Tariffs and Retaliation: A Macroeconomic Analysis*

Stéphane Auray[†] Michael B. Devereux[‡] Aurélien Eyquem[§]

October 20, 2025

Keywords: Protectionism, Trade Wars, Inflation Targeting

JEL Category, F30, F40, F41

Abstract

We quantify the macroeconomic effects of large tariff increases on the global economy through the lens of a New-Keynesian two-country model calibrated to the US and the rest of the world. We study both a unilateral 10pp tariff increase and a global trade war scenario with retaliatory tariffs of a similar magnitude. An important aspect of the model is to the distinction between the short run impact of tariff shocks when prices are slow to adjust and the steady state responses after prices, investment and imports have fully adjusted. Using a wide variety of assumptions regarding price setting, monetary policy, production and trade elasticities, we find that on impact, tariffs are usually, but not always contractionary for the tariff setter, and in most cases increase inflation and widen the trade deficit. In the long run, tariffs are always contractionary. Measured in welfare terms a unilateral US tariff generates gains due to a large terms of trade appreciation, but these welfare gains vanish with global retaliation.

*Devereux thanks SSHRC for research funding. Auray and Eyquem acknowledge financial support from the French National Research Agency (ANR-20-CE26-0018-01)

[†]CREST-Ensai and Rennes School of Business. ENSAI, Campus de Ker-Lann, Rue Blaise Pascal, BP 37203, 35172 BRUZ Cedex, France. `stephane.auray@ensai.fr`.

[‡]Vancouver School of Economics, University of British Columbia 6000, Iona Drive, Vancouver B.C. Canada V6T 1L4, CEPR and NBER. `michael.devereux@ubc.ca`.

[§]Department of Economics, University of Lausanne, Internef, CH-1015 Lausanne, Switzerland. Email: `aurelien.eyquem@unil.ch`.

1 Introduction

This year's dramatic rise in US tariffs on all its trading partners has led to a surge of academic interest in the macro effects of protectionist trade policies. While the open economy macro literature has widely explored the effects of monetary and fiscal shocks and their international transmission, until recently most analysis of trade policy shocks was done in the context of international trade models, abstracting from the importance of financial markets, monetary policy, and macro fluctuations coming from nominal rigidities.

This paper makes a contribution to the recent literature that is filling this gap. We analyze the impact of tariff shocks in a two country New Keynesian open economy model under a wide variety of different modelling specifications. We allow for different assumptions regarding production structures, monetary policy stance, relative country size, international trade invoicing, financial market completeness, and other scenarios. This is done both in the context of a unilateral tariff shock as well as a scenario where the 'victim' countries retaliate, precipitating a global trade war. The analysis encompasses both the short run effects of tariffs, when prices or imports are slow to adjust, leading to business cycle dynamics, and long run steady state effects when output gaps are closed.

Our aim is to provide a reasonably comprehensive understanding of the critical features that determine the impact of tariff shocks on output, employment, investment, the trade balance and the terms of trade. We explore these questions both for the impact of tariffs on the imposing country as well as on the receiving country - both the direct domestic effects and and the international spillovers - and to ask how these effects are altered in the presence of retaliation.

Although the paper is primarily theoretical, our model is calibrated to match the position of the US in the global economy, both in terms of size, degree of openness, GDP per capita, and in the magnitude of the tariff shock itself. This can help inform discussions concerning the short run and long run impact of the Trump tariffs as well as the questions of appropriate policy responses to the tariff shock.

Although at present there is little global retaliation in face of US tariffs, some countries have indeed retaliated, and China's possible response to US tariffs has still to be determined. Retaliation by trading partners can significantly amplify the effects of unilateral tariff increases. A trade war will reduce the volume of global trade, reducing welfare, employment and national incomes. Recent studies suggest that retaliatory tariffs may entirely offset any initial terms-of-trade gains for the US, leading to welfare losses of up to 1% and a decline in global employment of around 0.5% (Ignatenko et al. (2025); Piermartini and Teh (2005)). These findings underscore the risks associated with escalating trade conflicts. In addition, tariffs are likely to exert upward pressure on prices, prompting central banks to tighten monetary policy, or hesitate to loosen policy despite the recessionary effects of tariffs themselves. Higher interest rates depress aggregate demand, further weakening economic activity (Hunt et al. (2020)).

Our analysis is based on a general equilibrium model featuring trade in both final and intermediate goods, investment and capital accumulation, portfolio capital flows, sticky prices, and monetary policy. The model is calibrated to represent the US and the rest of the world, and we assess the effects of both unilateral and global increases in tariff rates. Given the difficulty in coming up with a precise number, we consider a (round) 10pp increase in tariffs, starting from a 3% global tariff rate. The model is such that the effects of higher tariff rates than these will scale up at least proportionally.

Tariffs are taxes on imports. They drive a wedge between pre- and post-tariff prices, reducing demand for imports and depressing prices for exporters in partner countries. At the same time, tariffs increase demand for domestically produced goods, raising their prices. As a result, for large countries, the terms of trade — defined as the relative price of domestic to foreign goods — improve, potentially benefiting local consumers. Whether this benefit outweighs the cost of tariffs depends on several factors. If tariff revenues are returned to households — either through lump-sum transfers or lower taxes — there may be a net welfare gain from unilateral tariffs. The extent of this gain critically depends many factors, most importantly on the price elasticity of imports.

While this mechanism applies to trade in final goods, trade in intermediate goods — where firms import inputs for production — operates in a similar fashion. However, the resulting effects now bear directly on production costs rather than consumption. Beyond these demand-side considerations, broader general equilibrium effects must be taken into account. First, retaliation by trade partners may negate the initial terms-of-trade improvement, leaving both sides paying more for traded goods and experiencing a negative income effect.[1] Second, household responses to tariffs, particularly in terms of labor supply, can affect the overall supply of goods, influencing prices and quantities in equilibrium. Finally, tariff-induced inflationary pressures may lead to monetary tightening, lowering aggregate demand and amplifying the contraction in economic activity.[2] Our model allows a simple yet comprehensive evaluation of the macroeconomic effects of a large tariff shock and possible retaliation, incorporating the diverse channels discussed above. As noted, we consider an arbitrary 10 percentage point increase in tariffs.

The main findings can be briefly summarized. First, the model predicts that the tariff is always contractionary in the long run. This comes from its negative effects on labor supply, investment, and the the use of imported intermediate inputs. In most cases, the short run or impact effect of the tariff shock is also negative and exceeds the long run or steady state effect. In the baseline case, output falls by 1.6 percent on impact in the US – 2.5 percent under retaliation, and converges to a lower steady state GDP by 1 percent. Under some alternative specifications of the model however, the short run effects of a tariff shock can be expansionary. In particular, if exchange rate pass-through is limited by local currency pricing (LCP), the tariff can generate a short run boom in the domestic economy before becoming negative during the adjustment phase. Second, we find that the spillover effects of a unilateral tariff shock is also negative, under all specifications, both in the short run and the long run - output falls in the rest of the world, but

[1]See Auray, Devereux, and Eyquem (2025b) for a macroeconomic set-up allowing for strategic trade policy.

[2]See Bergin and Corsetti (2023), Bianchi and Coulibaly (2025) for discussions regarding the optimal monetary response to tariff shocks, Bandera et al. (2023) for a discussion of how monetary policy should respond to supply shocks.

to a lesser extent than in the US.

A third key finding concerns the impact on the trade balance. While one ostensible aim of the US tariff increase is to eliminate the large US trade deficit, in most variants of our model the trade balance of the tariff imposing country *deteriorates* on impact. Surprisingly, this holds true in our calibrated model– and is further amplified – when the rest of the world retaliates with equal tariffs.

Although the model is relatively simple, it still allows for a rich set of predictions over the impacts of tariffs on trade volumes, investment and employment, interest rates, asset prices and exchange rates. It also allows for a welfare evaluation of the tariff shock on both the US and the rest of the world. While a unilateral tariff improves overall welfare for the US, as it generates a strong terms-of-trade improvement, this welfare gain is fully eliminated in the case of tariff retaliation, and global welfare is lower in the long run. In fact, in our calibrated model we find that with equal retaliation the US would suffer more in welfare terms.

Three key features of the baseline model are important in the understanding of the response to the tariff shocks. First, the calibrated model implies a substantial asymmetry between the US and the rest of the world. While the US is the largest single economy in the world, it is small as a fraction of global GDP, and evaluated in a bilateral sense, it is more open to trade with the rest of the world than the rest of the world with the US. This implies that an equal-sized tariff in both regions leads to a larger negative output effect on the US than on the rest of the world. Secondly, as noted above the response to a permanent tariff tends to be larger in the short run than in the long run. This is due to the presence of nominal rigidities combined with an endogenous response of monetary policy to the burst of CPI inflation following the tariff shock. Finally, the presence of global supply chains in the form of imported intermediate goods is critical for the scale effect of the tariff response. Both the impact and long run negative effects of the tariff shock would be substantially smaller in the absence of imported intermediate goods.

Beyond the baseline model, we explore a range of alternative assumptions about trade elasticities, labor supply, price flexibility, monetary policy responses, traded goods pricing, disbursement of the tariff revenue and the structure of international financial markets. While the quantitative responses vary, in all cases we find substantial output and welfare costs of global tariff increases, and in all cases, if there is full retaliation, the long run negative welfare effects are much larger for the US than the rest of the world.

The paper is structured to allow for a clear identification of these mechanisms: pure demand effects, combined demand and supply effects, unilateral versus global tariff shocks, the role of trade elasticities, and the consequences of monetary policy. The next section presents a short review of recent literature. The model setup is presented in Section 3. Section 4 sets out a simplified version of the model which can be solved analytically. Section 5 explains the calibration of the general model. The main results are discussed in Section 6.

2 Literature Review

There is a growing recent literature literature on the macroeconomic consequences of trade policy. Barattieri, Cacciatore, and Ghironi (2021) develop a small open economy model with firm entry and endogenous tradability that supports the empirical evidence on the effects of protectionist shocks. Erceg, Prestipino, and Raffo (2023) look at the impact of trade policies in the form of import tariffs and export subsidies. They find that the effects critically depend on the response of the real exchange rate, and that in turn depends on the expectations about future policies and potential retaliation from trade partners. Furceri et al. (2018) examine the macroeconomic consequences of tariff shocks, and shows that these shocks are generally contractionary. Lindé and Pescatori (2019) study the conditions under which Lerner symmetry holds, and how this affects the macroeconomic costs of a trade war.

Bergin and Corsetti (2020) also consider tariffs as policy instruments in addition to monetary policy, but their focus is rather on the implications of monetary policy on the building of comparative advantages. In a later paper, Bergin and Corsetti (2023) develop a multi-country DSGE model with trade in intermediate goods and firms entry. They look at the optimal response of monetary policy to exogenous tariff shocks, which they find to be expansionary given the deflationary effects of tariff hikes.

In the last few months, there has been an explosion of new papers on the macro effects of tariffs and monetary policy responses. Auclert, Rognlie, and Straub (2025) develop a dynamic open-economy New Keynesian model with tariffs. They show that tariffs can temporarily improve the trade balance through recessionary effects that reduce imports. They also show that whether tariffs are contractionary or not depends critically on the trade elasticities and intertemporal elasticity of substitution. Our paper is similar to theirs except we focus on differences in the nature of labor supply, the monetary rule, and more importantly focusing on a more quantitative evaluation.

Some other recent papers explore the role of monetary policy in shaping the impacts of tariff shocks. Bianchi and Coulibaly (2025) develop a baseline model of a small open economy with sticky prices, and show that the optimal monetary policy response to a tariff shock is expansionary. Monacelli (2025) also looks at how the response to tariff shocks depends on the monetary policy stance, and derives the optimal monetary policy response to such shocks. Our paper again differs in focusing on a positive rather than normative evaluation of tariff shocks, focusing on both short run and long run effects, allowing for retaliation, and providing a quantitative evaluation based on current tariff projections.

Itskhoki and Mukhin (2025) show how an optimal tariff may depend on the net foreign asset position of a country, and argue that valuation effects in the response of the terms of trade to tariffs may be equally important as traditional trade elasticities. A similar set of results is presented in Auray, Devereux, and Eyquem (2025b).

The temporal dimension of trade elasticities is further explored by Boehm, Levchenko, and Pandalai-Nayar (2023) and Chen et al. (2024). Boehm et al. estimate trade elasticities using local projection methods and find that short-run elasticities are significantly lower than long-run estimates, suggesting slow adjustment to trade shocks. Chen et al. offer a structural explanation via a general equilibrium model with staggered input sourcing decisions, showing that frictions in supplier switching generate substantial short-run rigidity.

Quantitative assessments of recent tariff episodes are provided by Rodríguez-Clare, Tintelnot, and Traiberman (2025) and Ignatenko et al. (2025). Rodríguez-Clare et al. simulate the 2025 U.S. trade war using a regional dynamic model incorporating nominal rigidities and find that although manufacturing employment initially rises, aggregate real income falls, with significant heterogeneity across U.S. states.

In a complementary analysis, Ignatenko et al. (2025) examine the "Liberation Day" tariff program through a global quantitative trade model that incorporates retaliation, endogenous fiscal policy, and input-output linkages. Their baseline results suggest that without retaliation, the U.S. may experience modest welfare gains by substituting tariff revenue for distortionary taxes. However, when trade partners respond, welfare declines. Our paper is complementary in that we focus on the effects of the tariff in a more conventional open economy macro model and stressing more macro channels.

Though somewhat earlier, the work of Limao and Saggi (2013) provides important theoretical underpinnings. Their analysis focuses on coordination externalities and firm size heterogeneity, showing how these structural features affect the responsiveness of an economy to trade policy and the formation of efficient trade agreements. While not modeling recent tariff events directly, their framework enriches our understanding of how micro-level characteristics influence macroeconomic outcomes.

3 The Model

We describe a model with two countries, denoted Home and Foreign. In the quantitative application we will calibrate so that Home represents the rest of the world and the Foreign the US economy. Households supply labor, consume and invest using goods from both regions. The world is populated with a unit mass of agents and Home has share n of these, with Foreign share $1 - n$. We assume that firms use a combination of capital, labor and traded intermediate goods to produce, set prices in the currency of producers (PCP) – as a baseline – and adjust prices constrained by Rotemberg adjustment costs. Households in both countries have preferences over consumption and hours worked. In the baseline model, financial markets are incomplete - there is international trade in non-contingent bonds issued in the US, and Home households face a cost when changing their net foreign asset position.

3.1 Households

The representative Home household maximizes its welfare index:

$$\mathbb{E}_t \sum_{s=0}^{\infty} \beta^s \left(\frac{C_{t+s}^{1-\sigma}}{1-\sigma} - \frac{H_{t+s}^{1+\psi}}{1+\psi} \right), \tag{1}$$

where σ is the degree of relative risk aversion and $1/\psi$ is the Frisch elasticity on labor supply. The internationally traded bond is issued by the Foreign (US) region. Home households also have access to domestic one-period bonds and capital goods. They face the following nominal budget constraint:

$$\begin{aligned} S_t F_t + B_t + P_{ht}\left(C_{ht} + I_{ht}\right) &+ \left(1+\tau_t\right) S_t P_{ft}^* \left(C_{ft} + I_{ft}\right) + P_t \Lambda_t^f \\ &= S_t F_{t-1} R_{t-1}^* + B_{t-1} R_{t-1} + R_t^k K_{t-1} + W_t H_t + \Pi_t + TR_t, \end{aligned} \tag{2}$$

Here B_t denotes the amount of Home one-period bonds bought by Home households paying a return R_t between t and $t+1$, while K_t is the amount of capital and paying a rental rate R_{t+1}^k between t and $t+1$, and F_t represents the internationally traded bond, paying a return R_t^* between t and $t+1$. Further, trading international bonds incurs the payment of a small adjustment cost $\Lambda_t^k = \frac{\nu}{2}\left(\frac{S_t F_t}{P_t} - \frac{SF}{P}\right)^2$, proportional to the deviation of real bonds to their steady-state value. In addition, investing I_t in capital incurs the payment of a quadratic investment adjustment costs so that the accumulation of capital is described by

$$K_t = (1-\delta) K_{t-1} + I_t \left(1 - \varphi \left(I_t / I_{t-1} - 1\right)^2 / 2\right)$$

, where δ is the depreciation rate of capital. The bundle structures of adjustment costs and investment goods mimic that of the final consumption good.

