong in 2021, despite significant restrictions on activity due to Covid-19. The increase in revenues has significantly outpaced the recovery in wages and salaries, resulting in a large increase in the effective tax rate. This may seem surprising given that there have been no major changes in tax policy. Official forecasts for the Irish economy and public finances contained in the *Stability Programme Update (SPU) 2022* show that this elevated effective tax rate is expected to be permanent.

This note analyses the contributions of different sectors to income taxes paid directly by employees. The relationships between taxes, hours worked, and hourly wages are assessed for three illustrative sector groupings: 'High 5', 'Middle 6', and 'Low 5', based on their ranking in hourly wages before the pandemic in 2019.

The findings show that hourly wages are forecast to grow more rapidly over coming years than over the past decade. This is especially the case for sectors with the highest hourly wages, in keeping with their faster growth since 1995. Based on available data, the relationship between effective tax rates and hourly wages is used to project effective tax rates at the sectoral level over the forecast horizon. While compositional effects are expected to reduce the effective tax rate for the 'Low 5' group, and little change is anticipated for the 'Middle 6' sectors, a higher effective tax rate for the economy as a whole would be supported by a further projected rise for the 'High 5' sectors.

While there are a number of downside risks to the *SPU 2022* projections, this note finds some upside potential for tax receipts: a set of bottom-up projections of employee taxes suggests that these receipts could be more than 5 per cent higher in 2025 relative to *SPU 2022* forecasts.

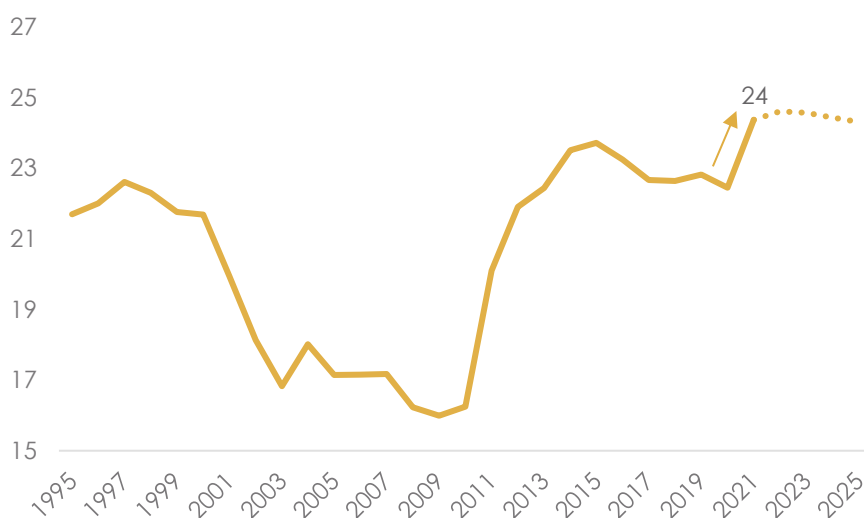
Overall, official forecasts anticipate continued growth in the real economy and incomes over the forecast horizon. If these forecasts prove accurate, the bottom-up projections presented in this note are consistent with a higher average effective tax rate than *SPU 2022* projects. However, caution should remain around the unexpected and sudden upwards shift in the average effective tax rate in 2021.

# 1. Introduction

Income tax receipts were exceptionally strong in 2021, despite significant restrictions on activity due to Covid-19, especially in the early part of the year. A rapid recovery in income taxes took place in the final quarter of 2020, and receipts have been consistently stronger than official forecasts.<sup>1</sup> For the first four months of the year, 2022 income taxes grew by 19 per cent compared to January–April 2021, by 27 per cent above the same period in 2020, and by 37 per cent over end-April 2019.

As a share of labour income, the average effective tax rate (ETR) for income increased by two percentage points to 24 per cent between its level in 2019 and 2020 and the level reached in 2021. This takes the ETR to its highest level in the series. This strength is puzzling in the absence of major income tax policy changes, and since the share has generally been fairly steady in recent years (Figure 1).<sup>2</sup> The *Stability Programme Update (SPU) 2022* projects a higher ETR to remain for 2022–2025.

Figure 1: Ireland's effective income tax rate increased sharply in 2021  
Income tax as a percentage of employees' labour income



Sources: Department of Finance, CSO, and author's calculations.

Notes: Income tax mainly comprises "pay as you earn" (PAYE), universal social charge (USC, which replaced the income levy in 2011), and self-assessed income taxes. It also includes life assurance exit tax, deposit interest retention tax, professional services withholding tax, dividend withholding tax, and other miscellaneous income tax.

<sup>1</sup> *Budget 2021* forecast income tax of €22.7 billion for 2021, below 2019's €22.9 billion. The 2021 outturn was €26.7 billion — €4 billion and 17 per cent more than forecast.

<sup>2</sup> Over the period, the Government implemented a partial indexation of the income tax system, meaning an increase in the level of income at or above which tax is charged. This implies a modest rise in the tax take as inflation and wage growth brings more income into the higher income tax brackets. However, these effects are small relative to the change seen in 2021 and there was no indexation at all in some prior years.

To assess the plausibility of the aggregate income tax forecasts contained in *SPU 2022*, this note uses detailed sectoral data to generate a bottom-up estimate of income tax forecasts across sectors.

The analysis shows that the sharp increase in the ETR in 2021 was mirrored across many sectors of the economy. However, the underlying dynamics at play varied, reflecting the uneven nature of the recovery from the pandemic. Sectors with the highest pre-pandemic hourly wages had strong growth in wages and hours worked, and tax receipts from these sectors increased rapidly in 2021, having increased marginally in 2020.

