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The Economic Implications of Varying Domestic Investment Share in UK Pensions:

A General Equilibrium Welfare Analysis

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Abstract

This thesis investigates how minimum domestic investment rules for pension funds shape lifetime consumption, wealth and welfare. It embeds an overlapping-generations lifecycle model in a small-open-economy general equilibrium framework, calibrated to the UK between 2010-2020. Agents work, earn income and split their earnings between a pay-as-you-go system and a defined-contribution account, which they then decumulate in retirement. A 'home-allocation' parameter θ mandates the share of DC savings invested domestically; foreign returns are taken as given. The model is calibrated by matching wealth moments using longitudinal data from the UK's Wealth and Assets Survey. Varying home-allocation θ from 0% up to 100%, higher domestic shares raises equilibrium capital stock and wages but lowers domestic returns and lifetime utility. Welfare falls in θ, with diminishing marginal losses as θ increases. Small increases in θ generate larger welfare losses when the initial θ is low. These results highlight trade-offs between domestic financial development and pension saver welfare, informing UK policy on pension investment mandates.

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1 Introduction

Pension funds sit at the heart of both individual retirement security and broader economic stability. The United Kingdom's total pension assets are worth roughly £3 trillion - the third largest in the OECD - and over the past thirty years, the system has shifted from defined benefit schemes toward defined contribution plans. This has placed greater investment risk and responsibility on individual savers and pension funds allocating their occupational pension savings. In addition, the UK faces several challenges including consequences of Brexit, low productivity, public debt, weak business confidence and slowing growth rates (OECD, 2024; Schomberg et al., 2024; Selfin et al., 2025). In this context, regulators and funds seem to have forgotten about the risks of home bias - the tendency to overweight domestic assets relative to what a world-market portfolio would imply - as several new trends and proposals have been put forward that could result in an increased home allocation and bias in pension savings.

Empirically, a modest home tilt can help hedge local currency and liability risks. However, when UK pension schemes hold more UK assets than the UK's $\approx 3.5\%$ share of global market capitalisation, they forgo substantial risk-adjusted returns. However, diversification alone does not tell the whole story. To isolate the core trade-offs, the paper distils three distinct real-world channels into simple primitives: the return differences, level of home allocation and general equilibrium feedbacks. The observed gap between domestic and foreign returns directly enters the model, capturing both performance differences and the dis-diversification premium. The degree of home allocation in pension savings is left agnostic on its source - whether a regulatory mandate, a behavioural familiarity bias or a liability matching motive - the domestic allocation parameter (θ) sets the minimum share of an individuals occupational pension invested in the domestic market. By modelling the UK as a small open economy, any increase in domestic savings via θ raises the wage (w) and lowers the domestic return (r_d) through endogenous capital accumulation.

To quantify these effects, the paper presents an overlapping-generations (OLG) lifecycle model embedded in a general-equilibrium (GE) framework, calibrated to UK data from 2010-2020 (Office for National Statistics, 2025e). Varying θ from 0% to 100%, one can trace out its nonlinear impacts on equilibrium wages, returns, aggregate capital and individual lifetime welfare. The study addresses the following research questions:

1) *What are the welfare implications for pension savers when a minimum level of domestic allocation constrains pension portfolio choices*?
2) *Is the welfare effect of a change in domestic allocation linear*?

This paper makes three main contributions to the literature on home bias and pension fund regulation. First, it distils real-world return gaps, share of home allocation (θ) and GE feedback, directly linking empirical measures of home bias to welfare relevant mechanisms. Second, calibrated to UK pension and macro data one can trace the nonlinear path of lifetime welfare, wages, returns and wealth as θ moves from 0% to 100%, showing that small marginal increases in the domestic allocation level impose sizeable welfare losses - but that these losses taper off at higher levels of θ. Third, by isolating the separate roles of return differences, allocation constraints, and GE effects, the paper demonstrates why blunt mandates increasing home allocation in DC pension savings θ can be very costly and derives a few concrete design principles for UK occupational pension regulation.

Section 2 reviews UK pension evolution, home bias studies and the papers contribution; section 3 lays out the OLG-GE model, data and calibration technique; section 4 presents equilibrium and welfare results; section 5 discusses implications for policy, limitations and future research; section 6 concludes.

2 Literature Review

The classic paper by French and Poterba pointed out that diversification in international equity markets was very low (1991). Since then, many papers have attempted to explain this phenomenon, mainly in developed markets. More recently, we have seen a clear trend towards international diversification among pension funds, especially in the UK.

This section is split into two parts. It first covers the UK pension landscape and home bias and its drivers, benefits and costs, and recent developments in the UK that suggest a potential return towards more home allocation and bias in retirement funds. Secondly, there is a short presentation of the lifecycle hypothesis and the foundation for the empirical method chosen to study and quantify the effects of greater home allocation and bias in the current UK pension fund landscape.

2.1 Overview of the UK pension system

2.1.1 State Pension (PAYG)

The foundation of UK retirement provision is the State Pension, a Pay-As-You-Go (PAYG) scheme funded by National Insurance (NI) contributions deducted from earnings. As of 2024/25, the NI rate is 0% on the first £242 of weekly earnings, 8% on earnings between £242.01 and £967, and 2% on any amount above £967. To earn a state pension, you have to pay the NI for a minimum of 10 years, while to receive the full state pension one needs 35 full years of contributions (Money Helper, 2025b, 2025d). NI contributions average around 12% of earnings and the State Pension typically replaces around 54.4% for an average earner's pre-retirement income (Harker, 2024; HM Revenue and Customs, 2025; OECD, 2023).

2.1.2 Occupational Schemes: Defined Benefit & Defined Contribution

Since 2012, employers must automatically enrol eligible staff into an occupational pension scheme. There are two main types of occupational pensions: Defined Contribution (DC) and Defined Benefit (DB) schemes (HM Government, 2025). The employer decides what type to offer. For someone entering the workforce these days, DC schemes are far more common (Okello & Silcock, 2024).

In a DC scheme, the employee and employer contribute each month to build up a pot of money for one's retirement (HM Government, 2025; Money Helper, 2025c). The amount one gets when taking one's pension pot will depend on how much one has contributed, how well the investments have performed, and whether one takes the money as an annuity or a lump sum. DB schemes guarantee a certain pension income when one retires, depending on salary and how long one has worked. How much one gets depends on the scheme's rules (HM Government, 2025). The contribution one has to make can vary and is set by the pension provider, who promises to give one a certain amount each year upon retirement (i.e. the employer bears the investment risk). If, for example, any remaining funding is required when you retire, the pension provider will be responsible for providing that amount so that it can give you the promised pension benefits (Money Helper, 2025a).

How much one pays into a workplace pension depends on the scheme and employer. The auto-enrolment rules for DC schemes set minimum contribution levels of 8% of

earnings. However, these 8% are made up of 3% that has to be paid by the employer and 1% from the government in tax relief, meaning the employee actually pays 4% (Money Helper, 2025c).

As mentioned, DB schemes also require contributions, but they can vary considerably. Different schemes can promise different benefit levels and retirement ages, and more benefits promised upon retirement usually mean higher contribution levels (Money Helper Representative, personal communication, April 10, 2025). Similarly, an employer or pension provider may promise a generous pension upon retirement at lower contributions instead of offering higher earnings while employed.

2.1.3 The Shift to DC and Auto-Enrolment Impact

Over the past half-century the pension system in the UK have undergone dramatic transformations. In the 1970s, DB schemes dominated, but by the 1990s, a shift towards DC schemes began. Savers with DC plans accelerated by the auto-enrolment in 2012 and has led to tripled enrolment from 4.6 to 14 million since then (Okello & Silcock, 2024; Wilkinson et al., 2024). While private and public DB schemes (including Local Government Pension Schemes) account for about two-thirds of total pension assets (private DB 50% and public DB 20%), DC schemes - including workplace schemes and individual pensions - make up about a third of the total (Wells, 2024). This evolution has placed more responsibility and risk on individual savers and points to a future where longer life expectancies, ageing populations and stagnating growth will further complicate retirement planning (Pension Protection Fund, 2024).

DC plans dramatically reduced their home allocation over the decade between 2010 and 2020. Around 2010, DC funds had roughly 50% of assets in UK investments (Wells, 2024). This reflected the historic domestic equity weighting in many UK DC funds. By mid-2010, auto-enrolment and a shift to global diversification had begun to reduce this level of home allocation. No precise official annual data exist for each year, but the trend was downward and by 2020, DC schemes held, on average, 20% of assets in domestic UK assets, with the most significant drop in equity from around 50% to 5-8% (Wells, 2024).

In the same period, public and private DB schemes maintained higher home allocations and bias than the DC plans, chiefly due to a shift from domestic equity to domestic bonds (Pension Protection Fund, 2024). In 2010, the domestic allocation share was similar to that of the DC schemes, around 45-50% for private DB and 45% for public DB in a mix of equity, government and corporate bonds, and property. As DB members were ageing and new members instead went into the DC schemes, in order to secure the funding for the payouts to the retired members (liability-matching), they switched from equity to bonds (Pension and Lifetime Savings Association, 2024; Pension Protection Fund, 2024; Wells, 2024). From 2010 to 2020, private DB reduced equity but increased bond holdings to the extent that they increased their domestic allocation above 2010 levels to around 60%. On the contrary, public DB eased back on their domestic allocation closer to 30% by 2020.

These structural changes have prompted policymakers to emphasise the dual role of pension funds: vital for retirement savings and as vehicles of domestic economic growth. Landmark initiatives - starting with the previous government and the 2023 Mansion House Reform, in which some of the UK's largest DC schemes committed to allocate 5% of their default funds to unlisted UK assets by 2030 (Clark, 2024). Initiatives continued under Chancellor Reeves's Mansion House Compact II in the first quarter of 2025 with

a proposed 10% allocation to private assets - half of which must be UK-based (Parker & Dunkley, 2025). Complementing these efforts, the November 2024 Interim Pensions Investment Review and measures outlined in recent government announcements (including new rules to unlock surplus DB funds for domestic investment) have laid out both fiscal and regulatory incentives to steer a greater share of pension capital into the domestic market (HM Treasury, 2024; Prime Minister's Office, 2025). Adding proposals in the most recent spring budgets and insights from the Pensions Investment Review, these policies aim to mobilise a share of the roughly £3 trillion held in UK pension schemes, the third largest stock among OECD countries, into domestic assets, thereby deepening local capital markets and supporting long-term economic growth (Department for Work and Pensions, 2024a, 2024b; HM Treasury, 2024; Huddleston, 2024; Wilkinson et al., 2024).

2.2 Home Bias

2.2.1 Definition & Measurement

Home bias refers to the tendency of pension funds to overweight domestic assets relative to their share in global markets (Cooper et al., 2013). Home bias is often measured by comparing the share of domestic allocations with the share implied by a neutral global portfolio such as the MSCI World Index. A seminal study by French and Poterba showed that US, Japanese and British investors held far less foreign equity than predicted by standard portfolio models, i.e. exhibiting home bias (1991).

2.2.2 Empirical Magnitudes

Although a globally diversified portfolio would allocate around 3.5% of equities to the UK, empirical evidence reveals deviations (MSCI, 2024). In the UK, home bias manifests differently across pension schemes. Bond and real-estate allocations remain heavily domestic, while on aggregate, UK pension funds invest only around 4.4% of assets in UK equities, down from over 50% a bit over a decade ago (Wright & Thornhill, 2024). By scheme type, private DB schemes are the lowest at 1.4%, then DC plans at 8% and public DB at 9% in domestic equities. We see a clear trend towards decreasing home bias on the equity side.

This phenomenon is not unique to the UK. Internationally, even significant pension funds display a home preference that often deviates significantly from global benchmarks. For example, Australian superannuation funds typically allocate 44–45% to domestic equities (down from $\approx$ 58% in 2014) despite Australia's modest $\approx$ 2% weight in global indices (Department for Work and Pensions, 2024b). Similarly, New Zealand funds hold about 42% of local equities despite New Zealand constituting less than 1% of global market capitalisation. Also, large US pension schemes lean heavily domestically. However, in this case, their home bias is relatively low since US assets dominate the global index, constituting around 60% (Department for Work and Pensions, 2024b).

