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Brexit and Non-Tariff Barriers:

Effects on UK Business Investment and Productivity

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Abstract

This paper investigates the macroeconomic impacts of increased non-tariff trade costs resulting from Brexit on UK business investment and productivity growth. We develop a three-country Dynamic Stochastic General Equilibrium model that accounts for differences in country sizes as well as tariff and non-tariff trade costs.

Our results suggest that the increased trade costs resulting from Brexit led to a sharp decline in trade between the United Kingdom and the European Union, with imports decreasing by 23.7 per cent and exports by 18.6 per cent. Following an initial decline of around 2.5 per cent, business investment gradually recovers but ultimately remains 1.2 per cent lower in the long term. We further provide simulations of the same shock using the National Institute Global Econometric Model, NiGEM, which suggests comparable macroeconomic effects. The long-term impact on per capita output is estimated at 1.2 per cent in our model, attributed solely to the rise in non-tariff trade barriers.

1. Introduction

The United Kingdom has experienced a prolonged period of sluggish productivity growth since the global financial crisis, a trend that has been widely discussed by economists and policymakers. According to OECD figures, output per hour worked increased by only 5.5 per cent between 2008 and 2023, compared to 21.9 per cent in the United States and 13.8 per cent in the European Union. A key contributor to this stagnation is the relatively low level of investment, both public and private, compared with other advanced economies. While countries such as Germany and the United States have significantly increased capital expenditure to drive technological innovation, infrastructure development, and workforce skills, UK investment levels have remained modest. This underinvestment has likely impeded the adoption of productivity-enhancing technologies and constrained the United Kingdom's economic growth potential, contributing to its weak productivity performance.

The United Kingdom's low investment levels are puzzling, particularly given the lower real interest rates in the post-global financial crisis period and the increased labour supply since 2008, which should have supported investment growth (Chadha and Samiri, 2024). Several explanations have been proposed to address this puzzle, ranging from the prevalence of zombie firms and industry concentration to structural changes and the misallocation of public resources. These impediments to productivity growth have been exacerbated by successive shocks, such as the Russia-Ukraine war and the Covid-19 pandemic, which have affected economic growth, trade, investment, and migration in the United Kingdom. However, perhaps the most significant structural shift affecting the United Kingdom's investment outlook has been the decision to leave the European Union, which has increased uncertainty and led to the loss of access to the large EU single market.

While the macroeconomic effects of Brexit are multifaceted, this paper focuses specifically on the role of non-tariff barriers (NTBs), isolating their impact from broader Brexit-related channels such as uncertainty, FDI and changes in the efficiency of labour. Three mechanisms through which NTBs may have adversely affected business investment are widely cited. First, despite the removal of trade tariffs through the Trade and Cooperation Agreement (TCA), businesses have faced increased bureaucratic hurdles, stricter border controls and transportation delays (Clarke *et al.*, 2023). The rise in NTBs and the introduction of rules of origin requirements have likely raised the cost of trading and investing in the United Kingdom (Gretton and Vines, 2018). Second, multinational companies may be more reluctant to invest

in the United Kingdom, now outside the European Union, as it has lost access to the EU single market (Mayer *et al.*, 2021). Higher trade and investment barriers limit access to foreign technology and human capital, thereby reducing competition and innovation (Ahn *et al.*, 2019). Finally, changes in the skill composition of foreign workers in the United Kingdom may have reduced the productivity of the labour force, further discouraging businesses from increasing their investment.

Earlier studies broadly agree that Brexit has significantly impacted UK business investment and productivity growth. In the short term, increased uncertainty and financial market volatility led to an estimated 10-15 per cent decline in business investment (Ebell and Warren, 2016; OECD, 2016; Springford, 2022). For longer term analysis, most studies employ a partial equilibrium approach, often focusing on firm-level outcomes or sector-specific effects of Brexit. For instance, Gornicka (2018) and Bloom *et al.* (2019) found significant declines in investment using firm-level data. Similarly, Du and Shepotylo (2022) and Du *et al.* (2025) show that services exports were particularly vulnerable to Brexit-related NTBs and uncertainty. Long-term productivity estimates suggest declines of around 3-8 per cent, with some studies linking these effects to new trade and foreign direct investment (FDI) barriers (Carella *et al.,* 2021; Kaya *et al.,* 2025*;* Millard *et al.,* 2025; OBR, 2020). Although some papers have argued that Brexit could bring deregulation benefits (Booth *et al.,* 2015; Minford, 2019; Minford and Zhu, 2023), the consensus highlights that it has exacerbated the United Kingdom's underinvestment and productivity challenges through its impact on the structure of trade, investment and labour efficiency.

While the literature is extensive, these studies largely fall short of quantifying the general equilibrium macroeconomic effects of NTBs. The present study seeks to address this gap by developing a three-country Dynamic Stochastic General Equilibrium (DSGE) model of international trade to assess the macroeconomic impact of increased NTBs following Brexit. Our model incorporates three representative regions – the United Kingdom, the European Union (EU), and the rest of the world (RoW) – and captures country size asymmetries and trade frictions through both tariff and non-tariff channels. While DSGE models are not new in the Brexit literature (see Minford and Zhu, 2023 and Jerger and Korner, 2019), their application to isolating NTB-related costs remains limited. Unlike most previous studies, which emphasise short-run uncertainty or partial trade channels, our model provides a coherent framework for

assessing the long-run general equilibrium consequences of NTBs on investment and productivity.

Our results suggest that, even in the absence of other Brexit-related shocks, business investment and output per capita in the United Kingdom could be approximately 1.2 per cent lower in the long term due solely to increased NTBs. While this estimate is lower than those in studies that incorporate broader costs, it highlights the macroeconomic impact of changing trade patterns alone – independent of uncertainty, potential loss of foreign investments or change in labour efficiency.

In what follows, Section 2 presents a review of the literature on Brexit's impact on the UK economy. Section 3 outlines the model in detail and how it captures trade costs through various channels. Section 4 discusses the results of our analysis and simulation findings, while Section 5 concludes.

2. Literature Review

The literature examining the economic effects of Brexit on the UK economy is extensive, with numerous studies emerging even before the 2016 referendum. Much of the literature focusing on the short-term impact emphasises the role of uncertainty and financial market volatility in shaping macroeconomic outcomes. HM Treasury (2016a) finds that business investment would be the main driver of the anticipated decline in UK output growth due to heightened uncertainty and financial instability. Douch and Edwards (2021) also observe that macroeconomic uncertainty surrounding post-Brexit outcomes had already affected businesses as early as mid-2015, in anticipation of the Brexit vote. Similarly, Baker *et al.* (2016) utilised the NIESR's Global Macroeconomic Model (NiGEM) to assess the immediate effects of the Brexit vote coming through financial markets. They introduced a series of shocks targeting exchange rates, bond yields, and lending spreads to simulate the impact of increased uncertainty. Their analysis found that Brexit caused a substantial drop in business investment, which fell by around 15 per cent relative to the counterfactual, although they suggested that investment levels would begin to recover gradually in the longer term. In a recent study, Keiller (2024) highlights the depreciation of sterling as a critical factor influencing investment decisions in the short term, especially in relation to trade.

However, the post-Brexit transition for the United Kingdom and the European Union reflects deeper structural changes that are likely to persist into the longer term. Ebell and Warren (2016)

suggests that Brexit would lead to a substantial reduction in trade with the European Union, a sharp decline in FDI inflows, and reduced fiscal contributions. These changes were projected to have a long-term impact on the UK economy, with estimates suggesting that business investment and productivity would remain 2.5 and 3 per cent lower, respectively, by 2030 compared to a scenario where the United Kingdom had stayed in the European Union. Similarly, the OECD (2016) projected that by 2030 the total capital stock in the UK business sector would be approximately 9 per cent smaller than it would have been without Brexit, primarily due to reduced total factor productivity and migration flows.