Although income taxes in 2021 more than recovered above their 2019 levels for middle- and low-wage sectors, the recovery in wages and hours worked was slower. As such, the rise in the ETR attributable to these sectors is more likely to reflect compositional factors that could unwind, if hours worked and wages recover strongly in 2022. The return to work of previous recipients of the Pandemic Unemployment Payment would boost hours worked, earnings, and tax receipts, but a decline towards the previous ETR for this group is likely. However, as a result of the progressive income tax system, these groups also contribute less than their share of earnings to total tax receipts and have a relatively low weight in the economy-wide ETR.

While uncertainty remains very high, the analysis in this note is consistent with official forecasts for total hourly wages and hours worked. The *SPU 2022* projections for income tax are in turn shown to be plausible and broadly aligned with projections for ETRs across sectors. However, a reduction in the ETR over the forecast horizon could occur if there is a stronger rise in wages and salaries from sectors with lower hourly pay, or if wage growth in sectors with higher hourly pay is weaker than anticipated.

Section 2 describes the approach and introduces three sector groups ranked by hourly pay in 2019, which form the basis for analysis throughout the note. Section 3 presents data on income tax and its components, and finds that the sharp increase in 2021 was broadly based across sectors. This is

followed in section 4 by a decomposition of official forecasts of employee wages and salaries, partly relying on hours worked.<sup>3</sup>

In section 5, each sector group's ETR is projected using the elasticity of the ETR with respect to hourly wages. With suitable decompositions and projections, the plausibility of income tax forecasts can be assessed in terms of the implied path for ETRs across sectors — however, this assessment is conditional on the official top-down projections for hours worked and labour income.

Finally, section 6 presents analysis of the change in ETRs for each sector group in terms of the contributions of employee taxes, hours worked, and hourly wages. This illustrates how compositional effects of the pandemic could unwind for sectors with lower hourly pay, reducing their effective tax rates. However, despite various downside risks to the outlook, it is plausible that the increased tax richness of sectors with higher hourly pay will persist over coming years.

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<sup>3</sup> Wages and salaries comprise the main component of labour income — whereas employers' social contributions are not liable for employee taxes, and are therefore excluded from the analysis in this note. For income tax, the focus in this note is employee income taxes (PAYE and USC), and not employees' Pay-Related Social Insurance (PRSI). For PRSI receipts, the recovery from Covid-19 has been more gradual, and only recently recovered to pre-pandemic trend levels. This is likely as a result of a flatter (less progressive) structure compared to PAYE and USC.

## 2. Approach

An average effective tax rate (ETR) is simply income tax receipts divided by labour income. To assess the rise in the ETR in Ireland in 2021, and its likely path over coming years, it is useful to consider the contributions by different sectors of the economy, along with the components of tax receipts and labour income, given that there are big differences in earnings and marginal tax rates across different groups.

The Department of Finance's official projections for income tax, labour income, and hours worked are top-down estimates. This means that these variables are not forecast from a set of sectoral contributions. This note employs mechanical decompositions for employee hours worked and wages and salaries by sector, to assess which parts of the economy are likely to explain the path for employee taxes.

A challenge with sectoral analysis concerns presentation of the data. While this note uses data from 16 NACE Rev 2 sectors, the findings are summarised with three broad categories.<sup>4</sup> These are based on the pre-pandemic rank of employees' wages and salaries per hour worked across sectors in 2019. Table 1 lists these sectors and their hourly employee wages for 2019.

**Table 1: Ranking hourly employee wages across NACE Rev 2 sectors**  
€ wages per employee hour worked in 2019

<b>High 5</b>	€	<b>Middle 6</b>	€	<b>Low 5</b>	€
Info/communication	49	Mining/utilities	28	Wholesale/retail	20
Real estate activities	48	Health/social	26	Transport/storage	20
Professional/scientific	40	Admin/support	26	Construction	17
Financial/insurance	39	Manufacturing	25	Accomm/food	15
Education	34	Public admin	23	Agri/forestry/fishing	12
		Other activities	22		

Sources: Eurostat; and author's calculations.

Note: As a basis for ranking sectors, hourly wages are preferred to weekly or month averages due to the impact of the pandemic on official labour market statistics, which counted many recipients of Pandemic Unemployment Payments as employed. Across all sectors, the average employee hourly wage in 2019 was €26.

The 'High 5' group are concentrated in high-skill activities and also sectors where many multinational enterprises operate.<sup>5</sup>

<sup>4</sup> 'High 5' includes the following NACE Rev 2 codes: J, L, M, K, and P. 'Middle 6' includes B, D and E, Q, N, C, O, and R-T. 'Low 5' includes G, H, F, I, and A.

<sup>5</sup> Information and communications has the highest hourly wage, and although foreign-owned firms in the sector employed 55 per cent of employees (CSO, 2022), their wages accounted for 73 per cent in terms of employees' labour income (CSO, 2021a).

### 3. Data and decompositions

Ireland's taxes on employees are quite progressive. Sectors with high hourly pay contribute 40 per cent of PAYE and USC receipts, while sectors with the lowest hourly pay are almost half that at 22 per cent. Table 2 summarises the pre-pandemic shares of employee taxes, wages and salaries, and hours worked for the three sector groupings introduced in Table 1.

**Table 2: Employee taxes, wages and salaries, and hours worked in 2019**  
Percentage of total for employees in all sectors

	High 5	Middle 6	Low 5
PAYE and USC	40	38	22
Wages and salaries	33	42	25
Hours worked	22	43	36

Sources: Revenue Commissioners; Eurostat; and author's calculations.