2.2.3 Drivers of Home Bias

There are several explanations for home bias brought forth in the literature. First, hedging and liability matching. Pension funds often prefer domestic assets as a natural hedge against local risks, such as inflation and currency fluctuations. For pension funds

paying benefits in local currency, investing at home helps to better match liabilities and reduce exposure to international shocks (Cooper et al., 2013).

Second, information and familiarity advantages. Local market knowledge, superior access to corporate governance information and a deeper understanding of domestic business environments contribute to a preference for home investments. These informational advantages are particularly pronounced among smaller or less sophisticated funds compared to larger (K. Chan et al., 2005; Cooper et al., 2013).

Third, restrictions and differences in market development have long influenced domestic allocations (see the Canadian example below). Although explicit mandates are less common in the UK, existing regulatory frameworks and disclosure requirements shape pension funds' investment behaviours (Cooper et al., 2013). As reported above, we see a changing environment and regulatory frameworks regarding pension funds that could affect the level of home allocation and bias.

Lastly, going beyond economic rationales, behavioural biases like patriotism or the belief in superior domestic performance (sometimes described as "pension nationalism") can also drive home bias. This effect is observed across different fund sizes, suggesting that even sophisticated investors are not immune to behavioural inclinations to invest extra at home (Cooper et al., 2013).

Others have also looked at factors such as: labour income hedging, introduction of the euro and the dot-com crisis, focusing on the Netherlands, distribution costs, home bias in goods trade and political bias (Harms et al., 2015; Rubbaniy et al., 2014; Sihvonen, 2023; Van Wincoop & Warnock, 2006).

2.2.4 Risks and Benefits of Domestic Concentration

While domestic investments offer valuable hedging benefits, an excessive home bias introduces concentration risk. A portfolio heavily weighted toward domestic assets is highly susceptible to (and correlated with) the fluctuations of the local economic cycle. For example, asset returns and pension liabilities may suffer simultaneously during a downturn.

Performance outcomes in recent decades illustrate the trade-off. If the home market underperforms global markets, a strong home tilt can hurt pension returns. A comparative study of five major pension markets (UK, Japan, Canada, Australia, and the US) between 2008 to 2019, found that home bias detracted from performance in four of the five cases (Soubeyran, 2019). In the UK, Japan, Canada, and Australia, domestic equities delivered higher risk-adjusted returns than foreign equities in only about 0–25% of the periods examined (meaning global diversification beat a home-heavy stance most of the time). The United States was the only exception: US stocks vastly outperformed international markets in the 2010s, so a US investor and pension saver benefited from an overweight to domestic equities during that era. Generally, a lack of diversification incurs an opportunity cost: holding assets at home above what a neutral globally diversified index would suggest means one is forgoing higher risk-adjusted returns by not investing proportionately more in foreign markets. The steep decline in domestic equities held by UK pension funds, paralleled with the drop in the UK's share of the world market cap (from $\approx 8\%$ in 2010 to $\approx 3.5\%$ in 2024) and the strong performance of US equities, seem to prove this point (Department for Work and Pensions, 2024b). The UK government's analysis notes that US equities outpaced UK equities in the 2010s, and a failure to diversify would mean missing those higher returns (Department for Work and Pensions,

2024b).

Nevertheless, there are potential benefits to some local investment. Domestic assets - especially in less correlated sectors like private equity, infrastructure, or real estate – might improve portfolio efficiency. The UK Government Actuary's Department modelled pension portfolios and found that adding higher allocations of domestic private-market assets (e.g. UK infrastructure, property, private equity) could improve risk-adjusted returns compared to a portfolio concentrated mainly in overseas public equities or domestic public equities for that matter (Department for Work and Pensions, 2024b). Their analysis, however, built on strong assumptions of high future returns in domestic assets. This study suggests that home bias via alternative assets (not just public equity) might enhance diversification by asset class and currency.

The optimal asset allocation strategy involves striking a balance that meets both liability-matching needs and returns optimisation goals. On the one hand, domestic assets help hedge local risks. For example, US pension plans often hold substantial US bonds and equities because of high returns and because their benefit payments are in USD. From an asset-liability management perspective, this lowers currency volatility in funding (Craft, 2006). On the other hand, international investments offer diversification benefits through exposure to different economic cycles. Some significant multi-national pension funds (like Canada's Pension Plan Investment Board or the Government Pension Fund of Norway) have explicitly global mandates, seeking the best risk-adjusted returns worldwide and treating home bias as a risk to be managed. A World Bank analysis suggests that incremental return gains of about 1% per year are achievable by moving from a heavily domestic portfolio towards an internationally diversified one (Afanador et al., 2021).

As can be noted, there is a critical balance where domestic investments can hedge specific risks (e.g., currency or inflation risks). However, excessive reliance on them may sacrifice the risk-adjusted benefits of global diversification, which is crucial for current and future pension beneficiaries.

2.2.5 Home Bias & Economic Growth

Domestic pension investments extend beyond portfolio management. By channelling a larger share of assets into the domestic market, pension funds can benefit economic growth.

The most direct way is by boosting productivity. Investments in domestic infrastructure, technology, and private equity have the potential to drive corporate innovation and overall economic development. However, empirical evidence on these effects is predominantly from developing countries and can, therefore, overestimate the effects on a developed country like the UK (Holzmann, 1997; Thomas & Spataro, 2016). A more recent and geographically closer study was conducted by Beetsma and colleagues (2024), which used Danish data and identified a significant relationship between pension fund equity investment and firm productivity. On average, the firm productivity effect was between 3-5% but increased with the amount invested nonlinearly. They also note that pension funds invest over longer periods compared to other institutional investors, such as private equity. There is a less strong effect for listed equities, which they think is because they have access to alternative sources of finance.

A central point highlighted in the literature is that it can deepen capital markets. Liang and Bing analyse UK data from 1970-2008 and find that pension fund growth pos-

itively affects the deepening of financial market development (2010). Enhanced domestic investments improve market liquidity and encourage better corporate governance through long-term shareholder engagement from pension funds. These factors could contribute to lowering the cost of capital and stimulating economic growth. Alda and Marco use data on eight European stock markets (including the UK) (2017). They find that pension funds' growth positively impacts short-term market size, long-term growth, liquidity, activity, return, and stability. Furhermore, Alda finds that pension fund investment in equities helped stock market development (defined as market cap) across 13 European countries between 1999 and 2014 (2017). In the UK, this finding was positive but not statistically significant. Babalos and Stavroyiannis find that pension fund investment in equities enhances stock market development (defined as market cap) in the five sub-country groups, covering 29 OECD countries between 2001 and 2016 (2020). However, this finding was positive but not statistically significant in Anglo-Saxon countries (which include the UK).

2.3 Policy Initiatives

The policy debate is divided on whether pension funds should be forced to increase their domestic allocations or be nudged through market-based incentives - perhaps now more than ever, following both previous and current UK governments efforts to increase domestic investment by pension funds (Thurley et al., 2024; Wells, 2024). On one side, many have been vocally against any sort of mandates forcing pension funds to invest more at home, including the Governor of the Bank of England (S. P. Chan, 2024). At the same time, they have also welcomed efforts to make UK investment more attractive (Association of Professional Pension Trustees, 2024; Pension and Lifetime Savings Association, 2024; PLSA, 2024; The Society of Pension Professionals, 2024).

Policymakers have often grappled with the tension between global diversification and using pension capital to support the local economy. Some governments impose or consider mandates and incentives to tilt pension investments domestically, aiming to channel these large pools of capital into economic development. For example, many emerging markets initially set strict limits on foreign assets, requiring pension funds to hold mostly domestic bonds and equities (Darvas & Schoenmaker, 2017). These rules were meant to develop local capital markets and ensure pensions financed domestic public debt. In Latin America, Chile's pension system had low foreign investment caps that gradually liberalized for many years. Similarly, Canada had a "30% foreign property rule" until 2005 that constrained Canadian plans to invest primarily at home. Such regulatory home bias does create a captive demand for domestic assets, but it can come at the cost of lower returns. The World Bank finds that many developing-country funds, once allowed to diversify more abroad, could gain significantly – in the order of 1.5% or more per year in extra returns for markets like Brazil, Turkey, or Indonesia if they moved to an optimal global mix (Afanador et al., 2021). In Mexico, after foreign investment limits stopped rising post-2013 (capped around 20%), the foregone returns from not increasing international exposure were estimated at $\approx 0.9\%$ per year over the subsequent six years.

Early experiments forcing pension funds into domestic projects have sometimes backfired; for instance, the World Bank notes that in some countries attempts to channel pension savings to domestic investment were hampered by public mismanagement and corruption, leading to poor outcomes (Davis et al., 2021). In short, using pension funds as a tool of industrial policy or deficit financing risks undermining the fund's core mandate

of securing returns for retirees.

In the UK context, recent policy initiatives - including the Mansion House reforms - have opted for softer measures. For instance, voluntary commitments from large DC providers to allocate a portion (e.g., 5%) of their funds to unlisted UK equities. The current government also plans to require pension schemes to disclose the proportion invested in UK assets by 2027, effectively a transparency nudge to spur competition on supporting domestic business (Allen, 2024; Benefits Expert, 2024).

Tax incentives are another lever. Surveys show UK savers broadly support measures like tax breaks for pensions investing in UK companies' assets (Department for Work and Pensions, 2024b). Australia's "franking credit system" is an example of a structural incentive that encourages domestic equity investment by boosting after-tax yields for domestic investors.

Importantly, and as briefly referenced earlier, academic and industry experts caution against heavy-handed mandates. A recent study of Canadian pension funds asks "Should Canada require its pension funds to invest more domestically?" and concludes that forcing allocations at home would disturb the risk-return calibrations which could lead to financial losses for the fund members (Ambachtsheer et al., 2024). The authors show Canadian funds already invest a large share in domestic assets (especially in bonds and real estate), but have prudently diversified more globally over the past decade as Canadian opportunities became saturated (Ambachtsheer et al., 2024). One major reason Canadian funds looked abroad is the lack of sufficient large-scale "strategic" domestic assets. There are only so many significant infrastructure projects or real estate deals in Canada, whereas opportunities increase if one is open to looking at other countries. In such a scenario, mandating funds to reinvest at home could mean accepting lower returns or higher risk for members. Instead, the paper recommends facilitating more investable domestic projects. Proposals include privatising or offering long-term leases for public infrastructure: airports, harbours and utilities to provide pension funds with attractive domestic investment opportunities that still meet their risk–return criteria (Ambachtsheer et al., 2024). This Canadian example resonates globally: pension capital can support the home economy, but the initiative should come from improving the investment case, not overriding portfolio optimization.

A modest bias can be beneficial when the home market offers distinct advantages (tax benefits, matching of liabilities, or uncorrelated asset classes). However, purely concentrating on domestic public securities against the principles of diversification tends to raise volatility without improved returns.

2.4 The Lifecycle Hypothesis & the OLG GE model

The overlapping generations (OLG) model embedded in a general equilibrium framework, presented in the next section, is based on a version of the OLG (Diamond, 1965; Samuelson, 1958) introduced by Auerbach and Kotlikoff (1987). This method emerged from the lifecycle hypothesis (Ando & Modigliani, 1963; Modigliani & Brumberg, 1954). It provides the basic theoretical framework needed for modelling household behaviour. According to the theory, households rationally choose consumption, leisure and saving levels in order to smooth consumption over the lifecycle. Additionally, and perhaps the most memorable feature of the theory, is that the wealth accumulation over the lifecycle follows a "hump-shaped" pattern of net saving during middle age followed by dis-saving during retirement.

What Auerbach and Kotlikoff did was to develop a lifecycle dynamic simulation model that solved for the economy's path under assumptions that individuals take rational decisions, taking account of future changes in economic conditions, i.e. having perfect foresight (1987, ch. 3). This has later been built upon to create a range of OLG Auerbach and Kotlikoff-type models for different applications, e.g. adding stochastic survival (Chai & Kim, 2018; Domeij & Floden, 2006; Fehr et al., 2003), bequests (Chai & Kim, 2018; Fehr et al., 2003), PAYG schemes (Alho & Borgy, 2007; Börsch-Supan et al., 2006; Domeij & Floden, 2006) and different utility functions - to mention a few.