Hantzsche *et al.* (2018) provide a more comprehensive scenario analysis of Brexit's economic impact using NiGEM, estimating a 4 to 5 per cent reduction in total investment and a 3 to 5 per cent lower capital stock by 2030, leading to a long-term reduction in potential output by 3 to 4 per cent. Hantzsche and Young (2019) attribute similar declines to increased trade and migration barriers and reduced productivity growth under the final Brexit deal. They argue that while short-term effects may be mitigated through accommodative policies, these measures do not address the deeper structural challenges Brexit poses to trade and investment relations with the European Union. Kaya *et al.* (2025) revisited the NiGEM scenarios of the impact of Brexit on UK investment and estimated that business investment will fall to around 12 per cent lower than it would have been without Brexit, with a gradual stabilisation at 7–8 per cent below baseline by 2035.

Brexit's impacts on business investment have also been examined extensively. Simionescu (2017) found that Brexit led to a significant reduction – up to 90 per cent – in foreign direct investment projects in the United Kingdom, while Górnicka (2018) demonstrated that increased trade costs negatively affected firms' investments after the referendum. Welfens *et al.* (2018) observe a marked decline in FDI inflows following the United Kingdom's exit from the single market and Breinlich *et al.* (2020) report a 9 per cent reduction in new investments from the European Union into the United Kingdom within a year of the referendum. Using data from the Decision Maker Panel, Bloom *et al.* (2019) show that Brexit-related uncertainty led to an 11 per cent decline in firm investment over the three years following the referendum, with effects unfolding more slowly than anticipated. The study also found that Brexit reduced UK firm productivity by 2 to 5 per cent, primarily due to within-firm inefficiencies. An updated analysis by Anayi *et al.* (2021) revealed a sharper investment decline of 23 per cent by 2021, though investment began to recover with reduced uncertainty following the Trade and

Cooperation Agreement (TCA). Springford (2022) showed that Brexit led to a 13.7 per cent decline in UK investment by the end of 2021 using a synthetic control method. Carella *et al.* (2023) highlight Brexit-related uncertainty as the main factor driving the decline in UK business investment. Keiller (2024) focuses on the manufacturing sector and found that investment growth fell by around 7 per cent, or £2.4 billion annually, between 2016 and 2021, with the most pronounced effects occurring after the formal exit from the European Union in 2021.

In terms of trade, Douch and Edwards (2021) argue that the anticipation of future trade barriers, even before formal tariffs were introduced, led to a decline in both imports and exports by around 25 per cent. Keiller (2024) finds that firms with a high reliance on EU imports experienced a 36 per cent reduction in investment compared to firms sourcing inputs domestically. This finding is echoed in a study by Du *et al.* (2024), which reports a significant decline in the value of UK imports from and exports to the European Union, affecting 82 per cent of sectors, particularly in manufacturing and agrifood products. Similarly, according to findings by Kren and Lawless (2024), Brexit reduced goods trade between the United Kingdom and the European Union by nearly 20 per cent in both directions, once data discontinuities in measuring trade impacts have been addressed. On services trade, Du *et al.* (2025) find that Brexit-related uncertainty led to a 9.2 per cent annual decline in UK services exports between 2016 and 2019, disproportionately affecting SMEs while prompting multinational companies to relocate.

Many studies have investigated Brexit's long-term impact on productivity. Nearly all studies converge on the idea that Brexit has led to significant productivity losses, albeit with varying estimates. A review by the Office for Budget Responsibility (OBR, 2020) suggests that the central estimate of Brexit's long-term impact on productivity hovers around 4 per cent. HM Treasury (2016b) estimated a long-term productivity reduction of between 3 and 8 per cent, depending on the nature of the future UK trade arrangements with the European Union. Van Reenen (2016) highlights that long-term productivity will be negatively affected by the loss of dynamic trade gains, which could further exacerbate the United Kingdom's structural economic weaknesses. Latorre *et al.* (2020) find that Brexit would lower average productivity by 2.3 per cent in many manufacturing sectors, primarily due to reduced competition and increased protectionism. Fingleton *et al.* (2023) support this conclusion, estimating that Brexit would reduce productivity by 0.6 per cent in the short term and 0.9 per cent in the long term,

affecting all regions of the United Kingdom. In more recent work, Kaya *et al.* (2025) reports that there will be around a 5.5 per cent long-term decline in labour productivity by 2035 because of Brexit.

In conclusion, the literature suggests that Brexit has exacerbated the United Kingdom's existing structural challenges, including underinvestment and sluggish productivity growth. The literature argues that the introduction of additional barriers to trade, investment, and FDI inflows have negatively affected the UK economy in both the short and long term. While some studies, such as Booth *et al.* (2015), Minford (2019) and Minford and Zhu (2023), argue that Brexit could lead to positive outcomes through deregulation and reduced budget contributions to the European Union, the consensus is that the net effect is likely be negative. The present paper aims to contribute to the research by providing a general equilibrium analysis of the impact of NTBs resulting from Brexit.

3. Model

This section outlines our three-country DSGE model. The model consists of three representative countries: the United Kingdom, the European Union (EU) and the rest of the world (RoW). Agents in each economy – households, firms, and the government – are symmetrical across countries in that they have the same preferences and face the same technological constraints. However, asymmetries arise from differences in country sizes and trade costs due to tariff and NTBs. Below, we describe each of their problems, with all variables expressed in per capita terms.

3.1. Households

Households in each country, for example, country *i*, are homogenous, consuming domestically produced and imported goods, and supplying $h_{i,t}$ units of labour to domestic firms at time *t*. The representative household maximises their expected utility from consumption and leisure:

$$max\ E_0 \sum_{t=0}^{\infty} \beta^t \left(\frac{c_{i,t}^{1-\sigma_c}-1}{1-\sigma_c} - \zeta_i \frac{h_{i,t}^{1+\sigma_h}}{1+\sigma_h} \right) \quad \textbf{(1)}$$

where $\beta \in (0,1)$ is the subjective household discount factor, $c_{i,t}$ denotes aggregate consumption, σ_c is the inverse of the intertemporal elasticity of substitution in consumption, σ_h is the inverse of the Frisch elasticity of hours worked and ζ_i is the scaling factor for labour disutility.

The aggregate consumption good $c_{i,t}$ is defined in a constant elasticity of substitution (CES) form:

$$c_{i,t} = \left(\omega_{i,i}^{\frac{1}{\psi}} c_{i,i,t}^{\frac{\psi-1}{\psi}} + \omega_{i,j}^{\frac{1}{\psi}} c_{i,j,t}^{\frac{\psi-1}{\psi}} + \omega_{i,k}^{\frac{1}{\psi}} c_{i,k,t}^{\frac{\psi-1}{\psi}} \right)^{\frac{\psi}{\psi-1}} \quad \textbf{(2)}$$

where $c_{i,l,t}$ are goods consumed in country *i* produced in country *l* (*l* = *i*, *j*, *k*), $\omega_{i,l}$ denotes the steady-state share of goods produced in country *l* in country *i*'s representative household's consumption basket and ψ is the Armington elasticity of substitution between different consumption goods.

Setting the domestically produced good as the numeraire, we define the consumer price index, *P*, as the minimum level of expenditure required to obtain one unit of aggregate consumption. We assume that consumption goods are subject to import costs, $\tau_{i,j}$ and $\tau_{i,k}$. Setting the consumer price index to unity, we then need to solve the problem:

$$\text{Minimise} \quad P_{i,t} c_{i,t} = c_{i,i,t} + \left(1 + \tau_{i,j}\right) e_{i,j} c_{i,j,t} + \left(1 + \tau_{i,k}\right) e_{i,k} c_{i,k,t} \quad \textbf{(3)}$$

subject to equation **(2)**. Here $e_{i,j}$ denotes the exchange rate between countries *i* and *j* (units of country *i* currency per unit of country *j* currency).