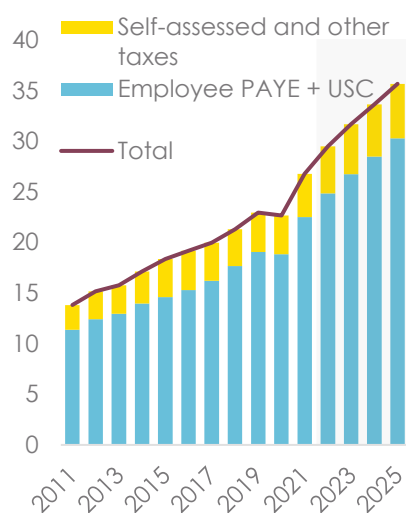
Note: The sector groupings are based on a ranking of 2019 hourly employee wages for NACE Rev 2 sectors, as shown in Table 1.

Revenue data on income taxes by taxation category for 2011–2021 are presented in Figure 2 (including SPU 2022 forecasts for 2022–2025). The largest contribution to the rise in income taxes in 2021 related to employee taxes.

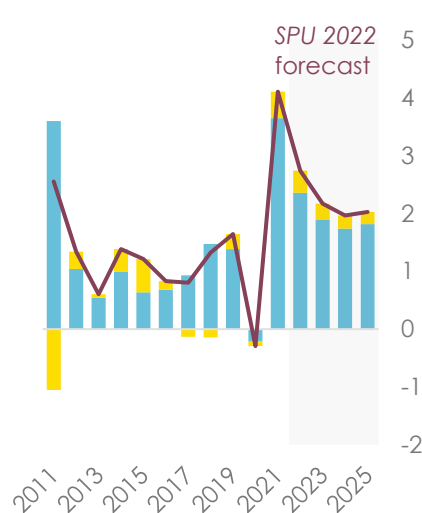
**Figure 2: Income taxes recovered strongly in 2021, driven by employee taxes**

€ billion

A. Levels



B. Year-on-year change



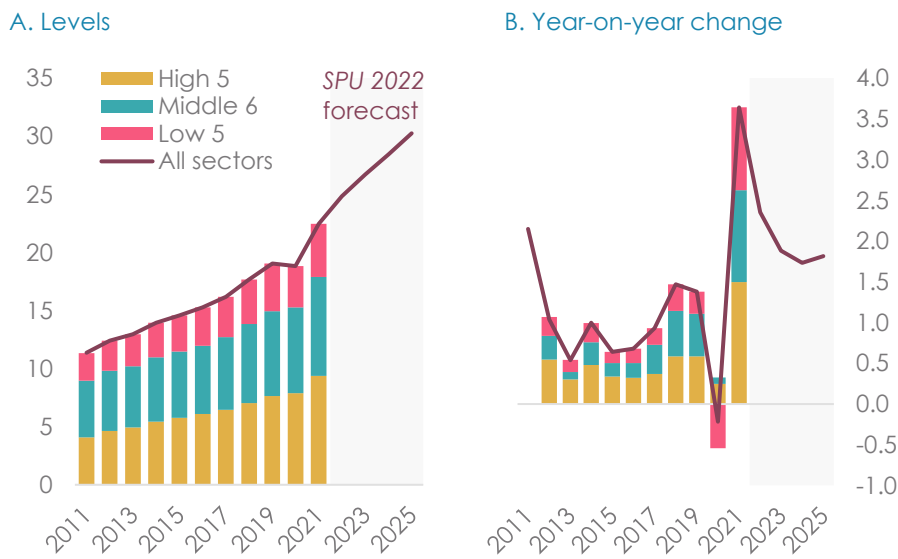
Sources: Revenue Commissioners; Department of Finance; and author's calculations.

Note: Income tax mainly comprises "pay as you earn" (PAYE), universal social charge (USC, which replaced the income levy in 2011), and self-assessed income taxes. It also includes life assurance exit tax, deposit interest retention tax, professional services withholding tax, dividend withholding tax, and other miscellaneous income tax.

As summarised in Table 1, employee income taxes are also available by sector, as presented in Figure 3.



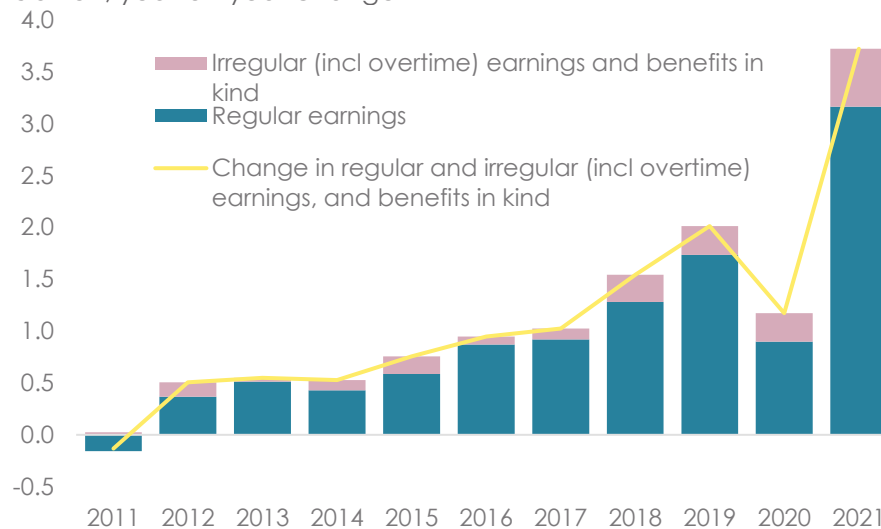
Figure 3: Employee taxes grew across all sector groups in 2021  
€ billion



Sources: Revenue Commissioners; Department of Finance; and author's calculations.  
Note: 2021 sector outturns are approximated with Figure 3 of Collins and O'Rourke (2022). A re-classification affecting Education and Public admin/defence data means that their 2011–2013 receipt are estimated based on the 2014–2021 average shares.

For high-skill sectors, bonuses and benefits increased in 2021. CSO earnings data show a rise in irregular earnings and benefits in kind during the pandemic, and these are likely to be taxed at a relatively high rate. However, these earnings are not the main component of earnings growth for these sectors (Figure 4).