The representative household in the Home economy consumes (or buys investment and pays adjustment costs) Home goods in quantity C_{ht} (or I_{ht} and Λ_{ht}^f) at the price P_{ht} and in Foreign goods in quantity C_{ft} (or I_{ft} and Λ_{ft}^f) at the price $(1+\tau_t) S_t P_{ft}^*$, where S_t is the nominal exchange rate, P_{ft}^* is the foreign-currency price of the Foreign good, and τ_t is the ad valorem import tariff rate. The corresponding bundles are:

$$x_t = \left(\gamma^{\frac{1}{\lambda}} x_{ht}^{\frac{\lambda-1}{\lambda}} + (1-\gamma)^{\frac{1}{\lambda}} x_{ft}^{\frac{\lambda-1}{\lambda}} \right)^{\frac{\lambda}{\lambda-1}}, \text{ for } x = \left\{ C, I, \Lambda^f \right\}, \tag{3}$$

where $\gamma = n + x(1-n)$, and x denotes Home bias. The aggregate true price index is:

$$P_t = \left(\gamma P_{ht}^{1-\lambda} + (1-\gamma) \left((1+\tau_t) S_t P_{ft}^* \right)^{1-\lambda} \right)^{\frac{1}{1-\lambda}}, \tag{4}$$

The demand functions of Home and Foreign goods by Home households are respectively:

$$C_{ht} + I_{ht} + \Lambda_{ht}^{f} = \gamma \mathcal{P}_t^{\lambda} \left(C_t + I_t + \Lambda_t^{f} \right), \tag{5}$$

$$C_{ft} + I_{ft} + \Lambda_{ft}^{f} = (1-\gamma) \left(\frac{\mathcal{P}_t}{(1+\tau_t)\,\mathcal{S}_t} \right)^{\lambda} \left(C_t + I_t + \Lambda_t^{f} \right), \tag{6}$$

where we defined $\mathcal{P}_t = P_t / P_{ht} = \left(\gamma + (1-\gamma)\left((1+\tau_t)\,\mathcal{S}_t\right)^{1-\lambda} \right)^{\frac{1}{1-\lambda}}$ as the inverse of the relative price of the Home consumption good, and $\mathcal{S}_t = S_t P_{ft}^{*} / P_{ht}$ as the Home terms of trade. The first-order conditions of the Home household imply:

$$Q_t \left(1 - \frac{\varphi}{2} d_t^2 - \varphi d_t \left(1 + d_t\right) \right) + \beta \mathbb{E}_t \left\{ \frac{u_{ct+1}}{u_{ct}} Q_{t+1} \varphi \left(1 + d_{t+1}\right)^2 d_{t+1} \right\} = 1, \tag{7}$$

$$\beta \mathbb{E}_t \left\{ \frac{u_{ct+1}}{u_{ct}} \left(\frac{\mathcal{R}_{t+1}^{k}}{\mathcal{P}_{t+1}} + Q_{t+1}\left(1-\delta\right) \right) \right\} = Q_t, \tag{8}$$

$$\beta \mathbb{E}_t \left\{ \frac{u_{ct+1}}{u_{ct}} \frac{S_{t+1} R_t^{*}}{\pi_{t+1} S_t \left(1 + \nu\left(f_t - f\right)\right)} \right\} = 1, \tag{9}$$

$$\beta \mathbb{E}_t \left\{ \frac{u_{ct+1}}{u_{ct}} \frac{R_t}{\pi_{t+1}} \right\} = 1, \tag{10}$$

$$H_t^{\psi} = \frac{\mathcal{W}_t}{\mathcal{P}_t} u_{ct}, \tag{11}$$

where u_{ct} is the marginal utility of consumption, $\pi_t = P_t / P_{t-1}$ is the gross rates of CPI inflation in the Home country, Q_t is Tobin's Q, $\mathcal{W}_t = W_t / P_{ht}$ and $\mathcal{R}_t^{k}$ are the PPI-based real wage and rental rates, $d_t = I_t / I_{t-1} - 1$ is the growth rate of investment, and $f_t = S_t F_t / P_t$ denotes Home real holdings of international bonds. The Foreign (US) representative household has a similar utility function, and its consumption and investment good bundles are:

$$x_t^{*} = \left(\gamma^{*1/\lambda} x_{ft}^{*\frac{\lambda-1}{\lambda}} + (1-\gamma^{*})^{1/\lambda} x_{ht}^{*\frac{\lambda-1}{\lambda}} \right)^{\frac{1}{1-1/\lambda}}, \text{ for } x = \{C, I\}, \tag{12}$$

while the price index is:

$$P_t^{*} = \left(\gamma^{*} P_{ft}^{*1-\lambda} + (1-\gamma^{*}) \left((1+\tau_t^{*}) \frac{P_{ht}}{S_t} \right)^{1-\lambda} \right)^{\frac{1}{1-\lambda}}, \tag{13}$$

and the corresponding demand functions are given as:

$$C_{ft}^{*} + I_{ft}^{*} = \gamma^{*} \mathcal{P}_t^{*\lambda} \left(C_t^{*} + I_t^{*} \right), \text{ and } C_{ht}^{*} + I_{ht}^{*} = (1-\gamma^{*}) \left(\frac{\mathcal{S}_t \mathcal{P}_t^{*}}{(1+\tau_t^{*})} \right)^{\lambda} \left(C_t^{*} + I_t^{*} \right), \tag{14}$$

where $\mathcal{P}_t^{*} = P_t^{*} / P_{ft}^{*} = \left(\gamma^{*} + (1-\gamma^{*}) \left((1+\tau_t^{*}) / \mathcal{S}_t \right)^{1-\lambda} \right)^{\frac{1}{1-\lambda}}$. Using total expenditure on goods, Foreign households face a slightly different nominal budget constraint expressed in the Foreign currency, since they do not have access to Home bonds:

$$F_t^* + P_t^* \left(C_t^* + I_t^*\right) = F_{t-1}^* R_{t-1}^* + R_t^{k*} K_{t-1}^* + W_t^* H_t^* + \Pi_t^* + TR_t^*, \tag{15}$$

and its first-order conditions imply:

$$Q_t^* \left(1 - \frac{\varphi}{2} d_t^{*2} - \varphi d_t^* \left(1 + d_t^*\right)\right) + \beta \mathbb{E}_t \left\{ \frac{u_{ct+1}^*}{u_{ct}^*} Q_{t+1}^* \varphi \left(1 + d_{t+1}^*\right)^2 d_{t+1}^* \right\} = 1, \tag{16}$$

$$\beta \mathbb{E}_t \left\{ \frac{u_{ct+1}^*}{u_{ct}^*} \left(\frac{\mathcal{R}_{t+1}^{k*}}{\mathcal{P}_{t+1}^*} + Q_{t+1}^* \left(1 - \delta\right) \right) \right\} = Q_t^*, \tag{17}$$

$$\beta \mathbb{E}_t \left\{ \frac{u_{ct+1}^*}{u_{ct}^*} \frac{R_t^*}{\pi_{t+1}^*} \right\} = 1, \tag{18}$$

$$H_t^{*\psi} = \frac{\mathcal{W}_t^*}{\mathcal{P}_t^*} u_{ct}^*, \tag{19}$$

where u_{ct}^* is the marginal utility of consumption, π_t^*, $\mathcal{W}_t^*$ and $\mathcal{R}_t^{k*}$ are the Foreign CPI inflation rate, PPI-based real wage and PPI-based rental rate, respectively.

3.2 Firms

Here we focus on Home firms but Foreign firms are assumed to solve a symmetric problem. A measure n of firms in the Home economy produce differentiated goods. The aggregate Home good is a composite of these differentiated goods, where the elasticity of substitution between individual goods is denoted $\epsilon > 1$. The production function for firm i in the Home country is:

$$Y_t(i) = A_t \left(K_{t-1}(i)^{\alpha} H_t(i)^{1-\alpha} \right)^{1-\eta} X_t(i)^{\eta}, \tag{20}$$

where A_t is an exogenous aggregate productivity term. Here, $X_t(i)$ represents the use of intermediate goods by the Home firm i, $H_t(i)$ the use of labor and $K_{t-1}(i)$ the amount of capital rented from households. Intermediate good inputs are composed of Home and Foreign goods in a potentially different composition than the consumption aggregator. Namely,

$$X_t(i) = \left(\gamma_x^{\frac{1}{\lambda}} X_{ht}(i)^{\frac{\lambda-1}{\lambda}} + (1 - \gamma_x)^{\frac{1}{\lambda}} X_{ft}(i)^{\frac{\lambda-1}{\lambda}} \right)^{\frac{\lambda}{\lambda-1}}, \tag{21}$$

where $X_{jt}(i)$ is the Home firm's use of inputs from country $j = \{h, f\}$, and

$$P_{xt} = \left(\gamma_x P_{ht}^{1-\lambda} + (1 - \gamma_x)((1 + \tau_t) S_t P_{ft}^*)^{1-\lambda} \right)^{\frac{1}{1-\lambda}}, \tag{22}$$

is the price index relevant for the firm's use of intermediate inputs. Here τ_t is the tariff rate on imports, assumed to be the same as the rate paid by household consumers. The profits of Home firm i are then:

$$\Pi_t(i) = \left((1 + s) P_{ht}(i) - MC_t\right) Y_t(i), \tag{23}$$

where MC_t denotes the firm's nominal marginal cost, and s represents a subsidy to potentially offset the monopoly distortion in pricing. Cost minimization by the firm implies:

$$(1-\eta)\,\alpha\frac{Y_t(i)}{K_{t-1}(i)}=\frac{R_t^k}{MC_t},\;(1-\eta)(1-\alpha)\frac{Y_t(i)}{H_t(i)}=\frac{W_t}{MC_t},\,\eta\frac{Y_t(i)}{X_t(i)}=\frac{P_{xt}}{MC_t}, \tag{24}$$

with

$$X_{ht}(i)=\gamma_x\mathcal{P}_{xt}^{\lambda}X_t(i)\,,\text{ and }X_{ft}(i)=(1-\gamma_x)\left(\frac{\mathcal{P}_{xt}}{(1+\tau_t)\mathcal{S}_t}\right)^{\lambda}X_t(i)\,, \tag{25}$$

where $\mathcal{P}_{xt}$ is the equivalent of $\mathcal{P}_t$ for intermediate goods.[3] The firm then chooses its price to maximize the present value of expected profits, net of price adjustment costs:

$$\mathbb{E}_t\sum_{j=0}^{\infty}\omega_{t+j}\left(\Pi_{t+j}(i)-\frac{\phi}{2}\left(\frac{P_{ht+j}(i)}{P_{ht+j-1}(i)}-1\right)^2P_{ht+j}(i)\,Y_{t+j}(i)\right), \tag{26}$$

where we defined $\omega_t=\beta\frac{u_{ct}\mathcal{P}_{t-1}}{u_{ct-1}\mathcal{P}_t}$ as the firm's nominal stochastic discount factor. Parameter ϕ captures the presence of a price adjustment cost for the firm. Price adjustment costs are proportional to the nominal value of Home output, to be consistent with the nominal profit objective function of the firm. The first-order condition for profit maximization for the Home firm i takes into account the individual demand of good i, *i.e* $Y_t^d(i)=(P_{ht}(i)/P_{ht})^{-\epsilon}Y_t$ and is the same for all producers so that $P_{ht}(i)=P_{ht}$ and $Y_t(i)=Y_t$ and that the i index can be dropped. It implies:

$$\theta+\phi\epsilon^{-1}\left(\pi_{ht}(\pi_{ht}-1)-\mathbb{E}_t\left\{\omega_{t+1}\pi_{ht+1}(\pi_{ht+1}-1)\frac{Y_{t+1}}{Y_t}\right\}\right)=\mathcal{MC}_t, \tag{27}$$

where $\theta=\frac{(1+s)(\epsilon-1)}{\epsilon}$, and $\mathcal{MC}_t=MC_t/P_{ht}$ is the PPI-based real marginal cost.

3.3 Economic Policy

There are three separate policy levers in the model. Fiscal policy may be used to subsidize monopoly firms, but this plays a very minor role in the analysis. The stance of monetary policy is critical for the evaluation of the impact of tariff shocks. In our baseline model, we assume that policy follows a simple Taylor rule in each country:

$$\log(R_t\beta) = \rho_r\log(R_{t-1}\beta)+(1-\rho_r)\mu\log(\tilde{\pi}_t), \tag{28}$$

$$\log(R_t^*\beta) = \rho_r\log(R_{t-1}^*\beta)+(1-\rho_r)\mu\log(\tilde{\pi}_t^*), \tag{29}$$

where $\tilde{\pi}_t=\pi_t\pi_{t-1}\pi_{t-2}\pi_{t-3}$ is the annual CPI inflation rate of the Home economy, and $\tilde{\pi}_t^*$ is defined similarly. In a later section we allow for an output gap term in the Taylor rule.

Finally, trade policy is used to levy tariffs on imported goods. In the baseline model, tariff revenue is rebated to domestic households with a transfer TR_t. Assuming zero government net

[3] Variables $\mathcal{P}_t$ and $\mathcal{P}_{xt}$ only differ by the presence of potentially different degrees of home bias, respectively in the use of final or intermediate goods.

supply of bonds, the government budget constraints are:

$$TR_t = \tau_t S_t P^*_{ft} \left(C_{ft} + I_{ft} + X_{ft} + \Lambda^f_{ft} \right) - sP_{ht} Y_t, \quad (30)$$

$$TR^*_t = \tau^*_t S^{-1}_t P_{ht} \left(C^*_{ht} + I^*_{ht} + X^*_{ht} \right) - sP^*_{ft} Y^*_t. \quad (31)$$

3.4 Aggregation and market clearing

Given that Rotemberg costs are paid in units of local goods and using the demand functions for intermediate and final goods, the goods market clearing conditions are given by:

$$nY_t \left(1 - \frac{\phi}{2} \left(\pi_{ht} - 1 \right)^2 \right) = nD_t + (1-n) M^*_t, \quad (32)$$

$$(1-n) Y^*_t \left(1 - \frac{\phi}{2} \left(\pi^*_{ft} - 1 \right)^2 \right) = (1-n) D^*_t + nM_t, \quad (33)$$

where:

$$D_t = \gamma \mathcal{P}^\lambda_t \left(C_t + I_t + \Lambda^f_t \right) + \gamma_x \mathcal{P}^\lambda_{xt} X_t, \quad (34)$$

$$D^*_t = \gamma^* \mathcal{P}^{*\lambda}_t \left(C^*_t + I^*_t \right) + \gamma^*_x \mathcal{P}^{*\lambda}_{xt} X^*_t, \quad (35)$$

are domestic absorptions and imports – which are also the other region's exports are:

$$M_t = \left(\frac{\mathcal{S}^{-1}_t}{1+\tau_t} \right)^\lambda \left((1-\gamma) \mathcal{P}^\lambda_t \left(C_t + I_t + \Lambda^f_t \right) + (1-\gamma_x) \mathcal{P}^\lambda_{xt} X_t \right), \quad (36)$$

$$M^*_t = \left(\frac{\mathcal{S}_t}{1+\tau^*_t} \right)^\lambda \left((1-\gamma^*) \mathcal{P}^{*\lambda}_t \left(C^*_t + I^*_t \right) + (1-\gamma^*_x) \mathcal{P}^{*\lambda}_{xt} X^*_t \right). \quad (37)$$

Finally, Home bonds are in zero-net supply so that $B_t = 0$ and the clearing condition in the market for international (Foreign) bonds is given by:

$$nF_t + (1-n) F^*_t = 0. \quad (38)$$

Defining $f_t = \frac{S_t F_t}{P_t}$ and $f^*_t = \frac{F^*_t}{P^*_t}$ as the real per-capita net foreign asset positions, Equation (38) implies:

$$nf_t + (1-n) \frac{\mathcal{S}_t \mathcal{P}^*_t}{\mathcal{P}_t} f^*_t = 0. \quad (39)$$

Further, the combination of Home and Foreign Euler Equations on Foreign bonds gives rise to a modified uncovered interest rate parity condition:

$$\mathbb{E}_t \left\{ \frac{\omega_{t+1}}{\omega^*_{t+1}} \frac{\mathcal{S}_{t+1}}{\mathcal{S}_t \left(1 + \nu \left(f_t - f \right) \right)} \right\} = 1, \quad (40)$$

where we recall that ω_t and ω^*_t are the stochastic discount factors. Last, the consolidation of the Home household budget constraint with other equilibrium and market clearing conditions gives the following net foreign asset dynamics:

$$f_t = \frac{\mathcal{S}_t \mathcal{P}_{t-1}}{\mathcal{S}_{t-1} \mathcal{P}_t \omega_t^*} f_{t-1} + \mathcal{P}_t^{-1} \left(\frac{1-n}{n} M_t^* - \mathcal{S}_t M_t \right). \tag{41}$$

4 A Simple Illustrative Example

Before launching into the main quantitative results, it may be useful to illustrate some general features of the analysis by way of a special case of the general model. This simplified special case restricts attention to a small economy with a given world demand for its export good, one-period price setting in advance, and abstracts away from investment and capital accumulation. In addition, we make a number of simplifying assumptions on parameter values.

In particular, assume that the home country's preferences are given by (1) with the additional restriction that $\sigma = 1$. Further assume that there is a given outside world demand for the home good given by:

$$C_{h,f}^* = \Lambda \left(\frac{P_{h,t}}{S_t} \right)^{-\zeta} \tag{42}$$

where Λ is a normalizing constant and $\zeta > 1$.

In this example, the home firm's firm production function (20) is replaced by

$$Y_t\left(i\right) = AH_t(i)^{1-\eta} X_t(i)^{\eta}, \tag{43}$$

Production uses only labor and intermediate inputs. We assume that intermediate inputs are comprised of home and foreign goods in the same composition as private consumption.

In this special case, the price of the home good is set one period in advance, before the tariff is known. As in the main analysis below, we assume that at time $t = 0$ there is a permanent, unanticipated tariff shock. The price fully adjusts after one period, so that the second period is effectively the new steady state. In period 0 however, output is demand determined, and responds directly to the tariff shock, to changes in domestic consumption, and adjustments in the exchange rate.