The first-order conditions for this problem yield the following demand equations for each consumption goods:

$$c_{i,i,t} = c_{i,t} \omega_{i,i} \left(\frac{1}{P_{i,t}} \right)^{-\psi} \quad \textbf{(4)}$$

$$c_{i,j,t} = c_{i,t} \omega_{i,j} \left(\frac{\left(1+\tau_{i,j}\right) e_{i,j}}{P_{i,t}} \right)^{-\psi} \quad \textbf{(5)}$$

$$c_{i,k,t} = c_{i,t} \omega_{i,k} \left(\frac{\left(1+\tau_{i,k}\right) e_{i,k}}{P_{i,t}} \right)^{-\psi} \quad \textbf{(6)}$$

Equations **(4), (5)** and **(6)** imply that consumption of each good is proportional to aggregate consumption in country *i*, the share of the relevant good in the representative household's steady-state consumption basket and the relative price of the relevant good, which is determined by the trade costs and the nominal exchange rate between two countries. The price level for the aggregate consumption basket in country *i* can be derived as:

$$P_i = \left(\omega_{ii} + \omega_{ij}\left(e_{i,j}(1+\tau_{ij})\right)^{1-\psi} + \omega_{ik}\left(e_{i,k}(1+\tau_{ik})\right)^{1-\psi}\right)^{\frac{1}{1-\psi}}$$

The budget constraint of the representative household is given by:

$$e_{i,j,t}B_{i,t} + V_{i,t}x_{i,t} = e_{i,j,t}(1+r_{t-1})B_{i,t-1} + \left(V_{i,t} + Div_{i,t}\right)x_{i,t-1} + W_{i,t}h_{i,t} + T_{i,t} - P_{i,t}c_{i,t} \quad \textbf{(7)}$$

where B_i denotes end-of-period holdings of nominal risk-free bonds denoted in sterling (where we've denoted the United Kingdom as country *j*), x_i denotes end-of-period holdings of equities, V_i is the value of an equity share in the representative firm, r is the (sterling) nominal risk-free rate of interest, $Div_{i,}$ denotes dividends, W_i denotes the nominal wage and T_i denotes transfers from the government to the household for country *i* in time *t*. We assume all nominal bonds are denominated in pounds and pay the same nominal interest rate, and that they are in zero net supply across the world. While bonds represent lending between households in different countries, we assume that households only hold shares of firms that operate in the domestic economy.

The first-order conditions from the household's optimisation problem yield the consumption Euler equations for bond and equity holdings and the labour supply equations:

$$\frac{e_{i,j,t}\, c_{i,t}^{-\sigma_c}}{P_{i,t}} = \beta(1+r_t)E_t\frac{e_{i,j,t+1}\, c_{i,t+1}^{-\sigma_c}}{P_{i,t+1}} \quad \textbf{(8)}$$

$$\frac{c_{i,t}^{-\sigma_c}V_{i,t}}{P_{i,t}} = \beta E_t\frac{c_{i,t+1}^{-\sigma_c}(V_{i,t+1}+Div_{i,t+1})}{P_{i,t+1}} \quad \textbf{(9)}$$

$$\frac{W_{i,t}}{P_{i,t}} = \zeta_i h_{i,t}^{\sigma_h} c_{i,t}^{\sigma_c} \quad \textbf{(10)}$$

Equation **(8)** guides the intertemporal consumption choice of households, linking current consumption to expected future consumption and the nominal sterling interest rate adjusted for exchange rate movements and domestic inflation. If we rearrange equations **(8)** and **(9)**, we obtain the 'no arbitrage' condition that the expected return to holding shares will be equal to the expected return to holding bonds, adjusted by the risk premium:

$$E_t\frac{V_{i,t+1}+Div_{i,t+1}}{V_{i,t}} \approx (1+r_t)E_t\frac{e_{i,j,t+1}}{e_{i,j,t}} \quad \textbf{(11)}$$

3.2. Firms

Firms in country *i*, say, produce homogeneous goods in a perfectly competitive market in each time *t*, using their beginning-of-period stock of capital, $k_{i,t-1}$, imported goods from countries *j* and *k*, $M_{i,j}$ and $M_{i,k}$, respectively, as inputs and employing h_i units of labour that is supplied by households in country *i*. Firms pay a wage to their employees and face additional trade costs for their intermediate imports, from each of their trade partners and also invest in new capital, I_i. Firms in each country aim to maximise the present discounted value of their current and expected future dividend payments (which corresponds to their stock market value):

$$\max V_0 = E_0 \sum_{t=0}^{\infty} \beta^t \frac{c_{i,t}^{-\sigma_c}}{c_{i,0}^{-\sigma_c}} \frac{P_{i,0}}{P_{i,t}} \left(P_{i,t} y_{i,t} - W_{i,t} h_{i,t} - \left(1+\tau_{i,j}\right) e_{i,j} M_{i,j,t} - \left(1+\tau_{i,k}\right) e_{i,k} M_{i,k,t} - P_{i,t} I_{i,t}\right) \quad \textbf{(12)}$$

subject to the production function and the law of motion of capital with investment adjustment costs:

$$y_{i,t} = k_{i,t-1}^{\alpha} h_{i,t}^{\gamma} M_{i,j,t}^{\theta_{i,j}(1-\alpha-\gamma)} M_{i,k,t}^{(1-\theta_{i,j})(1-\alpha-\gamma)} \quad \textbf{(13)}$$

$$k_{i,t} = (1-\delta) k_{i,t-1} + \left(1 - \frac{\varphi}{2}\left(\frac{I_{i,t}}{I_{i,t-1}} - 1\right)^2\right) I_{i,t} \quad \textbf{(14)}$$

where α is the output elasticity of capital, γ is the output elasticity of labour, $\theta_{i,j}$ is the share of country *i* intermediate imports from country *j*, δ is the depreciation rate of capital, and φ is the parameter that governs the size of the investment adjustment costs with larger changes in investment being penalised more. The first-order conditions for the firm's profit maximisation problem yield the following labour, capital, import demand and investment equations:

$$\frac{W_{i,t}}{P_{i,t}} = \gamma \frac{y_{i,t}}{h_{i,t}} \quad \textbf{(15)}$$

$$Q_{i,t} = \beta E_t \frac{c_{i,t+1}^{-\sigma_c}}{c_{i,t}^{-\sigma_c}} \frac{P_{i,t}}{P_{i,t+1}} \left(\alpha \frac{y_{i,t+1}}{k_{i,t}} + (1-\delta) Q_{i,t+1}\right) \quad \textbf{(16)}$$

$$M_{i,j,t} = \frac{\theta_{i,j}(1-\alpha-\gamma) y_{i,t}}{(1+\tau_{i,j}) e_{i,j}} \quad \textbf{(17)}$$

$$M_{i,k,t} = \frac{(1-\theta_{i,j})(1-\alpha-\gamma) y_{i,t}}{(1+\tau_{i,k}) e_{i,k}} \quad \textbf{(18)}$$

$$1 = Q_{i,t}\left(1 - \frac{\varphi}{2}\left(\frac{I_{i,t}}{I_{i,t-1}} - 1\right)^2 - \varphi\frac{I_{i,t}}{I_{i,t-1}}\left(\frac{I_{i,t}}{I_{i,t-1}} - 1\right)\right) +$$

$$\beta E_t \frac{c_{i,t+1}^{-\sigma_c}}{c_{i,t}^{-\sigma_c}}\frac{P_{i,t}}{P_{i,t+1}} Q_{t+1}\,\varphi\left(\frac{I_{i,t+1}}{I_{i,t}}\right)^2\left(\frac{I_{i,t+1}}{I_{i,t}} - 1\right) \quad \textbf{(19)}$$

Equation **(15)**, the labour demand equation, shows that real wages are set equal to the marginal product of labour. Capital demand in equation **(16)** is forward looking, meaning that firms make investment decisions based on their expectations of future output and returns, including accounting for potential changes in the shadow value of capital, Tobin's *Q*. Equations **(17)** and **(18)** show the demand of country *i* for imported intermediates from countries *j* and k. For each country, imported intermediate demand depends both on domestic demand and the bilateral trade costs between these two countries. Any increase in trade costs or decrease in domestic demand would lead to a reduction in the imports of country i. Finally, equation **(19),** Tobin's *Q* equation, shows that the shadow price of capital, *Q*, depends on firms' investment decisions – yesterday, today and tomorrow – and the adjustment costs, measuring how much the firm values an investment, given adjustment costs. If there is no adjustment cost (meaning that $\varphi = 0$), then the market value of firm always equals the replacement cost of its assets, ie, $Q = 1$.