Figure 4: Regular earnings explain most of the 'High 5' increase in 2021  
€ billion, year-on-year change



Sources: CSO; and author's calculations.  
Note: Data shown are for 'High 5' sectors as listed in Table 1, according to annual averages of quarterly data in the CSO's *Earnings and Labour Costs* release. In 2020 and 2021, paid hours are adjusted to reflect actual hours worked.

For the 'High 5' sectors, irregular earnings and benefits in kind increased from €2.3 billion to €2.9 billion. For all (non-agriculture) sectors, the corresponding increase was from €5.2 billion to €6

billion. For an assumed marginal tax rate of 50 per cent, this would imply an increase of €0.4 billion in tax receipts.

Combined with sectoral data for wages and salaries, the sectoral tax data allows for the calculation of ETRs across sectors. Figure 5 presents these ETRs according to the three broad categories in Table 1, which confirms that the ETR for 'High 5' is usually about 10 percentage points higher than for 'Low 5'.<sup>6</sup> Any shift of overall income towards this group, for example due to higher growth of wages in that sector, will tend to raise the aggregate ETR. As shown in Table 2, the 'High 5' accounted 40 per cent of employee tax receipts despite only representing 22 per cent of employee hours worked.

Figure 5: The increase in effective tax rates in 2021 was widespread across sectors

Employee PAYE + USC as a % of employee wages and salaries



Sources: Revenue Commissioners; Eurostat; and author's calculations.

Note: 2021 sector outturns for employee taxes are approximated with Figure 3 of Collins and O'Rourke (2022). A re-classification affecting Education and Public admin/defence data means that their 2011–2013 receipt are estimated based on the 2014–2021 average shares.

Figure 5 also shows that ETRs for many sectors have been fairly flat or declining in the years prior to the pandemic, but all picked up sharply in 2021. One possible explanation for this is that the rates of USC charged have been reduced at various stages since their introduction over ten years ago, although an increase in part-time employment could also be a factor.

<sup>6</sup> Wages and salaries are the taxable component within compensation of employees, which also includes employers' social contributions. The sector groupings are based on a ranking of 2019 employee wages per hour worked for NACE Rev 2 sectors shown in Table 1. Appendix 1 shows the further detail at NACE Rev 2 level for 16 sectors.

## 4. Forecasting wages and salaries by sector

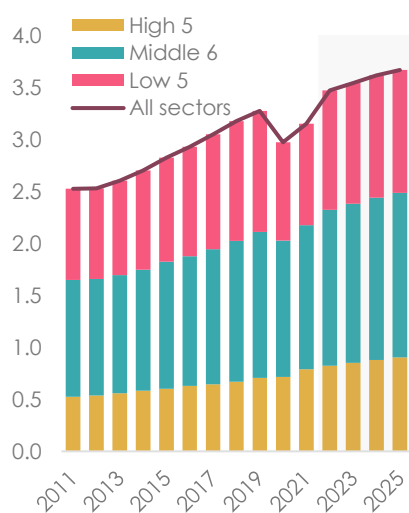
A mechanical decomposition of the *SPU 2022* forecasts for employee hours worked is a useful starting point for a bottom-up analysis of wages and salaries. The slow-changing nature of hours worked shares across sectors provides a simple basis for forecasting using linear trend extensions. The sample period used is from ten-year trends for sectoral shares (2012–2021).

Employee hours worked data from Eurostat are used up to 2019, but extended forward for 2020 and 2021 using actual hours worked data published by the CSO. This is to reflect the impact of the pandemic on hours worked more accurately.<sup>7</sup> For 2022–2025, the series for total employee hours worked is extended using the *SPU 2022* forecasts for the growth rate in total hours worked (this level is then allocated across sectors based on the ten-year sectoral shares). Figure 6 depicts the mechanical decomposition of employee hours worked.

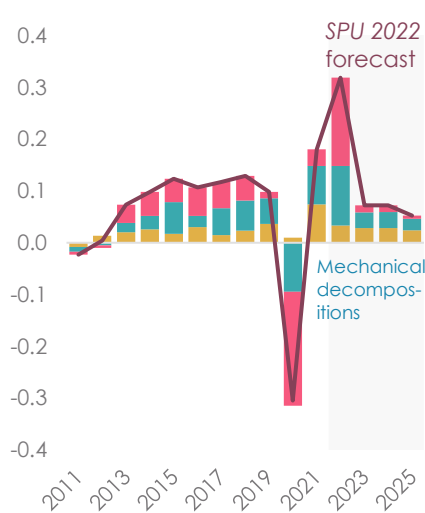
Figure 6: Decomposition of employee hours worked

Billions of hours worked

A. Levels



B. Year-on-year change



Sources: CSO; Eurostat; and author's calculations.

Note: The sector groupings are based on a ranking of 2019 employee wages per hour worked for NACE Rev 2 sectors.

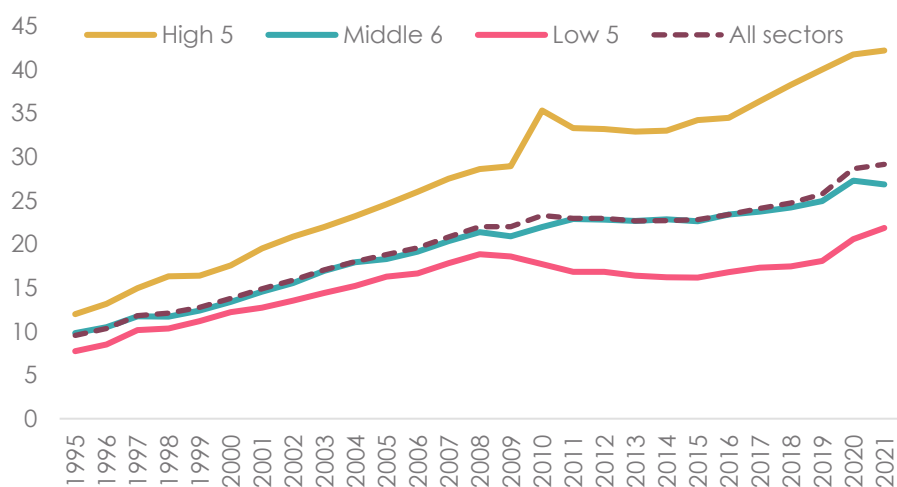
<sup>7</sup> Actual hours worked data cover all employment, rather than specifically employee hours worked at NACE Rev 2 sector detail provided by Eurostat, which is the focus of the analysis in this note. Actual hours worked data are preferable anchors for 2020 and 2021 as unlike standard ILO labour market data which included many Pandemic Unemployment Payment recipients as employed, they better reflected the impact of the Covid-19 pandemic.

