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From Demographic Dividend to Demographic Drag: Fertility Decline and Long-Run Economic Performance

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From Demographic Dividend to Demographic Drag: Fertility Decline and Long-Run Economic Performance

Abstract

Declining fertility is reshaping the demographic outlook of advanced economies, but its long-run macroeconomic consequences remain insufficiently understood. Using a dynamic simulation model calibrated to Sweden, this paper examines how alternative fertility and migration scenarios affect population dynamics, dependency ratios, GDP, GDP per capita, and economic growth between 2025 and 2100. We identify an important intertemporal trade-off. Lower fertility initially raises GDP per capita through a temporary demographic dividend as the share of children declines. Over time, however, these gains are reversed as population ageing reduces the working-age population and slows economic growth. At current fertility rates, GDP in 2100 is approximately 13 percent lower than under a stable demographic scenario, while declining fertility combined with lower migration reduces GDP to less than half the stable-scenario level. Importantly, demographic composition matters at least as much as population size: similar population levels can generate markedly different economic outcomes depending on age structure. Migration can moderate the adjustment but cannot fully offset the long-run effects of persistently low fertility. These findings highlight demographic structure as a key determinant of long-run economic performance and sustainable public finances.

Keywords: Fertility, demographic change, economic growth, welfare state, microsimulation

JEL Classification: J11, E24, H55

1. Introduction

Declining fertility has emerged as one of the defining demographic challenges facing advanced economies. Across the 38 countries in the Organization for Economic Co-operation and Development (OECD), fertility rates have fallen well below replacement level, usually set at 2.1, while increasing life expectancy has accelerated population ageing. In many countries, shrinking birth cohorts are projected to reduce the size of the labour force for decades to come, raising concerns about economic growth, fiscal sustainability, and the future financing of welfare states. Yet despite the growing policy attention devoted to declining fertility, its long-run macroeconomic consequences remain insufficiently understood.

Sweden provides an informative case for studying these questions. Although Sweden has historically maintained comparatively high fertility rates, extensive family policies, high female labour-force participation, and positive net migration, fertility has recently fallen to historically low levels. The total fertility rate reached only 1.42 children per woman in 2025, well below the replacement rate of 2.1 (Statistics Sweden, 2026). Because Sweden represents one of the more demographically resilient welfare states in the OECD, understanding the economic implications of continued fertility decline is particularly relevant. If sustained low fertility generates substantial macroeconomic consequences even under relatively favorable institutional conditions, similar or larger effects are likely to arise elsewhere.

A large literature has examined demographic transition, population ageing, and economic growth (Lee, 2003; Dyson, 2010; Galor, 2011; Lee & Mason, 2011). Previous research has shown that declining fertility may initially generate a demographic dividend through lower youth dependency (Bloom et al., 2003), while population

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ageing eventually slows labour-force growth and increases fiscal pressures (Bloom et al., 2010; Maestas et al., 2023; Kotamäki & Lehtimäki, 2025). However, much of the existing literature focuses on population ageing or dependency ratios rather than on the long-run macroeconomic consequences of persistently low fertility itself. Moreover, relatively few studies analyze these effects within detailed welfare-state institutions where taxes, transfers, and publicly financed services amplify the economic consequences of demographic change.

This paper addresses that gap by examining how alternative fertility and migration trajectories influence long-run economic performance using a dynamic microsimulation model calibrated to the Swedish economy. Unlike aggregate macroeconomic models, the microsimulation framework combines detailed demographic processes with institutional features of the Swedish welfare state, allowing us to trace how changes in fertility and migration affect population size, age structure, dependency ratios, GDP, GDP per capita, and economic growth over the period 2025–2100.

The results show that demographic developments are a key determinant of long-run economic performance. Persistently low fertility substantially reduces aggregate GDP through a shrinking labour force and increasing dependency ratios. At the same time, GDP per capita follows a markedly different trajectory. Lower fertility initially raises GDP per capita through a temporary demographic dividend arising from lower youth dependency. However, these gains are gradually reversed as population ageing accelerates, labour-force growth slows, and GDP per capita growth weakens. Migration mitigates part of these effects by increasing the working-age population but cannot fully offset the long-run consequences of persistently low fertility.

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The paper makes three contributions to the literature. First, it quantifies the long-run macroeconomic consequences of alternative fertility and migration trajectories using a detailed dynamic microsimulation model rather than a stylized macroeconomic framework. Second, it distinguishes between aggregate economic performance and living standards by jointly analyzing GDP, GDP per capita, and their respective growth rates. Third, it demonstrates how demographic change affects economic performance primarily through changes in population age structure rather than population size alone, highlighting the importance of demographic composition for long-run growth and fiscal sustainability.

The remainder of the paper is organized as follows. Section 2 reviews the relevant literature. Section 3 describes the simulation model and data. Section 4 presents the projected demographic scenarios and their implications for dependency ratios. Section 5 analyses the effects on GDP, GDP per capita, and economic growth. Section 6 discusses the broader implications of the findings, and Section 7 concludes.

2. A Brief Literature Review

There is a longstanding literature on the relationship between demographic change and economic performance. This brief review does not aim to provide a comprehensive survey, but rather to highlight the complexity of the relationship and the fact that causality runs in both directions: economic development influences demographic behaviour, while demographic change shapes economic outcomes (Dyson, 2010). This paper focuses on how the current phase of demographic change, characterized by persistently low fertility, increasing longevity, and population ageing, impacts economic performance.

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A large body of research has examined the demographic transitions and their implications for economic development (Lee, 2003; Dyson, 2010; Galor, 2011; Galor & Weil, 2000). The first transition was associated with declining mortality, at least partly due to economic development, followed by declining fertility, and resulted in rising productivity. The second demographic transition, with falling fertility, was rather caused by changes in values, family formation, and women entering the labour force. The current transition has focused on falling fertility rates to persistently low levels, in many cases below or around one. Declining fertility contributes to population ageing and, ultimately, population decline, with potentially important consequences for long-run economic performance.

The economic consequences of fertility decline are not necessarily negative. Bloom et al. (2003) argue that declining fertility may initially generate a demographic dividend by increasing the share of the population that is of working age relative to the dependent population. However, Bloom et al. (2010) emphasize that these gains are temporary. As population ageing accelerates, slower labour-force growth and rising old-age dependency ratios gradually reduce economic growth unless offset by higher productivity, labour-force participation, or capital accumulation. Yoon et al. (2014) argue that demographic change is a major driver of long-term macroeconomic performance. The transition from high fertility and mortality to low fertility and an ageing population affects labour supply, savings, investment, inflation, economic growth, and public finances. While the early stages of demographic transition may generate a demographic dividend, population ageing ultimately creates fiscal pressures through slower labour force growth and rising pension and healthcare expenditures.

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Lower fertility may also lead to increased investment in children, raising human capital levels (Ashraf et al., 2023; Karra et al. 2017). This can contribute to higher economic growth, stronger public finances, and rising living standards. Similarly, Lee and Mason (2014) argue that lower fertility reduces youth dependency and may increase capital intensity, thereby supporting higher consumption and living standards. However, these benefits are generally temporary and depend on supportive institutions, labour market conditions, and educational investments.