3.3. Government

The government's only revenue comes from the tariffs imposed on domestic firms' intermediate imports and final imported consumption goods. These revenues are redistributed to households in the form of lump-sum transfers.

$$T_{i,t} = \tau_{i,j}e_{i,j}M_{i,j,t} + \tau_{i,k}e_{i,k}M_{i,k,t} + \tau_{i,j}e_{i,j}c_{i,j,t} + \tau_{i,k}e_{i,k}c_{i,k,t} \quad \textbf{(20)}$$

3.4. Market Clearing

In equilibrium, total output produced in country *i* at time *t* equals the sum of the domestic consumption, investment, and exports to countries *j* and *k*:

$$n_i y_{j,t} = n_i c_{i,i,t} + n_i I_{i,t} + n_j e_{j,i}M_{j,i,t} + n_k e_{k,i}M_{k,i,t} + n_j e_{j,i}c_{j,i,t} + n_k e_{k,i}c_{k,i,t} \quad \textbf{(21)}$$

where n_j, n_i and n_k denote the country sizes.

The 'Balance of Payments' equation, showing how a country's net foreign asset position changes in response to current account imbalances, is given by:

$$n_i e_{i,j}(B_{i,t} - B_{i,t-1}) = n_j M_{j,i,t} + n_k M_{k,i,t} + n_j c_{j,i,t} + n_k c_{k,i,t} - n_i e_{i,j} M_{i,j,t} - n_i e_{i,k} M_{i,k,t} - n_i e_{i,j} c_{i,j,t} - n_i e_{i,k} c_{i,k,t} + n_i e_{i,j} r_{t-1} B_{i,t-1} \quad \textbf{(22)}$$

Equation **(22)** shows that the change in net financial assets (financial account) in each country is equal to the sum of the trade balance and the primary income balance, which consists of returns on foreign bond investments. The global bond market clears when the sum of all bonds held by households in each country balances each other. This condition ensures that one country's borrowing (current account deficit) must be met by another country's savings (current account surplus):

$$n_i B_{i,t} + n_j B_{j,t} + n_k B_{k,t} = 0 \quad \textbf{(23)}$$

3.5. Calibration

We assume each period represents one quarter and calibrate parameters using standard values from the literature. The household's subjective discount factor, β, is set to 0.9925, implying a risk-free real interest rate of 3 per cent in steady state. The parameters σ_c and σ_h are set to 1 and 0.5, respectively. We set the output elasticity of labour, γ, to 0.6, based on the labour income share from the National Accounts. The output elasticity of capital, α, is calculated as 0.2, assuming constant returns to scale and using the share of intermediate imports in UK gross output as the elasticity of intermediate imports following Kara and Nelson (2003). The depreciation rate, δ, is assumed to be 0.025, ie, 10 per cent per annum. The investment adjustment costs parameter, φ, is set to 1 based on the findings by Groth and Khan (2007).

The ζ_j parameters for each country are calibrated as 0.5383 for the United Kingdom, 1.1499 for the European Union, and 0.5370 for the Rest of the World, which implies steady-state hours worked are normalised to unity in each country. For the country sizes, we use each country's share in the global economy in 2023 from the IMF *World Economic Outlook* database. Accordingly, n_j, n_i and n_k are set to 0.03 for the United Kingdom, 0.18 for the European Union, and 0.79 for the Rest of the World, respectively.

Intermediate import share parameters, $\theta_{j,i}$, are calculated using the 2022 shares of non-consumer goods imports for each country from the *World Integrated Trade Solution* database.[1] According to our calculations, the EU share of UK non-consumer goods imports, θ_{12}, is 33.2

[1] We consider both capital goods and intermediate goods are part of the production processes.

per cent, the UK share of EU non-consumer goods imports, θ_{21}, is just 3.2 per cent, and the UK share of Rest of the World non-consumer goods imports, θ_{31}, is 4.9 per cent.

Parameters for the shares of different consumption goods in the households' consumption basket in each country are obtained from different sources. Domestic items that UK households purchase as final consumption good constitutes 79.6 per cent (Dhingra and Page, 2023). We distributed the remaining part equally, considering that half of UK imports come from the European Union. Imported consumption goods correspond to only 10 per cent of total final consumption expenditures in the European Union in 2023 according to Eurostat figures and the UK share in total consumption goods import is limited. For the rest of the world, we assumed that the share of domestically produced consumption goods is similar to the UK level, which is 80 per cent. To sum up the consumption share parameters are set as follows: $\omega_{11} = 0.80$, $\omega_{12} = 0.10$, $\omega_{13} = 0.10$, $\omega_{22} = 0.90$, $\omega_{21} = 0.01$, $\omega_{23} = 0.09$, $\omega_{33} = 0.80$, $\omega_{31} = 0.02$, $\omega_{23} = 0.18$. Following Delahaye and Milot (2020), we set the elasticity of substitution between different consumption goods, ψ, to 1.5.[2]

Trade costs are calculated using the ESCAP – World Bank *Trade Cost Database* for the period between 2011 and 2020 for UK trade with the European Union and the Rest of the World. This database provides bilateral trade costs for over 180 countries from 1995 to 2022. Trade costs are defined as 'ad valorem equivalent' and capture wider direct and indirect costs involved in the trade of manufactured goods and agricultural products, including but not limited to transportation and tariffs. Therefore, they reflect the additional costs in internationally traded goods relative to the domestic goods (Arvis *et al.,* 2016). We calculated UK export and import costs with the European Union and the Rest of the World by using the trade-weighted average of bilateral trade costs with each of the United Kingdom's trading partners. Following Millard *et al.* (2019), we assumed that export and import costs between the European Union and the Rest of the World are the same as the costs between the United Kingdom and the Rest of the World due to being in the same customs union (at least prior to Brexit) and sharing the same geographical features. For the pre-Brexit steady state, we calculated the trade cost parameters as follows: $\tau_{j,i} = 0.4634$, $\tau_{j,k} = 0.8875$, $\tau_{i,j} = 0.4607$, $\tau_{i,k} = 0.8875$, $\tau_{k,j} = 0.8750$ and

[2] The estimated value of Armington elasticities varies significantly in the literature and by sector. While GTAP estimates of Armington elasticities for manufactured goods range between 3 and 4, Delahaye and Milot (2020) find that previous GTAP estimates are too high for the UK economy. Our results remain robust across calibrations using a range of values between 1 and 4, with no substantial changes observed. The results of these calibrations are available upon request.

$\tau_{k,i} = 0.8750$ where *j* is the United Kingdom, *i* is the European Union, and *k* is the Rest of the World. A summary of all parameter values for the model calibration is presented in the Appendix table A1.

4. Impact of Brexit

4.1. DSGE Model Results

To analyse the impact of rising trade costs due to Brexit, it is essential to establish a reasonable calibration for post-Brexit trade costs. The ESCAP–World Bank database provides data for only two years following the United Kingdom's formal departure from the European Union, indicating an approximate 5 per cent increase in trade costs to date. However, it is plausible to assume that these costs will continue to rise gradually, converging towards levels observed in the United Kingdom's trade with the rest of the world. Notably, the geographical proximity of the European Union to the United Kingdom implies that part of the trade cost differential between UK-EU and UK-RoW can be attributed to distance rather than being an EU member.

To isolate the effect of EU membership on trade costs, we estimate a simple regression model, where trade costs are regressed on a binary variable equal to one for EU member states and zero otherwise.[3] Our findings indicate that EU membership reduces trade costs by approximately 69 per cent, even after controlling for geographical distance between the United Kingdom and its trading partners. Based on these estimates, the post-Brexit trade cost parameters between the United Kingdom and the European Union, $\tau_{j,i}$ and $\tau_{i,j}$, are calibrated to 0.7828 and 0.7782, respectively.