4.1 Equations of the simple model

The full set of equations determining this simplified model is described as follows:

$$\begin{aligned}
\text{Balance of Payments} \quad &: \quad \frac{B_t}{R^*} - B_{t-1} = \frac{P_{h,t}}{S_t}\Lambda\left(\frac{P_{h,t}}{S_t}\right)^{-\zeta} \\
&\quad -(1-\gamma)\left(\frac{S_t(1+\tau_t)}{P_t}\right)^{-\lambda}\left(C_t + \eta\frac{P_{h,t}}{P_t}Y_t\right), \qquad (44) \\
\text{Market clearing} \quad &: \quad Y_t = \gamma\left(\frac{P_{h,t}}{P_t}\right)^{-\lambda}\left(C_t + \eta\frac{P_{h,t}}{P_t}Y_t\right) + \Lambda\left(\frac{P_{h,t}}{S_t}\right)^{-\zeta}, \qquad (45) \\
\text{Labor market} \quad &: \quad P_{h,t}(1-\eta)\frac{Y_t}{H_t} = P_t C_t H_t^{\phi}, \qquad (46) \\
\text{Imported inputs} \quad &: \quad P_{h,t}\eta\frac{Y_t}{X_t} = P_t, \qquad (47) \\
\text{Period 0 demand} \quad &: \quad Y_0 = \gamma\left(\frac{P_{h,0}}{P_0}\right)^{-\lambda}\left(C_0 + \eta\frac{P_{h,0}}{P_0}Y_0\right) + \Lambda\left(\frac{P_{h,0}}{S_0}\right)^{-\zeta}, \qquad (48) \\
\text{Euler equation} \quad &: \quad 1 = \beta\frac{C_0}{C_t}R^*\frac{P_0}{P_t}\frac{S_t}{S_0} \qquad (49) \\
\text{Monetary Policy} \quad &: \quad P_t = \left(\gamma P_{h,t}^{1-\lambda} + (1-\gamma)(S_t(1+\tau_t))^{1-\lambda}\right)^{\frac{1}{1-\lambda}} = 1,\ t = 0, 1.., \qquad (50)
\end{aligned}$$

We make three additional assumptions to emphasize the intuition. First, we normalize so that all prices are set to unity initially, and $\Lambda = (1-\gamma)(1-\eta(1-\gamma)) + \eta$. On top of this, we assume specific parameter values $\eta = \gamma = \frac{1}{2}$. This is important only to reduce excessive algebra, and to emphasize the key role of the two elasticities ζ and λ and the elasticity of labor supply ψ^{-1} in the adjustment to a tariff.[4] Second, we follow Auclert et al. (2025) by approximating around the limiting case where $\beta \to 1$, which allows us to analyze the impact of a tariff shock on the trade balance without incorporating the impact of the period 0 trade balance on future net foreign assets (NFA), while also assuming a zero initial NFA position with a zero tariff. Finally, rather than following a Taylor rule, we assume that the monetary authority follows a policy of stabilizing the CPI.

The special case model is solved by log linear approximation around the initial steady state described in the previous paragraph, and let $\hat{X} \equiv d\log(X)$ for any variable X. As noted before, there is an unexpected positive tariff shock $d\tau$ in period zero.

4.2 Results for the simple model

We may first describe the impact of the tariff on period t variables, for all $t > 0$. This describes the response of a fully anticipated tariff, since after $t > 0$ the home goods price can fully adjust. The response of gross output and GDP (H_t) are given by

$$\hat{Y}_t = -\frac{((2\zeta-1)(3+\psi)+2\lambda)}{2(1+\psi)(2\zeta+\lambda)}d\tau \qquad \hat{H}_t = -\frac{1}{1+\psi}d\tau$$

[4] To fix ideas, here we assume that $\lambda > 1$ and $\psi \geq 1$

The long run effect of the tariff is to reduce labor supply and GDP due to the tilting of consumption away from foreign goods towards home goods. Both gross output and GDP fall in the long run. The fall in gross output is greater, the higher the elasticity of foreign demand, and both gross output and GDP fall more, the higher the elasticity of labor supply (lower is ψ). The response of the exchange is given by

$$\hat{S}_t = -d\tau + \frac{((2\zeta - 1)(1+\psi) - 2)}{2(1+\psi)(2\zeta+\lambda)} d\tau$$

The exchange rate appreciates, but by less than the tariff rate, so the domestic price of the imported good rises. As we would expect, the extent of appreciation is less, the more elastic is foreign demand for the country's exports ζ, and converges to $-\frac{1}{2}d\tau$ as $\zeta \to \infty$.

Given that monetary policy stabilizes the CPI, the response of the home good price is $\hat{P}_{h,t} = -(\hat{S}_t + d\tau)$ Then the home terms of trade appreciates in response to the tariff shock:

$$\hat{\mathcal{S}}_t = -\frac{(\lambda(1+\psi) + \psi + 3)}{((1+\psi)(2\zeta+\lambda))} d\tau$$

. The improvement in the terms of trade is smaller, the higher is the elasticity of demand for home exports ζ, but (given that $\zeta > 1$ is assumed) higher, the higher is the home elasticity of demand for imports, λ.

The impact of the tariff on the consumption aggregator is given by

$$\hat{C}_t = -\frac{(2\zeta - \lambda(1+\psi) - 3)}{(1+\psi)(2\zeta+\lambda)} d\tau$$

Aggregate consumption may rise or fall, depending on the size of ζ relative to λ. The higher is ζ, the less is the terms of trade improvement coming from the tariff, reducing the long run wealth effect of the tariff, and the more likely it is that $\hat{C}_t < 0$. A larger value of λ has the opposite effect, increasing the wealth effect and the response of C_t.[5] The impact on intermediate goods imports is given by

$$\hat{X}_{f,t} = -\frac{((2\zeta - 1)(\lambda(1+\psi) + 2\psi) + 8(\zeta - 1) + 2)}{2(1+\psi)(2\zeta+\lambda)} d\tau < 0$$

Intermediate goods imports unambiguously fall after the tariff increase.

Finally, because the tariff shock is permanent, all the adjustment is achieved in the second period, and there is no change in the trade balance - the tariff increase reduces both imports and exports in the same proportion.[6]

To determine the impact of the tariff shock on period 0 variables, we impose the fact that the home goods price is fixed at period 0, and output is fully demand determined. Since the monetary authority stabilizes the CPI, and the home goods price is predetermined, the exchange

[5]In the quantitative model below we find aggregate consumption rises in the long run following a unilateral tariff. Also, while aggregate consumption may fall in this special case, consumption of home goods will likely rise due to expenditure switching. Note also that the tariff can still increase welfare since total hours worked fall.

[6]Note we are here using the assumption that $\beta \to 1$ as discussed above.

rate must appreciate exactly in proportion to the tariff shock, so that

$$\hat{S}_0 = -d\tau$$

Comparing with $\hat{S}_t$ we see that the exchange rate overshoots in the first period.

From the Euler equation, given constant CPI for all $t \geq 0$, the consumption response in time 0 must be forward looking, and depends on future consumption and the rate of change of the exchange rate

$$\hat{C}_0 = \hat{C}_t + \hat{S}_0 - \hat{S}_t, \quad t > 0 \tag{51}$$

Substituting gives

$$\hat{C}_0 = \hat{C}_t - \frac{((2\zeta - 1)(1+\psi) - 2)}{2(1+\psi)(2\zeta + \lambda)} d\tau$$

Again, period 0 consumption may rise or fall, and it is more likely to fall the higher is ζ. Moreover the response must be below the response of long run consumption. This is consistent with the results of the full quantitative model below.

The response of period 0 GDP is given by[7]

$$\hat{H}_0 = \gamma(1-\eta)\hat{C}_0 + \gamma\eta\hat{H}_0(1-\gamma)\zeta d\tau$$

Substituting, this gives

$$\hat{H}_0 = \hat{Y}_t - \frac{((2\zeta - 1)(1+\psi) - 2)}{2(1+\psi)(2\zeta + \lambda)} d\tau \tag{52}$$

It follows that GDP falls by more in period 0 than in the long run, since the home goods price cannot adjust downwards in response to the shock.

How does the trade balance respond? While we noted above that a permanent tariff shock has no implications for the trade balance, in period zero, we can show that

$$dTB = -\frac{2(\zeta - 1)((2\zeta + \lambda)(1+\psi) + \psi - 1) + \Gamma}{6(1+\psi)(2\zeta + \lambda)} d\tau$$

where $\Gamma = 4\lambda\psi + 2\lambda + 5\psi + 7$. The trade balance will deteriorate in period 0, in response to the permanent tariff shock. Since the exchange rate appreciates by more in the short run than the long run, exports fall by more. The exchange rate response exactly offsets the tariff, so there is no expenditure switching away from imported goods. While aggregate consumption may fall, this is more than offset by the fall in net output, and thus the trade balance deteriorates.

4.3 LCP in the simple model

As we show in the main analysis below, the short run effect of the tariff shock may differ under different specifications regarding monetary policy and price setting. In particular, when prices are set in buyer's currency (local currency pricing or LCP), we find that the tariff may be

[7] Since the tariff shock is exactly offset by the exchange rate, there is no change in the ratio of employment to intermediate imports, so that intermediate imports and employment respond in equal proportion to the shock.

expansionary in the short run. Here we illustrate the logic of that result.

We continue with the simplified model, and since the period $t > 0$ results are unchanged, we can focus just on the effects at time $t = 0$, but now imagine that the export price is preset in the currency of the foreign country, so an exchange rate change has no effect on export demand. Likewise, the price of the import good is set in domestic currency, but the tariff falls on top of this price, so the Home CPI is now

$$P_t = \left(\gamma P_{h,t}^{1-\lambda} + (1-\gamma)(P_{f,t}(1+\tau_t))^{1-\lambda}\right)^{\frac{1}{1-\lambda}}$$

where both $P_{h,t}$ and $P_{f,t}$ are preset at the $t = 0$.[8]

Since with LCP, the monetary authority can no longer affect the CPI, we assume instead that monetary policy keeps the nominal interest rate constant. In that case, since UIP must hold, the time zero exchange rate response to the tariff shock is equal to the time $t > 0$ response. Then by condition (51)

$$\hat{C}_0 = \hat{C}_t$$

Goods market clearing (52) is then replaced by

$$\hat{H}_0 = \gamma(1-\eta)\hat{C}_0 + \gamma\eta\hat{H}_0 + \gamma(1-\eta)(1-\gamma)\lambda d\tau \tag{53}$$

Now in contrast to (52), the tariff increases aggregate demand by switching expenditure away from imports towards domestic goods. This can be expansionary. The impact on GDP is now

$$\hat{H}_0 = \frac{2\zeta\lambda + \lambda^2 - 2\zeta + \lambda + 4}{6(2\zeta + \lambda)} d\tau \tag{54}$$

When both elasticities λ and ζ exceed one, this is unambiguously positive. In the fully calibrated model below, we find that tariffs may be expansionary in the model with LCP.[9] It is then straightforward to show that for LCP in this example, the trade balance response is positive rather than negative.

5 Baseline Parameter Values

We now turn to the analysis of the results from the full quantitative model. The model is parameterized to a quarterly frequency. The Home country represents the rest of the world while the Foreign economy represents the US. Our baseline parameter values are reported in Table 1.

Households. The discount factor of households is $\beta = 0.99$, consistent with an annual real interest rate of 4%. The relative size of the Foreign country (the US) is calibrated using the relative population of the US, $1 - n = 0.083$ as in Auray, Devereux, and Eyquem (2025b). Regarding

[8] To simplify exposition, assume now that $\psi = 1$, so the Frisch elasticity of labor supply is unity.

[9] This is *not* the case with DCP however, as we show below.

preferences, we consider a baseline value of $\sigma = 1.5$, and a Frisch elasticity of $\psi^{-1} = 0.4$ following Chetty et al. (2011). Regarding capital accumulation, the quarterly depreciation rate is $\delta = 0.025$, and we set the investment adjustment cost parameter to $\varphi = 2.75$ based on simulating persistent productivity shocks and obtaining a standard deviation of investment relative to that of GDP of 3.

Trade and Financial markets Further, we assume a home bias parameter $x = 0.665$ to match a trade openness of 0.25 in the US with a baseline (pre-shock) level of tariffs of $\tau = \tau^* = 0.03$. This leads to $\gamma = \gamma_x = 0.6928$, while in the rest of the world import weights are $\gamma^* = \gamma_x^* = 0.9722$, and illustrates the fact that the US, even though they are relatively less open than many economies, are more reliant on imports from the rest of the world than the other way round – think for instance, about how much imports from the US represent as a percentage of GDP in the rest of the world. The trade elasticity is $\lambda = 5$, which is on the high end of the range estimated by Feenstra et al. (2018), but is more appropriate for the evaluation of trade policy. It is also consistent with the average empirical estimates proposed by Imbs and Mejean (2017). In a later section we allow for import adjustment costs to gauge the importance of short-run vs long-run elasticities. Finally, the bond adjustment cost parameter suggested by Ghironi and Melitz (2005) is $\nu = 0.0025$.

Firms. The elasticity of substitution between varieties is $\epsilon = 6$, consistent with a 20% steady-state price-cost markup. The Rotemberg parameter is $\phi = 100$, which, along with the value of and the baseline value of $\epsilon = 6$ produces a 0.06 slope of the (linearized) new Keynesian Phillips Curves. The elasticity of output to the capital stock is $\alpha = 0.36$. Following Bergin and Corsetti (2023) and close to Itskhoki and Mukhin (2021), we consider the share of intermediate goods to be around $\eta = 0.4$. Finally, we draw on Auray, Devereux, and Eyquem (2025b) and assume that the relative TFP of the US is $A^*/A = 1.987$. Note that national accounting consistency requires computing GDP as output minus intermediate goods, *i.e.* $GDP_t = Y_t - \mathcal{P}_t X_t$.

Monetary policy and long-term bonds. The persistence of the monetary policy rules is $\rho_r = 0.8$ and the response to annual CPI inflation is $\mu_\pi = 1.5$, in line with empirical estimates. Alternative policy settings will be analyzed.

6 Results

We now look at the effects of a large increase in tariffs. According to the Peterson Institute for International Economics, the average tariff on US imports rose 7pp since early April 2025 from 3% before 'Liberation day'.[10] However, since the US administration seems determined to impose a minimum 10% tariff on all imports, 7pp seems like a rather lower bound and we consider a 10pp increase in tariffs, from 3% to 13%. From our starting value of $\tau_0 = \tau_0^* = 0.03$, which is supposed to represent the situation before 'Liberation Day', we consider two scenarios: (*i*) one

[10]See https://www.piie.com/research/piie-charts/2019/us-china-trade-war-tariffs-date-chart.

Table 1: Baseline parameter values.

Parameter (description)	Value	Target or Source
Households		
β (discount factor)	0.99	4% annual real interest rate
σ (risk aversion)	1.5	Standard value
ψ^{-1} (Frisch elasticity)	0.4	Chetty et al. (2011)
δ (capital depreciation rate)	0.025	Quarterly value
φ (inv. adjustment cost)	2.75	Matches $\sigma_I/\sigma_Y = 3$
$1-n$ (US share of world pop.)	0.083	Auray, Devereux, and Eyquem (2025b)
Trade and Financial Markets		
x (home bias)	0.665	Matches US trade openness (25%)
τ, τ^* (initial US and RoW tariff)	0.03	Pre-shock level
γ (US import share in CES)	0.6928	Derived from x and τ
γ^* (RoW import share in CES)	0.9722	Implied from CES bundles
λ (trade elasticity)	5	Imbs and Mejean (2017)
ν (bond adjustment cost)	0.0025	Ghironi and Melitz (2005)
Firms		
ϵ (substitution elasticity)	6	Implies 20% markup
ϕ (Rotemberg cost)	100	Matches Phillips curve slope of 0.06
α (capital share)	0.36	Standard value
η (share of intermediates)	0.4	Bergin and Corsetti (2023)
A^*/A (US relative TFP)	1.987	Auray, Devereux, and Eyquem (2025b)
Monetary Policy		
ρ_r (policy inertia)	0.8	Standard Taylor rule persistence
μ_π (inflation response)	1.5	Standard rule coefficient

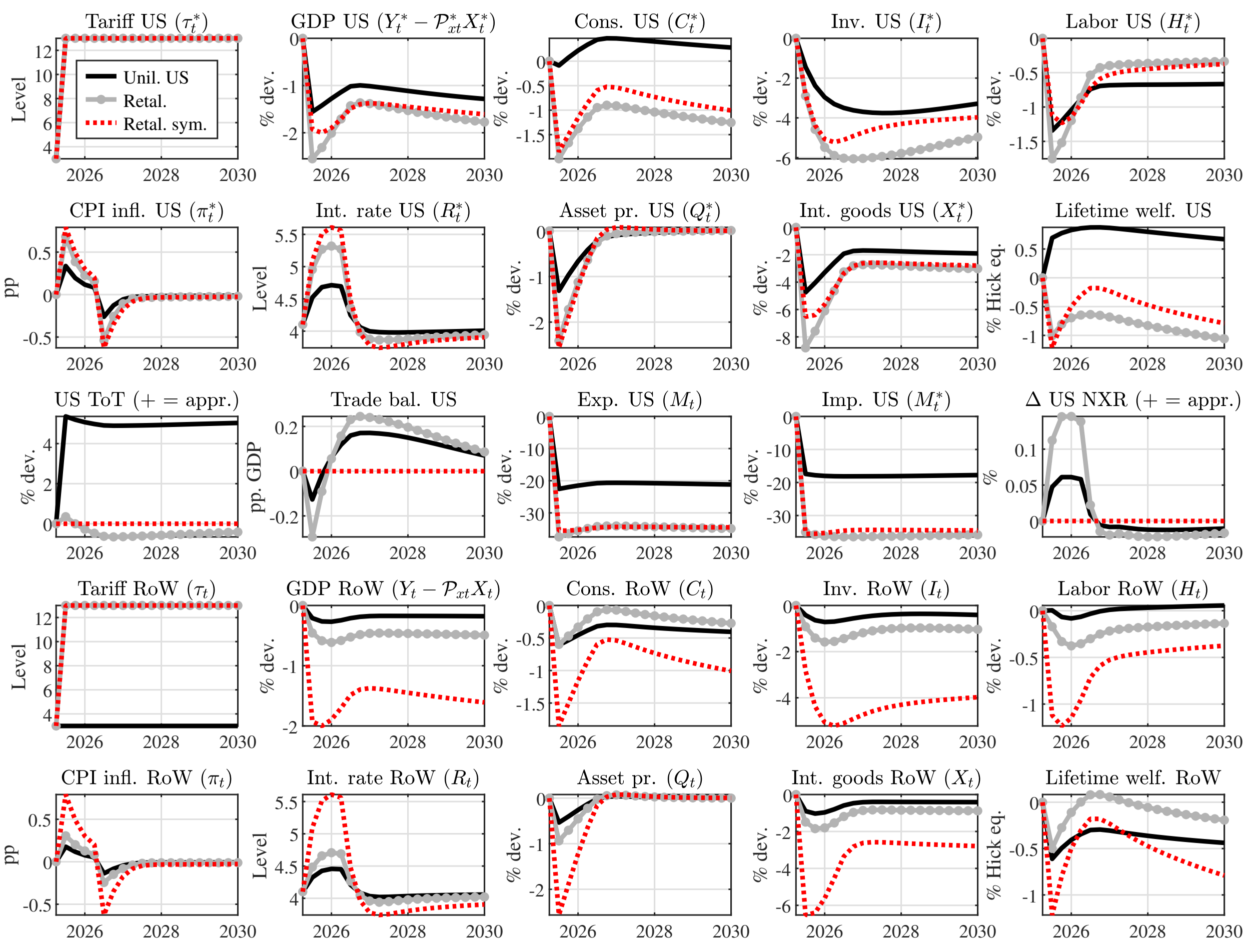
where the US unilaterally increase tariffs to $\tau^* = 0.13$ and (*ii*) one where the rest of the world retaliates and tariffs increase everywhere to $\tau = \tau^* = 0.13$.

