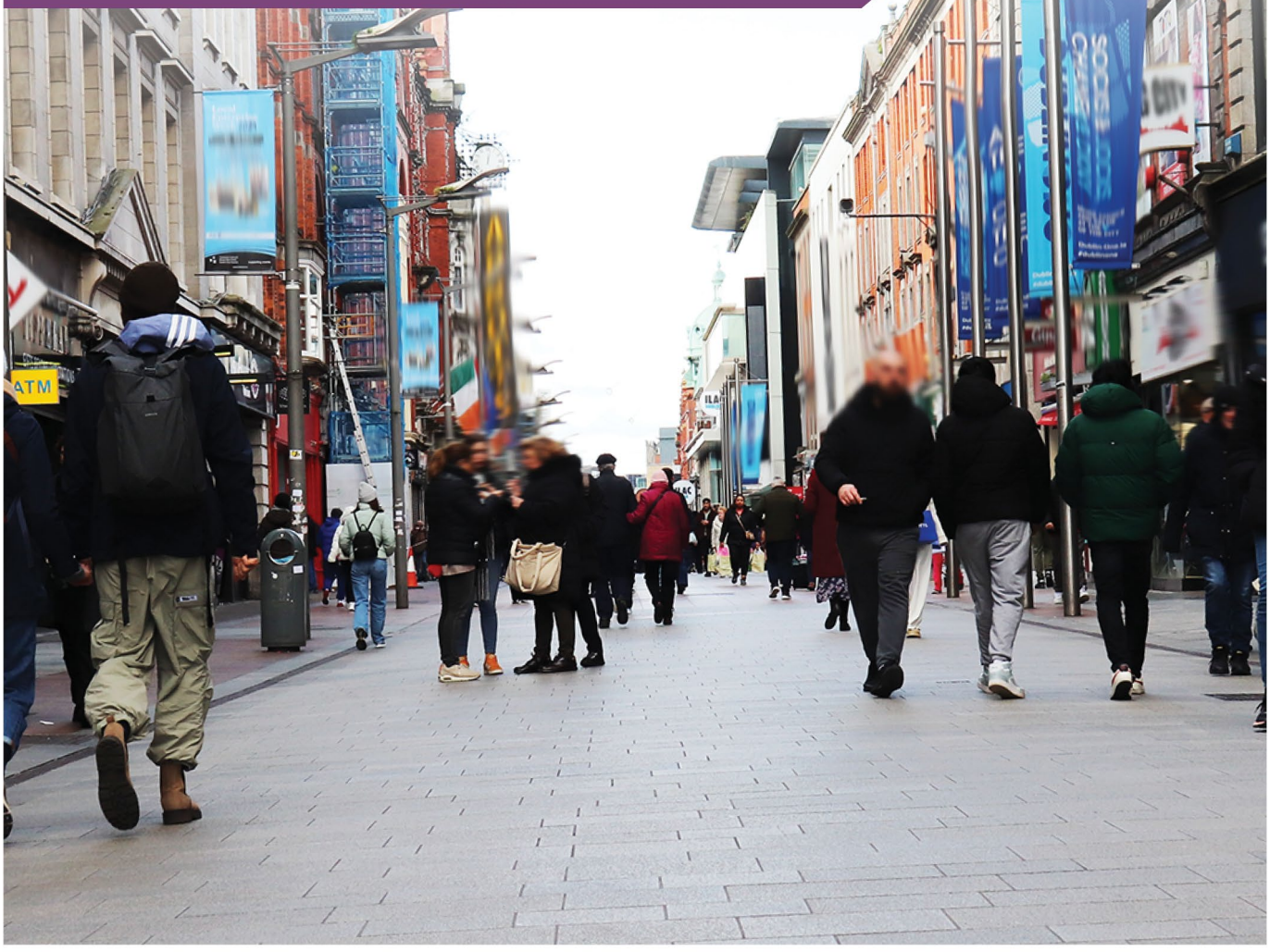
Banc Ceannais na hÉireann
Central Bank of Ireland
Eurosystem

Signed Article

QB4 – December 2024



Contents

Long-Term Growth Prospects for the Irish Economy

Thomas Conefrey, Enda Keenan, David Staunton and Graeme Walsh [1]

The long-term outlook for the economy will be determined by fundamental factors such as population growth, investment and productivity. In this *Article*, we provide a framework for assessing the economy's long-term growth prospects and evaluate how major structural changes already underway could influence it. Our analysis shows that, as the population ages, the long-term growth rate of the economy is projected to slow by 2050 to below half its historic average growth rate observed over the last half century. The level of inward migration and the length of working lives will affect the extent to which the rate of improvement in living standards can be maintained in light of population ageing. The climate and digital transitions and the effects of trade fragmentation could have a significant impact on the long-run outlook. Sensitivity analysis shows that increases in investment or productivity linked to these transitions could improve long-term growth prospects, but these gains are uncertain and will require concerted policy focus to enable the economy to benefit from the profound changes ahead.

1. Introduction

The near-term outlook for the Irish economy is likely to be shaped by developments including the response of consumer spending to projected improvements in real incomes, the performance of net exports in the context of trade policy uncertainty and the evolving stance of fiscal and monetary policy, as outlined elsewhere in this *Bulletin*. Looking beyond the immediate period of the next three years, it is important to consider and analyse the

[1] Irish Economic Analysis Division. We would like to thank Robert Kelly, Martin O'Brien and Gerard O'Reilly (Central Bank) and Luke Rehill (Department of Finance) for comments on an earlier draft. The views expressed in this Article are those of the authors and do not necessarily reflect those of the Central Bank of Ireland or the European System of Central Banks.

factors that will determine the prospects for the economy and living standards over an extended horizon.

Over the longer-term, abstracting from transitory shocks, the factors which will determine the economy's growth prospects – and hence the living standards of its residents – include the change in the size of the population and the proportion of the population at work, the rate of change in investment and the capital stock and the efficiency with which these capital and labour resources are combined to increase sustainable output (known as total factor productivity or TFP). These long-run drivers of growth will, in turn, be affected by major structural transitions currently underway related to the ageing of the population, climate change and the transition to net zero, the growth of Artificial Intelligence (AI) and digital technologies and geoeconomic fragmentation.

To assess the implications of projected changes in the key determinants of growth over time in the context of these transitions, we employ a widely used analytical framework known as growth accounting. We first decompose the drivers of growth in the Irish economy over the period 1970 to 2023. This provides the context for assessing the long-term prospects for the economy out to 2050. Estimating the economy's growth rate over such an extended period is an inherently uncertain exercise, especially in the face of major structural transitions. The ultimate impact of these transitions on the labour market, investment, productivity and growth is not yet fully understood and is the subject of ongoing analysis and research. Accordingly, in this *Article*, we carry out sensitivity analysis to demonstrate the potential impact on the economy's long-term growth outlook of alternative assumptions on the working age population, investment and productivity.

Our analysis builds on other work for Ireland using a similar methodological framework. Department of Finance (2023) examine the long-term outlook for the economy out to 2050 using population projections from 2021 from the European Commission. Egan and McQuinn (2024) focus on alternative paths for population growth and investment and demonstrate how future growth is sensitive to assumptions on these key inputs. Fiscal Council (2020) examine the fiscal challenges and risks from 2025 to 2050.

Taking the historic period from 1971 to 2023, our analysis shows that TFP and capital each accounted for about 40 per cent (1.3 percentage points) of the average growth rate of the economy over this period, with labour accounting for the remaining 20 per cent (0.5 percentage points). We estimate a baseline scenario out to 2050 using the CSO's (2024) high migration population variant.

In this scenario, the potential growth rate of the economy is projected to slow markedly over the coming decade. This is primarily driven by the ageing of the population which sees the working age population peak in 2045 and then decline, even assuming high levels of net inward migration. If net inward migration was lower than this (in line with the forecasts in the CSO's *Low Migration* scenario), this would reduce the annual average growth rate of the economy by around one third from 2030 to 2050. Over time, the age at which workers in Ireland transition into retirement has been increasing slowly. To illustrate the impact on economic growth of longer working lives, we present sensitivity analysis whereby the retirement age is assumed to rise gradually, broadly guided by the parameters of the 2021 Pension Commission recommendations. This would boost labour supply and the potential growth rate of the economy relative to the baseline case, helping to maintain improvements in incomes per head in line with their historical trend.

The transitions linked to AI, geoeconomic fragmentation and climate change will affect the economy's growth path through their impact on the labour market, productivity and investment, amongst other channels. We carry out sensitivity analysis where the investment-to-GNI* ratio is raised above its recent observed level and where the rate of TFP is assumed to be boosted as a result of the adoption of AI and digital technologies.

The baseline and related sensitivity analysis presented in the *Article* should not be interpreted as forecasts of particular outcomes but rather paths for the economy based on a specific set of assumptions. A limitation of the analysis is that it is static in nature and does not consider wider spillovers and important interactions between the main drivers of growth in the economy. In particular, key assumptions such as the labour force participation rate and total factor productivity are taken as exogenous. While this makes the methodology tractable and useful for the type of analysis considered in this paper, in reality, the evolution of these variables are themselves interrelated, but the full extent of these interlinkages are not captured in a growth accounting framework.

Relatedly, although growth accounting can be used to identify the *proximate* causes of growth, it cannot identify the *underlying* causes of growth. *Proximate* causes of growth refer to capital, labour, and technology. *Fundamental* causes of growth are the underlying factors that determine these three inputs, such as institutions, the business environment, geography and culture. Lastly, alternative growth paths estimated using this methodology are highly stylised because they use a *ceteris paribus* assumption and do not take into account the general equilibrium effects of changes to endogenous variables.

The paper is organised as follows. Section 2 explains the growth accounting methodology and applies the approach to assess the historic performance of the economy from 1970 to 2023. Section 3 describes the key assumptions used to estimate a baseline for the economy out to 2050 and presents the results. In Section 4, sensitivity analysis is carried out to illustrate the impact on the growth outlook of changes in key assumptions related to the working age population, investment and TFP, in the context of the major structural transitions currently underway. Section 5 concludes.

2. Historical Contributions to Growth

In this section, we present the growth accounting (or equivalently, the production function) approach that will be used throughout this article. To provide context for the long-term projections in Section 3, we first apply the method to the historic data to identify the sources of growth in the Irish economy over time (1970-2023).