While shares of hours worked typically change slowly, the composition of wages in an economy can change quickly.

To illustrate this, Figure 7 presents data for 1995–2021 for employees' hourly wages in the Irish economy. This shows that the 'High 5' sector grouping has seen considerably faster hourly wage growth over time compared to the 'Middle 6' and 'Low 5'. For these two groups with lower employee hourly wages, the pandemic resulted in a compositional increase in 2020 and 2021, since job losses were concentrated among workers with lower earnings (Redmond, 2020).

Figure 7: Employee hourly wages have grown rapidly for the five sectors with the highest 2019 hourly wages

€ per hour worked



Sources: CSO; Eurostat; and author's calculations.

Note: The sector groupings are based on a ranking of 2019 employee wages per hour worked for NACE Rev 2 sectors.

This shows that there has been a long-standing trend divergence between the higher-paid and other sectors in terms of the hourly wage, compared to 1995. This reflects stronger productivity growth in those sectors. By contrast, hourly wages have barely increased in cash terms since the Great Recession in the lowest paid sectors, implying a decline in real hourly wages. However, this also reflects a compositional rise in hourly wages in 2008/2009, as the fall in hours worked was proportionally larger than the fall in wages and salaries. An increase in part-time work hours in these sectors during the recovery could also explain the relatively stagnant hourly wages for these sectors.

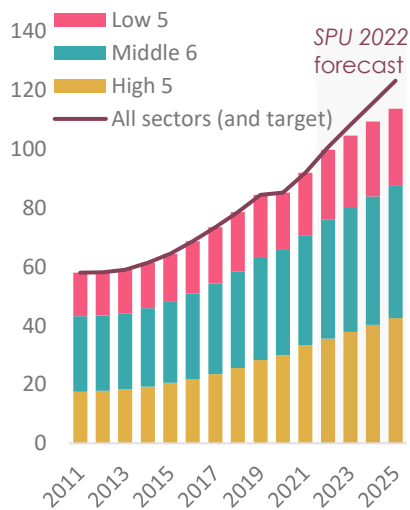
Due to the varying trends in employee hourly wages shown in Figure 7, an assumption about their future paths is required to calibrate a mechanical decomposition of the *SPU 2022* forecasts for total wages and salaries. Given that the sectoral

trends are relatively strong, Figure 8B uses an 'uncalibrated' approach based on extending the ten-year linear trend for 2012–2021, and applying it to the 2022–2025 forecast period. This implies that the tick-up in hourly wages due to the pandemic is largely unwound in the years ahead. Multiplying these estimates with hours worked across sectors (as in Figure 6A) provides an estimate of employee wages and salaries, and this acts as a preliminary check on the SPU forecasts.

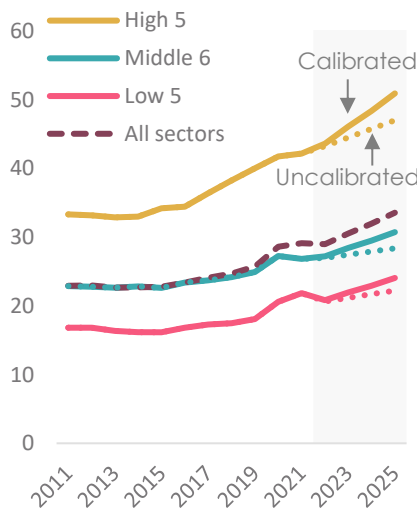
As shown in Figure 8A, this approach based on sectoral ten-year linear trends is insufficient to explain the official forecasts for wages and income, falling short by €9.5 billion (7.7 per cent).<sup>8</sup> To match the totals, a “calibrated” version of the estimates is constructed by allocating the differences for the total each year in proportion to each sector's share of uncalibrated total wages and salaries for the same year. This raises the 2025 average hourly wage by about €2.50 (8 per cent). These 'calibrated' wages and salaries are shown as bottom-up employee hourly wages over the forecast horizon in Figure 8B.

Figure 8: Calibrating wages and salaries, and deriving the implied hourly employee wage rates across sectors

A. Bottom-up, uncalibrated projection for employee wages, and target  
€ billion



B. Employee hourly wages  
€ per hour worked



Sources: Revenue Commissioners; Eurostat; Department of Finance; and author's calculations.

Notes: In panel A, the uncalibrated wages and salaries projections come from the hours worked decomposition shown in Figure 6A, and the ten-year linear trend extensions of employee hourly wages shown as dotted lines in Figure 8B.