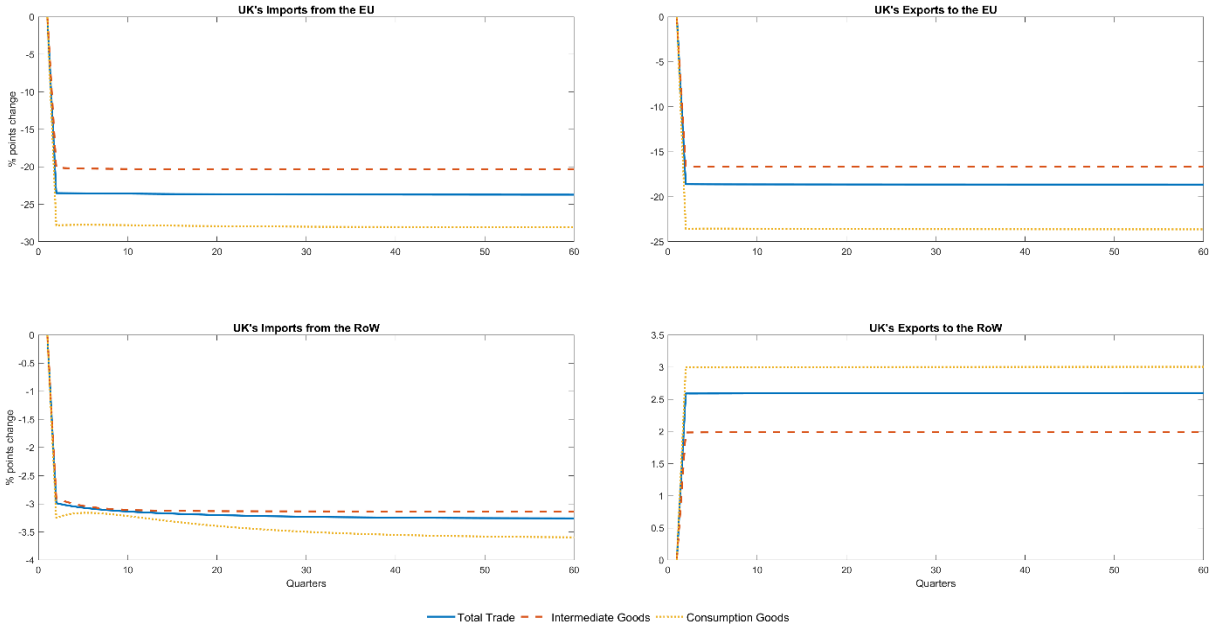
The impact of such a shock on the United Kingdom's trade with the European Union is shown in figure 1. Both imports and exports to the European Union experience a sharp initial decline and remain lower in the new steady state, with imports (23.7 per cent) contracting slightly more than exports (18.6 per cent). As shown in the first row of figure 1, this fall is mainly driven by a reduction in the trade of final consumption goods, although the trade in intermediate goods also drops significantly. Furthermore, due to lower output in the country, the import demand of UK households and firms from the rest of the world also declines by approximately 3 per cent.

[3] The regression equation is $log(\tau_{UK,i}) = \beta_0 + \beta_1 log(distance_{UK,i}) + \beta_2 EU + \varepsilon_i$, where *i* represents 179 trade partners of the United Kingdom. The results are available upon request.

In contrast, UK exports to the rest of the world show a slight increase, indicating signs of some trade diversion.

The rapid nature of this adjustment suggests that firms and households immediately cut their demand for imports in response to higher trade barriers. This is consistent with recent empirical literature on Brexit's impact on the United Kingdom's trade relationship with the European Union. For instance, Kren and Lawless (2024) find that Brexit reduced trade with the European Union by around 20 per cent in both directions. Du *et al.* (2024) also estimate that Brexit led to a decline in UK exports and imports by 27 per cent and 32 per cent, respectively, within just two years. Similarly, Douch and Edwards (2021) report that UK exports to EU countries may have declined by around 25 per cent by early 2018, primarily due to uncertainties and anticipatory effects following the Brexit referendum in 2016. Overall, our results align closely with these recent estimates.

Figure 1: Impact of Brexit trade costs on UK trade

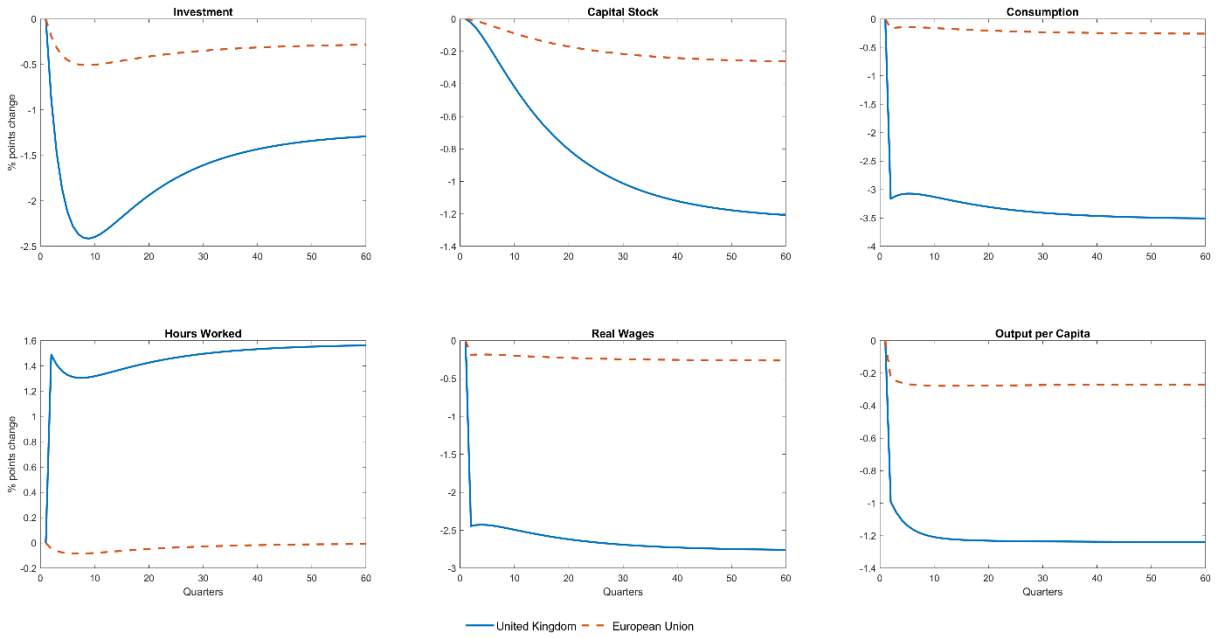


The increase in trade costs also has broader macroeconomic consequences, as shown in figure 2. The results indicate a sharp decline in investment of approximately 2.5 per cent in about two years after the rise in trade costs. This 'overshooting' of investment is likely driven by firms' immediate response to increased trade costs and the jump in interest rates, where they significantly cut back on investment spending. Over time, interest rates come down, reflecting firms' reduction in capital demand, and investment gradually recovers as lower interest rates, as well as a decline in real wages, encourage some degree of investment. However, this

recovery is insufficient to offset the ongoing depreciation of capital stock, resulting in a sustained decline in both investment and capital stock. In the new steady state, investment and capital stock are approximately 1.2 per cent lower than their pre-Brexit levels, while interest rates return to pre-Brexit levels.

Figure 2 also demonstrates that the UK households increase their total hours worked to prevent a further drop in their utility. Together with lower investment demand, this pushes real wages down by about 2.5 per cent, leading to a sharp drop in consumption, mostly driven by the fall in imported final consumption goods from the European Union, as shown in figure 1. At the new steady state, real wages and consumption are 2.8 per cent and 3.5 per cent lower, respectively. Output per capita initially declines by around 1 per cent, reflecting the sharp drop in investment and consumption, and remains stagnant after the initial shock, as the gradual recovery in investment is almost completely offset by the continued decline in consumption. Overall, while our results suggest that output per capita would be 1.2 per cent lower in the post-Brexit steady state, the impact is sharp and immediate. This can be attributed to agents having rational expectations, adjusting their behaviour immediately after facing the rise in trade costs in the post-Brexit period.