Unless stated otherwise, the tariff increase is immediately implemented, unexpected and treated as permanent. To compute the response to these large MIT shocks, we perform non-linear perfect foresight transition from one steady-state to the new.

6.1 Baseline case

In the baseline case, prices are sticky and exporters set prices in their own currency (PCP). A later section looks at the case with either local currency pricing or dominant (dollar) currency pricing (LCP or DCP). Figure 1 reports the responses of key variables to the tariff shock.

Figure 1: Response to an exogenous tariff shock.



Note: **Unil. US**: 10pp tariff hike in the US, **Retal.**: joint 10pp tariff hike in the US and in the rest of the world (RoW), **Retal. sym.**: joint 10pp tariff hike with a symmetric calibration ($n = 1/2$ and $A = A^* = 1$).

Figure 1 presents several striking results. Focusing first on the unilateral case, the tariff shock reduces US output by nearly 1.6% on impact, while US consumption and investment are initially muted. The fall in output is mostly attributable to a larger fall in exports than imports. US stock price fall by 1.3%, as the expected future return on investment falls due to the higher cost of foreign goods for investment. At the same time, the tariff shock raises the US CPI inflation rate by 0.33%, prompting the central bank to increase its policy rate by more than 60 basis points. The tariff also leads to an appreciation of US goods by around 5%, while simultaneously reducing the availability of imported intermediate goods. US consumption moves little on impact - the positive wealth effect of terms of trade appreciation is countered by the rise in real interest rate. But over time the first channel dominates and consumption rises, peaking at 0.55% after two years as households cut investment by almost 3.5%. The tariff hike depresses US imports by 17% and US exports by 22%.

Since the US has market power in the global economy, the tariff raises the relative price of US exports - the terms of trade appreciates by 5 percent. Consistent with the resulting terms of trade appreciation, US households reduce their labor supply by 1.4% – employment falls – in response to the terms-of-trade appreciation. In this model the fall in employment has positive welfare implications. One key implication of Figure 1 is that the trade balance deteriorates, even though this is a permanent increase in the tariff. The trade balance deterioration is accounted for by the large fall in output relative to the muted impact effect on consumption and investment. This is consistent with the result of the simplified model above. The fall in the trade balance is modest however. In spite of the huge reduction in trade flows, the trade balance falls 'only' by 0.17 percentage points of GDP on impact. Over time however, the trade balance reverses and goes into surplus, due to the persistent fall in US investment.

It is apparent from Figure 1 that the impact effect of the tariff shock is greater than the steady state effect. In the new steady state with a permanently higher tariff rate, US output falls by almost 1.3%, stemming from a combination of a permanently lower capital stock and lower labor supply. The greater impact effect on output illustrates the importance of price stickiness and the monetary policy response to the tariff shock. The burst of CPI inflation leads to a sharp rise in the US real interest rate which compounds the contractionary impact of the tariff given the degree of price stickiness implied by the Rotemberg specification.

By construction, households in the rest of the world (Home) experience the opposite movement in their terms of trade, which lowers their real income and pushes them – all else equal – to an increase in labor supply. Gross domestic product in the rest of the world declines only slightly. Their exposure to trade with the US is much smaller than that of US households to trade with the rest of the world, as discussed in the calibration section. As a result, even a large increase in US tariffs has a relatively limited direct impact on them – reflecting, for example, their ability to trade among themselves rather than exclusively with the US. The drop in GDP is just 0.25% after 4 quarters, before returning to its pre-shock value. Consumption, however, is more negatively affected, declining by 0.5% on impact and by 0.4% in the long run. The shock also pushes the CPI inflation rate up in the rest of the world, albeit to a lesser extent than in the US – recall that US goods, whose relative price rises in equilibrium, represent only a small share of the CPI in the rest of the world. As a result, the monetary policy tightening abroad is much milder, with policy rates rising by around 35 basis points, and asset prices falling by just 0.5%, less than in the US.

Although US output falls, in welfare terms, US households experience a short-run gain of approximately 1% in consumption equivalent terms after 4 quarters (0.75% after 5 years), primarily driven by the reduction in their labor supply. In contrast, households in the rest of the world face a 0.65% welfare loss on impact, gradually converging to lower values (0.45% after 5 years). The main driver of this welfare overshooting is the slow adjustment of prices and the response of monetary policy.

While these results are instructive, the unilateral case may not be the most plausible scenario. As shown in Auray, Devereux, and Eyquem (2025b), once a country adopts non-cooperative trade policies, the prospect of substantial welfare losses for passive trade partners provides strong incentives for retaliation. We therefore analyze a case where there is a one for one retaliation by the rest of the world.

In this retaliatory scenario, the negative effect on US GDP is much larger, declining by 2.5 percent before converging to a larger steady-state decline than in the unilateral case. In addition, there is now a clear contraction of US consumption, falling by more than 1.8%. Inflationary pressures are amplified – roughly doubled – prompting the US central bank to increase its policy rate by 120 basis points, while policy rates abroad rise by a more moderate 60 basis points at their peak. Although the US tariff is fully matched by that in the rest of the world, the terms of trade still moves in favour of the US on impact, although significantly less than under the unilateral case. This is due to the asymmetry in openness between the US and the rest of the world. A given tariff has a greater impact on the terms of trade, the more open is a country.

Despite the fall in US consumption, the US trade balance deteriorates even more – almost twice the response under the unilateral case, around 0.35 percentage points of GDP. Again this is due to the smaller terms of trade appreciation with tariff retaliation, which causes the ratio of expenditure – imports – to GDP to fall by less than exports to GDP – converted in the same unit of goods.

Under retaliation, US households now experience a large welfare *loss* of 1.7% on impact, which gradually turns into a 0.4% welfare loss in the long run. In comparison, households in the rest of the world experience a 0.55% welfare loss on impact, which turns into a smaller 0.2% loss in the long run. Why does the symmetric tariff increase affect the US economy so much more severely than the rest of the world? First, the critical difference lies in the tariffs imposed by the rest of the world, which apply to US exported goods. Second, because the US is substantially more reliant on trade with the rest of the world than the reverse, it is disproportionately affected. This underscores the importance of a potential coordinated response of the rest of the world to US tariffs. While the US is the largest single economy in the world and is the largest export market for many countries, it is still a small share of the world economy and world trade. Given an increase in tariffs against all US trading partners, it is legitimate to imagine a coordinated response from all other countries, although in reality this is unlikely to happen. But with a fully equal retaliation, the US becomes a smaller and more open economy than the rest of the world, and in the end would suffer more from a trade war.

6.2 Welfare-maximizing tariffs

How far from the welfare-maximizing tariffs are the tariff hikes considered in the baseline case? To answer this question we run the following experiments.

First, consider the US choosing their tariff rate unilaterally – the tariff remaining 3 percent in the rest of the world – to maximize national households' welfare, computed on the entire transition path towards the resulting new steady state. The left panel of Figure 2 below shows that the optimal unilateral US tariff is around 12 percent, very close to the 13 percent considered in the baseline case. The figure also shows that *decreasing* tariffs starting from 3 percent *decreases* US welfare and *raises* other countries' welfare. On the contrary, *raising* tariffs first *raises* US welfare but then starts distorting the US economy beyond the optimal motives to set tariffs, while welfare *declines* monotonically in the rest of the world.

The interior optimum around $\tau^* \approx 0.12$ reflects the trade-off between exploiting US market power in the terms of trade and the domestic distortions that higher tariffs induce through sticky prices and monetary tightening (see Auray, Devereux, and Eyquem (2025b)).[11] On net, moving from $\tau^* = 0.03$ raises US transition welfare up to about 0.2% at the peak, while ROW loses roughly 0.55% under unilateral US action; beyond the optimum, domestic distortions dominate and US welfare declines. These patterns also echo the mechanisms in Auray, Devereux, and Eyquem (2025a): with inflation-targeting rules that stabilize CPI instead of PPI inflation, optimal non-cooperative tariffs are lower even than under flexible prices because policy removes part of the markup distortion, reducing the marginal benefit of terms-of-trade manipulation.

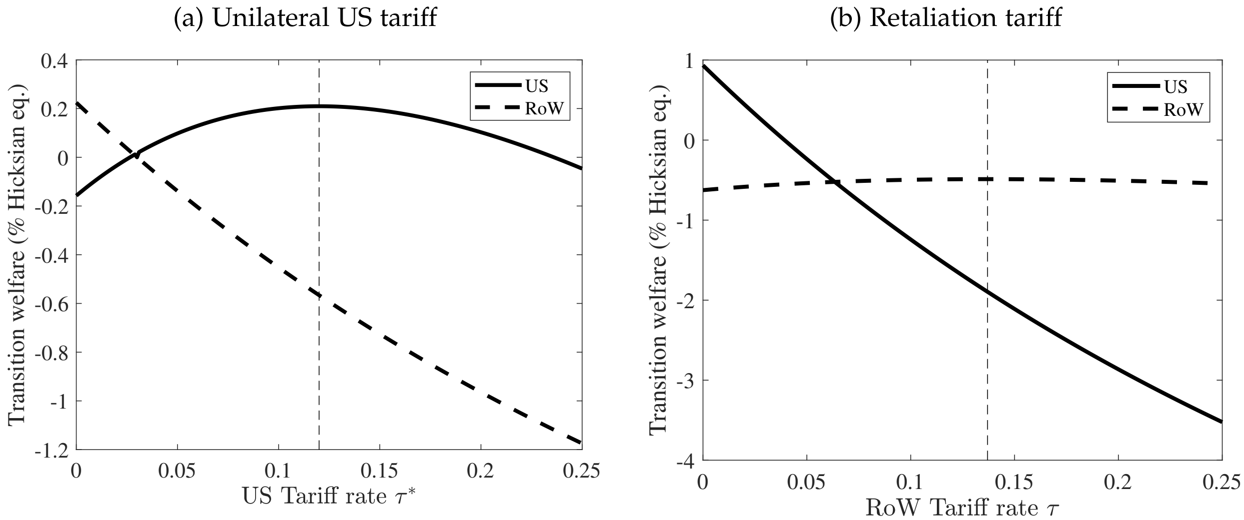
Second, starting from a situation of 3 percent tariffs worldwide, if the US implemented a 12 percent (welfare-maximizing) tariff, what would be the welfare-maximizing retaliation against US exports by other countries? The right panel of Figure 2 shows that other countries' welfare increases with the retaliation tariff, even though both countries experience welfare losses. The graph shows only modest welfare gains from imposing the retaliation tariff but large welfare losses imposed on US consumers. We find the optimal retaliation tariff to be 13.2 percent, a situation in which both regions are eventually worse-off. The rest of the world loses 0.5 percent and the US 1.9 percent of permanent consumption.

The intuition is straightforward: retaliation serves as a defensive tool to limit terms-of-trade losses against the US, but in doing so it exacerbates distortions in domestic production and consumption. The rest of the world gains relatively little because much of the burden falls on its own consumers through higher import prices and reduced efficiency, while the US faces significant welfare losses as its export markets shrink. In equilibrium, retaliation thus resembles a "mutually assured destruction" outcome: the rest of the world cannot substantially improve its own welfare, but it can reduce the US advantage at the cost of making both sides worse off.

We now turn to specific cases designed to highlight the contribution of key modelling assumptions to the baseline results, starting with the outcome resulting from alternative supply dynamics.

[11] In Auray, Devereux, and Eyquem (2025b), it is shown that optimal tariff rates would be significantly higher than these levels in the absence of domestic monopoly distortions.

Figure 2: Welfare-maximizing unilateral and retaliation tariffs.



<u>Note:</u> **Unilateral US tariff**: The figure shows US and other countries' welfare computed on the entire transition for different permanent levels of US tariffs τ^*, keeping other countries' tariff at $\tau = 0.03$. The dotted vertical line materializes the welfare-maximizing tariff rate. **Retaliation tariff**: The figure shows US and other countries' welfare computed on the entire transition for different permanent levels of other countries' tariff at τ, keeping the US tariff rate at its welfare-maximizing level $\tau^* = 0.12$. The dotted vertical line materializes the welfare-maximizing tariff rate.

6.3 Alternative Supply Dynamics

Our first analysis of alternative cases starts by considering different supply dynamics. We look at two alternative cases; (a) assuming that no intermediate goods in production ($\alpha = 0$), and (b) assuming that labor supply is fully inelastic. Figure 3 presents the responses to a unilateral tariff shock, comparing the dynamics in the baseline case with those without intermediate goods in production and with inelastic labor supply..[12]

In the first variant, without intermediate goods in production (dashed black line), US GDP declines much less than in the baseline, both on impact (-1.1% against -1.5% in the baseline) and in the long run (-0.6% against -1.3% in the baseline). Similarly, the decline of GDP in the rest of the world is far less than that of the baseline, both on impact and in the steady state. Without intermediate goods, changes in labor and capital are dampened because roundabout production has a multiplier effect that is shut off. Another key difference is in the response of the trade balance. Somewhat counter–intuitively, the trade balance deterioration is greater in the absence of intermediate goods. This is because consumption actually rises on impact and the fall in investment is much less in this case, so that both factors tend to dominate the smaller decline in output.

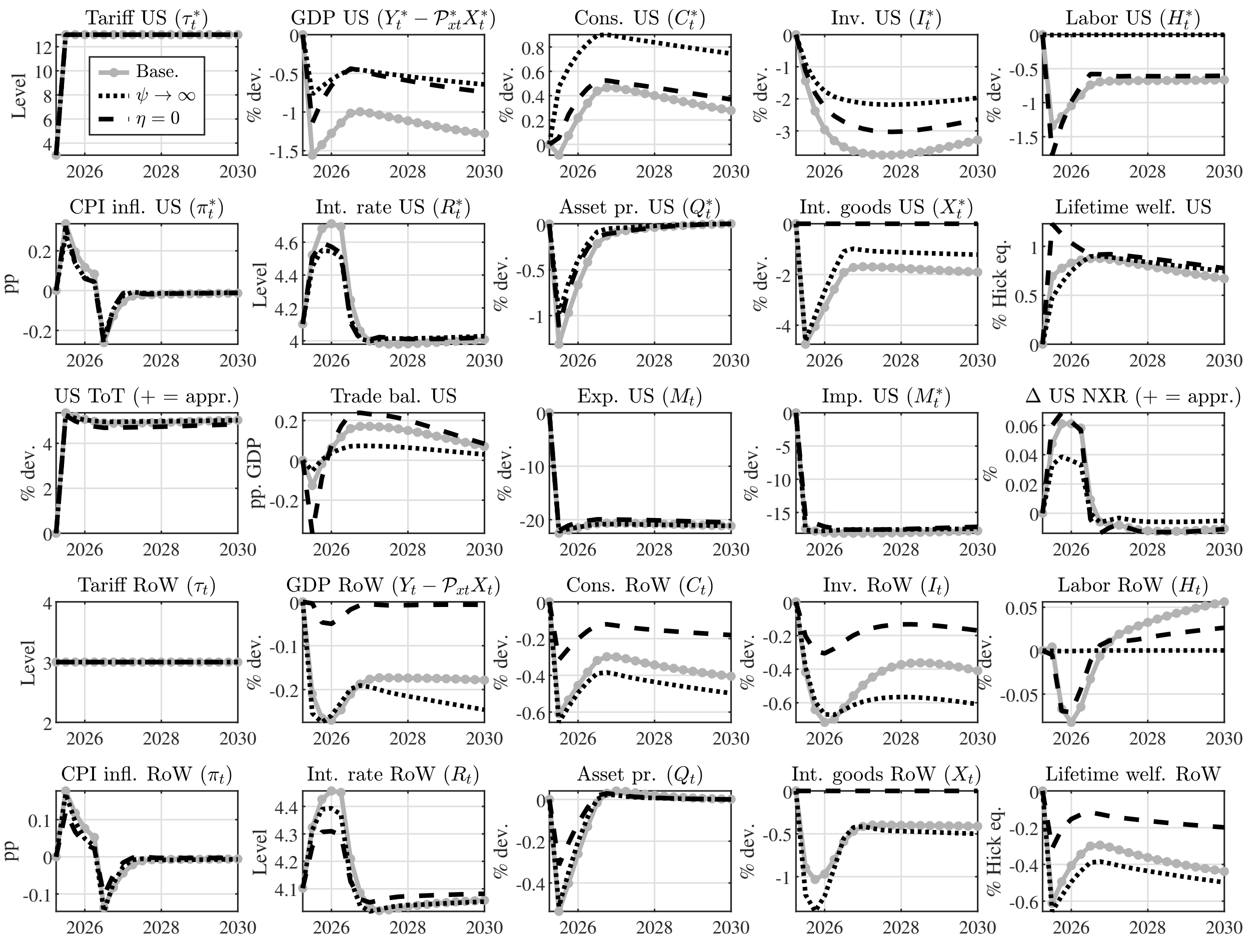
For the US, the absence of intermediate goods has little effects on the size of fall in hours, but given the rise in consumption, lifetime welfare rises by more than in the baseline case following a unilateral tariff increase. In addition, as noted, the investment decline is much lower in the

[12]For all the following alternative scenarios, we look at the effect of a unilateral tariff. For the full effect with retaliation, the relevant figures are contained in Appendix ..

absence of intermediate goods in production. Similarly in the rest of the world, the welfare losses from the tariff shock are dampened. These results highlight the key role of global value chains in amplifying the effects of tariff hikes, and in shaping their welfare implications both qualitatively and quantitatively.