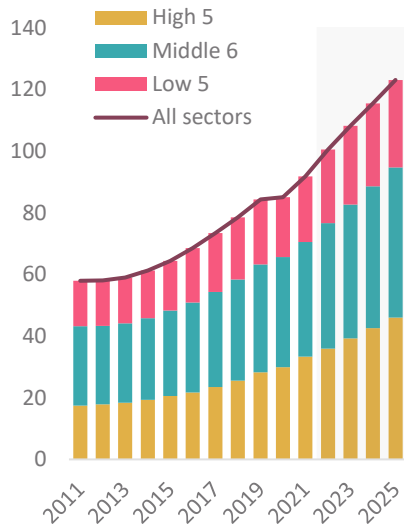
<sup>8</sup> This is not altogether surprising, as the harmonised index of consumer prices grew by just 0.6 per cent annually for 2012–2021, whereas SPU 2022 projects prices growth of 3.6 per cent a year for 2022–2025, implying a higher expected growth in wages.

Figure 8B is consistent with achieving the target path in employee hourly wages from *SPU 2022*. In this 'calibrated' scenario, hourly wages for 'High 5' would grow more rapidly than other sectors. Figure 9 updates Figure 8A for the split among 'calibrated' wages by sector group.

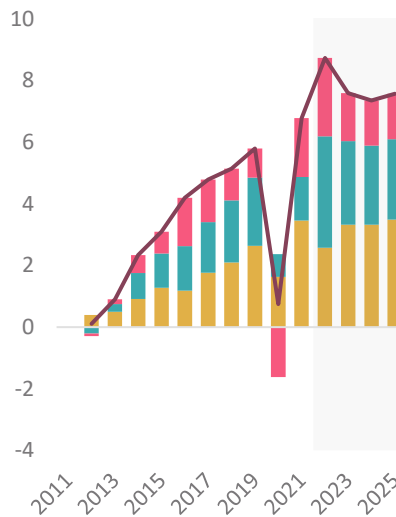
Figure 9: Calibrating wages and salaries

€ billion

A. Calibrated employee wages



B. Year-on-year changes



Sources: Revenue Commissioners; Eurostat; Department of Finance; and author's calculations.

Notes: For panel B, the performance for wages and salaries was supported by the Government's wage subsidy schemes, amounting to €4 billion for 2020 and €4.6 billion for 2021 (CSO, 2021b and Revenue Commissioners, 2022), and these subsidies were concentrated in the 'Low 5' sectors and in "other activities" (NACE Rev 2 sectors R-U). Pandemic Unemployment Payments are not included in wages and salaries, however.

Notably, only the 'Low 5' sectors combined had a year-on-year fall in wages and salaries in 2020, whereas 'Middle 6' grew modestly, and 'High 5' increased more in line with previous years. In 2021, over half of the increase in all wages and salaries was for 'High 5' employees. In 2022, the calibrated scenario shows a more moderate implied increase for the highest earning sectors, while the other sectors would catch up on further lost growth in earnings during the pandemic.

## 5. Projecting employee income taxes across sectors

Based on the projected sectoral income developments, it is possible to combine this with the sectoral average effective tax rates (ETRs) to assess changes in the aggregate ETR. Income taxes across sectors are then calculated by multiplying employee wages and salaries with projected ETRs.

Ireland's progressive tax system means that higher earners will pay more tax on an additional euro of income than lower earners. As income tends to grow faster in higher paid categories, this tends to raise the ETR.

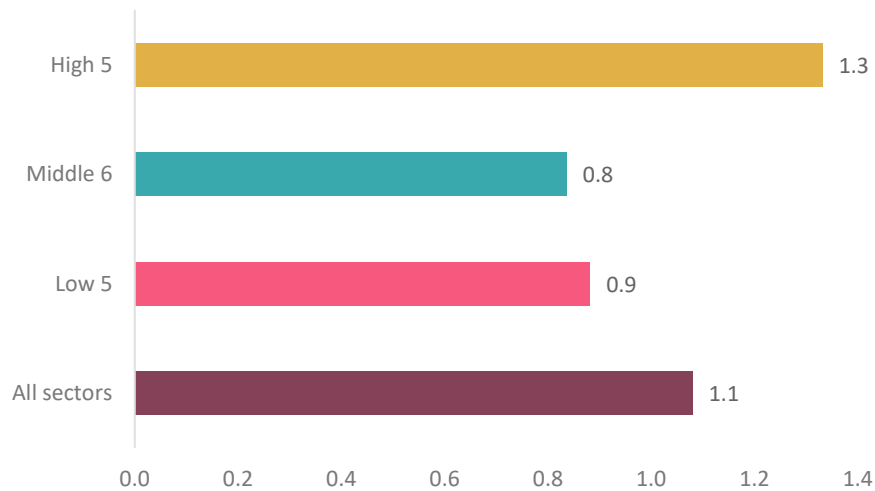
At sectoral level, the ETR of some sectors is far higher than in other sectors as shown in Figure 5, and higher wage growth in these sectors will tend to boost the ETR. In addition, the *marginal* tax rate for employees is higher than the average rate, while new workers may enter at a lower marginal rate particularly in sectors with lower hourly wages.<sup>9</sup>

As a result, the ETR may change over time. This can be captured through the elasticity of the ETR to sector hourly wage growth. A positive relationship greater than 1 means that an ETR typically grows faster than hourly wages. Using available data, Figure 10 shows the average elasticities over 2011–2021, calculated across sectors.

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<sup>9</sup> An exception to this could occur with compositional effects. For example, if a sector experiences a shift towards part-time workers instead of full-time workers in good times (e.g. an economic environment in which nominal hourly wages are rising), then the ETR for that sector is likely to decline — owing to a lower average tax burden on part-time workers relative to full-time workers. This scenario would not imply a positive elasticity of the sector's ETR with respect to hourly wages.

Figure 10: Elasticities of effective tax rates with respect to employee hourly wages (average for 2011–2021)  
 % change in effective tax rate for % change in hourly pay



Sources: Revenue Commissioners; CSO; Eurostat; and author's calculations.  
 Note: Policy-adjusted revenue data are not currently available by sector. 2021 sector outturns are approximated with Figure 3 of Collins and O'Rourke (2022). A re-classification affecting Education and Public admin/defence data means that their 2011–2013 receipt are estimated based on the 2014–2021 average shares.