Figure 2: Macroeconomic impacts of increase in post-Brexit trade costs



The adverse effects of higher trade costs also extend to the EU economy, though to a lesser extent. Investment and output per capita fall by about 0.3 per cent in the European Union, with similar declines in real wages and consumption in the new steady state.

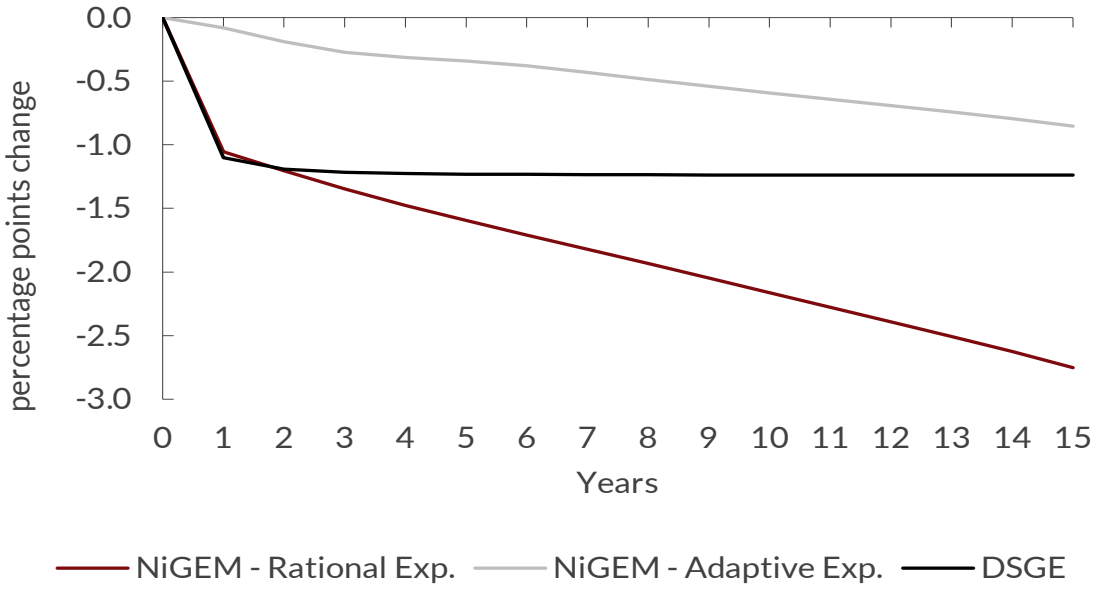
4.2. NiGEM Trade Scenarios

To provide context for our model results, we compare them with a trade scenario analysis using the National Institute's global macroeconometric model (NiGEM). NiGEM is a comprehensive global model that includes macroeconomic relationships for over 50 major economies, while the rest of the world is modelled through regional blocks, ensuring global consistency in trade flows (Hantzsche *et al.*, 2018). In an earlier work, we quantified the long-term economic impact of Brexit on the UK economy at approximately 5 to 6 per cent (Kaya *et al.,* 2025). However, unlike the present analysis, Kaya *et al.* (2025) also considered a number of channels through which Brexit is likely to have affected the UK economy that are missing from our analysis, including increased uncertainty, reduced foreign direct investment, and a decline in labour efficiency. For a more precise comparison with the results from the DSGE model, we focus solely on the trade impact of Brexit in the NiGEM scenarios discussed herein.

The trade impact of Brexit can be modelled through two primary channels in NiGEM. The first is the actual shift in trade markets. Because of the increase in non-tariff barriers, UK businesses may redirect their trade from EU countries to the rest of the world over time, which directly influences aggregate demand in the United Kingdom through changes in import and export volumes. The second channel concerns the terms of trade. Increased trade costs lead to higher import prices for UK households, thereby reducing their real personal disposable income and, consequently, consumption. Consistent with the findings of the DSGE model regarding trade, we assume that trade relations between the United Kingdom and the European Union will be approximately 25 per cent lower in the long term to calibrate the shock in NiGEM.

The results based on different assumptions regarding agents' expectations are presented in figure 3. The long-term decline in GDP due to rising trade costs is estimated at around 2.8 per cent under rational expectations and approximately 0.8 per cent under adaptive expectations. The main difference between these two scenarios is that, in the rational expectations case, households immediately reduce their consumption spending following Brexit. In contrast, it takes significantly longer for agents to adjust their behaviour in the adaptive expectations scenario. The negative GDP impact in the DSGE model lies between these two estimates from NiGEM, at 1.2 per cent.

Figure 3: NiGEM GDP impact of increase in Brexit trade costs



Figures 4 and 5 compare the impacts of the NiGEM trade scenario and the DSGE model on consumption and investment. The results show that both the initial decline and the long-term impact on consumption are larger in the NiGEM model than in the DSGE model. This might be because, in the DSGE model, households smooth their consumption by borrowing from abroad when hit by the price shock associated with trade costs. In NiGEM, however, there are 'hand-to-mouth' households who cannot smooth their consumption, leading to a larger initial impact. However, as Figure 5 shows, the impact of post-Brexit trade cost increases on business investment is almost identical in the DSGE model and NiGEM under rational expectations. The initial drop in business investment in NiGEM is slightly sharper, possibly due to investment adjustment costs in the DSGE model, but the longer-term impact is more pronounced in the DSGE model.

A comparison of the findings of our DSGE model with the literature reveals both similarities and notable differences in the estimated macroeconomic impacts of Brexit. Our model estimates a 1.2 per cent long-term decline in investment, which is considerably lower than the range of estimates between 7 per cent to 14 per cent in the literature, particularly by Ebell and Warren (2016), Bloom *et al.* (2019), Springford (2022) and Keiller (2024). These higher figures in the literature mainly due to broader factors such as Brexit-related uncertainties and foreign direct investment (FDI), which are not explicitly modelled in our trade-focused model.