The model in this paper builds of the Auerbach and Kotlikoff model but takes inspiration from the many others that followed. It differs in that it is applied specifically to the country UK and the topic of pension savings. Furthermore, it incorporates a domestic allocation parameter in individuals' pension savings. More details are discussed in the model section.

In order to isolate and quantify the key trade-offs of home bias in a tractable setting, the model abstracts away from many institutional details, but capture three core real-world mechanisms. First, return differences between domestic and foreign assets—that is, the empirical gap in risk-adjusted returns—are represented directly by allowing the domestic return (r_d) to differ from the world return (r_f). In practice this return gap reflects both performance differentials and the diversification premium that investors earn abroad. Second, the home allocation parameter (θ) is deliberately left agnostic regarding its precise economic interpretation: it can be viewed as a regulatory "mandated share", a behavioural "familiarity bias", a simplified proxy for the full set of hedging/liability-matching benefits that domestic assets provide, or any other reason why the pension fund who invests the pension savings would choose to allocate more at home. Third, general-equilibrium feedback, for example, the way an inflow of domestic savings pushes down (r_d) or pushes up the wage (w), directly captures the growth and price effects from large pension pools.

2.5 Contribution of this paper

The literature on pension fund investment policies highlights a complex balancing act. On the one hand, home bias offers essential hedging benefits, aligns with domestic liability structures, and can bolster local capital markets. On the other hand, over-concentration in domestic assets can increase portfolio volatility and miss opportunities for global diversification.

This paper contributes to the discourse on home bias in pension funds in the UK by empirically analysing and quantifying the welfare effects of varying domestic allocation through an OLG-GE model. It also sheds light on the largely overlooked heterogeneous effects following a change in domestic allocation at different levels of current domestic allocation. The results can provide valuable pension policy insights for policymakers in the UK of the consequences of more or less home bias in occupational and private pension accounts. Furthermore, it adds to the large basket of Auerbach and Kotlikoff-type models by introducing a simple DC account with a "domestic allocation" parameter that sets the share of the savings going to the domestic market vs. the foreign market.

3 Method

3.1 Model

This paper develops a dynamic lifecycle model embedded in a general equilibrium framework. It fundamentally builds on the lifecycle theory and its assumptions (Ando & Modigliani, 1963; Modigliani & Brumberg, 1954), as well as the seminal dynamic lifecycle model developed by Auerbach and Kotlikoff (1987, ch. 3) with its many later augmentations and modifications in subsequent research. At the core, it is assumed that individuals have perfect foresight, are rational and attempt to maximise the inter-temporal utility function subject to a lifetime budget constraint.

3.1.1 Differences & Similarities from Literature

This paper models the UK as a small open economy (similar to Bettendorf and Heijdra 2006; Chai and Kim 2018; Heijdra and Romp 2009). It is a simplifying assumption as the economy can invest in the foreign market but does not receive any investments from it - taking the foreign interest rate/return as given. In contrast, Börsch-Supan and co-authors model symmetric and large open economies (2006). In their model, ageing affects the international capital flows, modifying the effects of pension reforms and demographic change. This dynamic is not captured when assuming that the UK is a small economy since changes in the share of domestic allocation by pension funds do not affect the foreign interest rate, only the domestic.

The OLG framework in this model shares the same basic building blocks as most others in the literature. In each calendar period t, several cohorts of equal size enter the model and it does not distinguish between sexes (as in Alho and Borgy 2007). State variables and decisions are defined at the beginning of each calendar period t and at the start of each age period a. Similar to Domeij and Flodén (2006) individuals enter the model at age 20 and begins working immediately, retire at the state retirement age of 65 and live up to a maximum age of 90, as in Fehr and Kotlikoff (2003).

It is common to include demographic projections and taking into account an ageing population and fertility, where, for example, the cohorts size and thus labour supply changes over time (e.g. Börsch-Supan et al. 2006; Chai and Kim 2018; Fehr et al. 2003). In this model, because cohorts of age a_W are always of the same size, it reduces the dynamic complexities of the model but does not take into account the long term effects of an ageing population and changing fertility.

The individual allocates income between consumption and savings over the life cycle, where savings are split into general savings and pension account contributions. There is neither borrowing nor lending and, unlike other models, no leisure choice (e.g. Auerbach and Kotlikoff 1987). The most important aspect of the model, and primarily why it stands out, is the inclusion of a home allocation parameter θ that affects the pension savings by setting a floor on domestic pension savings investments, earning the domestic return rate. The model is divided into two distinct phases: the working phase, during which the individual accumulates wealth, and the retirement phase, during which wealth is decumulated. Other similarities and differences are discussed throughout.

3.1.2 The Individual's Lifecycle Optimisation Problem

Let age of an agent be indexed by $a = 0, 1, ..., T$, where $a = 0$ corresponds to birth and $a = T$ is the final period of life. Meanwhile, calendar time t is used to describe the overlapping generations structure, where in each period t a new cohort is born, and alive cohorts age and eventually exit.

During working ages ($a_W \leq a < a_R$), where W is the age at which work begins, and R is the age of retirement, labour income for individual i of age cohort a is given by:

$$y_{i,a} = w_t \cdot e(a) \cdot \epsilon_{i,a},$$

where w_t is the wage at the start of calendar time t, $e(a)$ is the effective labour supply (normalised to $e(a_W) = 1$) and $\epsilon_{i,a}$ is a multiplicative idiosyncratic shock drawn each period assumed to follow a lognormal distribution: $ln\ \epsilon \sim N(\mu, \sigma^2)$.

Lognormal is a plausible distribution for income shocks since it can't go negative, ensuring income stays positive after a shock. Furthermore, if μ is chosen such that the expectation of the shocks equals 1, it keeps the mean path of income unchanged since: $\mu = -\frac{1}{2}\sigma \implies \mathbb{E}[\epsilon_{i,a}] = exp(\mu + \frac{1}{2}\sigma) = 1$. Since the shocks have mean one, any change in behaviour such as precautionary savings, is purely due to the variance and not a shift in the average income.

The effective labour supply can be thought of as individuals working in a perfectly competitive market earning their marginal contribution. As they grow older, they earn experience and skills, which increase their marginal contribution and hence their income. This continues until the mid-40s when it begins to decrease (for more details see the section on normalisation of $e(a)$). This is slightly different from Bettendorf and Heijdra who assume exponentially falling work efficiency with age (2006) but similar to Domeij and Flodén (2006).

At the beginning of each period of working, a fraction τ_{DC} of $y_{i,a}$ is contributed to the DC pension account, and a fraction τ_{PAYG} is paid into a PAYG system (a simple version of the PAYG system in e.g. Alho and Borgy 2007; Domeij and Floden 2006). Whatever remains is available for consumption and general savings. In equilibrium, the total contributions from all alive working agents must finance the pension benefits paid to alive retirees. Since I assume that all cohorts are of equal size at entry, it is simple to assume that the pension benefit p is the average of the $\tau_{PAYG} \cdot y_{i,a}$ contributions over the working life of alive individuals. To ensure that the PAYG system is balanced we have:

$$p = \frac{\sum_{a=a_W}^{a_R-1} \Pi(a) \tau_{PAYG} \cdot y_{i,a}}{\sum_{a=a_R}^{T} \Pi(a)}.$$

where in the numerator, each cohort's income $y_{i,a}$ is weighted by $\Pi(a)$ to reflect that only a fraction $\Pi(a)$ of the original cohort ever reached age a and thus paid taxes at that age (see next sub-section for definition of $\Pi(a)$). In the denominator, summing $\Pi(a)$ over a_R to T counts the effective number of retirees alive to collect benefits.

Preferences are represented by the commonly used CRRA utility function (e.g. Domeij and Floden 2006; Heijdra and Romp 2009):

$$u(c_{i,a}) = \begin{cases} \dfrac{c_{i,a}^{1-\gamma}}{1-\gamma}, & \text{if } \gamma \neq 1 \\ \ln(c_{i,a}), & \text{if } \gamma = 1 \end{cases}$$

The agent has two state variables: z_a, general (non-pension) savings and m_a, DC pension account savings. These are defined at the start of age period a within calendar period t. The evolutions of the state variables are given by:

$$z_{i,a+1} = [z_{i,a} + (1 - \tau_{PAYG} - \tau_{DC})y_{i,a} - c_{i,a}](1 + r_d),$$

$$m_{i,a+1} = [m_{i,a} + \tau_{DC} \cdot y_{i,a}][\theta(1 + r_d) + (1 - \theta)(1 + r_f)],$$

where r_d is the domestic return, r_f is the foreign return and θ represents the domestic allocation share in pension investments (how much of an individuals DC savings pot is invested at home) and is exogenous. This means that while individuals (or pension funds) might have some flexibility to choose how much to invest in domestic vs. foreign markets in practice, this simplified model assumes the allocation is predetermined. This means it is modelled more like a mandated level of domestic allocation, which trivially implies the share invested in the foreign market. Since the UK here is modelled as a small open economy r_f is assumed exogenous and changing shares of investments domestically won't impact the foreign returns.

The working phase value function is denoted by $V_a^W(z, m)$ and describes the maximum utility achievable from age a given z_a and m_a. The dynamic programming problem (or Bellman equation) becomes:

$$V_a^W(z_{i,a}, m_{i,a}) = \max_{c_{i,a}} \left\{ u(c_{i,a}) + \beta P(a) \mathbb{E}_{\epsilon_{i,a}}[V_{a+1}^W(z_{i,a+1}, m_{i,a+1})] \right\}$$

for $a_W \leq a < a_R - 1$. $u(c_{i,a})$ is the CRRA utility function, β is the discount factor, $P(a)$ is survival probability and $\mathbb{E}_{\epsilon_{i,a}}$ is the expectation with respect to the current-period income shock to individual i of cohort a. Because $\mathbb{E}[\epsilon] = 1$, the Bellman policy c^* can be computed using the deterministic income $y_{i,a} = w_t \cdot e(a)$. The shocks only enter ex post in the simulation, which gives a smooth trajectory as opposed to a "squiggly one" as you would see in the data. You can see exactly this in the plot of the fitted model's wealth trajectory against the data's in Figure 2.

Similarly to Börsch-Supan and colleagues, when an agent is evaluating the utility of future consumption, that future utility is discounted not only by the time discount factor β but also by the probability that the agent survives to enjoy that consumption (2006). For example, a higher β means that the agent is more patient, i.e. they place relatively more weight on future consumption compared to current consumption. $P(a)$ captures the probability of surviving from age a to $a + 1$, which differs by age (Domeij & Floden, 2006; Fehr et al., 2003; Heijdra & Romp, 2009). This is also applied to working people, as opposed to only retired, as in Fehr and Kotlikoff (2003). As one grows older, the probability decreases and will have the agent value consumption today relatively more.

Similarly to Chai and Kim, however, higher life expectancy does not induce the young to supply more labour (consume less leisure), which in reality could be the case as it would increase the expected payoff of pension benefits by raising the effective discount factor - i.e. valuing future consumption relatively more (2018). The labour supply, like the pension benefit, remains constant over the ages since the total number of individuals in the economy does not change and the effective labour supply function, that governs how much supply each cohort supplies, is also constant over time.

At the last age of work $a = a_R - 1$ the individual goes to work as per usual and earns income. A share of it is simultaneously paid into the PAYG system and the DC account, while the rest is used for consumption and savings, where savings earn the domestic return. When the individual wakes up a retiree the next period, he receives his total

retirement savings/wealth as a lump sum denoted s_R: the sum of the net general savings and pension account savings from last period. It is given by:

$$s_R = [z_{R-1} + (1 - \tau_{PAYG} - \tau_{DC})y_{R-1} - c_{R-1}](1 + r_d) + m_R.$$

At retirement no labour income is earned. Instead, each retiree receives a fixed pension benefit p from the PAYG system. Since the pension account has been merged with general savings, the only state variable is total accumulated pension savings s_R. For $a \geq R$ The law of motion for retirement savings is:

$$s_{i,a+1} = \Big(s_{i,a} + p - c_a\Big)(1 + r_d),$$

where s_a is the total wealth at the beginning of retirement age a, p is the guaranteed state pension benefit from the PAYG system and r_d is the domestic return on unconsumed wealth at each age a.