The elasticity of around 1 for total income suggests that the ETR is relatively constant, and in line with other estimates of the relationship between income tax and wages.<sup>10</sup> However, the 'High 5' sectors have a higher elasticity, likely reflecting the importance of pay growth and high starting salaries. By contrast, the elasticity is less than 1 in the other sectors, possibly reflecting the greater role of increases in the number of jobs in these sectors and more part-time work.

Using these elasticities, and the derived hourly wages by sector, estimated employee taxes paid by sector can be calculated with the following equation:

$$Income\ tax_t = Wages_t * ETR_{t-1} * (1 + \beta * \% \Delta hourly\ pay_t)$$

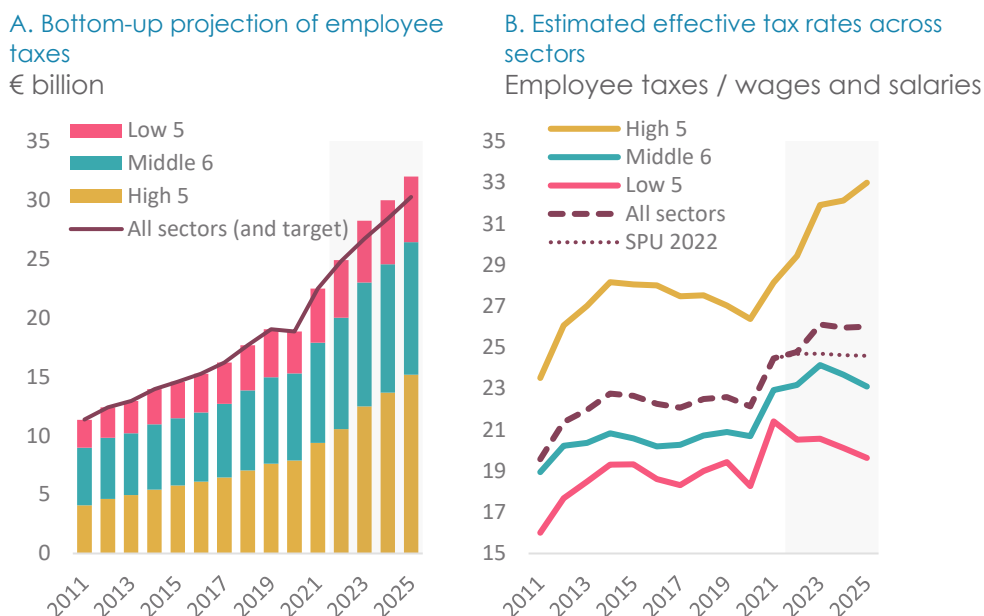
Figure 11A presents the performance of these projections relative to the *SPU 2022* forecasts for employee taxes, building on the calibrated wages by sector from the previous section (Figure 9A). In Figure 11B, the estimated ETRs are shown, including the implied *SPU 2022* projection.<sup>11</sup>

<sup>10</sup> See Table 5 in Conroy (2020) for a summary of estimated income tax elasticities in Ireland. Conroy's estimated elasticity using policy-adjusted income tax is 1.4, considerably higher than 0.8 when using income tax not adjusted for policy changes.

<sup>11</sup> Using linear extensions of ten-year trends in hourly wages by sector, as shown with dotted lines in Figure 8B, results in lower wages and salaries compared to *SPU 2022*, and an alternative set of ETR projections for the forecast horizon. Interacting these series yields a very similar level of employee tax receipts by 2025 (just €0.05 billion, or 0.2 per cent higher than *SPU 2022* projections show).



Figure 11: Bottom-up projections of employee taxes



Sources: Revenue Commissioners; Eurostat; Department of Finance; and author's calculations.

Notes: In panel A, the bottom-up projections come from the wages and salaries decomposition shown in Figure 9A, and the elasticity-based extensions of ETRs shown in panel B.

In all years, the bottom-up components sum to a higher level of income taxes than the official projections show in *SPU 2022*. This suggests that the increase in the aggregate ETR can more than be explained by aggregate pay growth from a bottom-up perspective, and by 2025, the bottom-up sum of projected tax receipts is €1.7 billion (5.8 per cent) above *SPU 2022* forecasts. This could partly reflect negative judgements applied by the Department of Finance to their PAYE and USC projections — see Supporting Information section S5 in the (forthcoming) May 2022 *Fiscal Assessment Report* for further details on these judgements (Fiscal Council, 2022).

In Figure 11B, the derived ETRs show a higher path across all sectors than the *SPU 2022* projections showed in Figure 5. This illustrates an increasing reliance on the tax richness in the 'High 5' sectors with the highest hourly earnings. The path for ETRs in the 'Middle 6' sectors does not revert to its pre-pandemic range following 2021, when compositional effects were likely to affect the outcome. For 'Low 5', it takes several years for a lower ETR to return.

While Figure 11B suggests some upside risk applies to the *SPU 2022* income tax projections, this finding is conditional on the decomposition of *SPU 2022* employee wages and salaries shown in Figure 9A. Furthermore, the bottom-up methodology presented in Section 5 relies on elasticities that are estimated

from a limited sample period (just 11 years), and the data do not adjust for policy changes. This is important since, for example, the rates of USC charged have been reduced at various stages since their introduction over ten years ago. An improvement to the estimates would be to estimate policy-adjusted series for PAYE and USC across sectors, along similar lines to the total income tax series constructed by Conroy (2020).