Figure 4: Impact on consumption – DSGE vs. NiGEM

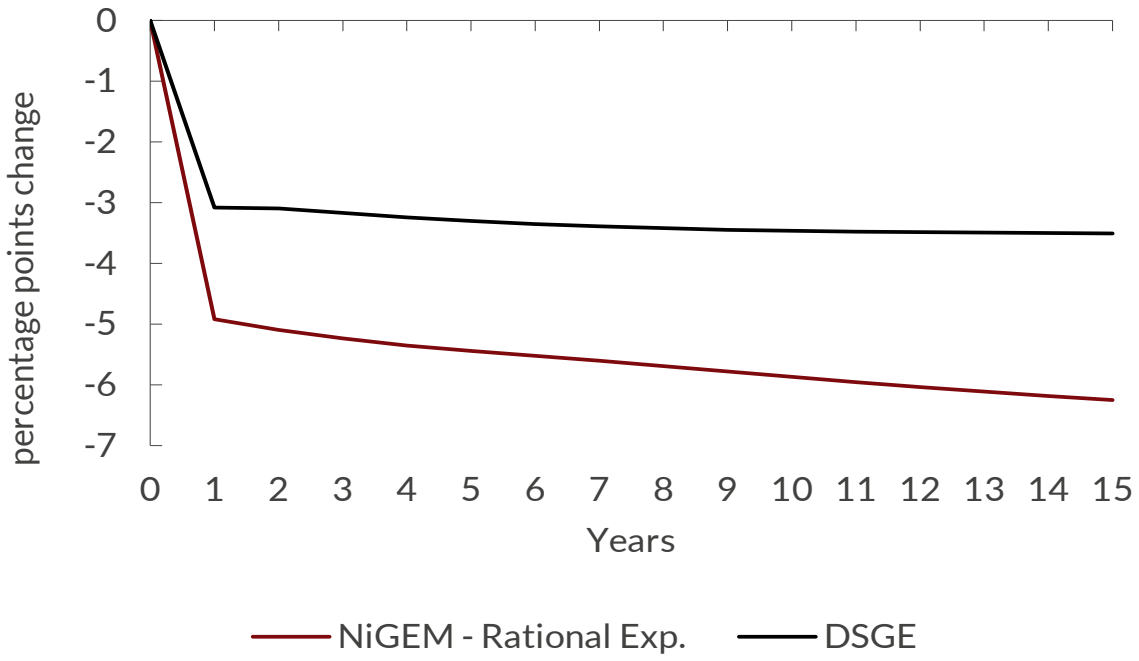
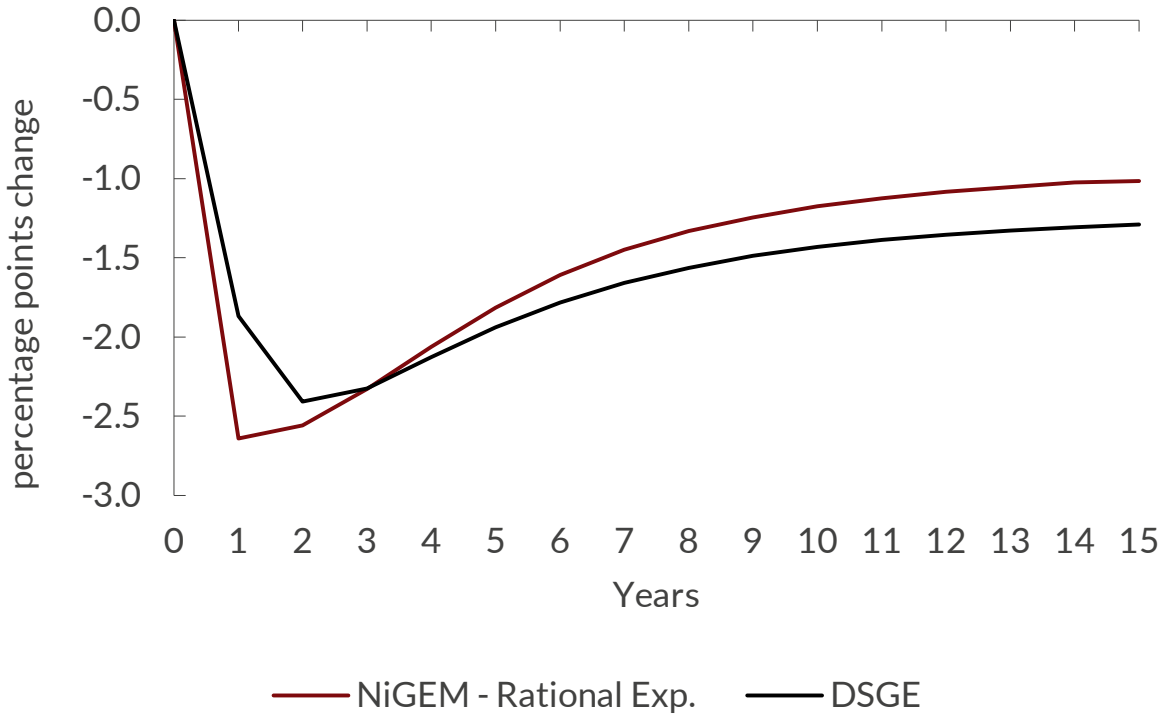


Figure 5: Impact on business investment – DSGE vs. NiGEM



Our model's predicted output per capita decline of 1.2 per cent post-Brexit is also more conservative compared to long-term estimates from Bloom *et al.* (2019) and the OECD (2016), which report 2-5 per cent declines in productivity. These differences suggest that our model,

while accurately capturing the direct effects of increased trade costs, may understate the broader macroeconomic consequences of Brexit, especially those arising from uncertainties and declines in labour productivity. Studies such as Carella *et al.* (2023) emphasize the role of uncertainty as a key factor in the downturn of business investment, with similar findings from Keiller (2024) for the manufacturing sector, which point to more substantial reductions in investment than our trade-focused DSGE model predicts.

5. Conclusion

Brexit has had a significant impact on the UK economy, but disentangling the specific effects of Brexit is complicated due to other global shocks, including the Covid-19 pandemic and the Russia-Ukraine war. Previous literature provides a considerable range of estimates of Brexit's impact on business investment, productivity, and output. The range of estimates reflects the complex nature of Brexit's economic impacts, which include but are not limited to trade disruptions, increased uncertainty, reductions in foreign direct investment and labour efficiency. Our paper contributes to this literature by developing a three-country DSGE model that isolates the impact of increased NTBs, offering a focused estimate of Brexit's long-run trade-related effects.

Our findings suggest that, even when controlling for uncertainty, labour efficiency and FDI, Brexit-related trade frictions alone may lead to a 1.2 per cent decline in UK business investment and output per capita in the long term. While this result is more modest than broader assessments of 3-8 per cent long-term productivity decline, such as the OBR (2020), Kaya *et al.* (2025) or Millard *et al.* (2025), it shows that Brexit has had a measurable effect through the trade channel alone. The findings also highlight the importance of the Trade and Cooperation Agreement (TCA) in preserving tariff-free trade, which has likely prevented even greater disruptions despite the persistence of costly NTBs.

These results suggest that mitigating NTB-related costs should be a priority for UK policymakers. Further trade facilitation measures, such as simplifying customs procedures, enhancing digital border systems or pursuing regulatory alignment, as well as more liberal bilateral trade policies for services sectors, could help reduce the burden on firms. At the same time, policies that improve labour efficiency, reduce uncertainty, and attract new investment remain essential to addressing the broader challenges that Brexit poses to the UK's long-term growth and productivity.

References

Ahn, J, **Dabla-Norris, E**, **Duval, R**, **Hu, B and Njie, L (2019)**, 'Reassessing the productivity gains from trade liberalization', *Review of International Economics*, Vol. 27, pages 130-54.

Anayi, L, **Bloom, N**, **Bunn, P**, **Mizen, P**, **Oikonomou, M and Thwaites, G (2021)**, 'Influences on investment by UK businesses: evidence from the Decision Maker Panel', *Bank of England Quarterly Bulletin*, Q2.

Arvis, J F, **Duval, Y**, **Shepherd, B**, **Utoktham, C and Raj, A (2016)**, 'Trade costs in the developing world: 1996–2010', *World Trade Review*, Vol. 15(3), pages 451-474.

Baker, J, **Carreras, O**, **Ebell, M**, **Hurst, I**, **Kirby, S**, **Meaning, J**, **Piggott, R and Warren, J (2016)**, 'The short–term economic impact of leaving the EU', *National Institute Economic Review*, Vol. 236, pages 108–20.

Bloom, N, **Bunn, P**, **Chen, S**, **Mizen, P**, **Smietanka, P and Thwaites, G (2019)**, 'The impact of Brexit on UK firms', *NBER Working Paper Series* No. 26,218.

Booth, S, **Howarth, C**, **Ruparel, R and Swidlicki, P (2015)**, 'What if...?: The consequences, challenges & opportunities facing Britain outside the EU', *Open Europe report* 03/2015.

Breinlich, H, **Leromain, E**, **Novy, D and Sampson, T (2020)**, 'Voting with their money: Brexit and outward investment by UK firms', *European Economic Review*, Vol. 124(C), pages 1-20.

Carella, A, **Chen, R and Shao, X (2023)**, 'Enhancing business investment in the United Kingdom', *IMF Selected Issues Paper* No. 2023/050.

Chadha, J S and Samiri, I (2024), 'Macroeconomic perspectives on productivity', *Cambridge Working Papers in Economics*, No. 2437.

Clarke, S, **Gasiorek, M and Hernandez, A S (2023)**, 'The challenges facing UK firms: trade and supply chains', *UK Trade Policy Observatory Briefing Paper* 73.