These findings suggest that the economic consequences of fertility decline are inherently ambiguous and depend on the balance between reduced youth dependency in the short and medium term and population ageing in the longer term. One of the most important channels through which demographic change affects economic performance operates through labour supply. A shrinking working-age population reduces aggregate production capacity and may dampen economic growth (Bloom et al., 2003; Maestas et al., 2023; OECD, 2025).

In addition, population ageing may reduce GDP beyond the impact of a lower working-age population. Older workers tend to have lower productivity than younger workers (Murphy & Welsh, 1990; MacDonald & Weisbach, 2004, Gordon, 2017), be less innovative and entrepreneurial (Liang et al., 2018: Peters & Walsh, 2021; Hopenhayn et al, 2022; Karahan et al. 2024) dampening growth potentials.

Empirical evidence suggests that population ageing is associated with slower economic growth through both reduced labour supply and lower productivity growth. Maestas et al. (2023) find that a 10 percent increase in the population aged 60 and above reduces GDP per capita by approximately 5.5 percent. They estimate that roughly two-thirds of

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the effect operates through slower productivity growth and one-third through lower employment growth. Similarly, Kotschy and Bloom (2023) find that population ageing reduces economic growth, although improvements in the health and functional capacity of older individuals may partly mitigate these effects. Aksoy et al. (2019) find, analyzing data across 21 OECD countries from 1970 to 2014, that an aging population leads to lower economic output growth, lower investment, and lower real interest rates.

The relationship between demographic change and productivity remains debated. Acemoglu and Restrepo (2017) argue that ageing societies may accelerate automation and technological adoption, thereby partially offsetting the negative consequences of labour scarcity. This suggests that demographic change affects economic performance not only through labour supply, but also through firms' incentives to innovate and adopt labour-saving technologies. In a recent working paper, Acemoglu et al. (2026) find that lower birth rates are associated with higher growth in GDP per working-age adult without impacting aggregate GDP or earnings. The mechanism is the adaptation of new technology to compensate for labour scarcity, which increases total factor productivity. Contrary to this view, several papers find that a larger population contributes to higher GDP by fostering faster technological progress through increasing returns in production or idea creation (Kremer 1993; Jones, 2022; Eden & Kuruc, 2023) or that population size in itself creates more innovations (Boserup, 2014; Lee, 1988).

Related literature focuses on capital accumulation. In the neoclassical Solow (1956) growth framework, slower population growth increases capital per worker. It may partially offset the negative effects of demographic decline and increase GDP per capita in the short run but reduce aggregate GDP. However, more recent research suggests that expectations of long-term population decline may reduce investment incentives and

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weaken capital accumulation, thereby slowing economic growth (Fernández-Villaverde et al., 2025).

Demographic change also affects economic performance through public finances. In welfare states characterized by extensive intergenerational transfers, population ageing increases the dependency ratio and places pressure on fiscal sustainability (Lee & Mason, 2011). Rising old-age dependency ratios increase expenditure on pensions, healthcare, and elderly care while simultaneously reducing the relative size of the tax-paying workforce.

Recent evidence suggests that these effects may be substantial. Using Finland as a case study, Kotamäki and Lehtimäki (2025) show that rapid population ageing has had significant negative effects on GDP per capita, productivity growth, and public debt. Using a synthetic control approach, they estimate that Finland's GDP per capita could have been considerably higher in the absence of the rapid increase in the old-age dependency ratio.

Migration may partially mitigate these effects by increasing the size of the working-age population. However, migration alone is unlikely to fully offset the consequences of persistently low fertility, particularly over the long run as fertility rates among migrants tend to converge toward native levels (OECD, 2025).

Methodologically, this paper contributes to a growing literature that uses simulation models to analyse long-run demographic and economic dynamics. Overlapping generations (OLG) models have long been used to study the interaction between demographic change, public finances, and intergenerational transfers (Auerbach & Kotlikoff, 1987). More recently, microsimulation models have gained prominence

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because they allow researchers to incorporate detailed institutional structures and heterogeneous agents while maintaining a close connection to observed population dynamics (Bourguignon & Spadaro, 2006).

While the existing literature provides extensive evidence on the consequences of population ageing and demographic change, relatively few studies quantify the long-run macroeconomic effects of sustained fertility decline within a detailed welfare-state framework. This is particularly true for Sweden, where extensive public transfers and high labour-force participation may amplify demographic effects.

The present paper contributes to this literature by using a dynamic microsimulation model calibrated to Sweden to evaluate how alternative fertility and migration scenarios affect population dynamics, GDP, and economic growth over the period 2025–2100. Rather than predicting the precise future path of economic growth, the purpose is to isolate and quantify the contribution of demographic change to long-run economic performance by comparing alternative demographic trajectories while holding other factors constant.

3. Simulation Model and Data

To quantify the long-run economic effects of demographic change, we use a dynamic microsimulation model of the Swedish economy (Flood, 2008a). The model simulates the life courses of individuals and households over time, incorporating detailed demographic processes alongside a comprehensive representation of the tax-transfer system and public welfare services. SESIM has been used by several Swedish Ministries, authorities, and researchers to study pensions, intergenerational transfers,

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and population ageing, making it a relevant tool for assessing the long-term fiscal consequences of fertility and demographic (Flood, 2008b; Klevmarken, 2022).

The key strength of the model lies in its ability to combine individual-level heterogeneity with institutional realism. The simulation is based on a representative sample of approximately 300,000 individuals and captures transitions related to fertility, mortality, age structure, migration, education, employment, and retirement. These transitions are governed by probabilistic rules estimated from administrative and survey data.

The model evolves in discrete time and produces projections of the population structure, labour supply, public finances, and aggregate economic outcomes over the period 2025–2100. By integrating demographic dynamics with economic behavior, the model allows us to evaluate how alternative population scenarios translate into macroeconomic outcomes.

Demographic developments in the model are driven by three key components: fertility, mortality, and migration. Fertility is modeled using age-specific birth probabilities calibrated to observed total fertility rates. Alternative scenarios are constructed by varying the total fertility rate over time, allowing us to analyze both constant and declining fertility paths. Mortality follows projections from Statistics Sweden, with life expectancy increasing over time, particularly among older cohorts. These assumptions are held constant across the different scenarios to isolate the effects of fertility and migration.

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Migration is incorporated through assumptions about net inflows of individuals, including their age and labour market characteristics. The model distinguishes between scenarios with baseline migration, reduced migration, and zero net migration.

On the economic side, the model captures key features of the Swedish welfare state. It includes detailed representations of labour income and employment dynamics, income taxation and social contributions, public transfers, including pensions and social benefits, and publicly provided services such as education and healthcare.