## 6. Assessing the bottom-up tax projections and implied effective tax rates

Although the bottom-up projections in Figure 11A do not precisely replicate the *SPU 2022* employee income tax forecasts, they provide a basis for assessing the forecasts' plausibility in terms of contributions across sectors. In this section, the corresponding effective tax rates (ETRs) in Figure 11B are assessed using a framework for the change in ETR as explained by a tax effect (i.e. the ETR's numerator), an hourly wage effect, and an hours worked effect (which are both factors in the ETR's denominator).<sup>12</sup>

Figure 12 shows that sectors with lower hourly wages (panel D) exhibited stronger compositional effects due to the pandemic — that is, increases in these ETRs in recent years are expected to prove temporary as the recovery from the pandemic continues. The pandemic-related rise in ETRs is projected to gradually unwind for the 'Low 5' sectors.

By contrast, the 'High 5' group saw continued increases in employee taxes, hours worked, and hourly wages throughout the pandemic. The limited evidence of compositional effects within the 'High 5' group is consistent with a more permanent rise in the ETR for these sectors, as the projections indicate for each of 2022–2025.

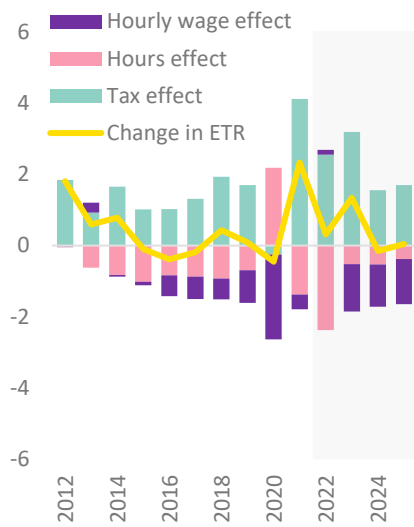
Overall, Figure 12 shows that employee taxes are forecast to increase each year between 2022 and 2025, and that the ETR for all sectors is projected to increase further over coming years.

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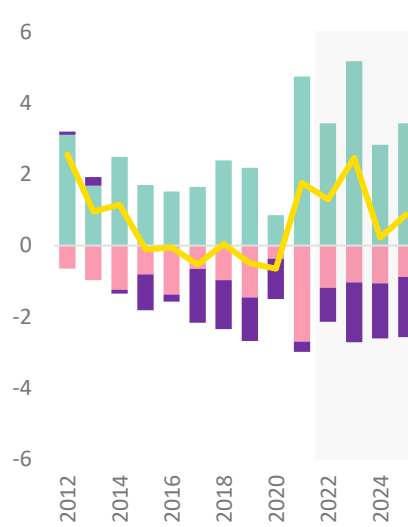
<sup>12</sup> An ETR is simply tax divided by income. An increase in employee taxes contributes positively to the change in ETR, whereas higher hours worked and hourly wages contribute negatively, as they add to employee wages and salaries in the ETR denominator.

Figure 12: Sectors with lower hourly wages show compositional effects due the pandemic that could unwind  
 Percentage points (for the change in effective tax rates)

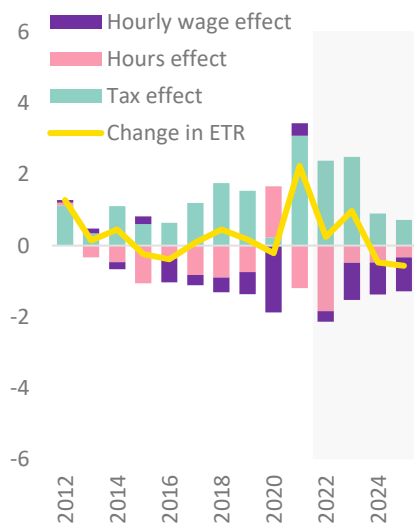
**A. All sectors**



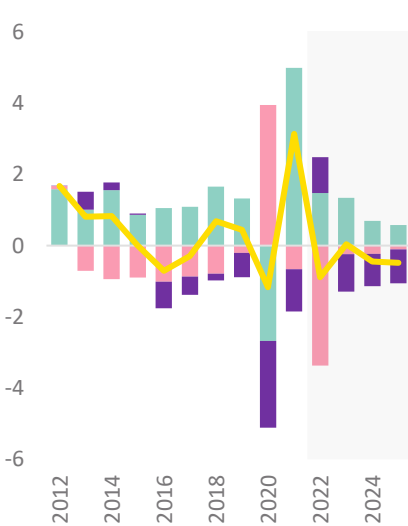
**B. 'High 5' sectors**



**C. 'Middle 6' sectors**



**D. 'Low 5' sectors**



Sources: Revenue Commissioners; Eurostat; Department of Finance; and author's calculations.

Notes: The contribution can be calculated algebraically, or equivalently, with proportions of the change in logs, as follows:

$$\text{ETR} = \text{tax} / \text{wages} = \text{tax} / (\text{hourly wages} * \text{hours worked})$$

$$\text{dlog}(\text{tax}/\text{wages}) = \text{dlog}(\text{tax}) - \text{dlog}(\text{hourly wages}) - \text{dlog}(\text{hours worked})$$

The proportional shares of the contributions, e.g.  $\text{dlog}(\text{tax}) / \text{dlog}(\text{tax}/\text{wages})$ , multiplied by the change in ETR, derives the contributions shown.

At any given time, there are numerous risks to any macroeconomic or fiscal projection, and the use of bottom-up projections across sectors is by no means immune to these risks. For example, hours worked could decline in some sectors, reflecting lower activity more generally; hourly pay could also fall, if the labour market weakens suddenly and wage bargaining power is adversely affected; unexpected compositional effects could see an increase in part-time

workers, which can result in lower tax receipts relative to an equivalent number of hours worked by full-time workers. However, given the expectation in *SPU 2022* for continued real economic growth over the forecast horizon, the bottom-up projections presented in this note show that the *SPU 2022* forecasts are plausible as a baseline. The analysis suggests some potential for upside risks to the official forecast for income tax.

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