The retirement phase value function $V_a^R(s_{i,a})$ is then:

$$V_a^R(s_{i,a}) = \max_{0 \leq c_{i,a} \leq s_{i,a}+p} \Big\{u(c_{i,a}) + \beta P(a) V_{a+1}^R\Big(s_{i,a+1}\Big)\Big\}$$

for $a_R \leq a < T$, with the terminal condition:

$$V_T^R(s_T) = u(c) + \phi \cdot B(s_T + p - c).$$

where ϕ is a parameter capturing the weight of the bequest motive and B is the bequest utility function, also in CRRA form like $u(c)$ (Fehr et al., 2003).

In this model, the retiree receives a guaranteed state pension p and any consumption above that will be financed by depleting total accumulated wealth s_a. Whatever remains of the total wealth is invested in the domestic market yielding the domestic return r_d. The terminal condition with a bequest motive ensures that in the last period alive (T), the individual gains some utility for leaving behind assets which encourages them to preserve some wealth rather than consuming it all.

3.1.3 Survival Weighted Aggregate Savings, Capital and Labour Supply

Because agents face age-varying mortality, the fraction of a given cohort alive at age $a > a_W$ is less than one. Like above in our value functions, let:

$$P(a) = 1 - q_x(a)$$

be the one-period survival probability at age a. $q_x(a)$ is the one-period mortality rate at age a reported in most national life-table data. The complement $1 - q_x$ is thus the probability of survival from age a to the next age $a + 1$. We define the probability that an individual who entered the model at age a_W survives to age a as:

$$\Pi(a) = \prod_{j=a_w}^{a-1} P(j), \qquad \Pi(a_W) = 1$$

where we normalise $\Pi(a_W) = 1$, i.e. no survival uncertainty upon entry.

In our OLG framework, the domestic capital stock at the start of each calendar period t, denoted K_t, is the sum of the savings of all living cohorts. By assumption, general savings z_a as well as total retirement savings s_a are all invested domestically, while for

DC pension savings m_a only a fraction θ is invested domestically. To take possible death into consideration in the model, we include the survival probabilities when calculating aggregate capital and effective labour supply. Aggregate domestic capital at the beginning of period t is given by:

$$K_t = \sum_{a=a_w}^{a_R-1} [\Pi(a)(z_{i,a} + \theta m_{i,a})] + \sum_{a=a_R}^{T} [\Pi(a) s_{i,a}].$$

The total effective labour supply L is given by summing all living working cohorts effective labour supply:

$$L = \sum_{a=a_w}^{a_R-1} \Pi(a) e(a).$$

Let k_t be capital per efficiency unit of labour (per effective worker) and be defined as $k_t = \frac{K_t}{L_t}$. In simulation, we approximate the sums over a by weighting each age-specific average wealth by $\Pi(a)$, which down-weights older ages (where mortality is higher). This ensures that both the numerator K_t and denominator L_t reflect the living population at each age.

Those who die in the beginning of period t leave behind their accumulated wealth which is contributed into an "accidental" bequests pool. The total accidental bequests per birth cohort is:

$$AccBeq_t = \sum_{a=a_W}^{T} \Pi(a)[1 - P(a)](z_{t,a} + m_{t,a})$$

which we then redistribute as a lump sum transfer $Transfer_{AccBeq} = AccBeq_t$ to agents who just entered the workforce at age a_W. Without this, we would underestimate the aggregate savings in the economy since this capital has to go somewhere. Another perhaps more realistic alternative is to split the accidental bequest between the children (Fehr et al., 2003), but families and parent-child networks are not modelled here. Having every cohort enter with the same initial resource simplifies it.

3.1.4 Production and Endogenous Domestic Returns

The economy's aggregate output is produced according to a neoclassical production function (Börsch-Supan et al., 2006; Chai & Kim, 2018; Fehr et al., 2003). We divide through by L to keep it in per-worker terms:

$$Y_t = AK_t^{\alpha} L^{1-\alpha} \quad \Leftrightarrow \quad y_t = Ak_t^{\alpha}$$

where y_t is total output per effective worker, k_t is the domestic capital stock per effective worker and $\alpha \in (0, 1)$ is the capital share. A_t is total factor productivity (TFP).

In equilibrium, the return for domestic assets r_d is determined by the marginal product of capital (MPK):

$$MPK_t = \frac{\partial y}{\partial k} = \alpha A k_t^{\alpha-1}$$

The net return on domestic capital is then given by:

$$r_d = MPK_t - \delta = \alpha A_t k_t^{\alpha-1} - \delta$$

where δ is the depreciation rate of capital. Similarly, in equilibrium the wage rate is given by the marginal product of labour (MPL):

$$w_t = MPL_t = \frac{\partial Y}{\partial L} = (1-\alpha)A\left(\frac{K_t}{L}\right)^{\alpha} = (1-\alpha)Ak_t^{\alpha}$$

3.1.5 The Model Mechanisms Behind Changes in θ

Recall that during working life, pension savings evolve according to:

$$m_{i,a+1} = [m_{i,a} + \tau_{DC} \cdot y_{i,a}][\theta(1+r_d) + (1-\theta)(1+r_f)]$$

.

From the equation for K_t:

$$K_t = \sum_{a=a_w}^{a_R-1} [\Pi(a)(z_{i,a} + \theta m_{i,a})] + \sum_{a=a_R}^{T} [\Pi(a)s_{i,a}],$$

increasing θ increases the share of pension savings going into the domestic economy, which increases the aggregate capital K_t. Of course, this means that also capital per effective worker k_t increases and the neoclassical production function, with the equations for (y, w and rd) delivers two effects: i) MPL and thus wage w increases with k and ii) MPK decreases when k increases, because $\alpha - 1 < 0$ we have diminishing returns to capital, so r_d falls.

In the individual's Bellman equation, consumption choices respond to both current resources and the expected return on savings. Hence, during working life, a higher steady-state k_t would be expected to result in lower returns on domestic savings r_d, which means less pension wealth to draw on in retirement. On the other hand, it increases the wage, meaning more income available to both consume and save. However, as r_d is lower, the incentive to save that extra income is reduced, potentially resulting in a switch towards more consumption. The welfare impact is ambiguous.

3.2 Data

3.2.1 Data Source and Sampling

The empirical analysis is based on the Wealth and Assets Survey (WAS), a biannual longitudinal household- and individual-level panel of private households in Great Britain spanning 2006–2020 (Office for National Statistics, 2025e). Waves 1–2 are omitted here because the early data lack detailed breakdowns of wealth components; our sample therefore begins in Wave 3 (2010–12) and continues through Wave 7 (2018–20). The WAS employs a multi-stage stratified random sample of private households (excluding communal establishments such as care homes or student halls). Within each responding household, all consenting adults aged 16+ (excluding full-time students aged 16–18) are interviewed by computer-assisted personal interviewing. Longitudinal weights account for initial selection probabilities and differential attrition across waves. Sample size by wave are summaries in Table 1.

Table 1: Sample Size by Wave

Wave	Households	Individuals
Wave 1	30 587	71 182
Wave 2	20 165	46 293
Wave 3	21 446	49 398
Wave 4	20 240	46 388
Wave 5	18 808	42 832
Wave 6	18 029	40 488
Wave 7	17 534	38 855

3.2.2 Variables

The following individual-level variables are used (all deflated to 2020 £ using the CPI series described below): *gross annual labour income*, *total wealth* and its components *physical-, property-, financial- and private pension* wealth. Physical wealth is based on respondents' banded estimates of household goods and personal possessions - including the contents of the main residence, contents of any other owned property, collectables, valuables, vehicles and number plates - which are converted to point estimates at the midpoint of each band and presented on a gross basis (i.e. without netting off any related liabilities) (Office for National Statistics, 2014). Property wealth reflects the market value of real estate holdings - both the main estate and any additional residential property - net of secured borrowing such as mortgages. Financial wealth comprises the gross value of formal financial assets (bank deposits, savings, stocks and shares) and informal holdings (cash saved at home, assets held by children), less liabilities such as overdrafts, loans and bill arrears, yielding net financial wealth (Office for National Statistics, 2014). Finally, private pension wealth captures the present value of all non-state pension entitlements—covering current contributions to DB and DC occupational schemes, personal and group personal pensions, additional voluntary contributions, retained rights in DB/DC schemes, income-drawdown funds, pensions in payment, and future pension rights based on former partner contributions (Office for National Statistics, 2014).

All component wealth variables were renamed to a common scheme, merged together with other variables from wide to long form and then summed - treating missing values as zero - to generate summary measures per wave. The individual wealth variable used in calibration and fitting is the summary of pension- and financial wealth. Throughout the paper median values are reported to mitigate the skewness of wealth data.

3.2.3 Age imputation and panel construction

Exact age is not reported in all waves to protect respondent privacy. To access the secure version of the dataset, one needs to be based in the UK and get authorised (UK DATA SERVICE). Some waves have the exact ages while others only have age intervals with four year spans. To avoid this constraint, one can interpolate exact ages across waves for individuals with exact ages in at least one wave. In other situations, it is possible o convert the interval codes to their midpoints, then estimate each individual's birth year as the survey year minus their imputed age in each wave, averaged across waves, and from that recover a continuous calculated age for every wave rounded to nearest integer.

After merging on the identifier, restricting the sample to ages 20 and above, dropping

missing values and weighting, the balanced long-panel sample consists of 31,564 usable observations. Figure 1 plots the age distribution of the final sample.

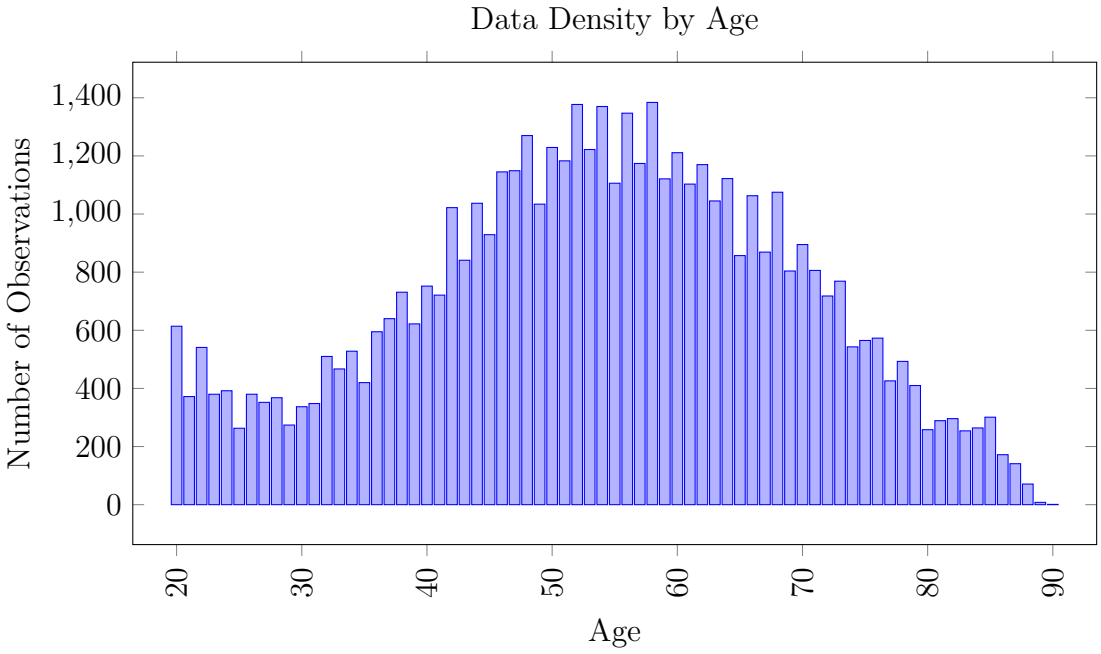


Figure 1: Age distribution of the final WAS sample used for the analysis.

3.2.4 Inflation adjustment

Monthly CPI data (2010-2020) from the Office for National Statistics are converted to annual cumulative indices and normalised to a 2020 base (2025b). Each survey year's nominal variables are divided by the corresponding annual index to yield real 2020 £ values.