Aggregate output, gross domestic product (GDP), is determined by the available labour input and assumptions about productivity growth. In line with standard macroeconomic frameworks, economic growth is driven by labour supply, capital accumulation, and technological progress. Labour supply evolves endogenously with the demographic structure, as the size and composition of the working-age population change over time. Capital accumulation is modeled in reduced form, with investment and depreciation determining the evolution of the capital stock. Technological progress is assumed to follow an exogenous path consistent with long-term projections used in fiscal policy analysis.

The model is calibrated using administrative data and official projections. Population projections are based on scenarios developed by Statistics Sweden, which specify alternative paths for fertility and migration. Macroeconomic assumptions, including productivity growth and inflation, are aligned with long-term projections used by the Swedish government. An important limitation of the model is that it does not fully capture short- to medium-term adjustments in the corporate sector or endogenous

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responses in investment and innovation. As a result, the model is best suited for analyzing long-run equilibrium effects rather than short-run dynamics.

Our empirical strategy is based on comparing simulated outcomes across alternative demographic scenarios. By holding institutional and macroeconomic assumptions constant, we isolate the causal impact of fertility and migration on economic outcomes. We focus on three main outcome variables: population size, GDP levels, and economic growth rates. In addition, we analyze dependency ratios to better understand how demographic change translates into macroeconomic effects. Specifically, we evaluate the impact of demographic developments by comparing our baseline scenario with five alternative projections. These scenarios are based on population projections developed by Statistics Sweden (Statistics Sweden, 2024) and extended to the year 2100.

The baseline scenario, referred to as **stable demography**, assumes a gradual recovery of fertility to 1.73 children per woman, continued positive net migration (approximately 30,000 individuals annually), and increasing life expectancy. Our five alternative scenarios are constructed to assess sensitivity to demographic change:

1. **Current birth rate**: Fertility remains at current levels (1.43), with baseline migration and mortality.
2. **Current birth rate and low migration**: Fertility remains at 1.43, and net migration is reduced to 16 500 individuals annually.
3. **Declining birth rate**: Fertility continues to decline until stabilizing in 2050 at a very low level (0.72), migration and mortality as in stable demography.
4. **Current birth rate and no migration**: Fertility remains at today's level (1.43) and migration ceases entirely.

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5. **Declining birth rate and low migration**: Combines continued fertility decline to 0.72 with reduced migration.

All scenarios assume unchanged policy conditions over time, defined as the impact and intent of the policies remaining unchanged, allowing the analysis to isolate the long-term effects of demographic change.

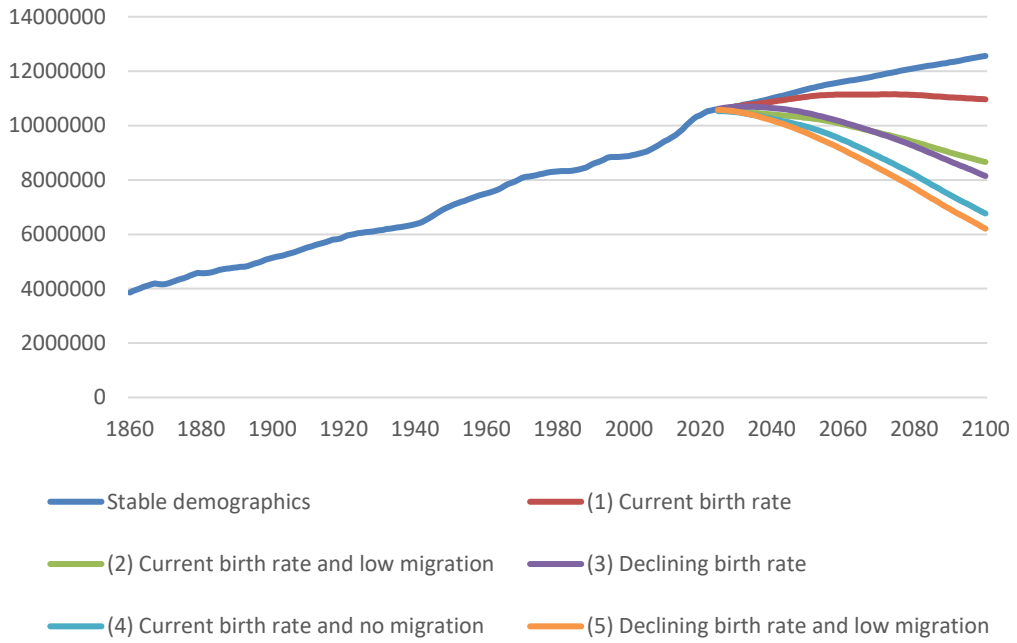
4. Resulting population developments and dependency ratios

4.1 Historical turning point – population growth turns into population decline

Fig. 1 illustrates how the Swedish population has evolved from 1860 to 2024, and thereafter our projections until 2100. In the stable demographic scenario, the population increases to 12.6 million in 2100, which is a growth of 2 million people from 2024, driven by continued positive net migration and increased life expectancy. In scenario (1), the current birth rate and fertility are assumed to remain at current levels, resulting in a more limited increase to 11.0 million (+0.4 million). If migration also declines (alternative (2) with current birth rate and low migration), the population will fall to 8.7 million, a decrease of 1.9 million. In a scenario with (3), a declining birth rate, in line with historical trends, the population will fall further to 8.1 million (−2.4 million). If migration ceases completely, scenario (4) with the current birth rate and no migration, there will be a dramatic decline to 6.8 million (−3.8 million). The most extreme alternative, (5) declining birth rate and low migration, leads to the largest decline, with a population of only 6.2 million in 2100, representing a reduction of 4.4 million people. An important result from the simulations is that migration plays an important role in population stability.

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Fig. 1 Sweden's population from 1860 to 2025 and projections up to 2100