2.1 Growth accounting methodology

Growth accounting is based on a production function formula that relates output (Y) to capital input (K), labour input (L), and total factor productivity (A):

$$Y = f(A, K, L)$$

This formula can be used to decompose output growth into the contributions from these three inputs, making it a simple and transparent framework for developing long run projections and exploring the sensitivity of growth to changes in assumptions.[2] The specific formula that we use is called the normalised Constant Elasticity of Substitution (CES) production function:[3]

$$Y = \left[\alpha K^{-\beta} + (1-\alpha)(AL)^{-\beta}\right]^{-\frac{1}{\beta}}$$

where Y is the potential sustainable output of the economy, K is capital input, L is labour input, and A is total factor productivity.[4] The parameters of the function are α, the capital share, and β, a substitution parameter.[5] In our framework, capital and labour are assumed to be fully employed, such that the capital stock is fully utilised and there is no labour hoarding.

[2] The growth accounting method originates from Solow (1957) and is one of the most popular tools in for this analysis macroeconomics (Acemoglu 2009).
[3] For simplicity, most growth accounting exercises use a Cobb-Douglas function, which is equivalent to a CES function with a unitary elasticity of substitution.
[4] The particular form of technology that we use is called labour augmenting technology.
[5] We calibrate the parameters of the CES production function using standard values, so we assume a labour share of 0.67 and an elasticity of substitution between capital and labour of 0.5.

We use the CES production function over the more common Cobb-Douglas production function because of its less restrictive assumption on the substitutability of capital and labour. The CES specification is more consistent with the production function used in the Bank's broader macroeconomic modelling toolkit, specifically in the semi-structural and DSGE models.

2.2 Data and calibration

The production function methodology requires data for four key variables: output, capital input, labour input and TFP.[6]

Output

For the measure of output, we use real GNI* instead of standard measures such as GDP or GVA (Figure 1). The use of GNI* as the measure of output is in line with the approach taken in other recent analyses for Ireland by Fiscal Council (2020) and Department of Finance (2023).[7] GNI* excludes transactions linked to the global activities of MNEs in Ireland and is a better measure of domestic economic activity than GDP. Since a modified measure of economic activity is used as our output variable (GNI*), it is important that modified or appropriately adjusted input series are used.

Capital input

The underlying formula for the capital input (K) is a function of the level of investment (I) and depreciation (δ):

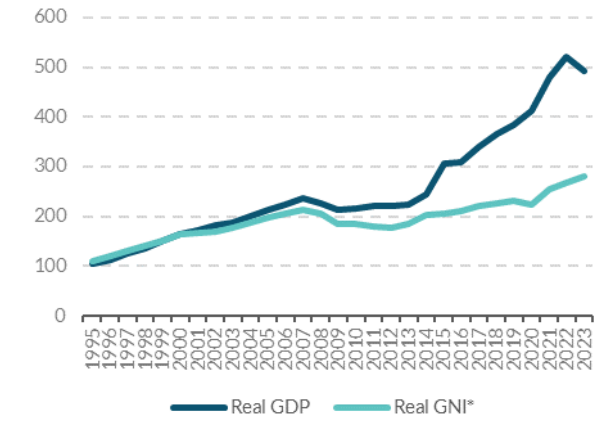
$$K = K_{-1}(1 - \delta) + I$$

where K is the modified capital stock, I is modified investment, and δ is the depreciation rate. To construct the modified capital stock series we follow Timoney (2023) by excluding investment in intangibles and transport equipment for the manufacturing, information and communication, and financial and insurance sectors. This modified capital stock series is more consistent with GNI* than the total capital stock (Figure 2).

[6] The historic data we use comes from the Central Statistics Office and is back dated, where necessary, to 1970 using the European Commission's AMECO database.
[7] Egan and McQuinn (2024) use Net National Product.

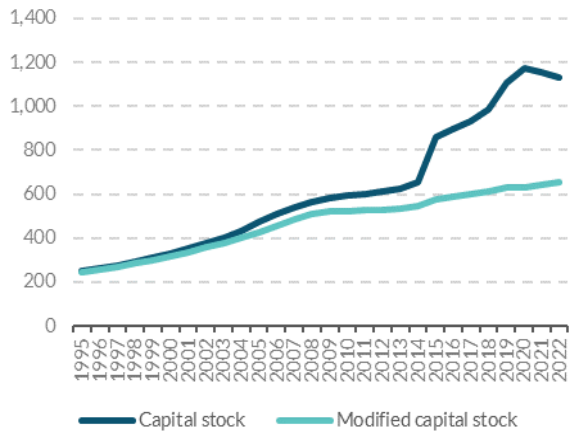
Aggregate measures of activity, 1995-2023

Figure 1
Euro billion, (constant prices 2022)



Modified capital stock, 1995-2023

Figure 2
Euro billion, (constant prices 2022)



Labour input

Labour input is measured as the total number of hours worked in a year (L) and is built up from its components using the following formula:

$$L = (H \times 52) \times N \times P \times (1 - U)$$

where H is the average length of the work week, N is the working age population, P is the labour force participation rate, and U is the unemployment rate. For the baseline scenario, standard definitions of the working age population and labour force participation rate are used based on those aged 15 to 64.

Total factor productivity (TFP)

In the growth accounting framework, TFP is calculated as the residual amount of GNI* that is not explained by the capital and labour inputs. This measure is known as the Solow residual. While TFP represents innovation and advances in technology, its measurement and interpretation need to be treated with caution for several reasons. First, TFP is an unobserved variable and is calculated as a residual. As such, it is a proxy, or indirect, measure of technology. Second, residual TFP has been said to be a measure of what we do not know and could be capturing the effect of elements such as, for example, the misallocation of factor inputs, market-improvements through better competition policy, market integration, specialisation, omitted variables, and measurement error (Hulten, 2001).

2.3 Historical contributions to growth

The results of our historic growth accounting exercise are summarised in Table 1, broken down into different time periods since 1970. Over the full sample from 1971 to 2023, the economy grew at an average rate of 3.2 per cent per annum (as measured by real GNI*), with TFP and capital each accounting for about 40 per cent (1.3 percentage points) of this average growth rate, and labour accounting for the remaining 20 per cent (0.5 percentage points).

Table 1: Historical decomposition of potential GNI* growth

Period	GNI*	TFP	Capital	Labour
1971 - 1980	3.6	1.1	2.4	0.1
1981 - 1994	3.0	1.9	0.9	0.1
1995 - 2001	5.1	2.4	1.9	0.8
2002 - 2007	3.8	0.5	2.1	1.3
2008 - 2012	0.3	0.0	0.6	-0.3
2013 - 2019	2.2	0.6	0.7	0.8
2020 - 2023	3.5	1.5	0.4	1.5
1971 - 2023	**3.2**	**1.3**	**1.4**	**0.5**

Source: authors' calculations.

Looking across the different time periods, GNI* growth and the associated input contributions have fluctuated over time during distinct phases of growth and decline in the Irish economy. This includes the period of contraction in the mid 1970s due to the oil price crisis of 1973. This was followed by the pro-cyclical fiscal expansion in the late 1970s, the fiscal crises in the 1980s, the period of recovery and convergence from 1995 to 2001, the construction bubble from 2002 to 2007, the economic and financial crisis (2008-12), the recovery period from around 2013 to 2019, and recently, the pandemic, Russia-Ukraine war and aftermath (2020-23).

There are a number of key results from the growth decomposition in Table 1 that are worth highlighting:

1. From 1970 up to the mid 1990s, the contribution of labour to economic growth was very small (0.1 percentage point), reflecting high levels of unemployment and prolonged net outward migration observed over this period.

2. The contribution of capital grew strongly over the 1995 to 2007 period, especially during the construction bubble, in both absolute and

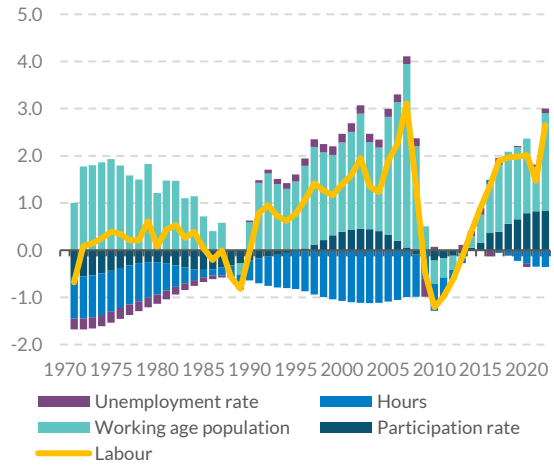
proportional terms, before falling in subsequent years due to weaker investment and the collapse of construction sector output (Figure 3).

Potential GNI* Growth, 1971-2023

Figure 3
Per cent

Potential Labour Growth, 1971-2023

Figure 4
Per cent



3. Trends in demographics and migration flows have played a key role in shaping the labour input and, in turn, its contribution to output growth in Ireland. The contribution of labour became a significant driver of output growth from 1995 onwards, reflecting the impact of strong population growth and rising levels of net inward migration. Added to this, the effect of investment in higher education and an increasing number of school leavers and college graduates raised labour force participation (Figure 3). Since the 1990s, the increase in the participation rate, particularly the female rate, has made a positive contribution to labour input growth (Figure 4).

4. The contribution of TFP to economic growth increased significantly from the mid 1990s up to the early 2000s. This was a period of rapid export-led growth enabled by greater EU and global integration that saw belated convergence of living standards in Ireland with those in Europe (Honohan and Walsh, 2002). The contribution of TFP to overall growth fell significantly during the mid 2000s as the construction sector became a major driver of growth.

5. The downward trend in the length of the average work week has made a negative contribution to labour input growth over time, but the size of its negative impact has declined in recent years (Figure 4).

Summing up, increases in population driven by high levels of net inward migration, improved educational attainment and labour force participation and the economy's capacity to harness the benefits from enhanced global

integration all played a prominent role in raising national output over the last 50 years. Although economic growth has been interrupted by multiple severe crises, the same factors have continued to play a central role in explaining Ireland's growth performance over the last 50 years.

3. Baseline Projection (2024 – 2050)

In this section, we use the production function approach described above to construct a baseline projection for GNI*, capital labour and TFP, from 2024 to 2050. The first three years of the projection are based on the forecasts presented in this *Quarterly Bulletin*.[8] For the remaining period from 2027 to 2050, we generate the projections for GNI* using the production function approach and assumptions on capital, labour and TFP. The assumptions underlying this long-run baseline projection are discussed in detail below.