Delahaye, E E and Milot, C A (2020), 'Measuring the UK Economy's Armington Elasticities', *Conference papers 333170,* Purdue University, Center for Global Trade Analysis, Global Trade Analysis Project.

Dhingra, S and Page, J (2023), 'Accounting for imported and domestically generated inflation: Supply chains, monetary policy, and the UK's cost of living crisis' *VoxEU Column*, 25 May.

Douch, M and Edwards, T H (2022), 'The bilateral trade effects of announcement shocks: Brexit as a natural field experiment', *Journal of Applied Econometrics*, Vol. 37(2), pages 305-329.

Du, J and Shepotylo, O (2022), 'TCA, Non-tariff Measures and UK Trade', *ERC Research Paper 98.*

Du, J, **Liu, X**, **Shepotylo, O and Shi, Y (2024)**, 'Unbound: UK trade post-Brexit', *Aston University Centre for Business Prosperity*.

Du, J, **Shepotylo, O and Yuan X (2025),** 'How did the Brexit uncertainty impact services exports of UK firms?' *Journal of International Business Policy,* Vol. 8, pages 80-104.

Ebell, M and Warren, J (2016), 'The long-term economic impact of leaving the EU', *National Institute Economic Review*, Vol. 236, pages 121–38.

Fingleton, B, **Gardiner, B**, **Martin, R and Barbieri, L (2023)**, 'The impact of Brexit on regional productivity in the UK', *ZFW – Advances in Economic Geography*, Vol. 67, pages 142-60.

Gornicka, L (2018), 'Brexit referendum and business investment in the UK', *IMF Working Paper*, WP/18/247.

Gretton, P and Vines, D (2018), 'Towards a framework for trade and investment policy in post-Brexit United Kingdom', in *Brexit and Trade Choices in Europe and Beyond*, CEPR and NIESR, London.

Groth, C and Khan, H (2007), 'Investment adjustment costs: evidence from UK and US industries', *Bank of England Working Paper,* No. 332.

Hantzsche, A, **Kara, A and Young, G (2018)**, 'The Economic Effects of the Government's Proposed Brexit Deal', *NIESR report*, 26 November.

Hantzsche, A, **Lopresto, M and Young, G (2018)**, 'Using NiGEM in uncertain times: Introduction and overview of NiGEM', *National Institute Economic Review*, Vol. 244, pages R1-14.

Hantzsche, A and Young, G (2019), 'The Economic Impact of Prime Minister Johnson's New Brexit Deal', *National Institute Economic Review*, Vol. 250, pages F34–F37.

HM Treasury (2016a), 'The immediate economic impact of leaving the EU', *HM Treasury analysis Cm9292*.

HM Treasury (2016b), 'The long-term economic impact of EU membership and the alternatives', *HM Treasury analysis Cm9250*.

Kara, A and Nelson, E (2003), 'The exchange rate and inflation in the UK', *Scottish Journal of Political Economy*, Vol. 50(5), pages 585-608.

Kaya, A, **Liadze, I**, **Low, H**, **Millard, S P and Sanchez Juanino, P (2025)**, 'Business investment, productivity and Brexit', *National Institute Economic Review,* Vol. 268, pages 30-45.

Keiller, A N (2024), 'Brexit and investment', *CEP Discussion Papers* dp2025, Centre for Economic Performance, LSE.

Kren, J and Lawless, M (2024), 'How has Brexit changed EU–UK trade flows?', *European Economic Review*, Vol. 161, 104634.

Latorre, M C, **Olekseyuk, Z and Yonezawa, H (2020)**, 'Trade and foreign direct investment-related impacts of Brexit', *The World Economy*, Vol. 43, pages 2-32.

Mayer, T, **Melitz, M and Ottaviano, G (2021)**, 'Product mix and firm productivity responses to trade competition', *Review of Economics and Statistics*, Vol. 103, pages 874-91.

Millard, S, **Nicolae, A and Nower, M (2019)**, 'International trade, non-trading firms and their impact on labour productivity', *Bank of England Working Paper*, No. 787.

Millard, S, **Nicolae, A and Nower, M (2025)**, 'Understanding the Effects of Brexit on UK Productivity', *National Institute Economic Review,* Vol. 268, pages 46-62.

Minford, P (2019), 'The effects of Brexit on the UK economy', *The World Economy*, Vol. 42(1), pages 57-67.

Minford, P and Zhu, Z (2024), 'Modeling the effects of Brexit on the British economy', *Journal of Forecasting,* Vol. 43(4), pages 1114-1126.

Jerger, J and Korner, J (2019), 'Brexit and macroprudential regulation: a DSGE perspective', *International Economics and Economic Policy,* Vol. 16, pages 51-64.

OECD (2016), 'The economic consequences of Brexit: A taxing decision', *OECD Economic Policy Paper Series*.

Office for Budget Responsibility (2020), *Economic and Fiscal Outlook*, March 2020.

Simionescu, M (2017), 'The influence of Brexit on the foreign direct investment projects and inflows in the United Kingdom', *GLO Discussion Paper* No. 68, Global Labor Organization (GLO), Maastricht.

Springford, J (2022), 'What can we know about the cost of Brexit so far?', *mimeo*, Centre for European Reform, London.

Van Reenen, J (2016), 'Brexit's long-run effects on the U.K. economy', *Brookings Papers on Economic Activity*, pages 367–83.

Welfens, P J J and Baier, F J (2018), 'Brexit and foreign direct investment: key issues and new empirical findings', *International Journal of Financial Studies*, Vol. 6(2), pages 1-21.

Appendix

Table A1: Parameter Values Used in the Model

Parameter	Value	Description
α	0.2	Output elasticity of capital
β	0.9925	Representative household's discount factor
γ	0.6	Output elasticity of labour
δ	0.025	Depreciation of capital
σ_c	1	Elasticity of substitution in consumption
σ_h	0.5	The Frisch elasticity of hours worked
ψ	1.5	Armington elasticity of substitution between consumption goods
$\omega_{i,i}$	0.8	Share of domestic items in UK households' consumption basket
$\omega_{i,j}$	0.1	Share of EU imports in UK households' consumption basket
$\omega_{i,k}$	0.1	Share of RoW imports in UK households' consumption basket
$\omega_{j,j}$	0.9	Share of domestic items in EU households' consumption basket
$\omega_{j,i}$	0.01	Share of UK imports in EU households' consumption basket
$\omega_{j,k}$	0.09	Share of RoW imports in EU households' consumption basket
$\omega_{k,k}$	0.8	Share of domestic items in RoW households' consumption basket
$\omega_{k,i}$	0.02	Share of UK imports in RoW households' consumption basket
$\omega_{k,j}$	0.18	Share of EU imports in RoW households' consumption basket
$\theta_{i,j}$	0.3321	EU's share in UK's non-consumer goods imports
$\theta_{j,i}$	0.0324	UK's share in EU's non-consumer goods imports
$\theta_{k,i}$	0.0488	UK's share in RoW's non-consumer goods imports
ζ_i	0.5383	Scaling parameter for the disutility of labour for UK
ζ_j	1.1499	Scaling parameter for the disutility of labour for EU
ζ_k	0.537	Scaling parameter for the disutility of labour for RoW
n_i	0.03	UK GDP relative to global economy
n_j	0.18	EU GDP relative to global economy
n_k	0.79	RoW GDP relative to global economy
$\tau_{j,i}$	0.4634	UK import costs from the EU (pre-Brexit)
$\tau_{i,j}$	0.4607	EU import costs from the UK (pre-Brexit)
$\tau_{j,i}$	0.7828	UK import costs from the EU (post-Brexit)
$\tau_{i,j}$	0.7782	EU import costs from the UK (post-Brexit)
$\tau_{j,k}$	0.8875	UK import costs from the RoW
$\tau_{k,j}$	0.8750	RoW import costs from the UK

$\tau_{i,k}$	0.8875	EU's import costs from the RoW
$\tau_{k,i}$	0.8750	RoW import costs from the EU
φ	1	Investment adjustment cost