In the second case, tariffs do not generate any additional 'supply' effects from changes in the use of labor.[13]

Figure 3: Unilateral US tariff shock — Alternative supply dynamics.



Note: **Base.**: joint 10pp tariff hike in the US and in the rest of the world (RoW) with a baseline calibration, **Inelastic labor supply**: $\psi \to \infty$, **No intermediate goods in production**: $\eta = 0$.

In Figure 3, any difference in output dynamics between the baseline (circled grey line) and the case of inelastic labor supply (dotted black line) is entirely due to the absence of a labor supply response. When labor supply is fixed, the supply effects (on GDP and capital accumulation) of the unilateral tariff hike are dampened while the effects on consumption are actually positive.

[13] Since a substantial share of international trade involves intermediate goods, tariffs still affect the supply side of the economy, but not through changes in labor supply.

The impact deterioration of the trade balance is slightly less than with elastic labor supply. The overall dynamics of inflation are slightly dampened by the assumption of inelastic labor supply.

The key lesson here is that the use of intermediate goods and changes in labor supply alter the transmission of tariff hikes mostly through their effects on output, and to a lesser extent through their effects on consumption. They matter for the short-run dynamics of the trade balance and for the short-run welfare losses, the use of intermediate goods also playing a role in the long-run welfare losses. They slightly amplify the impact of tariffs on inflation dynamics and subsequent monetary policy responses.

6.4 Trade Elasticities

We set $\lambda = 5$ in both regions as our baseline value for the trade elasticity. However, the literature in international macroeconomics often employs lower values, typically in the range of 1 to 2, to better capture the cyclical behaviour and volatility of the trade balance especially in the short-run. Moreover, many empirical estimates are based on product categories that may be too narrowly defined, potentially overstating the degree of substitutability across goods. This parameter is of critical importance because, in general equilibrium, the trade elasticity governs the extent of tariff pass-through – with lower elasticities leading to greater pass-through. In addition, one may argue that the US have a greater dependence on imports of both final and intermediate goods than the rest of the world. If the US depends more strongly on rare earths, critical raw materials or goods such as batteries to produce or consume, then their trade elasticity would be much lower than that of the rest of the world.

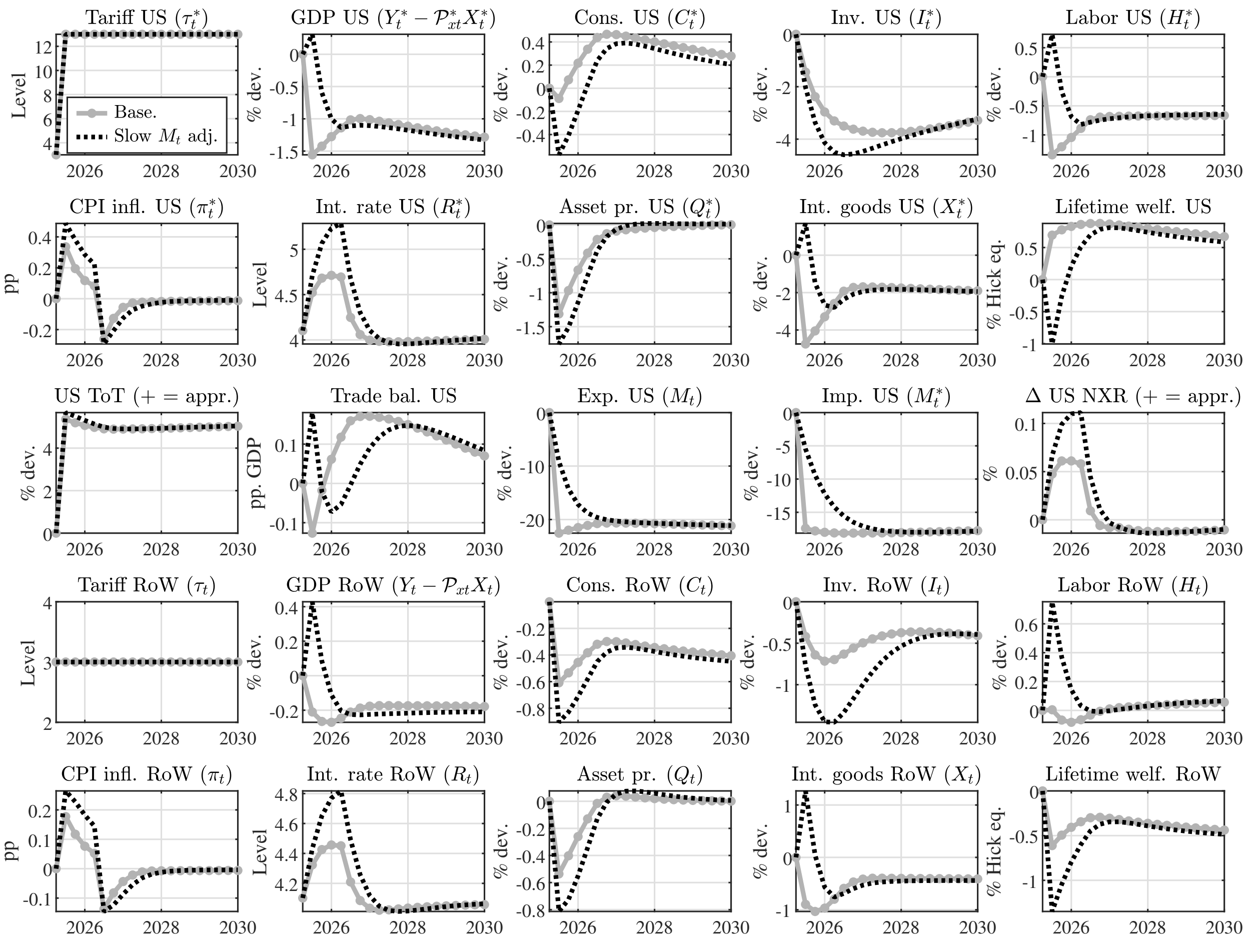
We thus conduct two types of counterfactual experiments regarding the trade elasticities. First, we introduce (ad-hoc) import adjustment frictions in the spirit of Erceg, Guerrieri, and Gust (2008) to slow down the adjustment of trade flows after the tariff hike, inducing lower short-run trade elasticities (see also Burstein and Gopinath (2014) and references therein). Second, we consider alternative values for the trade elasticities, one where $\lambda = 1.5$ (instead of $\lambda = 5$ in the baseline), and another one where the trade elasticity for the rest of the world is still $\lambda = 5$ but where the trade elasticity for the US is much lower (and slightly below one) at $\lambda_{US} = 0.9$.

6.4.1 Short-run vs. long-run trade elasticities

Figure 4 reports the effects of a symmetric tariff jump with or without import adjustment costs. In the case of adjustment costs, we assume that the full adjustment of import to their long-run value takes 8 quarters (2 years).

Constraining expenditure switching for consumption, investment and intermediate goods imports has striking effects on the short-run transmission of the tariff shock. The adjustment of GDP and intermediate goods are now much more protracted, while consumption and investment fall much more. Since the sluggishness of trade flows combined with a sharp terms of trade appreciation leads to the trade balance to immediately improve initially, output actually rises slightly even though consumption and investment fall. As a result, employment rises – which heats up real

Figure 4: Unilateral US tariff shock — Slow adjustment of imports.



Note: joint 10pp tariff hike in the US and in the rest of the world (RoW) with a baseline calibration vs. slow adjustment of imports.

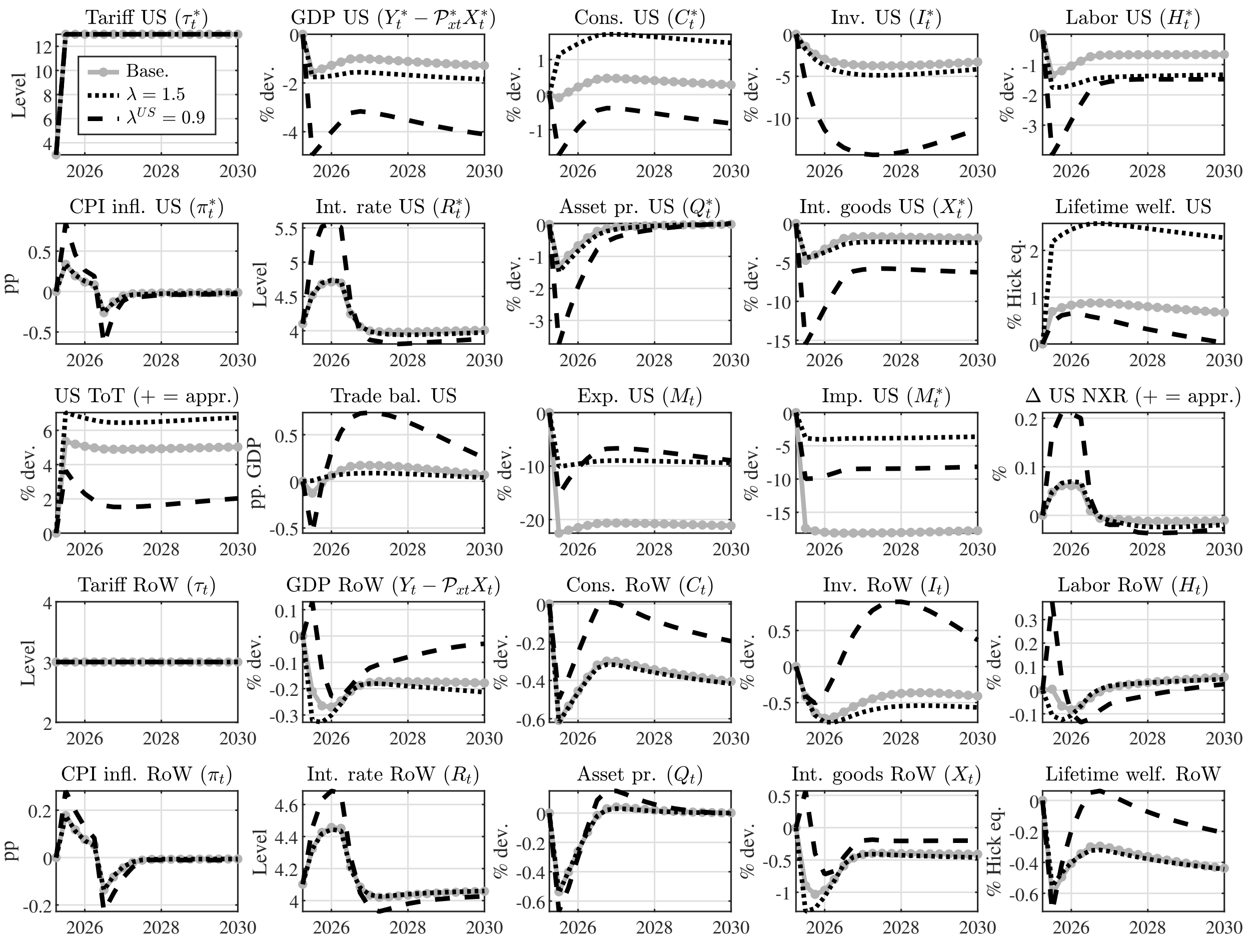
wages and fuels marginal production costs. As a result the GDP consequences of tariff hikes are decreased in the short-run but inflation overshoots its baseline trajectory. With a more depressed consumption and rising labor effort, the short-run welfare losses are substantially magnified. Note however that as trade flows adjust, the overall response of all aggregates approaches that of the baseline case - GDP falls, the trade balance deteriorates, and labor supply falls.

6.4.2 Lower trade elasticities

Figure 5 reports the effects of a symmetric tariff shock with a lower or different trade elasticities and compares these situations to the baseline case.

As one might expect, a uniformly lower trade elasticity increases the pass-through of the tariff shock and amplifies its effects. The US terms of trade appreciates by much more, leading to a substantial rise in consumption and a greater fall in labor supply. The response of trade flows is

Figure 5: Unilateral US tariff shock — Alternative trade elasticities



Note: joint 10pp tariff hike in the US and in the rest of the world (RoW) with a baseline calibration vs. alternative trade elasticities.

dampened, while the trade balance initially deteriorates more than in the baseline. The unilateral tariff shock has a significantly greater welfare gain for the US, given the lower trade elasticity and the greater terms of trade appreciation. The spillover to the rest of the world output is slightly more negative in this case, although the welfare effects are little changed with uniformly lower trade elasticities.

When the US trade elasticity is much lower than that of the rest of the world, the tariff hike now hits the US economy disproportionately more: foreign consumers substitute for US goods much more easily than the US substitute foreign goods. As a result the drop in US GDP reaches almost 4%, US consumption collapses and there is a much smaller terms of trade gain for the US anymore. US welfare gains are now much smaller than in the baseline case. While this case is exaggerated on purpose, it illustrates a potential fragility and dependence of the US economy to imported goods that can not be substituted in US consumption, investment or production. Tariff hikes in this case can be very destructive for the US economy.

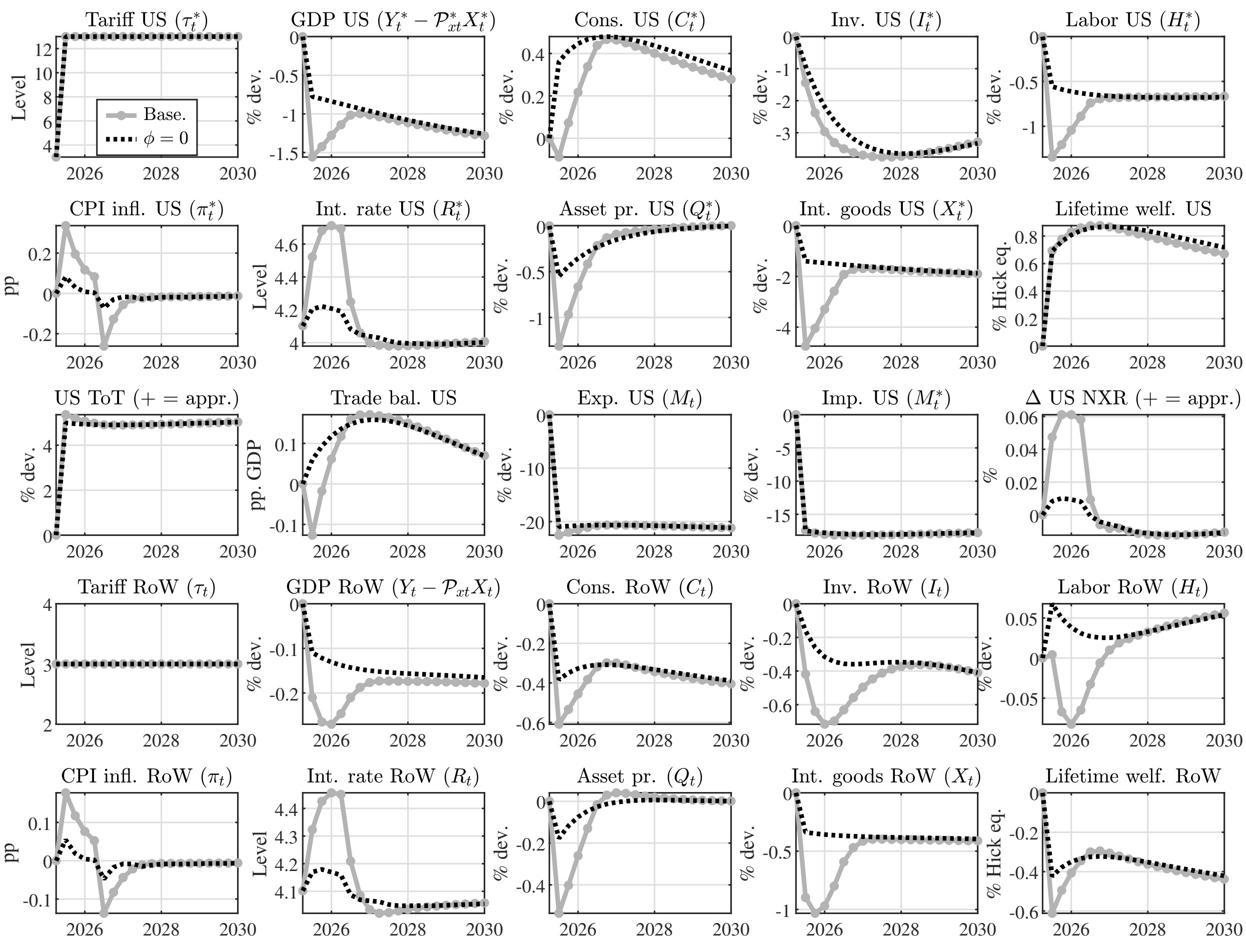
6.5 Prices and Alternative Monetary Policies

We now turn to the role of monetary policy and price stickiness in either amplifying or mitigating the effects of tariffs.