3.1 Labour input assumption

The baseline projection for labour input is built up by projecting forward the individual components of the labour input formula presented in Section 2.2.

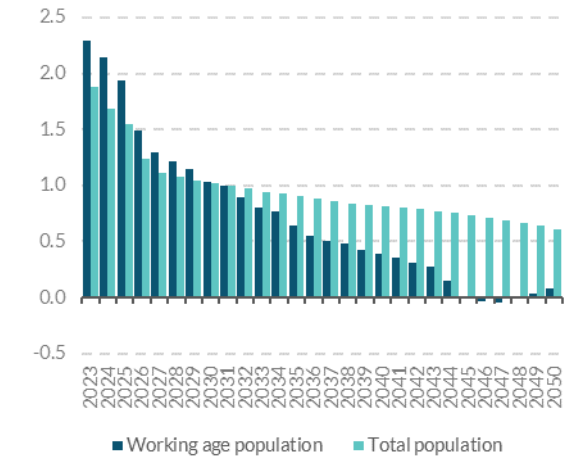
Working age population (N)

In the baseline, the working age population (15-64) is assumed to grow from 3.6 million in 2025 to almost 4.2 million in 2050 (Figure 5). This is based on the latest CSO population projections published in July 2024 that incorporate the results of Census 2022. In particular, we use the high net migration (M1) scenario, which includes an underlying assumption of net inward migration of 45,000 persons per annum from 2027.[9] In this scenario, growth in the working-age population is projected to gradually decline from an annual average of 2 per cent per annum in 2025 to zero by the mid-2040s (Figure 5).

[8] Over the 2024 to 2026 period, the production function is used to calculate the Solow residual.
[9] For more details about the CSO's population projections, visit: https://www.cso.ie/en/releasesandpublications/ep/p-plfp/populationandlabourforceprojections2023-2057/.

Projected Population Growth, 2023-2050

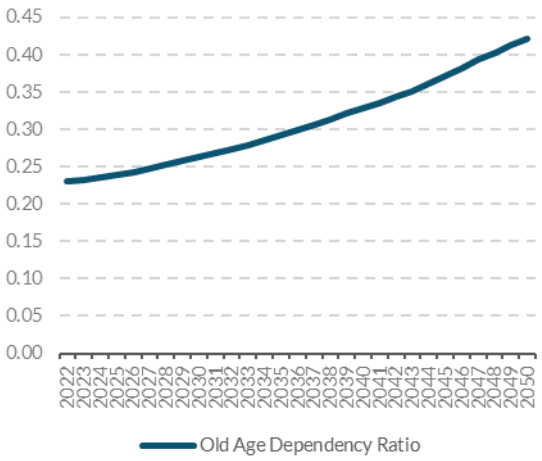
Figure 5
Per cent



Source: PEC19, M1 scenario, Central Statistics Office.

Old Age Dependency Ratio, 2023-2050

Figure 6
Population (65+) / population (15-64)



Source: PEC19, M1 scenario, Central Statistics Office.

Within the total population there are important changes occurring across the age distribution, which mean that the population of Ireland is set to age rapidly from the end of this decade (see Box A). While the working age population (those aged 15 to 64) is projected to increase from 3.5 million persons in 2024 to 4.1 million persons in 2050 – an increase of 17 per cent – the population over 65 years old is projected to more than double from 0.8 million persons in 2024 to 1.7 million persons in 2050. This means that the old age dependency ratio – the population aged over 65 as a proportion of the working-age population – is expected to increase from 24 per cent in 2024 to 42 per cent by 2050 (Figure 6). The slowdown in growth in the working age population means lower available labour supply and, as a result, a lower potential growth rate for the economy.

Average work week (H)

The average working week fell steadily from 44 hours per week in 1970 to 33 hours per week in 2010. For much of the subsequent decade up to 2019, the downward trend in the average working week stabilised. Since the pandemic, hours worked have declined further in a similar manner to that observed in many other European countries (Figure 4).[10] The future path of average hours worked will depend on a number of factors including the sectoral composition of the economy, changes in demographics and worker preferences. A cultural shift towards more flexible work hours could lead to a shorter average working week overall. For the purpose of this analysis, we make the simplifying

[10] See Keenan and McIndoe-Calder (2023) "Changes in Average Actual Hours Worked since the Pandemic" Quarterly Bulletin, Box F: QB1 2023

assumption of holding the average working week constant at its 2023 level of 31.4 hours from 2027 to 2050 (Figure 8).

Labour force participation rate (P)

Over the period from 1970 to 1998, the labour force participation rate (LFPR) for persons aged 15-64 years declined from 77 to 69 per cent. The participation rate then increased during the period of rapid economic growth during the 2000s reaching 75 per cent in 2007. Following the collapse of the construction bubble in 2008, the participation rate fell to 71 per cent but then recovered gradually. In 2023, the LFPR stood at 76 per cent, up from 73 per cent in 2019 prior to the pandemic.

Underlying these changes in the aggregate LFPR, there are significant differences in the male and female participation rates. The male LFPR declined over time since the end of the construction boom in 2007. The female LFPR also declined in the aftermath of the financial crisis but by much less than the male rate and has increased sharply in recent years by around 6 percentage points. This has brought female labour force participation to its highest ever level in the latest data and has driven the rise in the overall participation rate.

Changes in legislation, educational attainment, social norms, worker preferences and the state of the economy have shaped how the participation rate has evolved over time.[11] Looking ahead, labour force participation could decline as the population ages although there are offsetting forces. Participation tends to be at its highest for those of prime working age (the cohort aged 25-54), lower among under 25s (due to participation in education) and in low single digits for those aged over 75. As the growth in the prime age population slows with ageing, this effect will weigh on participation. A factor pushing in the opposite direction is the evidence from the data showing increases over time in age-specific participation for older workers with high levels of educational attainment.

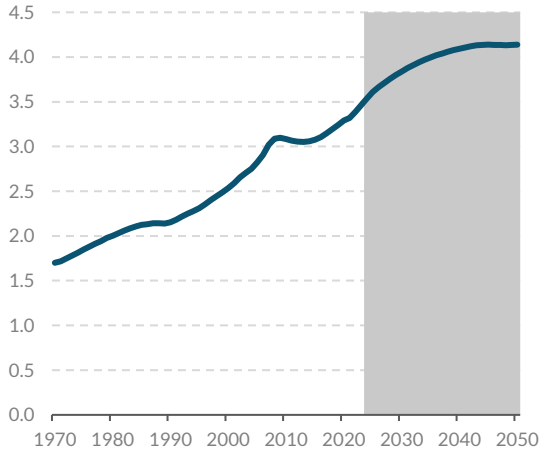
To project out to 2050, we use CSO labour force assumptions under the M1 scenario out to 2037 for each age cohort. Beyond this point, we assume gradual and continued increases in the LFPR for older age cohorts due to slow-moving birth-year effects. For instance, females born in 1990 have higher educational attainment than females born in 1970 and have a higher attachment to the labour force for a longer period through their careers. Aggregating up the individual age group participation rates based on this approach, the overall LFPR is assumed to increase steadily from 77.1 per cent

[11] See Boyd et al (2022) "Labour market recovery after a pandemic" for further details on female employment growth in recent years.

in 2037 to 78.3 per cent in 2050 (Figure 9). Combining the assumptions on the working age population and participation implies that labour force and employment growth would slow from about 1.3 per cent in 2027 to close to zero in 2050 (Figure 11 and 12).[12]

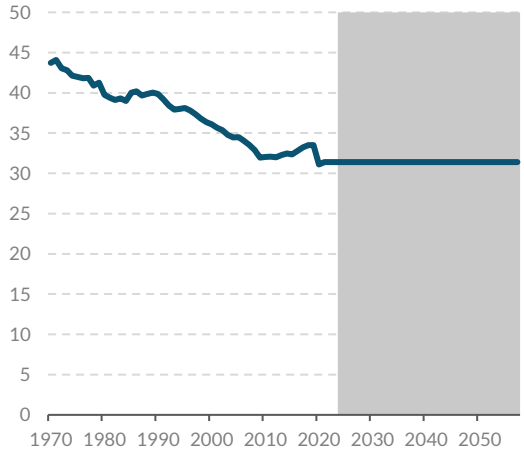
Working age population (15-64)

Figure 7
Persons (million)



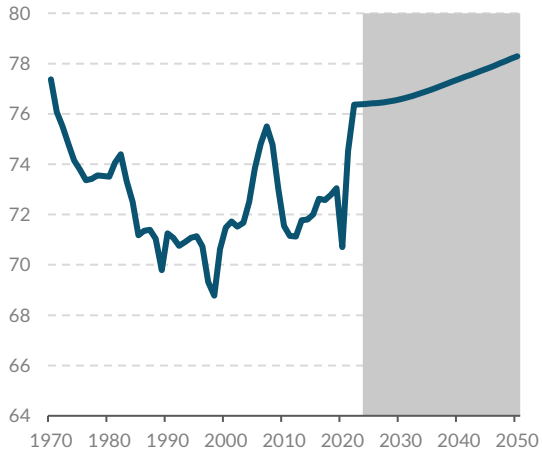
Average Weekly Hours Worked

Figure 8
Average hours per week



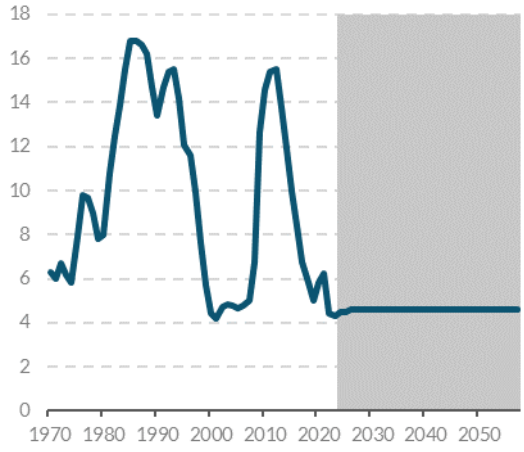
Labour Force Participation Rate

Figure 9
Per cent of working age population (15-64)



Unemployment Rate

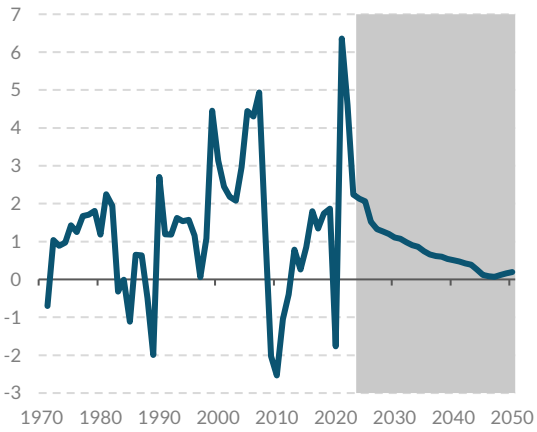
Figure 10
Per cent of labour force



[12] In growth accounting exercises, the unemployment rate is typically assumed to converge to its long-run equilibrium or natural rate. Estimating this rate for Ireland is complicated due to the openness of the labour market through migration. For example, during the construction boom in the 2000s, there was a large influx of workers from abroad but this reversed following the financial crisis with successive years of net outward migration from 2009. The highly elastic nature of labour supply makes it difficult to estimate a stable long-run equilibrium unemployment rate. In this analysis, the unemployment rate is assumed to stay within the range 4.5 to 5 per cent from 2027 to 2050.