Source: Statistics Sweden (SCB), SESIM, own calculations

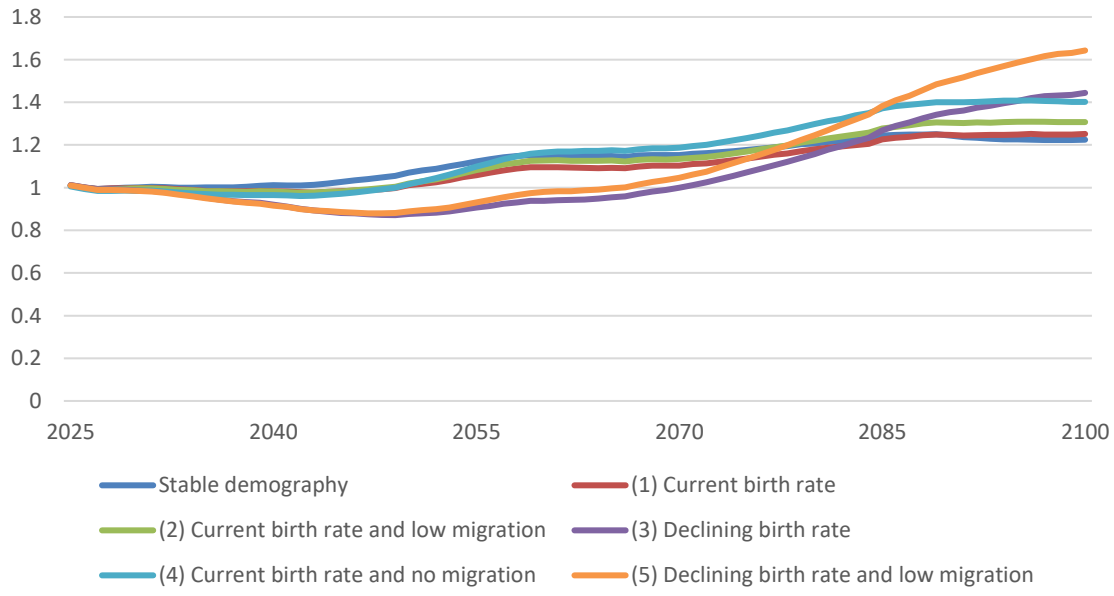
These alternative projections stand in sharp contrast to historical developments between 1860 and 2024, when Sweden's population increased from 3.86 million to 10.55 million – a growth of almost 175%. During the period 1860–1900, the population increased by over 30%, mainly as a result of reduced mortality and relatively high birth rates, despite extensive emigration. The post-war period, and especially the 21st century, has been characterized by accelerated growth, with the population increasing by nearly 20% between 2000 (8.85 million) and 2023 (10.55 million), primarily driven by positive net migration and favorable natality.

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4.2 Increasing dependency ratios

The age structure is at least as important as the size of the population for economic performance (Bloom et al., 2003; Lee & Mason, 2011; Maestas et al., 2023). Fig. 2 demonstrates how sensitive the dependency ratio, defined as the number of people aged 0–19 and 65+ as a proportion of employed individuals 20 to 64 years of age, is to different demographic developments.

Fig. 2 Dependency ratios measured as the proportion of individuals aged 0–19 and 65+ as a share of employed individuals aged 20–64 per year in six scenarios, 2025 to 2100



Source: Statistics Sweden (SCB), SESIM, own calculations

Initially, the dependency ratio is around one but decreases as the number of children declines. However, in the long run, lower total fertility leads to a sharp increase in the dependency ratio for the working population. The lowest future dependency ratio in 2100, 1.22, is found in the scenario with stable demographics. In the most extreme

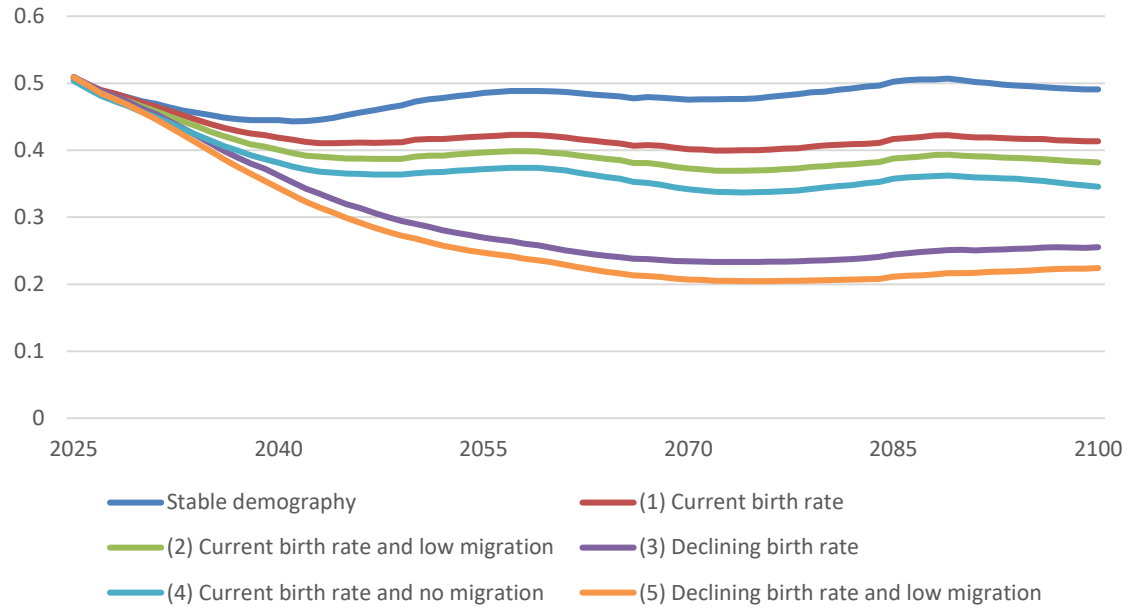
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scenario, in alternative 5 with a declining birth rate and low migration, the dependency ratio rises to over 1.6 in 2100. This means that one employed individual supports 1.6 others in addition to themselves. Even scenario (3), with a decline in the birth rate, yields a high ratio of 1.44. Migration has a clear improving effect: scenario (1) – current birth rate and migration at the same level as in a stable demographic situation – gives a significantly better dependency ratio of 1.25 in 2100, compared with scenarios (2) – current birth rate and low migration – and (4) – current birth rate and no migration – where the ratios in 2100 are 1.31 and 1.40, respectively. In the middle of the century, migration will increase the dependency ratio compared to a situation with no migration.

To further look into the age structure, Fig. 3 shows the share of young individuals (0-19 years) in relation to the employed in the age group between 20 and 64. Initially, the share of children constitutes about 50 percent of the employed. With declining birth rates and low migration (scenarios 3 and 5), the share of children rapidly decreases and is slightly over 20 percent in the latter part of this century. With the current birth rate, migration plays an important role. With no migration, the ratio of children declines more than with current levels of migration. With stable demography, the share of children falls initially to 45 percent and then turns back up again and stabilizes at 50 percent.

Fig. 3 Dependency ratios measured as the proportion of individuals aged 0–19 as a share of employed individuals aged 20–64 per year in six scenarios, 2025 to 2100