6.5.1 Flexible Prices

Figure 6 reports the dynamics implied by a unilateral tariff hike with flexible prices.

Figure 6: Unilateral US tariff shock — Flexible prices



With flexible prices, the short-run dynamics are dramatically different. Inflation dynamics are now only driven by changes in tariffs with no feedback effects on quantities. In the US, GDP still declines, since the steady state responses are still the same in this case, but the decline is much more gradual. The permanent tariff increase still leads to an investment decline, in fact almost the same as in the baseline model, but now consumption rises immediately. In this case, there is little impact response on the trade balance, but the trade balance improves gradually without any reversal as in the baseline case. We note also that the flexibility of nominal prices means there is a much smaller nominal exchange rate appreciation. In addition, the response of the rest of the world is also substantially ameliorated in this flexible price case, relative to the baseline.

This comparison emphasizes a key aspect of our analysis. The presence of price stickiness leads to a magnified negative effect of the tariffs, both in the US and the rest of the world. While the long run dynamics are unaffected, the negative impact effects of the tariff shocks are much larger when firms cannot adjust prices instantaneously. This case also supports the intuition obtained by the simple version of the model in section 4, where we showed that without immediate price adjustment, the impact effect of a tariff on output and the exchange rate was larger than the long run effect.

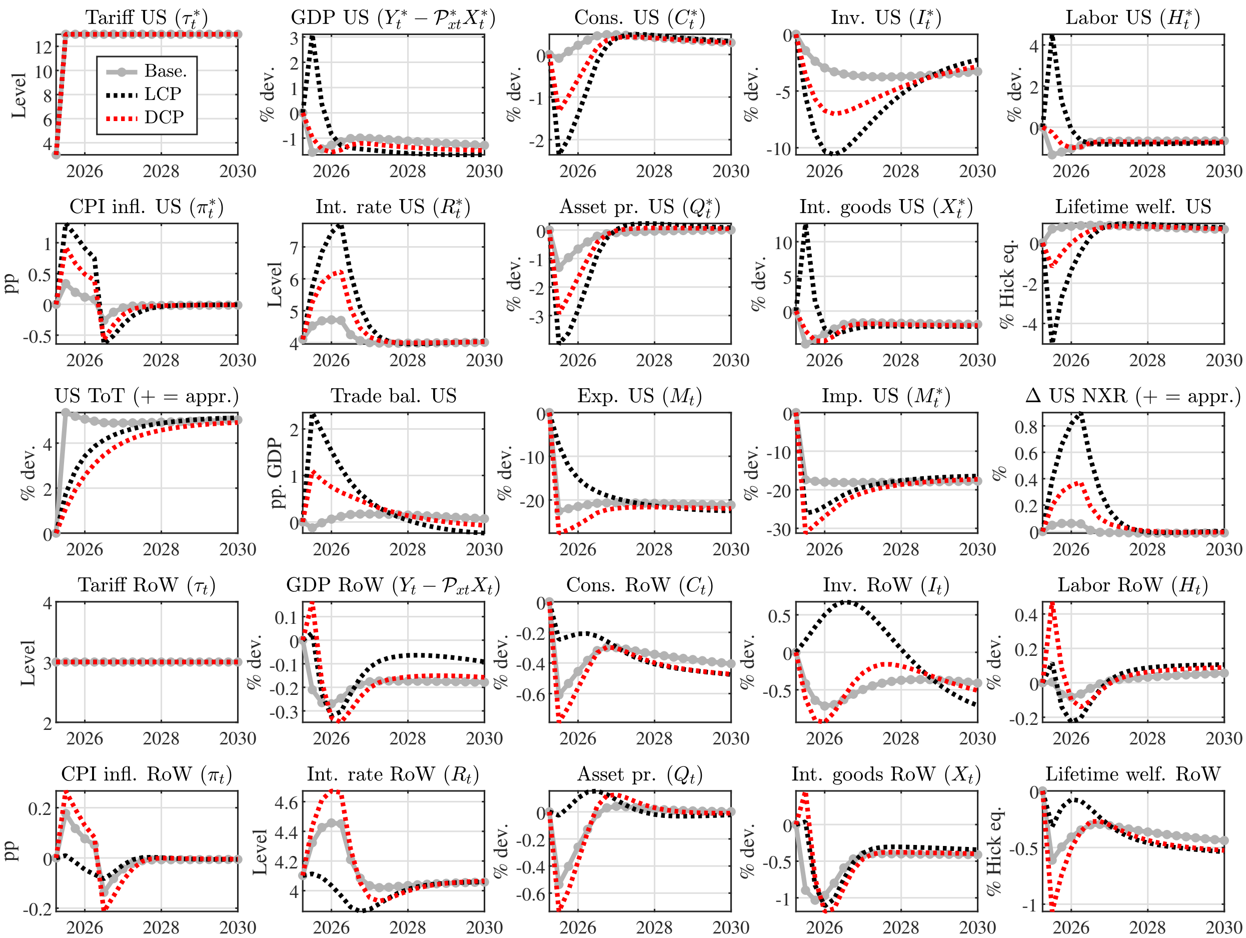
6.5.2 Alternative pricing

We now contrast the effects of alternative pricing assumptions. Extensive empirical evidence suggests that a substantial share of producers set their export prices in the currency of consumers (Local Currency Pricing). This assumption has been shown to matter for the transmission of shocks and for the conduct of monetary policy in open economies (see Engel (1999), Devereux and Engel (2003) and subsequent references). A more recent literature suggests that producers set prices in the dominant currency (the dollar) more than in the currency of buyers, and dominant currency pricing has gained the center of the stage of international macroeconomics (see Burstein and Gopinath (2014) for a discussion.) We investigate how both pricing assumptions affect the transmission of large tariff hikes. Appendix A sketches the main differences between our baseline model and a model featuring LCP and DCP. Figure 7 reports the effects of a symmetric tariff shock with alternative pricing assumptions for exports.

Focusing on the comparison between the baseline and the DCP case, we see first the the effect of the tariff hike on the terms of trade much more gradual. The appreciation occurs only over time as dollar prices of both imports and exports are slow to adjust. This dampens the welfare effects on leads to a greater fall in consumption and investment than in the baseline case. The effect on output is little changed, so the trade balance actually improves in this case. CPI inflation rises by more, since there is less pass-through of nominal appreciation into the CPI, and as a result the policy rate is raised by more partially accounting for the greater fall in consumption and investment. The response of output, consumption and investment in the rest of the world is almost the same as in the baseline case.

While DCP may be a compelling model for emerging markets, in the interaction between the US and many of its major markets, such as Canada, the EU, Japan and the UK, the LCP assumption would seem more relevant, since in these countries retail prices are clearly sticky in local currency, and exchange rate pass-through is found empirically to be very low. Figure 7 also illustrates the response to a unilateral US tariff shock under the LCP pricing assumption. There we see quite striking differences from the baseline case. Just as in the simple model of section 4, the impact effect of the tariff is expansionary for the US. Intuitively, the tariff shock leads to a sharp pivot in expenditure away from imported goods to domestic goods, while there is very small exchange rate pass-through either of US exports to the rest of the world, or from result of the world exports to US dollar prices. Again, due to the immediate inflationary effect of the tariff, policy rates spike more than in the baseline, so consumption and investment fall, but these effects are offset by the expenditure switching response - the figure shows that imports fall

Figure 7: Unilateral US tariff shock — Alternative pricing assumptions



Note: joint 10pp tariff hike in the US and in the rest of the world (RoW) with a baseline calibration vs. alternative pricing assumptions.

immediately due to the direct effect of the tariff, while exports fall only gradually as exchange rate pass-through takes effect.

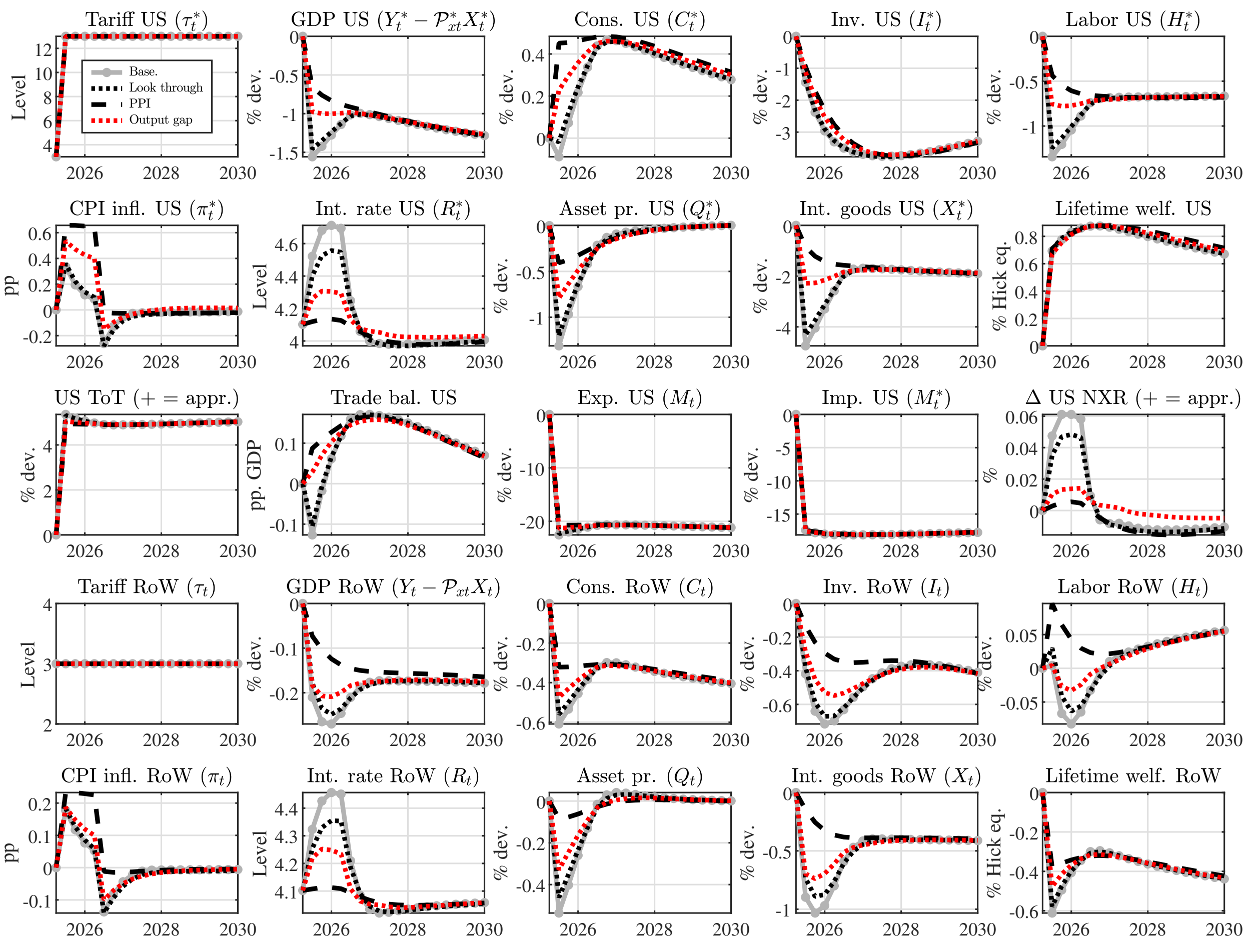
Although the tariff shock is expansionary for the US in this LCP case, we see the immediate welfare effect is sharply negative, as employment rises but consumption falls by more than before.

Finally, as we might expect, the LCP and DCP case do not differ greatly for the response of the rest of the world, because the price response for both cases are the same - import prices are invoiced in US dollars, so exchange rate pass-through is equally muted in both cases.

6.5.3 Alternative Monetary Policies

In the baseline scenario, central banks are assumed to follow a standard Taylor rule, whereby a substantial increase in CPI inflation calls for a tightening of monetary policy, with adverse consequences for aggregate demand. However, there has been extensive discussions about whether monetary policy should respond or not to supply shocks. Bandera et al. (2023) suggest that the optimal monetary policy response to a supply (tariff) shock may be to 'look through' the inflationary effects, *i.e.*, to refrain from adjusting the policy stance. We consider such a scenario by setting the Taylor-rule coefficient on CPI inflation μ close to unity, a configuration we refer to as 'look-through'. In addition, we analyze a case in which the monetary response targets PPI inflation instead of CPI inflation. Finally we consider the case of an output component to the Taylor rule, introducing a positive response of the nominal interest rate to the year-on-year output growth rate. The results are presented in Figure 8.

Figure 8: Unilateral US tariff shock — Alternative monetary policies



Note: joint 10pp tariff hike in the US and in the rest of the world (RoW) with a baseline calibration vs. alternative monetary policies.

Under a look-through policy, the short-run declines in output and consumption in the US are somewhat smaller, but the CPI inflation rate overshoots its baseline trajectory – although not by much. Naturally, the long-run effects are unaffected by this alternative monetary policy response, and the overall path of welfare losses remains essentially unchanged. The tariff shock is also slightly less disruptive in the rest of the world under a look-through policy, but once again, short-run welfare gains and losses remain mostly unchanged.

Milder short-run disruptions are also observed when monetary policies pursue a dual mandate and take into account negative output growth. In this case the interest increase is much smaller, leading to almost offset the negative short-run effects implied by monetary policy. A similar but stronger movement is observed under PPI inflation targeting since in this case the nominal interest rates remain almost constant in response to the tariff hikes. The path of most variables almost replicate their flexible price counterparts, and notably, the trade balance improves under PPI targeting, contrary to the baseline case. The similarity to the flexible price case is not surprising, since the New Keynesian open economy literature suggests that in most cases PPI targeting remains close to the optimal monetary policy under PCP pricing specifications.

6.6 Using Revenues from Tariffs to Buy Local Goods

One additional interesting experiment is the way tariff revenues are being used. In the baseline case, we assume they are simply rebated to households lump-sum.[14] But one argument of the US administration is that tariff revenue will help to finance the legislated tax cuts brought in by the 'Big Beautiful Bill'. In our Ricardian framework, it does not make a lot of sense to look at the effect of tax cuts, but we rather consider the alternative in which tariff revenues are used to buy local public goods. Assuming full home bias in government spending, the amount of government spending in each country is given by the following modified budget constraints for governments:

$$\begin{aligned} P_{ht}G_t &= \tau_t S_t P_{ft}^* M_t - sP_{ht}Y_t, && (55) \\ P_{ft}^* G_t^* &= \tau_t^* S_t^{-1} P_{ht} M_t^* - sP_{ft}^* Y_t^*. && (56) \end{aligned}$$

and the goods market clearing conditions are now:

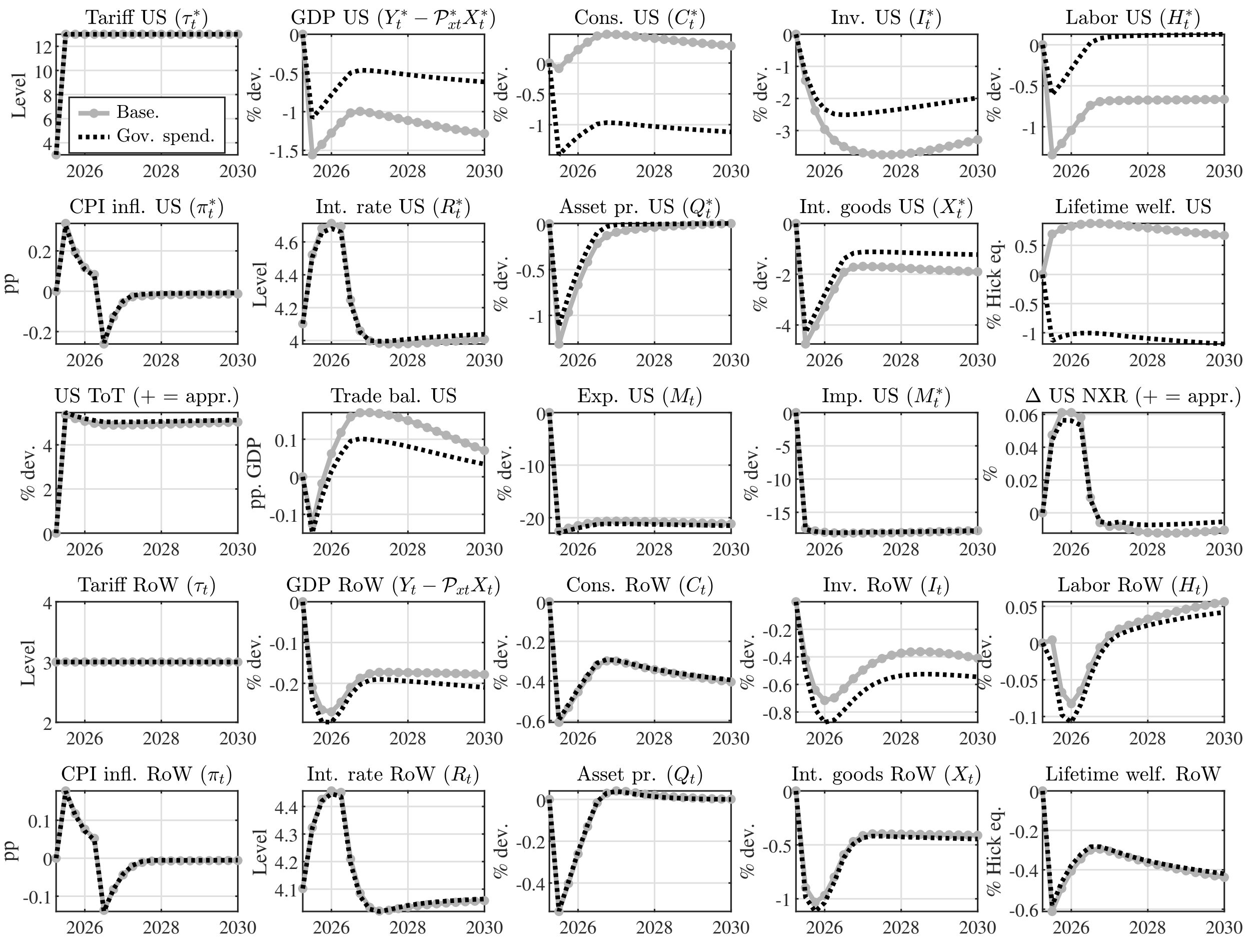
$$\begin{aligned} nY_t \left(1 - \frac{\phi}{2}\left(\pi_{ht} - 1\right)^2\right) &= nD_t + (1-n) M_t^* + nG_t, && (57) \\ (1-n) Y_t^* \left(1 - \frac{\phi}{2}\left(\pi_{ft}^* - 1\right)^2\right) &= (1-n) D_t^* + nM_t + (1-n) G_t^*, && (58) \end{aligned}$$

Under these assumptions, Figure 9 compares the outcome of a joint 10 percentage point increase in tariffs to the baseline case of a lump-sum rebate.