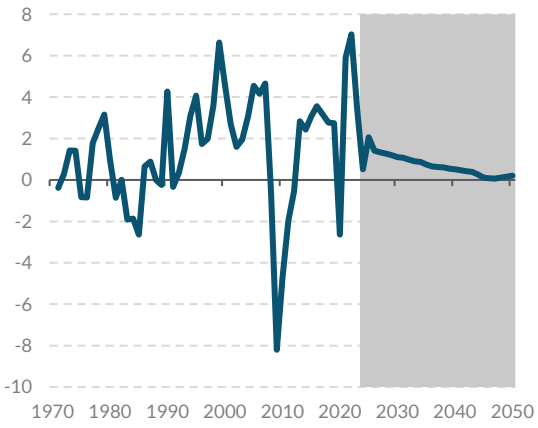
Labour Force Growth

Figure 11
Per cent



Employment Growth

Figure 12
Per cent



3.2 Total factor productivity assumption

TFP has been a key driver of growth in the Irish economy over the long-term (Table 1). As already noted, TFP is not directly observable and relies on an indirect measure called the Solow residual. Forming a baseline assumption for the value of this unobserved variable into the future is therefore a non-trivial exercise. Existing studies for Ireland (Fiscal Council (2020), Department of Finance (2023) and Egan and McQuinn (2024)) take the approach of assuming TFP growth remains fixed at a particular level over the forecast horizon. This level is typically based on recent observed TFP growth or assumed convergence to a particular TFP estimate. To inform the baseline projection in this *Article*, we analyse past trends in Irish TFP growth as well as the TFP growth outlook for Ireland's main trading partners; namely, the US and euro area.

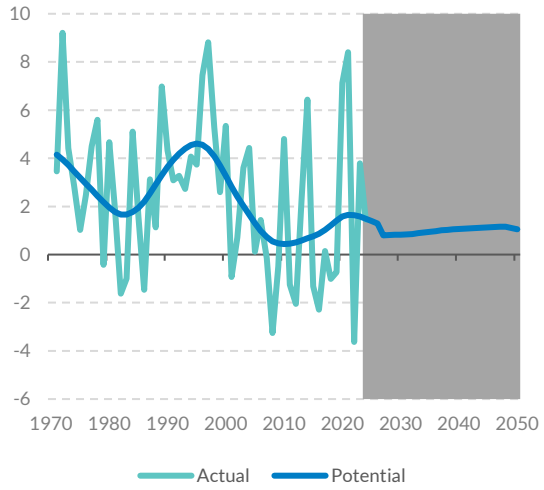
Figure 13 shows that TFP growth for Ireland is a volatile series. Over the sample from 1970 to 2023, TFP grew on average by 2.3 per cent per annum (1.4 percentage point contribution to growth). TFP grew rapidly in the second half of the 1990s, peaking during this period of rapid growth that reflected Ireland's "catch-up" with other advanced economies. TFP growth slowed thereafter and it would be optimistic to assume that growth rates similar to the late 1990s could be achieved again over the projection period. Since 2000, Ireland's TFP growth has measured a more modest 1.2 per cent on average (0.6 percentage point contribution to growth).

Figure 14 shows the average TFP growth rate for a selection of OECD countries over the 2012-2022 period using the Long Term Productivity (BCL) database. Over this decade, TFP growth for the euro area and UK has lagged

behind the US. Over the same period, estimated TFP growth in Ireland has been ahead of our main trading partners, including the US. In the long-run, it is expected that aggregate TFP growth for Ireland would be bound by the TFP growth rate of a frontier economy such as the US. The CBO (2024) has projected US TFP to grow by 1.1 per cent over the long-term out to 2050 while McQuinn and Whelan (2016) have projected a much weaker outlook for euro area, with TFP projected to grow by 0.2 per cent over the period 2014 to 2060.[13]

TFP Growth, Ireland, 1970 – 2050

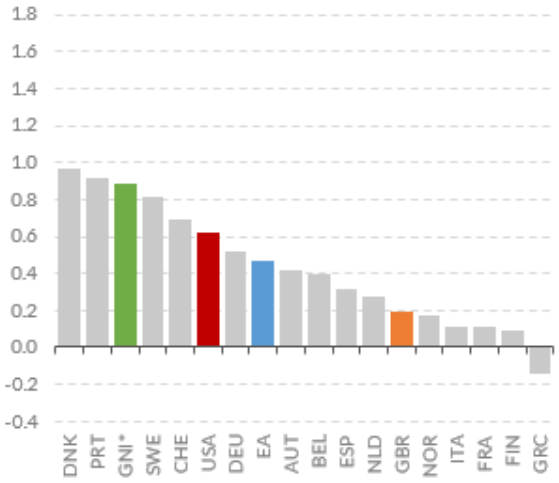
Figure 13
Per cent



Note: Green line shows the annual growth in TFP (outturn and projection). Blue line shows smoothed TFP growth derived from a HP filter applied to the raw series.

TFP Growth, OECD countries, 2012 – 2022

Figure 14
Per cent



Source: Bergeaud, A., Cette, G. and Lecat, R. (2016) and authors' calculations.

Taking into account this historical and cross-country information, our baseline projection for TFP assumes a growth rate (and contribution) of 0.6 per cent per annum from 2027 to 2050. This is equivalent to the average TFP growth rate for Ireland measured over the past 20 years. This projected TFP growth rate lies mid way between the projected estimates for the US and euro area. For comparison with other long-term growth studies for Ireland, Fiscal Council (2020) suggests that Irish TFP growth is somewhere between the range of 0.2 and 1 per cent while Egan and McQuinn (2024) assume a long-term TFP growth rate of 0.6 per cent. The Department of Finance (2023) assume that TFP would gradually decline from 0.8 per cent growth to 0.4 by 2050.

[13] A more recent paper by ECB (2021) estimates average TFP growth for frontier and non-frontier firms in the euro area of 3.4 and 0.6 per cent, respectively, since the GFC.

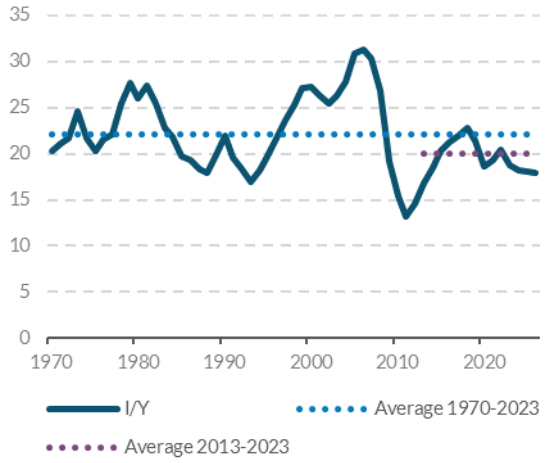
3.3 Capital input assumption

Our baseline projection for the capital stock involves making an assumption about the trajectory of the investment-to-output ratio.[14] Headline investment in Ireland is influenced by the global activities of MNEs, meaning that it is a poor indicator of investment in the domestic economy. To address this, FitzGerald and McQuinn (2024) estimate an underlying investment share for Ireland by relating modified investment to net national product instead of using total investment to headline GDP.[15] They find that the average ratio for Ireland over the 1995 to 2023 period was 25 per cent, which compares to 26 per cent for the rest of the EU. Egan and McQuinn (2024) subsequently use net national product and modified investment in their growth accounting exercise.

Consistent with the data in our production function framework, the investment share that we use is calculated as the ratio of modified investment to GNI* and is presented in Figure 15. In 2024, the investment share is estimated to be 17.9 per cent, which compares to the sample average of 22 per cent over the period from 1970 to 2023. Our baseline projection of the capital stock is based on the investment-to-output ratio gradually increasing from its current level of 17.9 per cent in 2024 to 20 per cent by 2050. This assumption reflects the more recent trend observed since the Global Financial Crisis (i.e. post-2012) and is consistent with an annual growth rate of 2.2 per cent for modified investment from 2027 to 2050 (Figure 16).

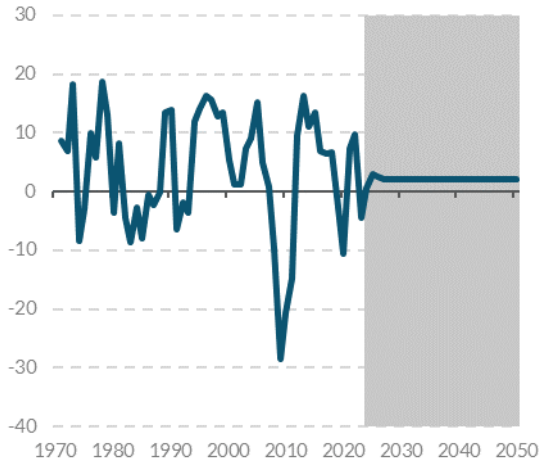
Investment to Output Ratio

Figure 15
Per cent of GNI*



Modified Investment Growth

Figure 16
Per cent



[14] The projection method for the capital input in this *Article* is similar to other recent papers such as Egan and McQuinn (2024) and Department of Finance (2023).
[15] Box D: What is the investment share of output in the Irish economy? (FitzGerald and McQuinn, 2024)

For comparison, Egan and McQuinn (2024) examine two investment scenarios. In the first, the investment rate rises gradually from 20 percent in 2023 to 25 per cent in 2030 and remains at that level out to 2040. In the second, the rate rises more sharply reaching 30 per cent by 2033. Department of Finance (2023) assume a baseline investment share of 23 per cent based on a historical average from 1995 to 2019.