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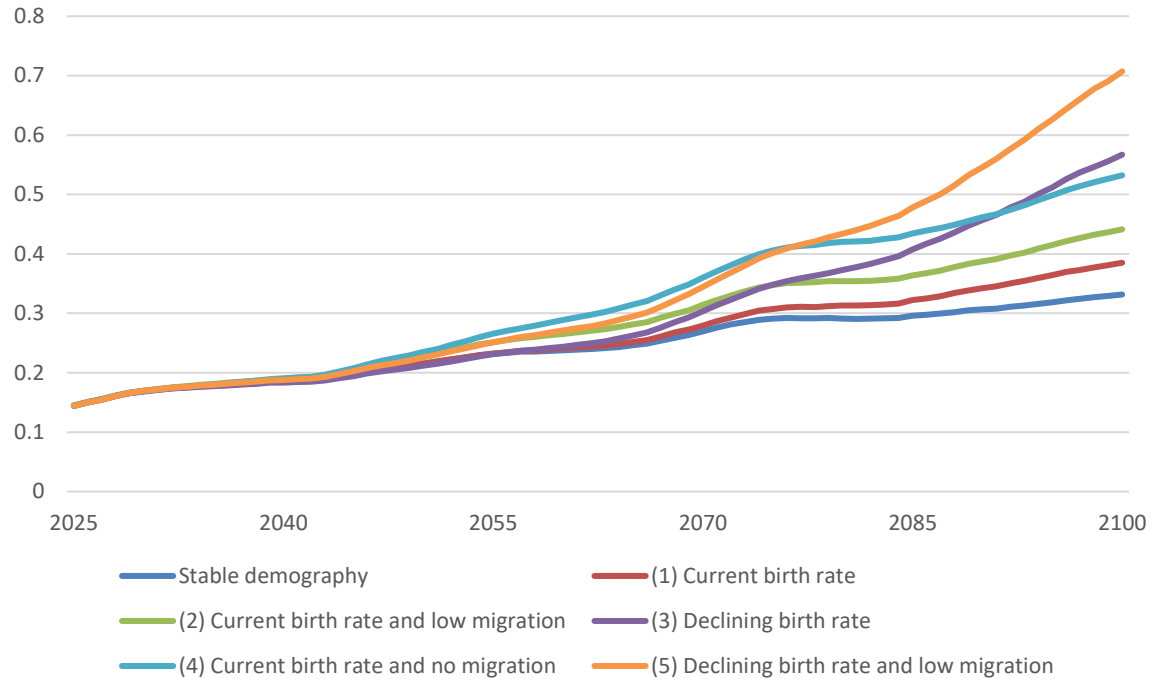


Source: Statistics Sweden (SCB), SESIM, own calculations

Fig. 4 focuses on the share of people aged 80+ as a share of employed individuals (aged 20–64). Initially, the proportion of people aged 80+ accounts for less than 15 percent of the employed in the 20–64 age group, but this proportion increases rapidly, particularly in the most extreme scenario. In alternative (5), with a declining birth rate and low migration, the share of people aged 80+ will account for 71 percent of the employed 20–64 age group in 2100. Even in a stable demographic, the proportion of people aged 80+ will more than double, from 15 to 31 percent.

Fig. 4 Dependency ratios measured as the proportion of individuals aged 80+ as a share of employed individuals aged 20–64 per year in six scenarios, 2025 to 2100

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Source: Statistics Sweden (SCB), SESIM, own calculations

As mentioned previously, age structure matters more than population size. Even if the population remains stable for the coming decades, the age structure will change in favor of more elderly and fewer young individuals. We now investigate how different demographic developments impact GDP and GDP per capita.

5. How population projections impact GDP, GDP per capita and economic growth

With lower total fertility and reduced migration, the population shrinks, and maybe more importantly, the age structure changes, both likely to impact long-term economic performance. Fig. 5 illustrates how sensitive GDP is to alternative demographic scenarios. Specifically, the figure presents the development of GDP in the different demographic scenarios compared to GDP in stable demography.

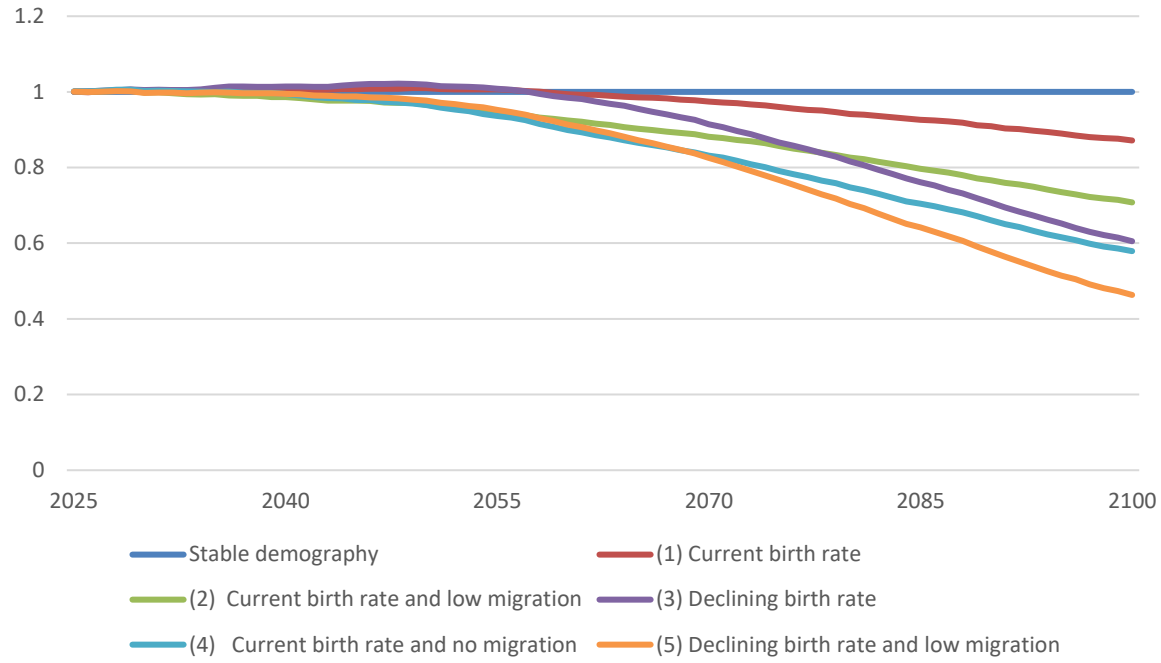
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It takes a while before GDP starts to deviate in the different scenarios, but by 2050, declining fertility and lower migration start to impact GDP. If the birth rate remains at today's level (1), GDP will be 87 percent, while scenario (3), with a decline in the birth rate, will result in GDP at approximately 60 percent of the level with stable demography. In the most extreme scenario (5), GDP will be only 46 percent of the level with stable demography in 2100.

Migration has a clear positive effect. In scenario (2), with the current birth rate and low migration, GDP shrinks to 71 percent, while in scenario (4), with no migration, GDP shrinks to 58 percent, compared with 87 percent if migration remains unchanged. The difference in GDP between the no-migration scenario and the scenario with net migration of approximately 30,000 individuals per year amounts to 29 percentage points in 2100. As can be seen, the size of the economy is very sensitive to future fertility rates and migration. In the short run, GDP increases slightly in scenario (3), with a decline in the birth rate, and (4), with the current birth rate and no migration, compared to stable demography. However, thereafter GDP declines, especially in the case with no migration.