3.2.5 Weighting and Summary Statistics

The variables and their summary statistics can be found in Table 2 and Table 3. All descriptive statistics are computed using the WAS longitudinal weights and are deflated to real 2020 £ terms. Different wealth components are added together into new variables. These are used in the calibration step.

Table 2: Summary Statistics (1/2)

	age	gross annual income	total wealth	physical wealth	property wealth
count	31564	31564	31564	31564	31564
mean	47.640	29881.352	410753.155	32183.014	129277.553
std	12.217	27659.873	1225520.465	30632.686	212465.320
min	20.000	10.902	453.356	433.511	0.000
25%	40.000	13652.254	82991.346	15561.421	0.000
Median	49.000	23141.252	233005.096	25184.929	81518.803
75%	56.000	37940.668	507915.042	39219.942	164934.562
max	87.000	761637.897	189162931.891	822568.928	10066585.386

Table 3: Summary Statistics (2/2)

	total pension	financial	pen+fin	pen+fin+phys	pen+fin+prop
count	31564	31564	31564	31564	31564
mean	189780.176	59512.412	249292.588	281475.602	378570.141
std	354243.765	1066101.982	1148128.095	1153124.646	1218556.730
min	0.000	0.000	0.000	453.356	0.000
25%	4964.965	1803.055	17185.763	42589.172	60101.759
Median	57526.021	10650.123	90488.716	123731.570	201233.722
75%	222065.589	41634.152	285901.984	324159.677	469270.780
max	8928737.162	184403415.325	186211585.041	186442796.545	188931720.386

3.3 Calibration

In the calibration stage, the model's parameters are split into two groups: those set exogenously based on external evidence (e.g. foreign return and demographics), and those determined endogenously (such as the equilibrium domestic return and wage rate). The remaining preference and shock–process parameters are pinned down by minimizing the distance between the model's median wealth–by–age profile and that observed in the WAS data.

3.3.1 Fitting the Model to the Data

To calibrate the model and pinning down the final parameter values, the model's median wealth by age profile is matched with the median of pension plus financial wealth ($pen + fin$) from the survey data. These wealth components map into the model's state variables - general and pension savings - and they both earn market returns each period. In contrast, property and physical wealth have different return processes that are not well represented in the lifecycle framework. This choice is important because one wants the fit to map the wealth stocks the model can replicate.

As a robustness check, the median wealth trajectories of the other summary variables, of different wealth components, were also plotted along the model's simulated trajectory. This revealed that both the non-calibrated and the calibrated baseline models clearly followed the $pen + fin$ the closest.

To fit the model, a baseline domestic allocation share θ is needed. Choosing the baseline θ_0, however, is not easy. To pin it down, it is matched to the best available snapshot of actual pension fund asset allocations in the UK, drawing on the most recent publications and data from the Pensions Policy Institute discussed in section 2. Findings are summarised in (Table 4). DC schemes holds about a third of investible assets while the private and public DB schemes split roughly 50% and 20% respectively. For the home bias (or home allocation) the simple midpoint of the trend over the period is used. DC went from around 50% to 20%, so the home allocation is set to 35%. Private DB went from roughly 45-50% to about 60%, yielding a 55% average over the period. Lastly, the public DB saw a decrease from around 45-50% to 30%, thus setting it to 40%.

Scheme	Share of Assets	Domestic allocation θ	Contribution to θ_0
DC	30%	0.35	$0.30 \times 0.35 = 0.105$
Private DB	50%	0.55	$0.50 \times 0.55 = 0.275$
Public DB	20%	0.40	$0.20 \times 0.40 = 0.080$
Total	**100%**		$\theta_0 \approx 0.47$

Table 4: Decomposition of overall domestic-allocation by pension scheme.

This single value abstracts away from the heterogeneity in home allocation across different pension schemes and asset classes, allowing us to ask what would happen to equilibrium values, in per effective worker terms, if the home allocation changed from this periods roughly 50-50 split. However, it should also be understood that the true underlying θ_0 is moving over time, varies by fund type and asset class, and data is not precise.

As described in the model section, the lifecycle model is embedded in a GE solver. First a preliminary grid search over plausible ranges of the preference parameters is performed (β, γ, ϕ). For each candidate parameter vector, both working- and retirement phase dynamic programming equations are solved and Monte Carlo simulations are done with a 150,000 individuals. The model's median wealth by age are obtained and units are scaled into real pounds using the scaler s_k by matching the steady-state capital per effective worker k^* to k_{data} (see subsection below). The iteration calculated the sum of squared errors (SSE) between the scaled model's median wealth profile and that of the WAS data. The parameters were iteratively refined to minimise the SSE as well as visually look like a better fit. The final parameters are shown in Table 5.

Figure 2 shows the fitted model's median wealth trajectory over the wealth trajectory of the data. While the primary goal was to choose parameters that reproduce the broad hump–shaped profile of median wealth by age, it is worth emphasizing why achieving a good fit here is important. The shape of the empirical wealth profile captures two key behaviours: how quickly agents accumulate savings in early and mid-career, and how they draw them down in retirement. In the results section many of the comparative statics such as marginal welfare effects, peak wealth, replacement rates etc., hinge on the baseline lifecycle profile. Therefore, a model that for example accumulates wealth too slowly will understate the benefits of higher returns and vice versa. Furthermore, the marginal effects rest on small deviations around calibrated θ-values. A misspecified baseline level amplifies these elasticities in nonlinear regions (e.g. around the retirement "kink"), leading to over- or underestimates of the true sensitivity to θ.

As Figure 2 shows, our model sits slightly above the data in the 20–35 age range. This could reflect an overly generous initial accidental bequest or simply the fact that the accidental bequest is distributed to the entrants rather than, for example, spread out across all living cohorts. The WAS median at older ages displays considerable volatility (the shaded 95% confidence interval widens a lot past age 75). Some of the divergence around retirement (ages 65–70) may be sampling noise or the lumpiness of realized pension windfalls, rather than genuine structural misspecification.

The close visual alignment in Figure 2 gives confidence that the core results - especially the welfare ranking of different θ and the signs and magnitudes of the marginal effects - reflect genuine model mechanics rather than calibration artefacts. Nevertheless, any policy interpretation should bear in mind the remaining miss-fit in especially young and

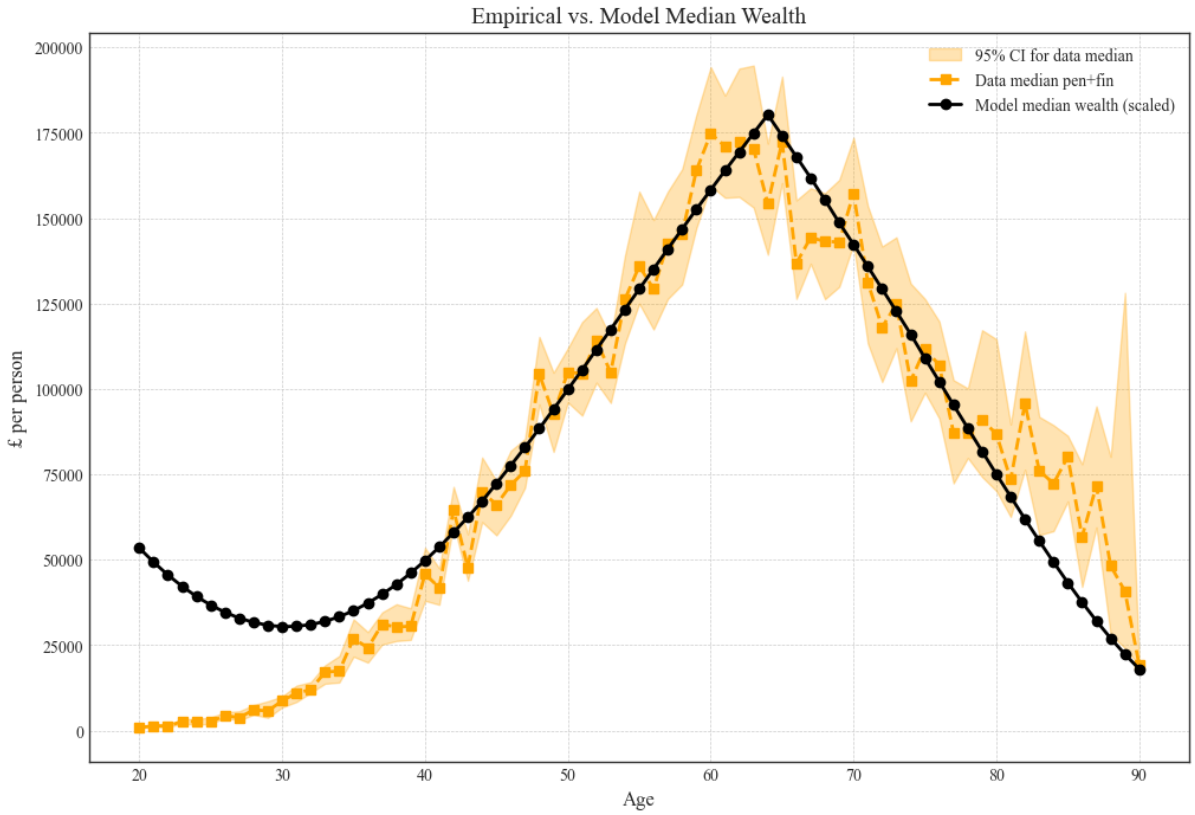


Figure 2: Model's simulated median wealth trajectory at baseline ($\theta = 0.47$) and the WAS-data median wealth trajectory

old cohorts as well as the scarce data of old individuals - the calibration anchors entirely on the aggregate wealth profile rather than median wages or capital-to-output ratios. Since the fit is imperfect, one should be cautious in interpreting *absolute* real £ changes and focus on the *relative* changes.

3.3.2 Parameters and Tuning

Table 5 lists all of the structural parameters in the model, their interpretation and final numerical values after calibration. Where a parameter is solved for in general equilibrium rather than exogenously set, its value is market with "Endog." for endogenous.

Table 5: Model parameters and their calibrated values.

Parameter	Description	Value
a_{work}	Starting age for work	20
a_{retire}	Retirement age	65
T	Terminal age	90
β	Time discount factor	0.97
γ	CRRA risk-aversion coefficient	2.0
r_d	Domestic return	Endog.
r_f	Exogenous foreign return	0.08
τ_{DC}	DC pension contribution rate	0.04
τ_{PAYG}	PAYG contribution rate	0.12
w	Wage	Endog.
θ_0	Baseline share of DC pension invested domestically	0.47
p	PAYG pension benefit	Endog.
β_1	Efficiency function linear coefficient	0.0977
β_2	Efficiency function quadratic coefficient	–0.0011
A	Total factor productivity (TFP)	1.0
k	Capital-per-worker ratio	Endog.
α	Capital share in production	0.33
δ	Depreciation rate	0.05
ϕ	Bequest utility weight	7
σ_{inc}	Standard deviation of income shocks	0.3
N	Number of simulated individuals	150 000

Note: Endog. stands for endogenously determined in the model and is not set before solving the model. The rest are calibrated and set before solving for the equilibrium.

Each choice is now justified briefly. *Demographics.* $a_{work} = 20, a_{retire} = 65, T = 90$ is set in line with typical working-life assumptions in the lifecycle literature (Domeij & Floden, 2006; Fehr et al., 2003). *Preferences.* The discount factor $\beta = 0.97$ and risk aversion $\gamma = 2.0$ follows from the fitting procedure. *Returns.* The real annual and risk-adjusted foreign return $r_f = 8\%$ is taken from long run real equity returns from the geographically neutral MSCI World Index, see Table 6 (S&P Capital IQ, 2025). Domestic return is endogenously determined. *Pension.* $\tau_{DC} = 4\%$ matches the current minimum auto-enrolment contribution rates in the UK DC pensions. $\tau_{PAYG} = 12\%$ is set to match the mandatory NI contributions necessary to receive full state pension. The baseline domestic allocation parameter $\theta_0 = 0.47$ is set to the rough empirical UK average DC and DB domestic assets share of total assets between 2010-2020. *Labour income profile.* $\beta_1 = 0.0977$, $\beta_2 = -0.0011$ are estimated by OLS, regressing log real annual wages on *age* and age^2 from the WAS data, see Table 7 (more details in subsection on normalisation of $e(a)$). *Production.* A Cobb–Douglas production function with $\alpha = 0.33$ is standard in the literature and technological progress is assumed away, setting $A = 1$ as in Chai and Kim (2018); in the literature, depreciation varies from 3% to above 10% in some cases, $\delta = 5\%$ was in the end calibrated to fit the model's wealth trajectory. *Bequest motive and income shocks.* The bequest weight ϕ is set so that terminal period utility from positive

bequest is enough to match the data. However, as mentioned, the observations in later ages and in particular the terminal age of 90 are extremely few. Hence there are a lot of uncertainty with this calibration. The income shock $\sigma_{inc} = 0.3$ is primarily calibrated to match the variance of log wages in the WAS data but has also been slightly tweaked to match the wealth trajectory of the model. Finally, a large enough sample is chosen for the Monte Carlo simulation to ensure a balance between computation and minimal simulation noise. Survival probabilities are decided by life-tables from the ONS, averaged over the period 2010-2020 (Office for National Statistics, 2025d).