3.4 Baseline projection – contributions to growth

To generate our baseline projection for GNI*, we use the assumptions described above for TFP, labour and capital as inputs into the production function. A summary of our baseline projection for GNI* growth is shown in Table 2. GNI* growth is estimated to slow from an average of 2.3 per cent from 2024-30 to 1.7 per cent per annum in the 2030s and 1.4 per cent in the decade up to 2050. The main drivers of the projection are TFP and capital with approximately equal contributions to overall growth. The labour contribution – while relatively strong in the short run – representing 36 per cent of GNI* growth, is expected to decline in the long run making only a marginal contribution to growth by 2040.

Table 2: Baseline decomposition of potential GNI* growth

% annual average growth rates

Period	GNI*	TFP	Capital	Labour
2024 – 2030	2.3	0.9	0.6	0.8
2031 – 2040	1.7	0.6	0.7	0.5
2041 – 2050	1.4	0.6	0.7	0.2
2024 - 2050	**1.8**	**0.7**	**0.7**	**0.4**

Source: authors' calculations.

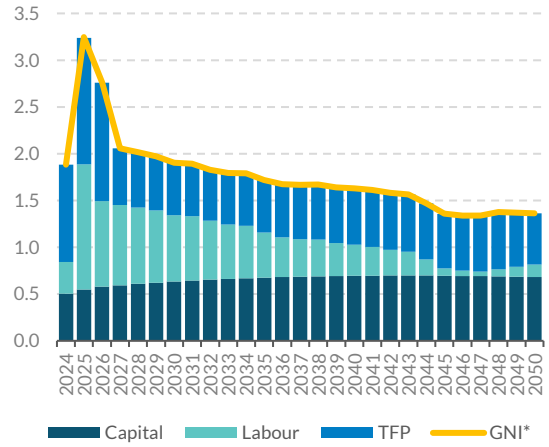
The full dynamics of the baseline projection are shown in Figure 17. The chart shows that the TFP contribution is projected to be stable over time and that the capital contribution increases slightly as the investment-to-output ratio gradually rises towards its historic average. The major offsetting factor is the gradual reduction in the labour contribution to growth. This declines out to 2050 as the growth of the working age population slows down, and then turns slightly negative from 2046.

It is useful to examine of the implications of the projections for overall economic growth for welfare, in this case proxied by GNI* per head, and to

compare this to its long-run trend.[16] Taking GNI* per head as a measure of living standards, this is projected to grow broadly in line with its long-run trend out to 2030, but to fall below the trend estimate thereafter (Figure 18).

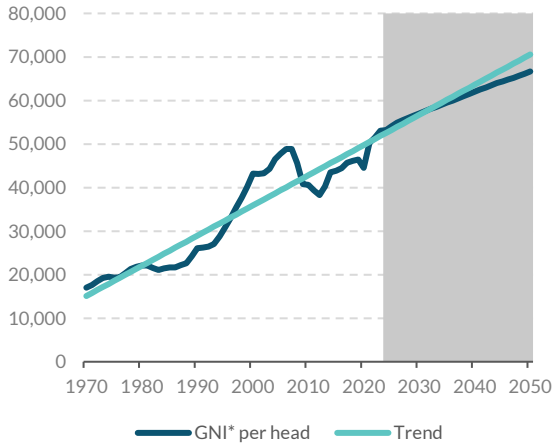
Baseline Projection of GNI* Growth 2024-2050

Figure 17
Per cent



Baseline Projection of GNI* per head 1970-2050

Figure 18
Euro million, (constant prices 2022)



Comparison with other recent long-term projections for Ireland

The baseline projections in this *Article* can be compared to the results from other similar exercises for Ireland over a common projection period for which the results are available, i.e. 2031-2050 (Table 3). The long-run potential growth estimate for this period of 1.6 is slightly above projections by Fiscal Council (2020), Department of Finance (2023), and Egan and McQuinn (2024). All of these recent estimates, including this *Article*, imply that the growth rate of the economy is projected to more than halve by 2050 from its estimated annual average outturn from 1970-2023.

[16] GNI* per head is a measure of welfare consistent with our framework. See Honohan (2021) for an analysis of aggregate welfare measures for Ireland. The long-run trend is estimated over the period 1970-2023.

Table 3: Summary of Recent Long-Term Growth Projections for Ireland

% annual average growth rates

	Period	Real GNI*	TFP	Capital	Labour
Fiscal Council (2020)	2031-2050	1.0	0.4	0.4	0.2
Department of Finance (2023)	2031-2050	1.3	0.4	0.7	0.2
Egan and McQuinn (2024) *	2031-2050	1.3	0.6	n.a.	n.a.
This Signed Article	**2031-2050**	**1.6**	**0.6**	**0.7**	**0.3**

Note: Egan and McQuinn (2024) use Net National Product.

4. Sensitivity Analysis informed by Medium to Long-Term Transitions

Four key structural transitions already underway will shape the future long-term growth prospects of the Irish economy. These are:

1. Demographic change and population ageing
2. Geoeconomic fragmentation
3. Technological change and the adoption of digitalisation
4. Climate change and the green transition

Each of these transitions will affect the long-term growth potential of the economy through their impact on the labour market, capital and TFP. In this section, we discuss the challenges posed by these four key transitions. We consider sensitivities around the baseline projection informed by the possible transmission channels of these changes to the economy.

4.1 Population growth, migration and retirement

The baseline scenario takes the CSO's high-migration population projection, which envisages a rise in the population of 1.4 million persons (26 per cent) by 2050. Migration is the most uncertain and volatile component of the change in the population. This is evidenced by the experience of Ireland over the last 50 years where prolonged periods of net emigration have been followed by years of sustained and significant net immigration. These large swings in migration flows have been influenced by the relative performance of the Irish economy along with global factors such as, for example, the start of the war in Ukraine. Future migration flows are difficult to forecast and will continue to be influenced by factors such as the performance of the Irish economy in a global context, geopolitical events and climate change.

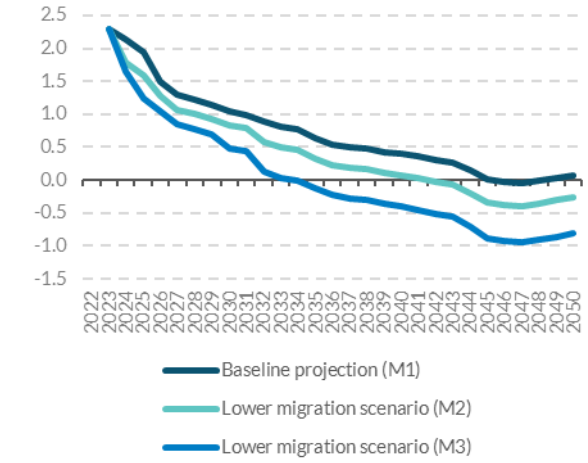
To illustrate the sensitivity of economic growth to the projected change in the population, we investigate the impact of an alternative assumption involving lower net inward migration than in the baseline. Our baseline assumption is net inward migration of 45,000 per year from 2027 to 2050 corresponding to the

CSO's M1 migration scenario. The alternative assumption is based on the CSO's M3 migration scenario, which assumes net inward migration of 10,000 per year from 2032.[17]

In the baseline scenario, growth in the working age population comes to a halt by the mid-2040s. In the alternative low migration case, this occurs much earlier in 2034 (Figure 19). This demographic effect would reduce the potential labour input and long-term growth of the economy. There is a corresponding rise in the old-age dependency ratio under the alternative M3 scenario, which would exert additional pressure on the government's fiscal position (Figure 20). The CSO also produces an intermediate case with net inward migration of 30,000 per year from 2032 and we include this for comparison (Figures 19 and 20).

Population Growth (15-64), 2023-2050

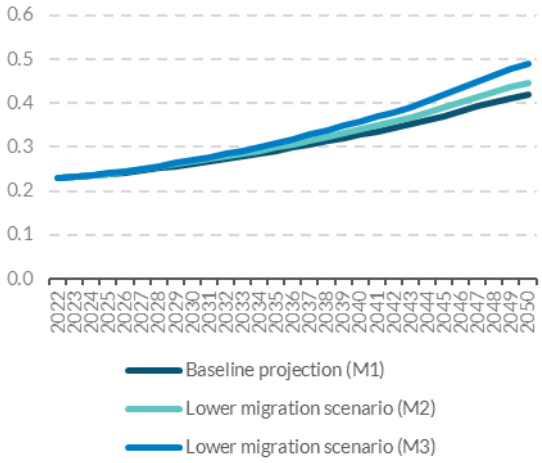
Figure 19
Per cent



Source: PEC19, M1 scenario, Central Statistics Office.

Old Age Dependency Ratio, 2023-2050

Figure 20
Population (65+) / population (15-64)



Source: PEC19, M1 scenario, Central Statistics Office.

Table 4 shows that under the baseline scenario, the contribution of labour gradually declines from 0.8 to 0.2 per cent over the long-run with GNI* growth converging to 1.4 per cent. Under the lower net inward migration assumption (M3), the labour contribution turns negative in the long-run from the early 2030s. This in turn results in lower GNI* growth over the projection horizon. From 3031 to 2040, GNI* growth falls to 1.1 per cent with low migration compared to baseline growth of 1.7 per cent (Table 4).

[17] From 2027 to 2032, net migration is 20,000 per annum in the *low migration* scenario. For a detailed description of the CSO's migration assumptions, see: https://www.cso.ie/en/releasesandpublications/ep/p-plfp/populationandlabourforceprojections2023-2057/migrationassumptions/.

Table 4: Sensitivity Analysis: GNI* growth and contribution of labour

Period	Baseline Projection (M1)			Lower Migration (M3)	
	GNI*	Labour		GNI*	Labour
2024 – 2030	2.3	0.8		1.7	0.4
2031 – 2040	1.7	0.5		1.1	0.0
2041 - 2050	1.4	0.2		0.7	-0.4

Source: authors' calculations.
Note: TFP and capital are unchanged from the baseline projection.