Figure 9 shows that buying local goods is fairly neutral for terms of trade and the trade balance dynamics. Output dynamics in both countries becomes less negative but the crowding out effect of government spending leads to a much greater fall in US consumption. As a result the welfare losses from the tariff hike are almost doubled when the tariff proceeds are used to buy local goods rather than just rebated to the households. This result highlights that the use of tariff revenues is far from neutral, a result that is further investigated by Alessandria et al. (2025), and extended to the case of distortionary taxes and investment subsidies.

[14] Since households are Ricardian in our model, the lump-sum rebate is equivalent to a reduction in public debt.

Figure 9: Unilateral US tariff shock — Using tariff revenues to buy local goods

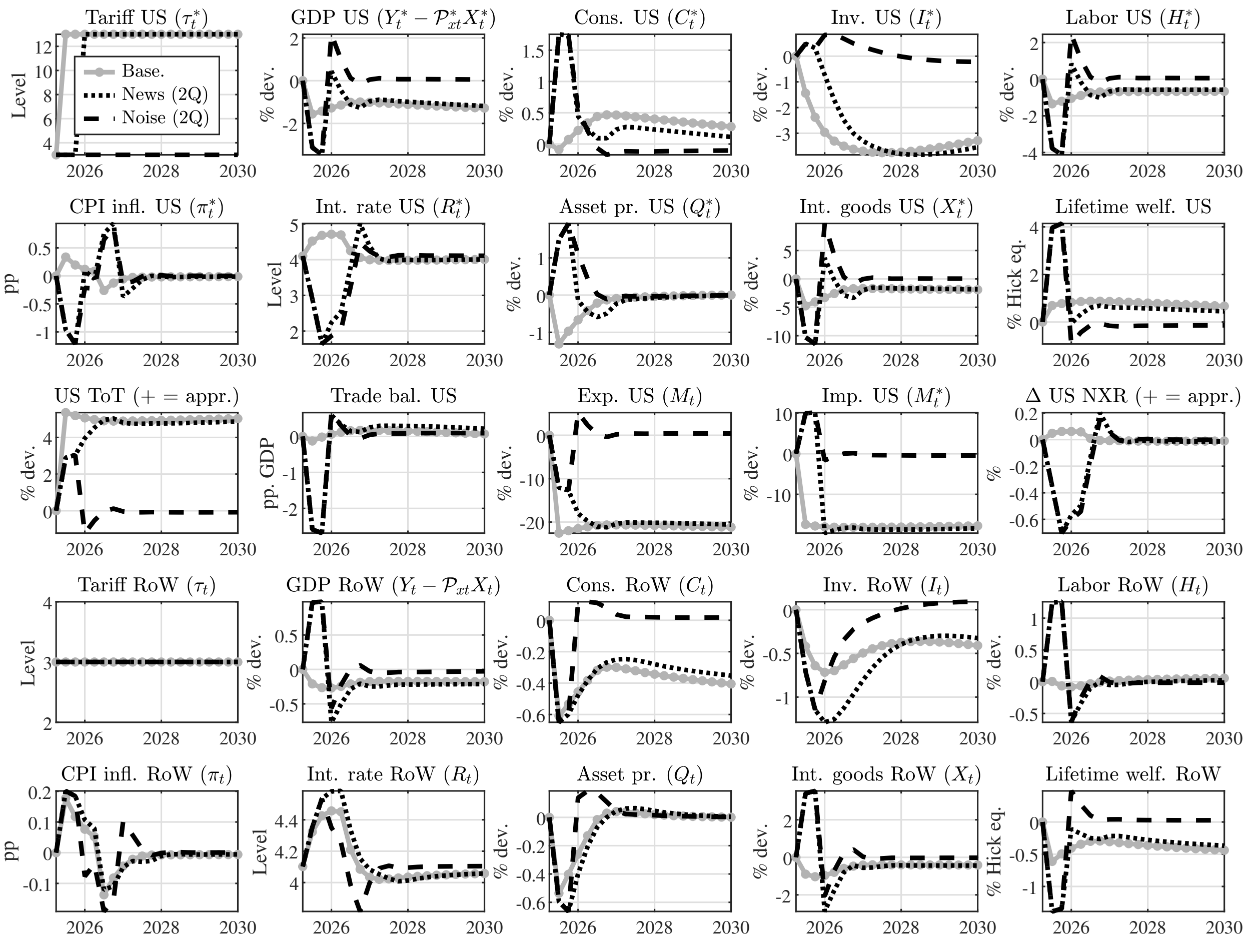


6.7 Anticipation effects

As this is often the case for tax reforms, tariffs did not rise entirely and immediately after announcement. This may lead to short-run import hoarding behaviour by which consumers and firms change adapt immediately because they anticipate future changes in taxes. We illustrate this point in the case of a unilateral US tariff hike in Figure 10 below by looking at two cases: one where there is a 2 quarter delay between announcement and implementation (news) and one where the announced tariff hike is retracted 2 quarters after announcement (noise).

Knowing that a a tariff on US imports will be implemented in 2 quarters Figure 10 shows that rational US consumers and producers start importing foreign goods immediately, before their price effectively increases. This leads to a substitution of US goods (raising imports) to non-US (lowering GDP). Since the relative price of US goods increases US exports are depressed and a large trade deficit appears (up to 2.6% of US GDP), and CPI inflation is driven down on impact by the declining PPI inflation rate induced by lower output. After implementation or cancellation, opposite movements are observed – substitution of US to foreign goods. If US tariffs actually rise, the adjustment path of most variables converges to the path observed in case of immediate implementation. If the tariff hike is not implemented, opposite movements

Figure 10: Unilateral US tariff shock — Delayed implementation (2 quarters)

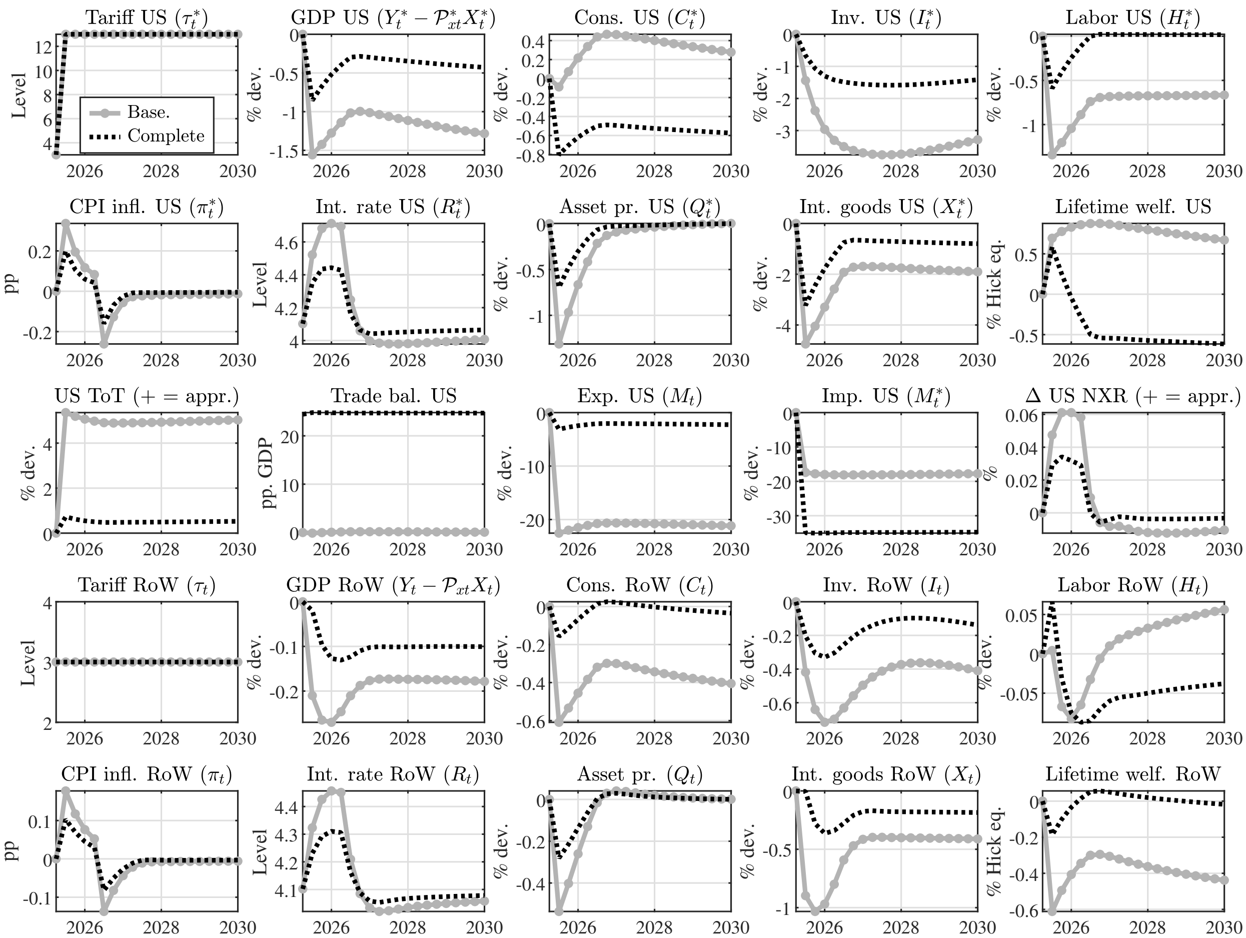


overshoot for the economy to (slowly) return to the steady state. Again, this case is most likely exaggerated because agents are perfectly rational and forward-looking in the model, but these cases shed light on the short-run trade deficit that may result from imports hoarding in case of a delayed implementation of tariff hikes.

6.8 Complete financial markets

A final case we examine is one which emphasizes that the impact of tariffs on trade is highly dependent on the structure of international financial markets. Figure 11 shows that if international financial markets are complete, both the direct effects and welfare gains from a unilateral US tariff shock are strikingly different. Complete markets are represented by the well-known Backus Smith risk sharing condition. In this case, consumption in each region falls by almost the same amount, and there is no direct wealth effect of terms of trade appreciation for the US economy. The terms of trade hardly moves at all in this case. The lower response of consumption means that US inflation is more muted, and the policy rate rises less, so that the movement in investment is much less negative. In addition, the impact on GDP is mitigated relative to the baseline case. With complete risk sharing there is no obvious measure of the trade balance, but

Figure 11: Unilateral US tariff shock — Complete financial markets



it is notable that the direct tilting effect of the tariff will lead to a fall in US imports, but almost no change in exports.

6.9 Summary and numbers

Wrapping up the results reported in the graphs, we now display the effects of tariff hikes for the US and the rest of the world in the different cases explored after 1 year and after 5 years. Table 2 reports the results after 1 year.

Overall, the short-run results find large negative effects on US output ranging from -0.5% to more than -6.4%. In the most likely case (2nd column) output falls by 1.7%. Inflationary effects range from zero (flexible prices or full stabilization monetary policy) to more than 1.3pp. The tariff hike generates welfare gains for US consumers only in the unilateral case, all other cases bring moderate to large welfare losses – the largest 1.13% loss occurring when US imports are less substitutable than foreign imports. Similarly, in almost all cases the tariff hike generates a US trade deficits in the very short run. As already discussed at length the effects in the rest of the world are much more moderate although not negligible. Table 3 now reports the results after 10 years.

Table 2: Effects of US tariff hikes after 1 year

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
									US variables									
US Tariff (%)	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00
US GDP (% ch.)	−1.14	−1.71	−1.71	−0.51	−0.53	−1.14	−1.64	−3.59	−0.87	−1.30	−1.47	−1.13	−0.88	−0.88	−0.63	−0.46	−0.46	−0.40
US Consumption (% ch.)	0.34	−1.14	−0.85	0.83	0.46	0.03	1.58	−0.67	0.47	−0.79	−0.20	0.34	0.47	0.47	−1.08	0.24	0.24	−0.55
US Investment (% ch.)	−3.30	−5.89	−5.22	−1.93	−2.53	−4.50	−4.26	−12.70	−2.61	−10.62	−7.02	−3.27	−2.77	−2.77	−2.48	−1.71	−1.71	−1.42
US Labor (% ch.)	−0.89	−0.86	−0.95	0.00	−0.76	−0.82	−1.59	−2.31	−0.63	−0.65	−0.96	−0.88	−0.64	−0.64	−0.13	−0.16	−0.16	−0.11
US CPI inflation (pp)	0.08	0.16	0.20	0.04	0.04	0.22	0.09	0.19	0.00	0.75	0.39	0.10	0.64	0.64	0.08	−0.05	−0.05	0.04
US Int. rate (level)	4.69	5.27	5.56	4.51	4.53	5.29	4.72	5.51	4.19	7.74	6.22	4.55	4.13	4.13	4.66	2.54	2.54	4.43
US Asset prices (% ch.)	−0.42	−0.64	−0.65	−0.21	−0.27	−0.75	−0.56	−1.29	−0.29	−1.85	−1.02	−0.42	−0.27	−0.27	−0.28	−0.45	−0.45	−0.17
US Int. goods (% ch.)	−2.58	−4.64	−4.53	−1.82	0.00	−2.80	−3.21	−8.77	−1.50	−3.43	−3.60	−2.54	−1.53	−1.53	−2.06	−0.21	−0.21	−1.22
US Welfare gains (%)	0.86	−0.65	−0.30	0.83	0.97	0.51	2.52	0.64	0.84	−0.41	0.36	0.86	0.85	0.85	−1.01	0.33	0.33	−0.29
									international variables									
US ToT (% ch.)	4.98	−0.47	0.00	4.99	4.75	5.13	6.59	1.90	4.92	3.85	3.07	4.98	4.91	4.91	5.11	4.53	4.53	0.50
US Trade bal. (pp of GDP)	0.12	0.16	0.00	0.06	0.17	−0.05	0.07	0.53	0.14	1.16	0.64	0.12	0.14	0.14	0.06	0.34	0.34	24.74
US Imports (% ch.)	−21.10	−34.85	−34.94	−21.12	−20.18	−18.79	−9.33	−8.56	−20.70	−16.89	−24.36	−21.09	−20.68	−20.68	−21.59	−19.79	−19.79	−2.24
US Exports (% ch.)	−18.10	−36.39	−34.94	−17.69	−17.40	−14.20	−3.99	−9.10	−17.88	−22.80	−24.92	−18.09	−17.92	−17.92	−18.07	−18.85	−18.85	−35.00
US NER (% ch.)	0.06	0.14	0.00	0.03	0.06	0.11	0.07	0.20	0.01	0.90	0.37	0.05	0.00	0.00	0.05	−0.50	−0.50	0.03
									RoW variables									
RoW Tariff (%)	3.00	13.00	13.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
RoW GDP (% ch.)	−0.25	−0.58	−1.71	−0.23	−0.04	−0.20	−0.26	−0.23	−0.14	−0.30	−0.35	−0.24	−0.14	−0.14	−0.27	−0.51	−0.51	−0.13
RoW Cons. (% ch.)	−0.38	−0.21	−0.85	−0.44	−0.16	−0.58	−0.40	−0.13	−0.31	−0.21	−0.44	−0.38	−0.31	−0.31	−0.37	−0.38	−0.38	−0.02
RoW Invest. (% ch.)	−0.70	−1.56	−5.22	−0.67	−0.28	−1.45	−0.77	−0.13	−0.34	0.62	−0.80	−0.67	−0.33	−0.33	−0.86	−1.25	−1.25	−0.30
RoW Labor (% ch.)	−0.06	−0.35	−0.95	0.00	−0.04	0.03	−0.07	−0.14	0.03	−0.20	−0.14	−0.06	0.03	0.03	−0.08	−0.34	−0.34	−0.09
RoW CPI (pp)	0.05	0.08	0.20	0.03	0.02	0.14	0.05	0.08	0.00	−0.07	0.08	0.06	0.23	0.23	0.05	0.08	0.08	0.03
RoW Int. rate (level)	4.45	4.69	5.56	4.37	4.29	4.82	4.44	4.67	4.16	3.97	4.66	4.35	4.11	4.11	4.44	4.58	4.58	4.31
RoW Asset prices (% ch.)	−0.13	−0.22	−0.65	−0.09	−0.04	−0.34	−0.13	−0.09	−0.05	0.15	−0.15	−0.13	−0.04	−0.04	−0.12	−0.21	−0.21	−0.06
RoW Int. goods (% ch.)	−0.80	−1.54	−4.53	−0.90	0.00	−0.76	−0.83	−0.67	−0.36	−1.02	−1.15	−0.76	−0.36	−0.36	−0.85	−1.76	−1.76	−0.34
RoW Welf. (% ch.)	−0.34	0.00	−0.30	−0.44	−0.13	−0.60	−0.36	−0.05	−0.33	−0.09	−0.36	−0.34	−0.33	−0.33	−0.32	−0.18	−0.18	0.01

Notes: (1) Unilateral (baseline), (2) Retaliation, (3) Retaliation with fully symmetric calibration (5) inelastic labor supply ($\psi \to \infty$), (5) No intermediate goods ($\eta = 0$), (6) Slow import adjustment, (7) Lower trade elasticity ($\lambda = 1.5$), (8) lower US trade elasticity($\lambda^{US} = 0.9$), (9) Flex. prices ($\phi = 0$), (10) Local Currency Pricing, (11) Dominant (Dollar) Currency Pricing, (12) Look-through monetary policy, (13) PPI inflation targeting, (14) Output gap in the monetary policy rule, (15) Tariff revenues used to raise government spending, (16) News, (17) Noise, (18) Complete markets. All values are reported after 1 year. Percent changes are relative to initial steady state. CPI inflation and trade balance in percentage points. Interest rates in levels. Welfare in Hicksian consumption equivalent.