Table 6: Average Annual Real, Risk-Adjusted Returns (2006-2020)

Index	Average Return	Volatility	Return Ratio
MSCI World	8.28%	12.65%	0.89
FTSE All Share	2.39%	15.59%	0.25

3.3.3 Scaling of Variables

To calibrate the model in real-world units, the model's capital per effective worker is matched to the same quantity in the data. One can also target other moments such as capital-to-output ratios or to calibrate the TFP factor to match the data (Barro & Sala-i-Martin, 2004; Kydland & Prescott, 1982). Specifically, we can define:

$$k_{data} = \frac{K_{data}}{L^{eff}_{data}}, \quad and \quad s_k = \frac{k_{data}}{k^*(\theta_0)}$$

where K_{data} is total gross capital data for household and non-profit institutions (excluding state and corporate capital) averaged over 2010-2020, which is transformed into real 2020 units using CPI data (Office for National Statistics, 2025a, 2025b); and L^{eff}_{data} is the total effective labour supply, constructed from age-group headcounts of employed (averaged over 2010-2020) and the model's age-efficiency profile $e(a)$ (Office for National Statistics, 2025c); $k^*(\theta_0)$ is the model's steady-state capital per effective worker at the baseline $\theta_0 = 0.47$.

Specifically, from ONS the number of people employed in each age bin 18–24, 25–34, 35–49 and 50–64 [1] is collected. Denote one bin by g. Then evaluate $e(a)$ at each integer age inside the bin, take the average of those efficiency function outputs which gives a single number, call it $\bar{e}_g$ - which represents how productive on average workers in bin g are. Then simply multiply the average efficiency $\bar{e}_g$ by the total number of workers in that bin. Summing up all the bins' effective labour contributions one gets the total effective labour supply from data L^{eff}_{data}.

The resulting total real gross capital is: $K_{data} = 2,8105$ trillion and total effective labour supply is $L^{eff}_{data} = 47,877$ million. Hence:

$$k_{data} = \frac{K_{data}}{L^{eff}_{data}} = 58,702 \quad \text{per effective worker.}$$

Since calibrating s_k at $\theta_0 = 0.47$, its real-£ mapping is exact only at the baseline. When θ changes, nonlinear feedback (through rates of return, pensions, utility curvature)

[1] I treat the bin 18-24 as 20-24 for averaging and omit 18 and 19 because labour supply in the model begins at age 20.

means the pound-per-unit conversion would shift. Therefore, all simulations are interpreted in relative terms, i.e.%-deviations from the baseline, rather than the absolute level of £ per effective worker.

3.3.4 Normalisation of $e(a)$

The log of labour income is modelled as:

$$ln(y_a) = \beta_0 + \beta_1 age + \beta_2 age^2$$

Using the WAS data, this is estimated with an OLS regression. Results are shown in Table 7. Differentiating with respect to age gives the instantaneous growth rate, of labour income:

$$\frac{\partial y}{\partial age} = \beta_1 + 2\beta_2 age$$

Then the efficiency factor is normalised so that at start of work $e(a_W) = 1$. Since the regression gives us the estimates, we can ensure this by defining:

$$e(a) = \frac{y(a)}{y(a_W)} = exp[(ln(y(a)) - ln(y(a_W))]$$

$$= exp[(\beta_1 a + \beta_2 a^2) - (\beta_1 a_W + \beta_2 a_W^2)].$$

So when $a = a_W$ we have $e(a_W)$ and hence get $y(a_W)/y(a_W) = 1$.

Each age has a different effective labour supply growth. For example, in the data the growth in log real wage is increasing in younger cohorts and then starts to decrease until it eventually hits 0 and turns negative after the mid-40s. One can see this in the slightly s-shaped curve of the model's trajectory in Figure 2, going up to retirement.

Table 7: OLS Estimation results for *log income* on *age* and age^2

	Dependent variable: log_income
	(1)
Intercept	9.472***
	(0.017)
age	0.0977***
	(0.002)
age^2	-0.0011***
	(0.000)
Observations	31564
R^2	0.057
Adjusted R^2	0.057
Residual Std. Error	0.831 (df=31561)
F Statistic	947.459*** (df=2; 31561)
Note:	*p<0.1; **p<0.05; ***p<0.01

4 Results

In this section the model's outcomes are presented. Varying the domestic allocation parameter θ affects the model's general equilibrium outcomes, lifecycle profiles and different welfare measures. All the movements follow from the general-equilibrium feedback and mechanisms outlined in the model section. Greater domestic allocation raises aggregate capital and wages, but at the cost of lowering the return on savings - shrinking retirement pots. This leads to lower consumption and wealth over the lifecycle. Despite higher wages, the reduction in asset returns and erosion of inter-temporal smoothing produces a welfare loss as θ rises.

4.1 Equilibrium Effects of Pension Home Bias

Table 8 presents the scaled general equilibrium outcomes for each decimal increase in θ. As the domestic allocation parameter θ goes from 0 to 1, equilibrium k^* climbs from about 52,600 to 64,200. This is expected and intuitive, because putting more pension savings into domestic assets raises the amount of aggregate savings going to the domestic capital stock, which raises k.

Through the production function and the two related MPK and MPL, one gets two effects from increasing k. First, the equilibrium wage rate (w^*) increases as higher k^* raises the MPL. As θ goes from 0 to 1, w^* rises from roughly £9,030 to £9,650 - an overall rise of approximatively 6.8%. This is exactly the neoclassical channel: more capital per effective worker boosts wages. Note that the model underestimates the median wage in Table 2. Secondly, the domestic interest rate (r_d) falls. With $\alpha < 1$, increasing k depresses MPK. Indeed, r_d slides from 3.5% down to 2.4% as θ rises (in proximity of the average annual real return of the FTSE All Share index in Table 6). The drop in r_d moderates the marginal return on new domestic investment, reflecting diminishing returns to capital.

Next, the PAYG pension benefit p rises. Since p is set to equal average contributions, higher wages (and hence higher labour income) mechanically boost aggregate PAYG contributions and thus benefits. p climbs from £1,749 to £1,868 over the θ-range, a 6.7% increase just like for the wages. If we divide the model's pension benefit with the model's implied wage rate at a given value of θ, we get replacement rates of close to 20%, which is below the replacement rates noted in literature of closer to 50%.

The accidental bequests $AccBeq$ decline with θ. It captures the lump sum transfer of wealth from those who die to those who enter in a given period. As θ increases, individual wealth paths become more front-loaded (due to higher w and k), but r_d falls, slowing compound accumulation. Simply put, relatively less wealth means relatively less bequests. There is a drop in average bequests from roughly £76,800 at $\theta = 0$ to £51,300 at $\theta = 1$, a 33% decrease.

Table 8: General-equilibrium outcomes

θ	k^*	w^*	r_d	p	$AccBeq$
0.000	52593.407	9030.896	0.035	1749.157	76843.429
0.100	52716.101	9037.843	0.034	1750.503	69616.546
0.200	53942.937	9106.718	0.033	1763.843	65205.312
0.300	55492.474	9192.227	0.032	1780.405	62420.368
0.400	57540.082	9302.801	0.030	1801.821	59812.295
0.500	58843.655	9371.829	0.028	1815.191	57860.385
0.600	60400.577	9452.943	0.027	1830.902	55954.700
0.700	61700.225	9519.587	0.026	1843.810	54419.704
0.800	62748.146	9572.641	0.025	1854.086	53194.279
0.900	63692.511	9619.946	0.024	1863.248	52100.791
1.000	64238.300	9647.072	0.024	1868.502	51281.844

Note: All levels are in real 2020 £ units. θ is domestic allocation share of DC pension savings, in equilibrium: k^* is capital, w^* is annual pay, r_d is domestic return, p is annual pension benefit, and AccBeq is annual accidental bequest.

Table 9 contains median consumption and wealth at age 20 and other welfare metrics. Median consumption at 20 declines slightly from £14,637 at $\theta = 0$ to £14,129 at $\theta = 1$, a 3.5% decrease. Consumers smooth their slightly lower lifetime resources when θ rises. Median wealth at age 20 falls monotonically from approximatively £72,220 to £46,361 - an approximate drop of 36% across the θ-range - reflecting lower bequests and slower compound growth under lower r_d.

The consumption replacement rate is not the same as the earlier mentioned replacement rate p/w. It is defined as the ratio of median consumption in the first retirement period to the individual's effective labour income in the last working period. It measures how much of last-period labour income is replaced by median consumption once the agent retires. We see that it steadily falls, from about 1.39 down to 0.94 (a 32% fall): as θ increases, peak wealth is lower relative to peak earnings, so retirees replace a smaller share of their max working-age income. Peak wealth decreases sharply from £223,300 to £160,500, a 28% decrease, suggesting that greater domestic allocation of pension savings reduces the build-up of retirement savings.

Lifetime utility V_{a_W} tells us which "θ-world" it is best to be born into, as it signifies the weighted sum of discounted utilities. It is strictly decreasing in θ (more negative), from –12.78 to –14.95 [2]. Higher θ reduces lifetime consumption opportunities and precautionary savings, lowering overall welfare.

While raising θ boosts aggregate capital and wages, the accompanying drop in the domestic return to savings and the compressed bequests essential for early-life smoothing, means individuals end up with lower peak wealth, lower replacement rates, and ultimately lower lifetime utility.

[2] All reported value-function magnitudes are negative because of the CRRA utility with $\gamma > 1$. For any $c > 0$, this specification yields $u(c) < 0$, so the lifetime value function - the discounted sum of these per-period utilities - remains strictly negative, and only differences across scenarios carry economic meaning.

Table 9: Lifecycle and welfare metrics.

θ	med_cons_20	med_wealth_20	cons_replacement_rate	peak_wealth	V_{a_W}
0.000	14637.343	72220.009	1.387	223331.594	-12.781
0.100	14426.906	64973.332	1.284	206906.310	-13.229
0.200	14234.719	60598.693	1.225	198754.417	-13.533
0.300	14088.999	57832.525	1.170	191510.396	-13.791
0.400	14146.789	55095.154	1.113	184313.575	-14.020
0.500	14239.165	52987.496	1.073	178948.308	-14.229
0.600	14126.144	51144.143	1.032	173694.515	-14.413
0.700	14207.406	49486.471	1.000	169338.057	-14.578
0.800	14275.957	48154.201	0.973	165713.105	-14.721
0.900	14204.410	47114.367	0.952	162777.791	-14.848
1.000	14128.618	46361.319	0.937	160503.364	-14.953

Note: All levels are in real 2020 £ units. θ is domestic allocation share of DC pension savings, in equilibrium: med_cons_20 is median consumption at entry (age 20); med_wealth_20 is median wealth at entry; cons_replacement_rate is the consumption replacement rate; and V_{a_W} is expected life-time utility at entry.

4.2 Lifecycle Wealth and Consumption

Figure 3 and Figure 4 plots the full age trajectories of median wealth and consumption for each θ. They tell the same story as Table 8 and Table 9 above, but illustrates the full lifecycle paths rather than moments.