Box A: Demographic risks to the Irish labour market

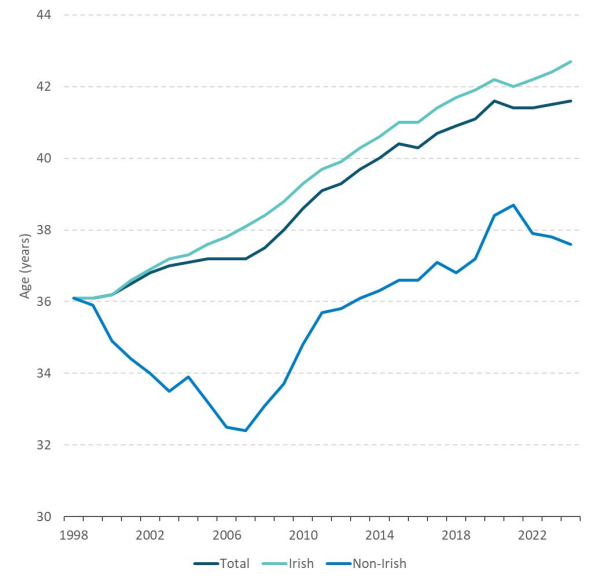
Ireland, like many other advanced economies, is facing the challenges associated with an ageing labour force. This demographic change could potentially reduce output levels as a greater number of workers flow into retirement than are replaced.[18] The loss of key skills can be disruptive to sectors and act to increase wage pressures as labour supply is diminished. The fiscal cost of an ageing population would likely place a strain on government finances as declining birth rates and rising life expectancy cause the number of pensioners to increase relative to workers. This *Box* identifies changes in the age profile of the labour market in Ireland with a focus on retirement trends and highlights potential risks to future labour supply growth.

The average age of the labour force in Ireland has increased from 36 years in 1998 to 42 years in 2024 (Figure 1). The trend is higher again for Irish workers with net inward migration of younger workers helping to slow down the rise in the average age of the overall workforce. Net inward migration has been particularly important for fuelling the expansion in the labour force since the pandemic. Non-Irish citizens have accounted for 42 per cent of the increase in the labour force since 2019 and now represent 20 per cent of the overall labour force. Using LFS panel microdata, we estimate that the average age at which an employee transitions to retirement has shown an upward trend to 64.8 years in 2024 up from 61.7 years in 1998 (Figure 2). We limit this analysis to persons with employee status only as retirement age may be set out in the contract of employment, while comparatively there is no set retirement age readily available for self-employed persons.[19,20.] There are

[18] Wider risks are outlined in greater detail in ECB analysis on macroeconomic and fiscal impact of population ageing
[19] The majority of self-employed workers aged 60 years or over are employed in the agriculture sector. The retirement age in this sector is higher than other for a number of reasons such as the nature of work and difficulties in changing ownership of a farm business as it is often linked to the family home.
[20] Mandatory retirement ages for set for certain occupations in the public sector, some of which are below 65 years, which contributes to the average transition age being lower than the state pension age.

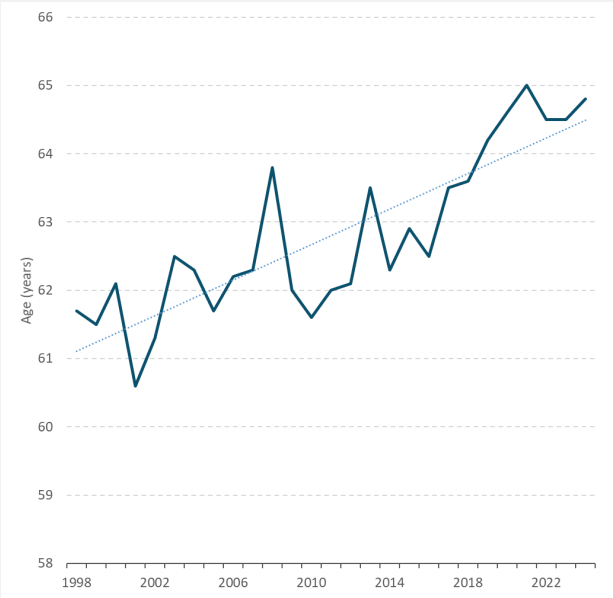
some fluctuations in the trend due to policy measures such as the Croke Park Agreement and increases in the state pension age to 66 years in 2014.[21] At the other end of the age distribution, the average age at which persons transition from education to employee status at the start of their career has increased from 19 years to 21 years. This is due in part to increased educational attainment and changes in the sectoral composition of the workforce.[22]

Figure 1: Average age of labour force by citizenship status



Source: CSO; LFS

Figure 2: Average retirement age for employees



Source: CSO; LFS

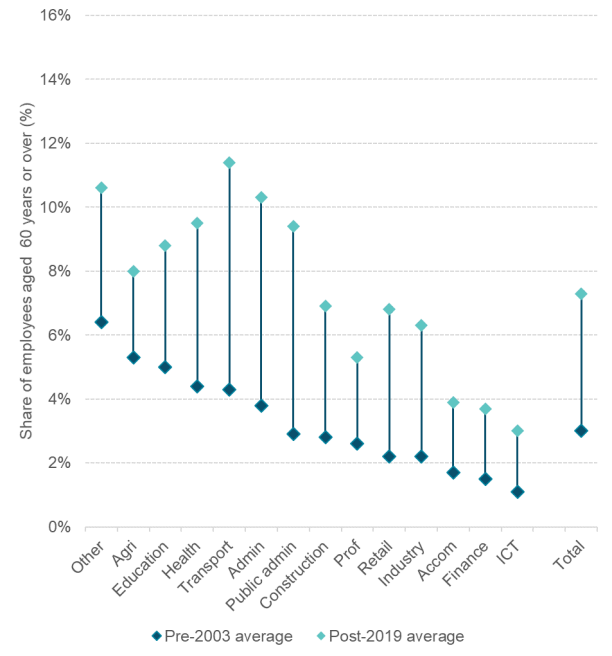
Note: LFS respondents are treated as retired when both ILO status is inactive and principal economic status is retired

These ageing trends are evident in each economic sector with average retirement ages rising across all NACE sectors over time.[23] The share of employees aged 60 years or over in recent years is notably higher than the pre-2003 period, increasing from 3 per cent to 7.3 per cent (Figure 3).[24] This places Ireland amongst the middle of the euro area distribution and below the average (9.1 per cent). An ageing society places additional pressure on healthcare, which aside from increased funding will require additional workers to provide adequate services with 9.5 per cent of employees already aged 60 years or over. Since 2020, the health sector has accounted for 1 in every 3 employment permits granted which points

[21] Under the Croke Park Agreement (2010-2014) a voluntary early retirement scheme was proposed to public sector staff. See Public Service Agreement for further details
[22] We define labour market entry if a person is ILO inactive with principal economic status (PES) as a student in time t-1, which then changes to employment status in both ILO and PES terms in time t.
[23] Average retirement ages between 2019-2023 ranges from 70 years in Agri to 63.3 years in ICT.
[24] The figure for agriculture in the post-2019 period is 36.4 per cent when including self-employed workers.

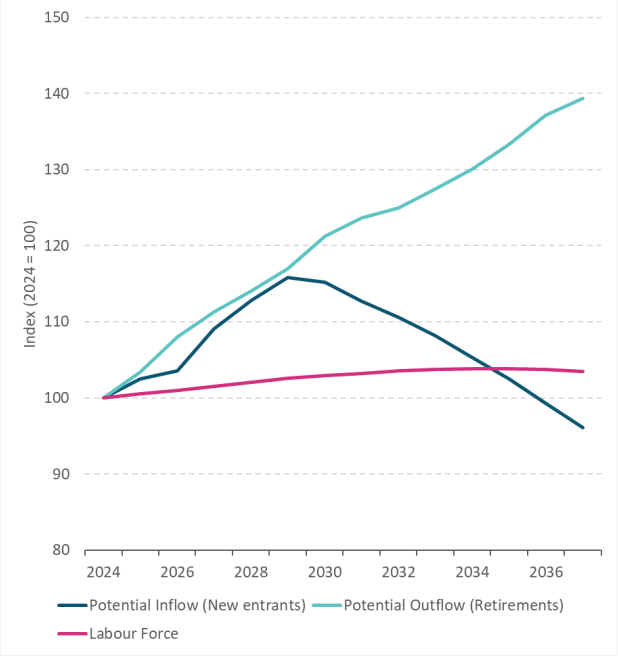
to the continued reliance on net inward migration to fill vacancies, many of which appear on the critical skills occupations list. Constraints may also appear in the transport and construction sectors over the coming years, which are amongst the sectors with the largest increases in older age cohorts.

Figure 3: Share of employees aged 60 years or over by NACE sector



Source: CSO; LFS

Figure 4: Projected path of domestic labour force inflows and outflows



Source: CSO and author's calculations

Note: Potential inflow is the sum of all persons aged 21 years or under weighted by expected LFPR. Potential outflow is the sum of all persons aged 65 years or over weighted by expected LFPR.

Within the CSO population and labour force projections, the share of persons in the overall labour force aged 60 years or over is expected to increase from 10.1 per cent in 2022 to between 12.9 per cent and 13.7 per cent in 2037 based on various scenarios for net migration. In order to assess the effects of ageing on the domestic labour force in the coming years in the absence of further net migration, we calculate the average participation rate for each age between 15-74 years based on 2024 values. These participation rates are then applied to the population by single year of age from CSO annual population estimates to calculate an expected annual labour force out to 2037 assuming no further policy changes to the state pension age (Figure 4). In the absence of net inward migration, the labour force growth would average just 0.5 per cent out to 2030 despite the potential inflow of younger cohorts peaking in 2029. Labour force growth would then turn negative from 2035 onwards with lower labour supply levels negatively impacting sectoral activity. This

highlights the importance of continued net inward migration to increasing labour supply in Ireland.

Retirement Age Impact on the Labour Force and Growth

Under the baseline projection, the weighted average age of the labour force would continue to increase out to 2050 beyond the current profile outlined in Box A. The annual growth rate in the working age population would converge toward zero with a subsequent negative effect on economic growth through the labour input channel. One way to mitigate these effects is to increase the pension age, which has risen gradually over time (Box A). In Ireland, the state pension aged was increased from 65 years to 66 years in 2014 as part of broader pension reform efforts aimed at addressing long-term fiscal sustainability challenges posed by demographic changes. The pension age has increased in many other European countries to address similar challenges with further increases proposed in some countries in the coming decades in line with changes in life expectancy.

The Pension Commission (2021) proposed a very gradual increase in the pension age by three months each year from 2028 to reach 67 in 2031.[25] This rate of increase would then slow to three months every two years from 2033 to reach 68 in 2039. The gradual implementation was envisaged to reduce the impact of the pension age increase on upcoming pensioners. To examine the sensitivity of the baseline growth outlook to a gradual assumed increase in the length of working lives, we estimate the impact on the labour force of increasing the retirement age to 70 by 2042, guided broadly by the parameters of the Pension Commission recommendations.