Fig. 5 GDP predictions 2025 to 2100 as a share of GDP in stable demography per year in six scenarios

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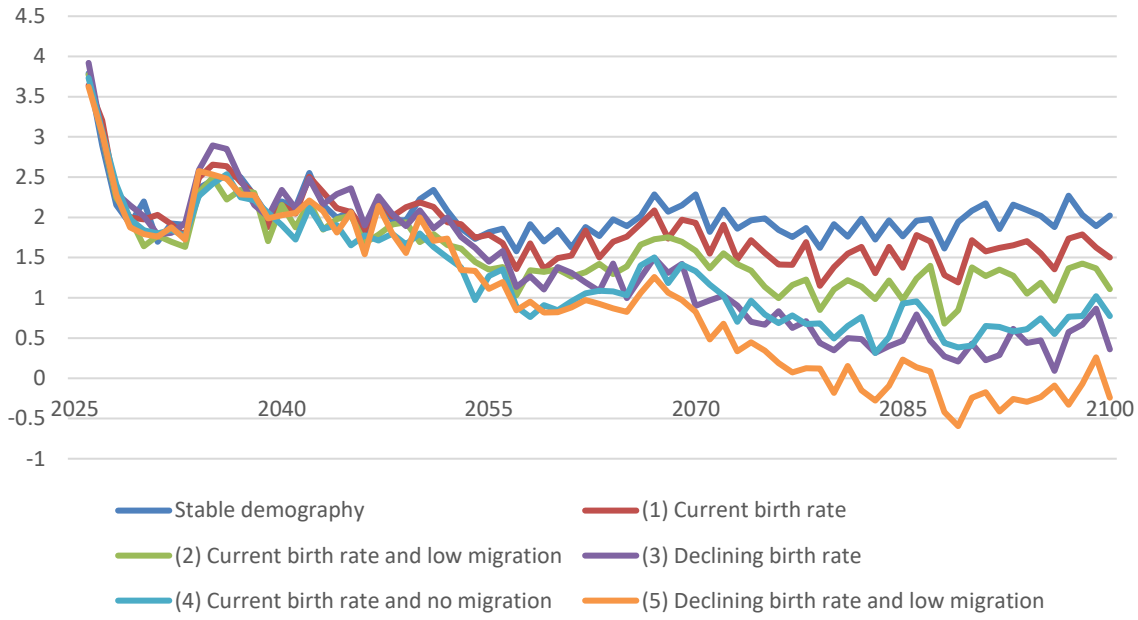


Source: Statistics Sweden (SCB), SESIM, own calculations

Fig. 6 presents simulations of Sweden's real GDP growth (in 2024 prices) in the different scenarios. The scenario with stable demographics has the most even development: growth starts and stays at around 1.5 – 2.5 percent per year, with some temporary peaks. Alternative (1), the current birth rate, follows a similar trend, but with a slightly lower growth path, ending at a growth rate of around 1.5 percent per year at the turn of the century.

Fig. 6 Real GDP growth rates per year in six scenarios, 2025-2100, 2024 prices

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Source: Statistics Sweden (SCB), SESIM, own calculations

When the current birth rate is combined with low migration (2), the decline becomes more pronounced: from around 2 -2.5 percent per year to around 1 percent per year towards the end of the period. In scenario (3), declining birth rates deteriorate significantly after 2050, with values falling below 0.5 percent by 2100. In scenario (4), the current birth rate and no migration, the growth path follows that of scenario (3). The most pessimistic alternative – (5) declining birth rate and low migration – shows a sharp decline and drops below zero percent at the end of the century.

All series show a downward trend over time, reflecting demographic deterioration and its impact on the economy. Periods of stability alternate with declines, especially in scenarios with low or no migration, indicating sensitivity to external factors.

Finally, we look at GDP per capita. In Fig. 7, we present projected GDP per capita under the six demographic scenarios. Unlike aggregate GDP, GDP per capita initially increases in all scenarios during the first half of the projection period. This reflects the

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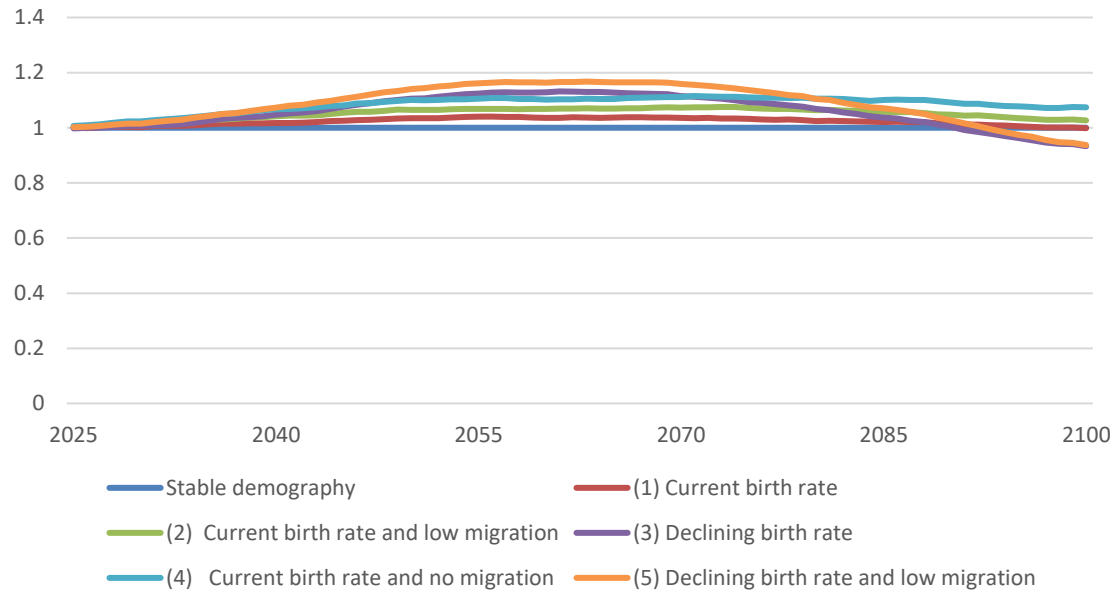
declining share of children in the population, which temporarily reduces youth dependency and increases output per capita despite slowing population growth. The improvement is most pronounced in the scenarios with declining fertility, where GDP per capita peaks at approximately 15–17 percent above the 2025 level around the middle of the century.

From around 2060 onwards, however, the trajectories begin to diverge. As population ageing accelerates and progressively smaller cohorts enter the labour market, the initial demographic dividend is gradually exhausted. Scenarios characterized by persistently low fertility experience the sharpest deterioration, particularly when declining fertility is combined with low migration. In these cases, GDP per capita falls steadily during the second half of the century and eventually drops below its initial level by 2100. By contrast, the stable demographic scenario remains broadly unchanged throughout the projection period, while the current birth-rate scenarios maintain GDP per capita slightly above the baseline at the end of the century.

The results illustrate that demographic change affects living standards differently over time. Lower fertility may generate a temporary increase in GDP per capita because fewer children initially reduce the dependency burden, consistent with the demographic dividend described by Bloom et al. (2003) and Lee and Mason (2014). Over the longer run, however, continued fertility declines result in a shrinking labour force and a rapidly increasing old-age dependency ratio. These effects outweigh the initial gains and lead to lower GDP per capita growth. Migration partly mitigates this development by expanding the working-age population, but cannot fully offset the consequences of persistently low fertility.