Let us start by looking a the wealth trajectory in Figure 3. From entry (age 20) to early career (mid-20s) the average wealth dips slightly as individuals draw on the initial accidental bequests and their income is low. Then it begins to turn upward once the individual has earned some experience, efficient labour supply starts to increase and labour earnings exceed consumption, ultimately resulting in the U-shape in the beginning. By mid-career, the gaps between different θ become pronounced: lower θ (purple) yields higher and increasing wealth accumulation by age 50 whereas the higher θ (green and yellow) sees a lower and decreasing accumulation. As shown in Table 9, the difference in peak wealth (around retirement) between $\theta = 0$ and $\theta = 1$ is roughly 28%. After peak, all lines slope downward at roughly the same rate (since retiree savings earn r_d only), but the entire retirement drawdown path for high-θ individuals lies well below that for low-θ ones. Additionally, we also see that the high-θ individuals leave behind a smaller bequest compared to the low-θ individuals.

Also this is expected and intuitive because higher θ means more of pension savings stuck at a lower domestic return rate (which itself is also decreasing in θ), so compounded growth is weaker and the lifetime accumulation "hill" is both lower and narrower.



Figure 3: The model's simulated median wealth trajectories for different levels of home allocation in DC pension savings θ.

Let us turn to the median consumption trajectories in Figure 4. The darkest purple line ($\theta = 0$) sits highest; as home allocation increases through the colour spectrum to yellow ($\theta = 1$), the entire consumption path shifts down by roughly 4–5%. Across all θ, consumption gradually rises from age 20 toward a broad plateau in the late 40s/early 50s, reflecting growing labour income and saving capacity, then dips slightly just before retirement.

At the beginning of retirement, the individual receives their DC retirement savings in a lump sum, merging with his/her general savings, as well as the PAYG pension benefit payments p each period. That is why we see a small jump in consumption. The magnitude of that jump shrinks with θ because larger θ means lower r_d, which means less compound growth, which in turn means a smaller lump sum. After 65, consumption decumulates smoothly, with higher θ trajectories lying uniformly below lower-θ ones.

We can see that raising θ lowers the effective return on pension savings $[(\theta \cdot r_d) + (1 - \theta) \cdot r_f]$ with $r_d < r_f$, which reduces the wealth base available for smoothing, so consumption everywhere is lower.

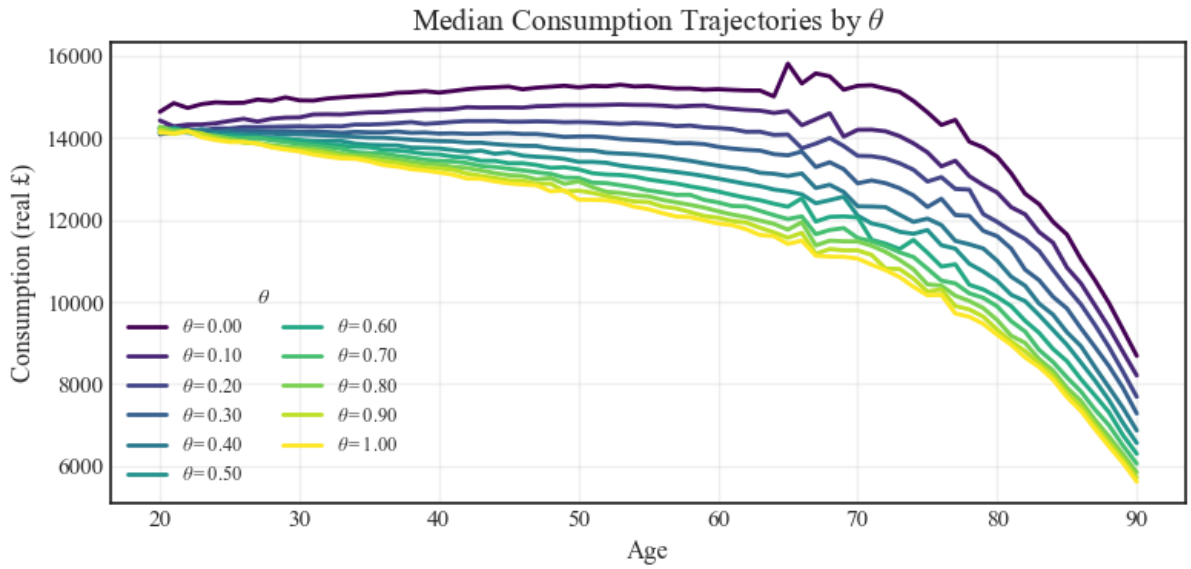


Figure 4: The model's simulated median consumption trajectories for different levels of home allocation in DC pension savings θ.

4.3 Welfare Implications

Figure 5 plots the lifetime-utility measure $V_{a_W}(\theta)$ (the value function evaluated at initial age 20) against θ. More specifically V_{a_W} is the present-value utility for a representative entrant into the model under each θ and tells which "θ-world" it is best to be born into. Welfare is highest at $\theta = 0$ ($V_{a_W} = -12.781$) and declines monotonically as θ increases, reaching -14.953 at $\theta = 1$. Importantly, it has a concave shape meaning that the greatest welfare loss per unit increase in θ occurs at low values of θ. Small increases in θ away from zero are especially damaging. It represents a sort of "diminishing marginal mis-diversification" cost.

Thus, in our calibrated setting the social planner would prefer a lower domestic portfolio share, since foreign assets offered at a higher return, support greater lifetime consumption smoothing and raise overall utility. They would also be relatively more cautious suggesting an increase in the domestic share if it currently is at a low level.

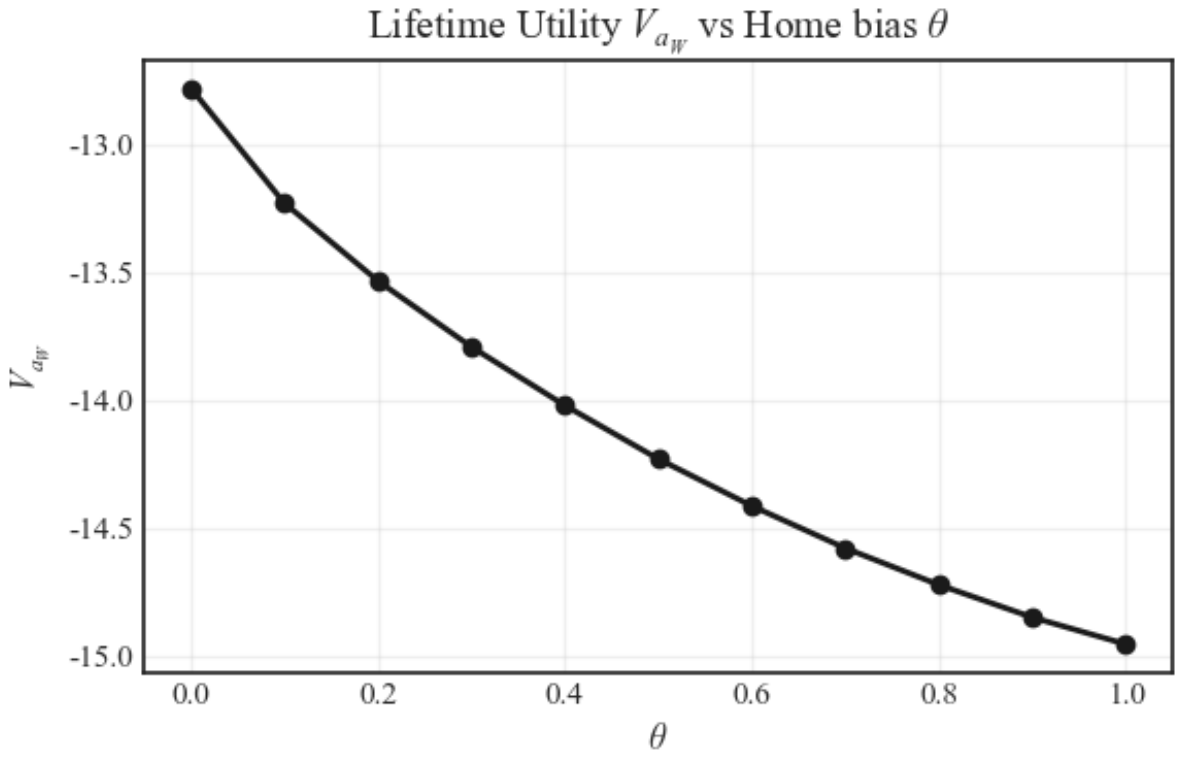


Figure 5: Expected life-time utility at entry vs. share of domestic allocation in DC pension savings θ

We can translate our raw value-function differences into a more interpretable metric by calculating the consumption-equivalent variation d (Lucas, 1987). This tells us how much more or less consumption, in percentage terms, an individual would need to be equally well-off in one θ-world compared to a baseline θ-world. With CRRA utility (recall $u(c) = c^{1-\gamma}/(1-\gamma)$), the d that makes the agent indifferent between θ-world A and θ-world B (baseline) is given by:

$$(1+d)^{1-\gamma} V^B_{a_W} = V^A_{a_W} \implies d = \left(\frac{V^A_{a_W}}{V^B_{a_W}} \right)^{1/(1-\gamma)} - 1$$

where V_{a_W} is the value at entry into the model. Using the calibrated $\gamma = 2.0$ and the rough baseline $\theta = 0.5$ ($\approx \theta = 0.47$), giving $V^B_{a_W} = -14.229$ from Table 9, one simply plugs in all other $V^A_{a_W}$ values from the table and calculate d.

The results are found in Table 10. The baseline $\theta = 0.5$ gives that row, by construction, a zero in the d-column. This marks this exercise's "real-world" calibration. As discussed elsewhere, $\theta = 0.47$ is a rough estimate, and therefore $\theta = 0.5$ is an approximation of a rough estimate. However, it still allows for more interpretability as to the consumption-equivalent welfare effects to changes in θ. The d-values quantify the welfare gains (positive d) from lowering θ below its "real-world" level and the welfare losses (negative d) from raising it above. For $\theta < 0.5$ d is positive: e.g. at $\theta = 0.0$, $d \approx 11.37\%$ means that the baseline agent, living in the $\theta = 0.5-$world, would need a permanent increase in consumption of 11.37% to leave him/her just as well off as the agent born into the $\theta = 0.0$-world. Conversely, for $\theta > 0.5$ d is negative: going from $\theta = 0.5$ to $\theta = 1.0$ carries a welfare cost of roughly -4.84% of lifetime consumption.

Table 10: Consumption-equivalent variation relative to baseline .

θ	$V_{a_W}(\theta)$	d (%)
0.0	−12.781	11.37
0.1	−13.229	7.52
0.2	−13.533	5.17
0.3	−13.791	3.16
0.4	−14.020	1.47
0.5	−14.229	0.00
0.6	−14.413	−1.28
0.7	−14.578	−2.41
0.8	−14.721	−3.31
0.9	−14.848	−4.19
1.0	−14.953	−4.84

Note: Baseline is $\theta = 0.5$ and calibrated $\gamma = 2.0$. Positive d for $\theta > 0.5$ means an agent in the baseline world would need a permanent boost to consumption to reach the higher welfare of the lower θ-world, while a negative d means the same agent would have to give up consumption to match the lower welfare of a higher θ environment.

4.4 Marginal Welfare Effects

To complement the previous subsection on welfare implications, specifically regarding the different elasticities following the concavity displayed in Figure 5, we can compute marginal percentage changes in welfare following a one percentage point (1 pp) increase in θ. To quantify local sensitivity of V_{a_W} to a small change in home allocation θ, we compute for each baseline θ the 1 pp (i.e. $\Delta\theta = 0.01$ percentage change:

$$ME(V_{a_W}) = 100 \cdot \frac{V_{a_W}(\theta + 0.01) - V_{a_W}(\theta)}{V_{a_W}(\theta)}\%$$

In practice, for each $\theta \in \{0.0, 0.1, 0.2, ..., 1.0\}$ the model is re-solved to obtain $V_{a_W}(\theta)$ and $V_{a_W}(\theta + 0.01)$ and then plugging them into the formula above. It is a simple approximation but should capture the models implied local elasticities with respect to a marginal 1 pp increase in θ.