To construct this projection, we use the CSO labour force assumptions as in the baseline projection out to 2037. This approach implements the same changes in LFPR driven by birth year and age cohort effects as the baseline scenario. Beyond this point, we gradually increase the LFPR for older age cohorts in line with changes in the retirement age. For instance, the LFPR for persons aged 55-59 years is gradually increased to match the participation rate for persons aged 50-54 years.[26] As the retirement age is pushed out to 70 years, the

[25] See Chapter 11 of "Report of the Commission on Pensions" (2021) for further details.
[26] The LFPR for persons aged 60-64 years in 2024 is gradually increased out to 2057 to match participation for those currently aged 55-59 years. The same is done to align increase persons aged 65-69 years to match current persons aged 60-64 years.

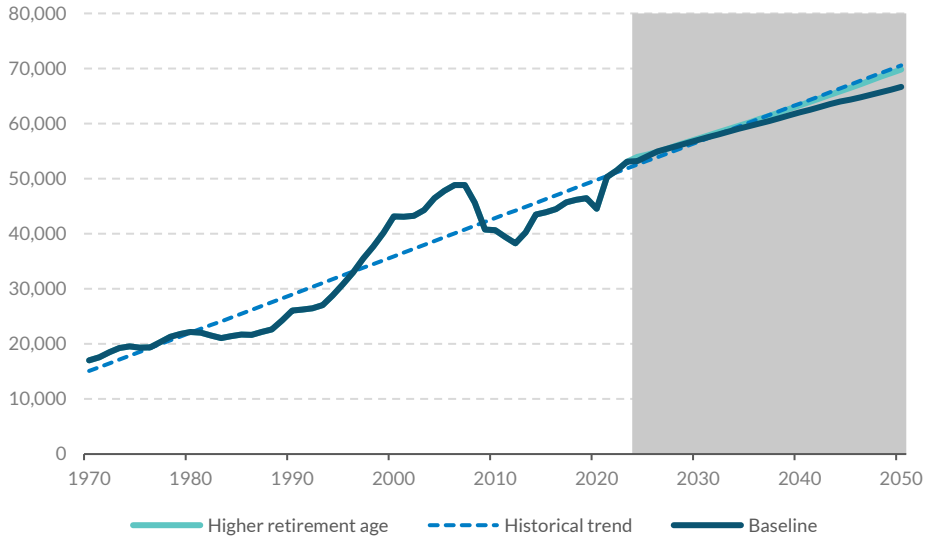
definitions of both the labour force and the working age population are expanded to 15-69 years under for this sensitivity analysis.

Table 5: GNI* growth and contributions

Period	Baseline Projection (M1)		With Retirement Age Increase	
	GNI*	Labour	GNI*	Labour
2024 – 2030	2.3	0.8	2.3	1.1
2031 – 2040	1.7	0.5	1.9	0.6
2041 – 2050	1.4	0.2	1.7	0.3

GNI* per head Baseline and Higher Retirement Age Sensitivity Analysis, 1970-2050

Figure 21
Euro million, constant prices 2022



These combined changes would see the expanded labour force reach 3.5 million persons by 2050 compared to 3.25 in the baseline. The effect of an increased retirement age yields a higher contribution from labour relative to the baseline of up to 0.3 percentage points (Table 5). The higher contribution from labour would raise the potential growth rate of the economy to 1.7 per cent from 2040-2050, compared to 1.4 per cent in the baseline. This faster pace of growth would sustain GNI* per head broadly in line with its long-run trend out to 2050 (Figure 21).

4.2 Geoeconomic fragmentation and improving economic resilience

Geoeconomic fragmentation refers to a policy-driven shift away from global economic integration towards more inward-looking domestic policies, such as

the re-shoring of manufacturing industries and imposing tariffs on imports. This emerging political trend poses a particular risk to the Irish economy, which is a small open economy dependent on the benefits of globalisation. According to Aiyar et al. (2023), the cost of geoeconomic fragmentation on global output could range from 0.2 per cent to up to 0.7 per cent of GDP. These estimates can reach up to 12 per cent of GDP for some countries depending on the severity of the scenario.

Geoeconomic fragmentation would represent an external shock to the Irish economy that could manifest through various effects. For example, foreign companies currently based in Ireland could decide to limit the extent of new investment taking place in Ireland or even to reshore some of their activities back to their home country. These risks could affect the potential growth of the Irish economy through each of the inputs to the production function. The most direct channel would be through lower investment, but there would also be a loss in terms of productivity as foreign MNEs typically provide high value-added jobs and can have positive technology spillovers to the rest of the economy. There would also be an adverse effect on the public finances from lower tax receipts. As discussed elsewhere in this *Bulletin*, the introduction of tariffs would reduce trade flows and could eventually lower investment and productivity with negative implications for long-run growth.

In a more benign scenario, Ireland could stand to benefit in some respects, for example if our main trading partners were to adopt friend-shoring policies. Under this kind of scenario, US and European companies could potentially move some production to Ireland. However, in the current context in which the Irish economy is operating at or above capacity there could be costs arising from capacity constraints in the labour, utilities and housing markets. Price pressures through any of these channels would work towards eroding the competitiveness of the Irish economy. Overall, depending on the precise nature and depth of fragmentation, it could have large economic ramifications for the global and Irish economies in the years and decades ahead.

To bolster the resilience of the economy and boost economic growth in Europe in the face of risks from geoeconomic fragmentation and other structural changes, the Draghi Report recommended an increase in investment across the EU, which has fallen to low levels since the financial crisis both in a historical context and in comparison to the US. For this sensitivity analysis, we consider an alternative assumption with a higher rate of investment in Ireland than assumed in the baseline to illustrate the impact on overall long-term growth. This more optimistic investment assumption could arise through a mix of both public and private investment. We assume that investment grows at a higher

rate of 3.2 per cent per annum compared to 2.2 per cent in the baseline. Under this assumption, the investment-to-output ratio increases to 25 per cent by 2050 with an average of 21 per cent over the projection period. This compares to an average investment-to-GNI* ratio of 18.5 per cent in the baseline. Table 6 for shows that this additional investment would lead to a larger capital contribution to growth and a higher long-term growth rate for GNI*. From 2030, the additional investment would boost growth by around 0.3 percentage points per annum compared to the baseline scenario. The model estimates are linear such that a decline in investment of 1 percentage point would reduce baseline growth by a similar amount.

Table 6: Baseline and Higher Investment Sensitivity Analysis, GNI* growth and contribution of capital

Period	Baseline Projection (M1)			With Higher Investment	
	GNI*	Capital		GNI*	Capital
2024 – 2030	2.3	0.6		2.4	0.6
2031 – 2040	1.7	0.7		1.9	0.8
2041 - 2050	1.4	0.7		1.7	0.9

Source: authors' calculations.

Note: TFP and labour are unchanged from the baseline projection.

4.3 Technological change, digitalisation, and AI

Technological change and digital technologies are constantly influencing society and the economy. The 1990s gave rise to the internet which fundamentally changed how we communicate and do business. Today, the current wave of transformative technologies includes, for example, cloud computing, high-performance computing, artificial intelligence, machine learning and big data. These technologies make it feasible to automate both routine and more complex tasks and to operate more efficiently. However, the digital transformation poses challenges as well as opportunities making it difficult to determine what the overall impact on the economy will look like. On the one hand, digitalisation promises to increase productivity and growth, create jobs, and even lead to completely new sectors. At the same time, the digital transformation is expected to include disruptive processes too, threatening to replace humans in some jobs while complementing them in others.

According to Cazzaniga et al. (2024), about 40 per cent of global employment is exposed to AI, with this estimate rising to 60 per cent for advanced economies due to their prevalence of cognitive-task-orientated jobs. Exposure to AI can, of course, can have a positive impact (e.g. productivity gains) or a negative impact (e.g. job loss). Indices aimed at measuring "AI complementarity potential" suggest that about half of the global employment exposed to AI could be negatively affected while the remaining 50 per cent could experience gains in productivity through the adoption of AI. Estimating the overall impact of AI and related technologies on the economy is a difficult exercise and will depend on modelling assumptions, but research by IMF (2024) suggests that the adoption of AI could have a positive medium-run impact on global economic growth in the range of 0.2 to 0.7 percentage points.

Table 7: Baseline and Higher TFP Sensitivity Analysis, GNI* growth and contribution of labour

Period	Baseline Projection			With Higher TFP	
	GNI*	TFP		GNI*	TFP
2024 – 2030	2.3	0.9		2.4	1.0
2031 – 2040	1.7	0.6		2.2	1.0
2041 - 2050	1.4	0.6		1.9	1.0

Source: authors' calculations.
Note: Labour and capital are unchanged from the baseline projection.

In Ireland, the presence of well-established ICT manufacturing and services sectors suggests that there may be opportunities for the economy to harness the benefits of enhanced digitalisation, but realising these gains will not be clear-cut. Older workers, those with lower levels of educational attainment and reduced job mobility are likely to face challenges in response to the changing nature of work triggered by digitalisation.

Motivated by the potential positive effects of the adoption of AI and digitalisation, we consider an alternative assumption where TFP grows at a higher rate than assumed in our baseline. Under this alternative assumption, TFP growth is assumed to grow at 1 per cent compared to 0.6 per cent in the baseline. This would bring TFP growth closer to the annual average observed for Ireland since 2012 and in line with the long-term projection for the US. Under this stylistic alternative assumption and more optimistic TFP growth path, the economy would grow at closer to 2 per cent in the long-run, compared to 1.4 per cent in the baseline (Table 7).

4.4 Climate change and the green transition

Climate change is a major structural issue that is already affecting society and the economy. Together with the transition towards a net-zero economy, there are significant implications for the macroeconomy that are complex and uncertain. The economic analysis of the potential impact of climate change focuses on physical and transition risks. Physical impacts of climate change can disrupt economic growth through damage to infrastructure and the capital stock, reduced labour productivity, slower human capital accumulation and diminished human health. Physical impacts are likely to lead to higher economic uncertainty and greater inequality (Lopez et al. (2022)), and raise inflation (Kotz et al. (2023)). The ultimate effects of physical risks on the capital stock and hence potential growth are highly uncertain and among other factors, will depend on the severity of the effects and progress with implementation of climate adaptation measures over the coming years.