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Fig. 7. GDP per capita predictions 2025 to 2100 as a share of GDP per capita in stable demography, per year in six scenarios



Source: Statistics Sweden (SCB), SESIM, own calculations

Fig. 8 presents the projected annual growth rate of GDP per capita under the six demographic scenarios between 2025 and 2100. All scenarios exhibit relatively high growth rates during the first decades of the projection period before gradually converging towards lower long-run growth. Initially, differences between the demographic scenarios are modest, suggesting that demographic change affects living standards only gradually due to the delayed adjustment of the population age structure.

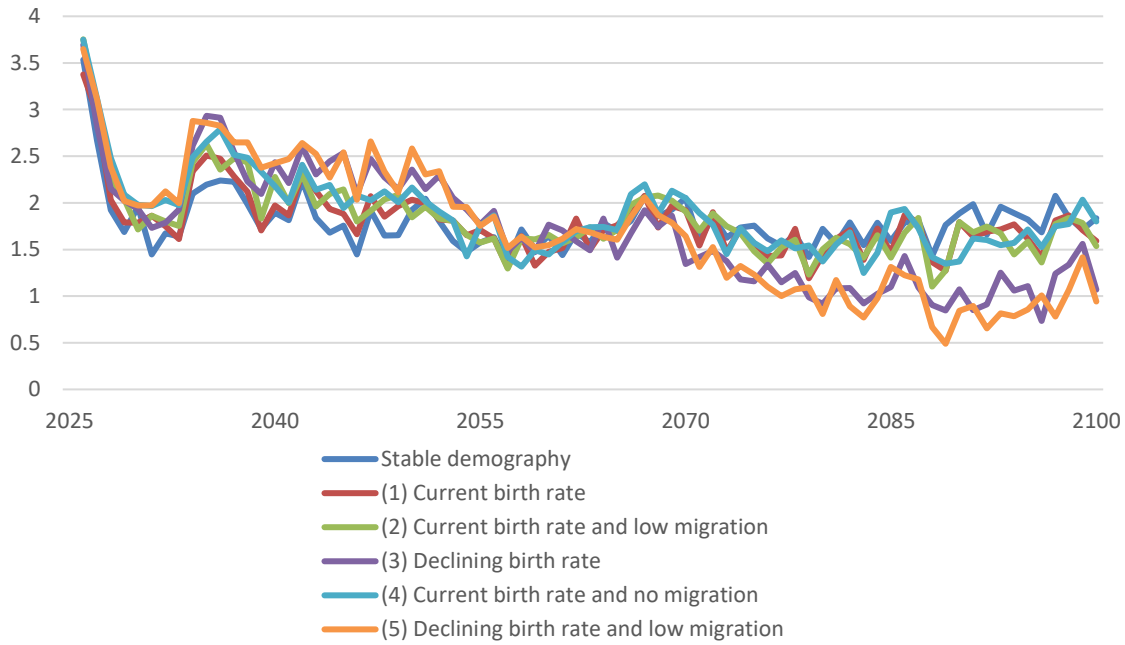
From approximately the 2060s onwards, however, the demographic assumptions begin to have a more pronounced effect on GDP per capita growth. The scenarios with stable demography and current fertility maintain relatively stable growth rates throughout the remainder of the century, whereas scenarios characterized by persistently declining fertility experience a clear downward trend. The weakest performance is observed in the

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scenario combining declining fertility with low migration, where GDP per capita growth falls below one percent during several years toward the end of the projection period.

These results illustrate that the adverse effects of low fertility on living standards materialize gradually rather than immediately. While the initial decline in the number of children reduces youth dependency and supports GDP per capita, this temporary advantage is eventually outweighed by a shrinking labour force and a rising old-age dependency ratio. Consequently, the long-run growth potential of the economy deteriorates as demographic ageing becomes increasingly dominant. Migration mitigates part of this slowdown by increasing the working-age population but does not fully offset the effects of persistently low fertility.

Fig. 8 Real GDP per capita growth 2025-2100, per year in six scenarios in 2024 prices



Source: Statistics Sweden (SCB), SESIM, own calculations

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6. Discussion

The results presented in this paper demonstrate that demographic change is not merely a consequence of economic development but also a powerful determinant of long-run economic performance. While declining fertility initially appears to have limited economic consequences, its effects accumulate over time through demographic momentum, eventually reshaping the size and age composition of the population. Our simulations show that these changes translate into substantially lower GDP, slower economic growth, and weaker growth in GDP per capita. The findings therefore reinforce the view that demographic developments should be regarded as a central component of long-term economic policy rather than solely a social or family policy issue.

An important contribution of the analysis is the distinction between aggregate economic performance and living standards. Aggregate GDP declines steadily under scenarios with persistently low fertility as the labour force contracts. GDP per capita, however, follows a different trajectory. During the first half of the projection period, GDP per capita actually increases in all demographic scenarios, with the largest gains occurring under the lowest fertility assumptions. This reflects the well-established demographic dividend (Bloom et al., 2003; Lee & Mason, 2014): when fertility falls, the share of children declines, temporarily reducing dependency and increasing output per capita.

However, our results clearly show that this dividend is temporary. Once the smaller birth cohorts begin replacing larger cohorts in the labour market, the demographic dividend gradually disappears. Population ageing accelerates, the working-age population contracts, and GDP per capita growth weakens substantially. By the end of the century, scenarios characterized by persistently low fertility no longer outperform

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the baseline with stable demography, illustrating that the long-run consequences of demographic ageing outweigh the short-run benefits of reduced youth dependency. This finding provides quantitative support for theories emphasizing that demographic transitions generate both winners and losers across different phases of economic development (Lee & Mason, 2011; Yoon et al., 2014).

The distinction between GDP levels and GDP per capita also highlights an important policy implication. Policymakers frequently focus on living standards measured by GDP per capita, which may continue to improve even as aggregate production stagnates. Our simulations suggest that this can mask an underlying deterioration in the productive capacity of the economy. Although individuals on average may initially become better off, society simultaneously faces a shrinking labour force, slower aggregate growth, and increasing fiscal pressure. Consequently, relying exclusively on GDP per capita risks underestimating the macroeconomic challenges associated with demographic decline.

Another central finding is that age structure matters at least as much as population size. Much of the existing public debate focuses on declining population numbers, yet our simulations indicate that changes in the dependency ratio are the primary mechanism linking fertility decline to economic performance. Even relatively modest reductions in fertility eventually produce substantially older populations, increasing the number of retirees supported by each worker. The simulations therefore reinforce previous findings that population ageing operates primarily through changes in the balance between producers and dependents rather than through population size alone (Lee & Mason, 2011; Maestas et al., 2023). In this sense, the composition of the population is ultimately more important than its absolute size.

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Migration emerges as an important mitigating factor throughout the analysis. Positive net migration slows population decline, increases the size of the working-age population, improves dependency ratios, and raises both GDP and GDP per capita relative to scenarios with lower migration. Nevertheless, migration does not fundamentally alter the long-run demographic trajectory. Even under relatively favorable migration assumptions, the effects of sustained fertility below replacement eventually dominate because migrant fertility converges toward native fertility over time and population ageing continues (OECD, 2025; Sobotka, 2008). Migration therefore appears to postpone demographic adjustment rather than eliminate it.