Table 11 shows the results. At $\theta = 0$ we see large effects. Raising the home bias to $\theta = 0.01$ leads to a larger lifetime utility loss (becoming more negative) compared to a 1 pp change when $\theta = 1$. The steep marginal welfare cost at low θ and its decline as θ grows mirror the concave curve in Figure 5: increases in home allocation in pension savings when current levels are low are most damaging to lifetime utility and the effect tapers of as θ increases.

This analysis confirms the message from the previous subsection, but also reveals a finer picture of the heterogenous effects following a marginal change in θ. We see strong concavity in how overall welfare respond to marginal changes in domestic allocation in individuals' DC pension savings. Higher elasticities at low levels of θ and a flattening effect at higher levels where the economy is already saturated with domestic savings and further shifts matter less.

Table 11: Percentage change in V_{a_W} per 1 pp increase from a given θ.

θ	ME% V_{a_W}
0.000	35.097
0.100	28.426
0.200	20.751
0.300	17.653
0.400	15.626
0.500	13.807
0.600	12.096
0.700	10.566
0.800	9.184
0.900	7.820
1.000	7.011

5 Discussion

This paper has explored the general equilibrium and welfare consequences of varying domestic allocations in pension savings in the UK by embedding an OLG lifecycle model within a general equilibrium framework. By introducing a simple minimum domestic allocation parameter θ, one can trace how pension fund asset allocation shifts reverberate through capital accumulation, factor prices, lifetime wealth and consumption, and ultimately, individual welfare.

5.1 Interpretation and Policy Implications

The main finding is that increasing home allocation reduces lifetime welfare, despite boosting domestic wages and short run consumption. The intuition follows directly from standard neoclassical general equilibrium forces.

The first we can call the portfolio return effect. Raising θ shifts pension savings away from higher return foreign assets r_f into lower return domestic capital r_d. As θ increases, aggregate capital per effective worker k increases as a result of the increased pension savings now flowing into the domestic economy. An increasing k decreases the MPK, ceteris paribus, and thus the domestic return rate r_d. This lower average return on savings impairs inter-temporal consumption smoothing, which is a critical channel in lifecycle models in general and with CRRA preferences in particular.

Secondly we have the capital-labour feedback. While an increased k lowers the domestic interest rate through the MPK, it raises wages through the MPL. But these gains are insufficient to offset the loss of pension-account returns in agents' lifetime budgets.

Thirdly, higher θ lowers the accumulated wealth, and wealth peak, resulting in lower standard of living in retirement. This is shown by a lower consumption trajectory relative to trajectories for lower values of θ. Although retirees in high-θ economies earn slightly more on remaining retirement balances, the overall smaller pension pots dominate, leaving them with lower consumption trajectories throughout retirement.

Finally, the lifetime utility curve $V_{aW}(\theta)$ is strictly decreasing and concave, with the steepest declines at lower levels of θ. Marginal welfare losses from an additional percentage point of home allocation are greatest when θ is already small: shifting from $\theta = 0 \rightarrow 0.01$ costs more in terms of welfare units compared to the shift $\theta = 0.99 \rightarrow 1.0$. This declining marginal sensitivity underscores a diminishing returns pattern where the first steps away from full international diversification inflict the greatest welfare penalty. This is also shown when analysing the consumption-equivalent variation from the baseline $\theta = 0.5$. The baseline agent living in the $\theta = 0.5-$world, would need a permanent increase in consumption of 11.37% to leave him/her just as well off as the agent born into the $\theta = 0.0-$world. In contrast, the same individual would need to give up -4.84% of lifetime consumption switching to a world with complete domestic allocation of DC pension savings.

5.2 Answering the Research Questions

RQ 1: *What are the welfare implications for pension savers when a minimum level of domestic allocation constrains pension portfolio choices*? The calibrated OLG-GE model predicts that higher domestic allocation θ - i.e. a higher minimum share of DC pension savings invested in UK assets - reduces lifetime utility for the representative entrant. The

net welfare impact of stricter home allocation constraints is unambiguously negative for individuals under the baseline calibration. In other words, requiring pension funds to hold more UK assets, ceteris paribus, diminish welfare of savers.

RQ 2: *Is the welfare effect of a change in domestic allocation linear*? The answers is no, welfare effects are nonlinear and greater when the current domestic allocation of DC pension savings θ is low and diminishing as θ increases. This suggests that when foreign assets dominate a portfolio, any reduction in global diversification worsens risk-return trade-offs and curbs welfare more than when most pension wealth is already at home.

5.3 Comparison with Literature

These results align closely with the empirical and theoretical insights. Data and industry voices have for a longer time displayed how global portfolios have outperformed home-heavy allocations in most major markets over the past decades, except in the US. This model quantifies this opportunity cost in terms of reduced welfare and flatter consumption profiles.

While domestic assets help pension funds hedge local currency and inflation risks, the magnitude of forgone returns from international diversification translates into substantial welfare losses over a lifetime. Furthermore, related to the academic discussion about policy nudges vs. mandates, the concave welfare vs. θ-curve suggests that small, targeted incentives (e.g. tax breaks) that induce marginal shifts toward domestic investment may be prudent compared to mandates requiring steeper increases in θ. This aligns with the Canadian experience, where policy experts argue for expanding investible domestic opportunities rather than imposing allocation quotas.

Relatedly, it is worth remembering that in the UK, especially in the growing DC schemes, there has been a clear trend towards global diversification over the past 15 years. Comparatively, they are showing little home bias in their pension fund investments. This gives reason to be cautious, as we know from the sensitivity analysis that already being at a low domestic investment level yields the greatest welfare losses once the domestic allocations increase. Hence, every little nudge that in one way or another increases the domestic allocation bears great welfare risk -especially if the domestic allocation is low and global diversification is high.

5.4 Implications for UK Pension Policy

Since the model presented in this paper abstracts from heterogenous asset classes, specific recommendations can't be given and the results are likely over-generalising. However, given the steep welfare costs at low θ these results agree with the anti-mandate side of the discourse. While the model can't give any input into the effects of unlocking certain assets or certain incentive structures, it models better how a mandate would behave. A change in θ, all else equal, is close to how a mandate imposes an increase, also keeping all else constant.

Shifting focus to reducing barriers to these strategic and productive asset classes might be an alternative for harnessing domestic pension capital more productively. This is backed by the UK Government Actuary's Department findings that domestic private market allocations (infrastructure, private equity, unlisted real estate) can enhance risk-adjusted returns.

Mandating annual disclosures of home allocations for DC schemes (as scheduled by 2027) can foster competitive differentiation: pension providers that unlock higher-yield domestic projects may attract cost-conscious savers, without resorting to blunt allocation rules. However, it could lead to increased home allocation if the disclosures are becoming instruments for spurring competition for which DC fund invest more domestically.

5.5 Limitations, Extensions & Future Research

While the calibrated OLG-GE framework delivers clear insights into the trade-offs of domestic pension investment allocations, it abstracts from several real-world complexities that would improve and nuance the results and which future work could address.

The current specification treats labour supply as fixed and exogenous, omitting agents' ability to substitute between consumption and leisure. Introducing a leisure choice would generate familiar income-substitution dynamics: higher θ raises wages, which may lead workers to enjoy more leisure (income effect), while lower returns on savings could encourage longer working hours (substitution effect). Allowing a leisure choice and trade-off would enrich the model's prediction of aggregate labour supply, wage adjustments, and welfare responses to changes in θ.

The production function assumes perfect competition, constant returns to scale, and a single homogeneous sector. Allowing for sectoral heterogeneity, such as distinguishing capital- from labour-intensive industries or introducing decreasing returns at the firm level, could yield more nuanced wage and return dynamics. For instance, an increase in domestic capital may disproportionately benefit sectors that are highly capital-complementary, altering both the level and distribution of wages across industries. Incorporating for example multi-sector production would therefore sharpen the understanding of how θ feeds through the real economy.

The welfare measure focuses solely on private lifetime utility from consumption and omits public-good spillovers that could come from increased domestic investment. If higher θ stimulates aggregate capital accumulation and growth, this could finance better healthcare, education, and infrastructure benefits that accrue outside the individual's pension account. Future work could for example endogenise a government budget constraint and public-good provision, or adopt a social welfare function that captures both private and public consumption. Accounting for these positive externalities may offset some of the private welfare losses documented here.

By design, the model relies on equal agents who lives in the exact same environment, and abstracts from differences in skills, age cohorts or sectors. Yet, an increase in θ can be interpreted as capital deepening or technological adoption (e.g., automation, AI) that raises returns to skilled labour while displacing lower-skilled workers. A heterogeneous agent extension, segmenting the workforce by skill level, sector, or demographic group would allow analysis of how automation-driven capital accumulation affects wage inequality and the welfare of distinct groups. This could offer additional guidance for targeted redistribution or retraining policies.

In reality, UK households diversify their general savings across cash, domestic and foreign equities, bonds, and property. These are choices the model currently aggregates into a single domestic capital pool. In particular, if households hold large cash buffers ("mattress money") or directly invest in equities both domestically and abroad (as seen in countries like Sweden), the effects of pension funds increasing domestic allocation may be more or less strong. For example, if one assumes forward looking and rational agents,

an agent could "compensate" increased domestic investment in their pension savings by investing relatively more in foreign assets in their personal savings. This would offset the negative welfare effects from increasing θ. Endogenising individual portfolio allocation, with distinct returns for each asset class, would paint a fuller picture of aggregate capital flows and welfare.

As alluded to in the model section, introducing endogenous fertility and longevity trends could amplify or dampen the general equilibrium feedback from changing θ amid an ageing population. Additionally, distinguishing returns on equities, bonds, real estate and private markets - both domestic and foreign - would capture cross-asset diversification opportunities more realistically. Finally, access to the fully disclosed WAS data, longer time horizons beyond 2010–2020, and alternative specifications for accidental bequests or wealth scaling could improve model fit and the precision of the quantitative estimates.

By pursuing these extensions, future research can deepen our understanding of how domestic investment mandates in pensions reshape not only aggregate capital and wages, but also labour supply, inequality, public-good provision, and the broader financial landscape.

6 Conclusion

This thesis has examined the welfare implications of DC pension home allocation and bias in the United Kingdom using a dynamic OLG lifecycle model embedded in a small-open-economy GE framework. Building on the Auerbach–Kotlikoff approach and calibrated to 2010-2020 UK data, the model endogenously determines wages, returns, savings, wealth and consumption trajectories, and welfare as the domestic share of DC pension savings allocations (θ) varies.

When θ increases, pension savings are increasingly channelled into domestic capital. This raises the capital stock per effective worker and boosts the marginal product of labour - pushing wages up as θ moves from zero to complete home allocation and bias. Yet, that same influx depresses the marginal product of capital, dragging down returns on both general and pension savings. Agents consequently accumulate less by retirement and decumulate more gradually in old age, leaving peak retirement wealth - and with it, consumption throughout retirement -consistently lower under greater home allocation and bias.

These shifts translate into material welfare losses. Lifetime utility decreases sharply as θ rises from zero to complete home allocation and bias. Moreover, the first few percentage-point increases from a low domestic allocation level inflict disproportionate harm as marginal welfare losses are steepest when θ is low and taper off as the share of home allocation grows.

Given these findings, blunt mandates that force higher domestic allocations risk substantial welfare costs for pension savers. If policymakers objective is to achieve economic growth objectives without sacrificing risk-adjusted returns for pension savers, other avenues than domestic investment mandates ought to be explored.

This analysis abstracts from important real-world complexities. It assumes homogenous domestic capital, constant cohort sizes, exogenous demographics and inelastic labour supply. Extending the model to incorporate ageing population dynamics, heterogeneous asset classes (equity, bonds, real estate, private markets), endogenous foreign returns, and labour–leisure choices would sharpen welfare estimates and better capture the nuances of cross-asset diversification and macro-financial feedbacks. Empirically, assessing alternative domestic vehicles, such as unlisted infrastructure or private equity, may reveal cases where greater home allocation and bias enhances risk-adjusted returns.

In the end, while domestic investment can play a useful risk-hedging and growth-supporting role, excessive home allocation and bias in pension savings undermines the inter-temporal smoothing essential essential for an individuals welfare over the lifecycle. Thoughtful incentives that broaden rather than bluntly constrain pension portfolios seem to offer a better path to balancing economic-growth ambitions with pension saver welfare.

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