Transition risks refer to the potential effects on the macro economy that may arise as it decarbonises and moves towards a net zero position. To mitigate against physical impacts, the transition to a net-zero economy will require increased investment and a reallocation of labour, which could reduce inflation and boost growth. For example, higher investment in renewables should reduce energy prices over the long run as the economy becomes more electrified and the share of renewables in electricity generation increases. However, a delayed transition could lead to more stringent policies being adopted in the future, leading to greater disruptions to the labour market and ultimately raising the cost of transition. This could lead to stranded assets, where there is a sudden/sharp fall in the value of the existing capital stock in 'brown' sectors.

The green transition may reduce productivity growth in the short term, as increased production costs (e.g. due to carbon taxes) coincide with a requirement to invest in technologies that may not increase firms' productive capacity relative to the more carbon intensive methods currently in use. The effect will likely vary across different sectors of the economy. There is evidence that the best-performing firms actually increase their productivity when faced with new environmental regulations, especially when they have access to credit and operate in countries where environmental regulations have existed for some time (Pisani-Ferry and Mahmouz (2023)). Low-performing firms are more likely to struggle to adapt to increased input costs and an accelerated depreciation of their existing capital. In the long-run, economy wide productivity could return to or surpass its pre-transition growth rate so that the economic benefit of climate adaption outweighs the costs

(Alestra *et al.* (2020)). There is some evidence of positive productivity spillovers e.g. Dechezlepretre et al (2017) find that knowledge spillovers, as measured by patent citations, are significantly higher for 'green' compared to 'brown' technologies. They suggest that the knowledge spillover effect of low-carbon technologies is comparable to that from information and communications technologies (ICT). The effect on overall growth will also depend on the nature of green taxation measures introduced between now and 2050, as well as the extent of Government support through subsidies. The policy mix will also have an effect on long-term growth, with carbon pricing policies associated with more positive productivity outcomes than regulations or subsidies (Gugler et al, 2021).

The impact on Ireland will also depend on the impact of climate change and transition-related policies in other countries i.e. international spillovers could be substantial. For example, this could be related to disruption to trade flows, to higher energy prices or to higher interest rates stemming from the higher demand for 'green' capital goods, along with the impact on international migration.

The Central Bank is in the process of modifying its structural macroeconomic models to incorporate the transmission channels for different types of climate-related risks. To capture the impact of climate risks on the supply side of the economy, this work includes modifying the CES production function to directly contain energy as a factor of production, split into fossil fuels and renewables. As this work progresses, it will allow the models to better account for the complex transmission channels for different types of climate-related risks.

4.5 Summary

Figure 22 presents a summary of the baseline and sensitivity analyses explored in this *Article*. In the baseline projection, GNI* growth is expected to slow over the coming decades with growth projected to be well below its long run historical trend of 3.2 per cent by 2050. Sensitivity analysis assuming higher labour supply (reflecting longer working lives), TFP and investment reflect more optimistic potential outcomes for the long-run outlook, allowing the economy to grow faster than the baseline. The lower migration growth path represents a less benign scenario and would reduce the estimated potential growth rate of the economy significantly.

From a welfare perspective, GNI* per head in the baseline is projected to fall below its long run historical trend by 2032 and remain on a lower path out to 2050 (Figure 23). Assuming a gradual rise in the retirement age and higher

investment would enable GNI* per head to grow broadly in line with its historical trend out to 2050. Assuming an increase in TFP growth would put GNI* per head on a permanently higher path when compared to both the historical trend and the baseline scenario. The lower migration assumption would result in a smaller economy and weaker GNI* per head than in the baseline.

Stylised growth paths for the Irish Economy, 2024-2050

Figure 22
GNI* (average) growth rate, per cent

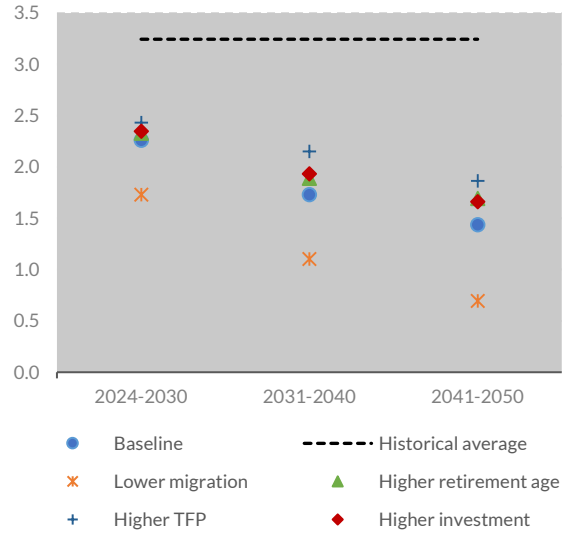
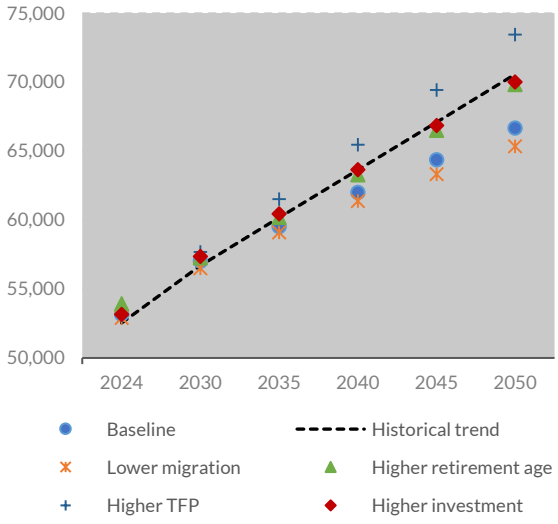


Figure 23
GNI* per head, euro million (constant 2022 prices)



Source: authors' calculations.

The sensitivity analysis in this *Article* considers the impact on long-term growth of individual changes in assumptions on population growth, investment and TPF. In reality, these fundamental drivers of growth interact with each other such that a change in one would cause spillovers to the others. Both more adverse or benign scenarios than presented in the baseline could emerge as a result of these interactions. For example, an adverse scenario could arise if key infrastructure challenges and the climate transition are not adequately addressed, leading to a lower capital stock. This could limit the extent of net inward migration, as well as the relative willingness of MNEs to expand activity in Ireland in the context of more fragmented global trade. Lower trade and investment would also negatively affect productivity, further weighing on overall growth.

A more benign scenario than presented in the baseline case is also possible if these effects were reversed. This would see well-targeted investment to address infrastructure deficits and the climate transition boosting the capital stock, enabling further growth in labour supply and raising the productivity of the workforce and the economy. These effects could be further enhanced if the

economy and labour market successfully embraces the opportunities presented by ongoing technological change. These interactions demonstrate how policy choices have an instrumental role to play in determining the future path for the economy and living standards.

5. Conclusion

This *Article* considers the long-term growth prospects for the Irish economy out to the middle of the century using a growth accounting framework. Given the uncertainty in assessing the outlook over such an extended period, we carry out sensitivity analysis around the key determinants of future potential growth. Taking the most optimistic official population estimate from the CSO based on continuing high levels of net inward migration, the potential growth rate of the economy is still projected to slow markedly over the coming decades as the population ages and the growth in the working age population slows. The annual average potential growth rate of the economy in this scenario would slow to 1.4 per cent from 2040, less than half the current estimated rate. If inward migration dropped below that assumed in the *high migration* case, the potential growth rate of the economy would slow further.

Along with high levels of inward migration, recent growth in the Irish economy has been boosted by increases in labour force participation. This has in part been driven by increases in participation for older workers, which in turn has benefited from the effects of educational attainment. Under an assumption where the retirement age is increased gradually to 70 by 2042, sensitivity analysis shows that this would raise labour supply and help to slow down the projected moderation in growth that would occur in the absence of this change.

Along with the demographic transition, the economy's growth outlook will be shaped by other major transitions currently underway linked to climate change and the transition to net zero, the growth of digital technologies and geoeconomic fragmentation. The ultimate implications of these changes for long-term growth and whether the effects will be positive or negative are uncertain and are the subject of much ongoing analysis and research in Ireland and abroad. In the case of the digital transition, existing evidence points to the potential for a positive impact on growth. Sensitivity analysis in the *Article* shows that if the Irish economy can harness the benefits of the transition such that productivity growth is raised, this could help to lift long-run potential growth.

Ireland's ratio of investment to output is currently low by historical standards. The eventual overall impact of geoeconomic fragmentation and the transition

to net zero on investment and the capital stock is uncertain. Our sensitivity analysis illustrates that raising the investment-to-output ratio by one percentage point could add between 0.3 and 0.4 percentage points to annual growth from 2030, raising incomes per head. A decline of one percentage point would reduce growth by similar amounts.

Achieving sustainable economic growth that delivers improvements in living standards, while at the same time the economy goes through these major structural transitions, undoubtedly presents government and policymakers with a tough task. Public policy has an important role to play in making the broader economy and labour market fit for purpose in light of the challenges that lie ahead. It is clear that Ireland's infrastructure in housing and other areas has not kept pace with the growth in population.[27] This may be reducing labour supply by discouraging much needed inward migration. In addition to investment, there is an important role for policy in improving the planning, development and delivery of infrastructure at scale.

In relation to the labour market, investment in human capital, skills and life-long learning is instrumental in ensuring that the workforce and the economy as a whole can adjust to, and take advantage of, the opportunities of the climate and digital transitions. Policies that promote the retraining of workers and improve labour mobility are paramount, as recommended by the National Competitiveness Council and OECD, and acknowledged in Ireland's National AI Strategy.[28, 29] Similarly for firms, a focus on investment in research and development and fostering innovation would improve productivity, better enabling firms to adjust to the green transition and digitalisation.

[27] See https://www.centralbank.ie/docs/default-source/publications/quarterly-bulletins/quarterly-bulletin-signed-articles/economic-policy-issues-in-the-irish-housing-market.pdf?sfvrsn=9879661a_12
[28] See National Competitiveness Council, 2023. "Ireland's Competitiveness Challenge 2023 (PDF 2.41MB)" and OECD, 2023. "OECD Employment Outlook 2023: Artificial Intelligence and the Labour Market
[29] See AI - Here for Good. A National Artificial Intelligence Strategy for Ireland. (PDF 6.41MB)

Banc Ceannais na hÉireann
Central Bank of Ireland

Eurosystem