An important feature of our results is the very long-time horizon over which demographic effects unfold. The consequences of fertility decline remain relatively modest for several decades before becoming increasingly pronounced after the middle of the century. This delay reflects demographic inertia: today's births determine tomorrow's labour force, while today's working-age population continues to support economic activity for many years before retirement. As a consequence, demographic policy differs fundamentally from conventional macroeconomic policy. Whereas fiscal or monetary interventions often influence economic activity within months or years, demographic developments evolve over generations. Delayed policy responses therefore have particularly high costs because opportunities to influence future labour supply diminish over time.

The findings also contribute to the ongoing debate regarding technological progress as a response to demographic ageing. Recent work argues that labour scarcity may stimulate automation and artificial intelligence, partially offsetting the negative effects of a shrinking workforce (Acemoglu & Restrepo, 2019, 2022; Acemoglu et al., 2026). While

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such mechanisms are plausible, our simulations suggest that technological progress alone is unlikely to fully compensate for demographic decline. Many sectors experiencing the strongest increase in demand — notably healthcare, elderly care, and other personal services — remain highly labour intensive and exhibit limited potential for complete automation. Consequently, technological progress should be viewed as a complement rather than a substitute for favorable demographic developments.

More broadly, the results suggest that demographic change should increasingly be viewed as a structural economic issue. Traditionally, fertility has primarily been discussed within family policy, while migration has been treated as an issue of labour markets and integration. Our findings indicate that these policy areas are deeply interconnected through their influence on long-run economic growth, fiscal sustainability, and living standards. Population policy is therefore not simply about determining the future size of the population but about shaping the future productive capacity of the economy.

From a policy perspective, the findings highlight a fundamental challenge: fertility decisions are individual, but their consequences are collective. While it is neither feasible nor desirable for governments to directly control fertility, the presence of persistently low birth rates suggests that structural barriers may prevent individuals from achieving their desired family size. These barriers may include labour market insecurity, housing constraints, and difficulties in balancing work and family life.

Finally, our results have important implications for countries beyond Sweden. Although Sweden has comparatively high fertility, high female labour-force participation, and positive net migration relative to most OECD countries, the simulations nevertheless

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show substantial long-run economic consequences from continued fertility decline. Countries with lower fertility, weaker labour market participation, or less migration are therefore likely to experience even stronger demographic headwinds. The Swedish case may thus represent a relatively optimistic scenario rather than an upper bound for the economic consequences of sustained low fertility.

Overall, the analysis suggests that declining fertility should be regarded as one of the defining structural challenges facing advanced economies during the twenty-first century. The effects emerge slowly but persist for generations, influencing labour supply, productivity, public finances, and long-run economic growth. Because demographic adjustment occurs over decades rather than business cycles, effective policy requires a correspondingly long-term perspective. While migration, labour market reforms, and technological progress can all mitigate demographic pressures, none appear capable of fully replacing the contribution of sustained fertility to long-run economic performance.

7. Conclusions

This paper has examined the long-run economic consequences of declining fertility using a dynamic microsimulation model calibrated to the Swedish economy. By comparing six alternative demographic scenarios, we isolate the contribution of fertility and migration to future population dynamics, dependency ratios, GDP, GDP per capita, and economic growth while holding other institutional and macroeconomic conditions constant.

The results demonstrate that demographic change is a powerful determinant of long-run economic performance. Persistently low fertility reduces population growth, accelerates

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population ageing, and leads to a progressively smaller labour force. These demographic changes substantially reduce aggregate GDP and weaken long-run economic growth. The effects are gradual but cumulative, becoming increasingly pronounced during the second half of the century as demographic momentum amplifies the consequences of smaller birth cohorts.

At the same time, the analysis reveals a more nuanced picture for average living standards. GDP per capita initially increases under all demographic scenarios, reflecting a temporary demographic dividend arising from lower youth dependency. However, this improvement is not sustained. As population ageing accelerates and labour force growth slows, GDP per capita growth weakens and, under the most adverse demographic scenarios, GDP per capita eventually falls below that of stable demography. These findings illustrate that demographic transitions involve important trade-offs over time: the short-run benefits of lower fertility are eventually outweighed by the long-run consequences of an ageing population.

A key insight from the analysis is that the age composition of the population matters at least as much as its size. The economic consequences of fertility decline arise not simply because fewer people are born, but because the balance between workers and dependents changes fundamentally over time. Rising dependency ratios increase fiscal pressure while simultaneously reducing productive capacity, making demographic structure a central determinant of long-run economic performance.

The simulations further show that migration can moderate the economic effects of low fertility by supporting the working-age population and slowing population ageing. Nevertheless, migration does not fundamentally alter the long-run demographic

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trajectory. Even under relatively favorable migration assumptions, sustained fertility below replacement eventually results in slower economic growth and increasing dependency burdens. Migration therefore appears to delay rather than eliminate the macroeconomic consequences of demographic decline.

More broadly, the findings suggest that demographic developments deserve greater attention within economic policy. Demographic change differs from most other macroeconomic challenges because it unfolds over generations rather than business cycles. Once fertility has remained low for an extended period, demographic momentum makes future population decline increasingly difficult to reverse. Consequently, policies aimed at eliminating and reducing barriers to family formation, supporting labour-force participation, facilitating productive migration, and adapting welfare institutions to an older population are likely to become increasingly important for maintaining long-run prosperity.

Although the analysis focuses on Sweden, the implications extend well beyond the Swedish context. Sweden combines comparatively high fertility, positive net migration, and high labour-force participation by international standards. If substantial long-run economic effects emerge even under these relatively favorable conditions, the challenges are likely to be even greater in countries experiencing lower fertility, weaker labour market participation, or more limited migration. The Swedish case therefore provides insights into demographic processes that are increasingly relevant across advanced economies.

Ultimately, the central message of this paper is straightforward. Fertility decline is not merely a demographic phenomenon—it is a fundamental determinant of future

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economic performance. Its consequences emerge slowly, but once they become visible, they are highly persistent. Understanding these long-term demographic dynamics is therefore essential for designing economic policies capable of sustaining growth, fiscal stability, and living standards throughout the twenty-first century.

Finally, the results should be interpreted in light of the assumptions underlying the simulation model. Productivity growth, technological change, labour market institutions, and behavioral responses are held largely constant to isolate the effects of demographic change. Future research could incorporate endogenous technological adoption, labour supply responses, and alternative migration patterns to examine how these mechanisms interact with demographic developments. Nevertheless, by isolating demographic factors, the present analysis provides a clear estimate of the magnitude and timing of the economic consequences of sustained fertility decline.

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Statements and Declarations

Competing interests: The authors declare that they have no competing financial or non-financial interests related to the work submitted for publication.

Data availability: The population projections underlying this study are publicly available from Statistics Sweden (SCB). The SESIM microsimulation outputs generated and analysed during the current study are available from the corresponding author on reasonable request.

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