After 10 years economies have almost converged to their new long-run values implied by tariffs. Qualitatively speaking the direction of changes in very similar looking at output and consumption, but somewhat smaller given that short-run dynamics and amplification induced by monetary policy vanished. US output still falls substantially – between -0.9% and -7.4% depending on cases. US consumption is also quite lower than before the tariff hikes – except in the case of a unilateral tariff setting – and US consumers experience moderate to large welfare losses.

7 Conclusion

This paper offers some perspective on the impacts of large tariff shocks in a global economy where countries have different exposure to international trade, where the monetary policy stance is an important feature of the adjustment, and where global supply chains act as important channels of shock transmission. A much more detailed analysis could be done allowing for a multi-sector, multi-country model, allowing for a detailed calibration of sectoral and country

Table 3: Effects of US tariff hikes after 10 years

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
									US variables									
US Tariff (%)	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00
US GDP (% ch.)	−1.46	−2.04	−1.86	−0.78	−0.89	−1.48	−2.03	−4.54	−1.45	−1.55	−1.52	−1.46	−1.46	−1.46	−0.71	−1.40	−1.40	−0.51
US Consumption (% ch.)	0.09	−1.55	−1.40	0.59	0.21	0.05	1.24	−1.22	0.12	0.21	0.14	0.09	0.12	0.12	−1.24	−0.07	−0.07	−0.65
US Investment (% ch.)	−2.36	−3.74	−3.60	−1.56	−1.90	−2.32	−2.99	−6.99	−2.38	−1.76	−2.06	−2.36	−2.36	−2.36	−1.50	−2.35	−2.35	−1.02
US Labor (% ch.)	−0.63	−0.28	−0.28	0.00	−0.57	−0.62	−1.27	−1.41	−0.64	−0.70	−0.67	−0.63	−0.64	−0.64	0.15	−0.55	−0.55	0.02
US CPI inflation (pp)	−0.01	−0.01	−0.01	−0.01	−0.01	0.00	−0.01	−0.01	−0.01	0.00	0.00	−0.01	−0.01	−0.01	0.00	−0.01	−0.01	0.00
US Int. rate (level)	4.06	4.04	4.01	4.07	4.06	4.07	4.06	4.02	4.06	4.08	4.07	4.06	4.06	4.06	4.08	4.06	4.06	4.09
US Asset prices (% ch.)	0.01	0.01	0.00	0.00	0.00	0.01	0.01	0.02	0.01	0.00	0.00	0.01	0.01	0.01	0.00	0.01	0.01	0.00
US Int. goods (% ch.)	−2.06	−3.26	−3.03	−1.34	0.00	−2.08	−2.59	−6.60	−2.05	−2.13	−2.11	−2.06	−2.06	−2.06	−1.32	−2.02	−2.02	−0.88
US Welfare gains (%)	0.47	−1.39	−1.24	0.59	0.59	0.42	2.00	−0.42	0.50	0.62	0.53	0.47	0.49	0.49	−1.33	0.25	0.25	−0.70
									international variables									
US ToT (% ch.)	5.16	−0.23	0.00	5.08	4.96	5.16	7.03	2.40	5.16	5.06	4.98	5.16	5.16	5.16	5.18	5.04	5.04	0.57
US Trade bal. (pp of GDP)	−0.04	−0.04	0.00	−0.02	−0.06	−0.03	−0.01	−0.18	−0.04	−0.19	−0.12	−0.04	−0.04	−0.04	−0.02	0.06	0.06	24.67
US Imports (% ch.)	−21.69	−35.53	−34.66	−21.43	−21.01	−21.68	−9.81	−10.64	−21.70	−22.34	−22.03	−21.69	−21.71	−21.71	−21.77	−21.27	−21.27	−2.48
US Exports (% ch.)	−17.36	−35.36	−34.67	−17.30	−16.74	−17.40	−3.35	−7.73	−17.33	−16.68	−17.03	−17.36	−17.32	−17.32	−17.58	−17.80	−17.80	−34.64
US NER (% ch.)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
									RoW variables									
RoW Tariff (%)	3.00	13.00	13.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
RoW GDP (% ch.)	−0.21	−0.57	−1.86	−0.31	−0.02	−0.23	−0.26	−0.08	−0.21	−0.20	−0.22	−0.21	−0.21	−0.21	−0.25	−0.24	−0.24	−0.12
RoW Cons. (% ch.)	−0.50	−0.44	−1.40	−0.60	−0.22	−0.52	−0.51	−0.35	−0.49	−0.56	−0.55	−0.50	−0.49	−0.49	−0.47	−0.44	−0.44	−0.09
RoW Invest. (% ch.)	−0.57	−1.19	−3.60	−0.70	−0.26	−0.55	−0.64	−0.55	−0.57	−0.74	−0.64	−0.57	−0.58	−0.58	−0.60	−0.58	−0.58	−0.27
RoW Labor (% ch.)	0.08	−0.09	−0.28	0.00	0.04	0.09	0.07	0.07	0.08	0.12	0.10	0.08	0.08	0.08	0.06	0.06	0.06	−0.02
RoW CPI (pp)	0.00	−0.01	−0.01	0.00	0.00	0.00	0.00	−0.01	0.00	0.00	0.00	−0.01	0.00	0.00	0.00	0.00	0.00	0.00
RoW Int. rate (level)	4.08	4.06	4.01	4.07	4.09	4.09	4.08	4.06	4.08	4.08	4.08	4.08	4.08	4.08	4.08	4.08	4.08	4.09
RoW Asset prices (% ch.)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	−0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RoW Int. goods (% ch.)	−0.45	−0.97	−3.03	−0.57	0.00	−0.47	−0.52	−0.27	−0.44	−0.44	−0.46	−0.45	−0.44	−0.44	−0.49	−0.47	−0.47	−0.21
RoW Welf. (% ch.)	−0.54	−0.39	−1.24	−0.60	−0.25	−0.57	−0.55	−0.40	−0.54	−0.63	−0.61	−0.55	−0.54	−0.54	−0.51	−0.47	−0.47	−0.08

Notes: (1) Unilateral (baseline), (2) Retaliation, (3) Retaliation with fully symmetric calibration (5) inelastic labor supply ($\psi \to \infty$), (5) No intermediate goods ($\eta = 0$), (6) Slow import adjustment, (7) Lower trade elasticity ($\lambda = 1.5$), (8) lower US trade elasticity($\lambda^{US} = 0.9$), (9) Flex. prices ($\phi = 0$), (10) Local Currency Pricing, (11) Dominant (Dollar) Currency Pricing, (12) Look-through monetary policy, (13) PPI inflation targeting, (14) Output gap in the monetary policy rule, (15) Tariff revenues used to raise government spending, (16) News, (17) Noise, (18) Complete markets. All values reported after 10 years. Percent changes are relative to initial steady state. CPI inflation and trade balance in percentage points. Interest rates in levels. Welfare in Hicksian consumption equivalent.

trade openness, price and wage stickiness, and differential factor intensities. Nevertheless, our preliminary results suggests that tariffs of the size being currently imposed and the suggested retaliation may have significant short run and long run costs on output levels, inflation rates and economic welfare.

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A Alternative pricing assumptions

Local currency pricing. Under local currency pricing the Home price of Foreign (US) goods (excluding the tariff) is not $S_t P^*_{ft}$ anymore but P_{ft}, and the US price of the Home good is not $S_t^{-1} P_{ht}$ but P^*_{ht}. The aggregate true price indices are now:

$$P_t = \left(\gamma P_{ht}^{1-\lambda} + (1-\gamma)\left((1+\tau_t) P_{ft}\right)^{1-\lambda}\right)^{\frac{1}{1-\lambda}}, \tag{A.1}$$

$$P^*_t = \left(\gamma^* P_{ft}^{*1-\lambda} + (1-\gamma^*)\left((1+\tau^*_t) P^*_{ht}\right)^{1-\lambda}\right)^{\frac{1}{1-\lambda}}, \tag{A.2}$$

and the demand functions of Home and Foreign goods by Home and Foreign households are respectively:

$$C_{ht} + I_{ht} = \gamma \mathcal{P}_t^{\lambda} (C_t + I_t), \; C_{ft} + I_{ft} = (1-\gamma)\left(\frac{\mathcal{P}_t}{(1+\tau_t)\mathcal{S}_t}\right)^{\lambda} (C_t + I_t), \tag{A.3}$$

$$C^*_{ft} + I^*_{ft} = \gamma^* \mathcal{P}_t^{*\lambda} (C^*_t + I^*_t), \; C^*_{ht} + I^*_{ht} = (1-\gamma^*)\left(\frac{\mathcal{P}^*_t}{(1+\tau^*_t)\mathcal{S}^*_t}\right)^{\lambda} (C^*_t + I^*_t), \tag{A.4}$$

where now:

$$\mathcal{P}_t = P_t / P_{ht} = \left(\gamma + (1-\gamma)\left((1+\tau_t)\mathcal{S}_t\right)^{1-\lambda}\right)^{\frac{1}{1-\lambda}}, \tag{A.5}$$

$$\mathcal{P}^*_t = P^*_t / P^*_{ft} = \left(\gamma^* + (1-\gamma^*)\left((1+\tau^*_t)\mathcal{S}^*_t\right)^{1-\lambda}\right)^{\frac{1}{1-\lambda}}, \tag{A.6}$$

with

$$\mathcal{S}_t = P_{ft}/P_{ht}, \text{ and } \mathcal{S}^*_t = P^*_{ht}/P^*_{ft}. \tag{A.7}$$

Similar modifications apply to the optimal demands of intermediate goods. Regarding firms, they now choose two prices (one for each destination) instead of just one, solving:

$$\max_{P_{ht}(i), P^*_{ht}(i)} \mathbb{E}_t \sum_{j=0}^{\infty} \omega_{t+j} \left[\begin{array}{c} \left[\begin{array}{c} (1+s) P_{ht+j}(i) - MC_{t+j} \\ -\frac{\phi}{2}\left(\frac{P_{ht+j}(i)}{P_{ht+j-1}(i)} - 1\right)^2 P_{ht+j}(i) \end{array} \right] D_{t+j}(i) \\ + \left[\begin{array}{c} (1+s) S_{t+j} P^*_{ht+j}(i) - MC_{t+j} \\ -\frac{\phi}{2}\left(\frac{P^*_{ht+j}(i)}{P^*_{ht+j-1}(i)} - 1\right)^2 S_t P^*_{ht+j}(i) \end{array} \right] M^*_{t+j}(i) \end{array} \right], \tag{A.8}$$

where parameters have the same interpretation as in the baseline model and $D_t(i) = (P_{ht}(i)/P_{ht})^{-\epsilon} D_t$ and $M^*_t(i) = \left(P^*_{ht}(i)/P^*_{ht}\right)^{-\epsilon} (1-n) D_t / n$ are individual sales on the Home and Foreign markets, respectively. It implies:

$$\theta + \phi\epsilon^{-1}\left((\pi_{ht} - 1)\pi_{ht} - \mathbb{E}_t\left\{\omega_{t+1}\pi_{ht+1}(\pi_{ht+1} - 1)\frac{D_{t+1}}{D_t}\right\}\right) = \mathcal{MC}_t, \tag{A.9}$$

$$\theta + \phi\epsilon^{-1}\left(\pi^*_{ht}(\pi^*_{ht} - 1) - \mathbb{E}_t\left\{\omega_{t+1}\pi^*_{ht+1}(\pi^*_{ht+1} - 1)\frac{S_{t+1}M^*_{t+1}}{S_t M^*_t}\right\}\right) = \Phi_t^{-1}\mathcal{MC}_t. \tag{A.10}$$

where θ and $\mathcal{MC}_t$ are defined as before, and where $\Phi_t = S_t P^*_{ht}/P_{ht} = \left(S_t P^*_{ft}/P_{ht}\right)\mathcal{S}^*_t$ is a measure of the Home deviation from the law of one price. Similarly Foreign (US) firms solve:

$$\max_{P^*_{ft}(i),P_{ft}(i)} \mathbb{E}_t \sum_{j=0}^{\infty} \omega_{t+j} \left[\begin{array}{c} \left[\begin{array}{c} (1+s)\, P^*_{ft+j}(i) - MC^*_{t+j} \\ -\frac{\phi}{2}\left(\frac{P^*_{ft+j}(i)}{P^*_{ft+j-1}(i)} - 1\right)^2 P^*_{ft+j}(i) \end{array} \right] D^*_{t+j}(i) \\ + \left[\begin{array}{c} (1+s)\, S^{-1}_{t+j} P_{ft+j}(i) - MC^*_{t+j} \\ -\frac{\phi}{2}\left(\frac{P_{ft+j}(i)}{P_{ft+j-1}(i)} - 1\right)^2 S^{-1}_{t+j} P_{ft+j}(i) \end{array} \right] M_{t+j}(i) \end{array} \right], \tag{A.11}$$

which gives the following New Keynesian Phillips curves:

$$\theta + \phi\epsilon^{-1}\left(\left(\pi^*_{ft} - 1\right)\pi^*_{ft} - \mathbb{E}_t\left\{\omega^*_{t+1}\pi^*_{ft}\left(\pi^*_{ft} - 1\right)\frac{D^*_{t+1}}{D^*_t}\right\}\right) = \mathcal{MC}^*_t, \tag{A.12}$$

$$\theta + \phi\epsilon^{-1}\left(\pi_{ft}\left(\pi_{ft} - 1\right) - \mathbb{E}_t\left\{\omega_{t+1}\pi_{ft+1}\left(\pi_{ft+1} - 1\right)\frac{S_t M_{t+1}}{S_{t+1} M_{t+1}}\right\}\right) = \Phi^*_t \mathcal{MC}^*_t, \tag{A.13}$$

where $\Phi^*_t = S_t P^*_{ft}/P_{ft} = \left(S_t P^*_{ft}/P_{ht}\right)/\mathcal{S}_t$ is the Foreign deviation from the law of one price. Goods market clearing conditions are now:

$$nY_t\left(1 - \frac{\phi}{2}\left(\pi_{ht} - 1\right)^2 - \frac{\phi}{2}\left(\pi^*_{ht} - 1\right)^2\right) = nD_t + (1-n)\, M^*_t, \tag{A.14}$$

$$(1-n)\, Y^*_t\left(1 - \frac{\phi}{2}\left(\pi^*_{ft} - 1\right)^2 - \frac{\phi}{2}\left(\pi_{ft} - 1\right)^2\right) = (1-n)\, D^*_t + nM_t, \tag{A.15}$$

where trade flows are:

$$M_t = \left(\mathcal{S}_t\left(1+\tau_t\right)\right)^{-\lambda}\left(\left(1-\gamma\right)\mathcal{P}^\lambda_t\left(C_t + I_t + \Lambda^f_t\right) + \left(1-\gamma_x\right)\mathcal{P}^\lambda_{xt} X_t\right), \tag{A.16}$$

$$M^*_t = \left(\mathcal{S}^*_t\left(1+\tau^*_t\right)\right)^{-\lambda}\left(\left(1-\gamma^*\right)\mathcal{P}^{*\lambda}_t\left(C^*_t + I^*_t\right) + \left(1-\gamma^*_x\right)\mathcal{P}^{*\lambda}_{xt} X^*_t\right). \tag{A.17}$$

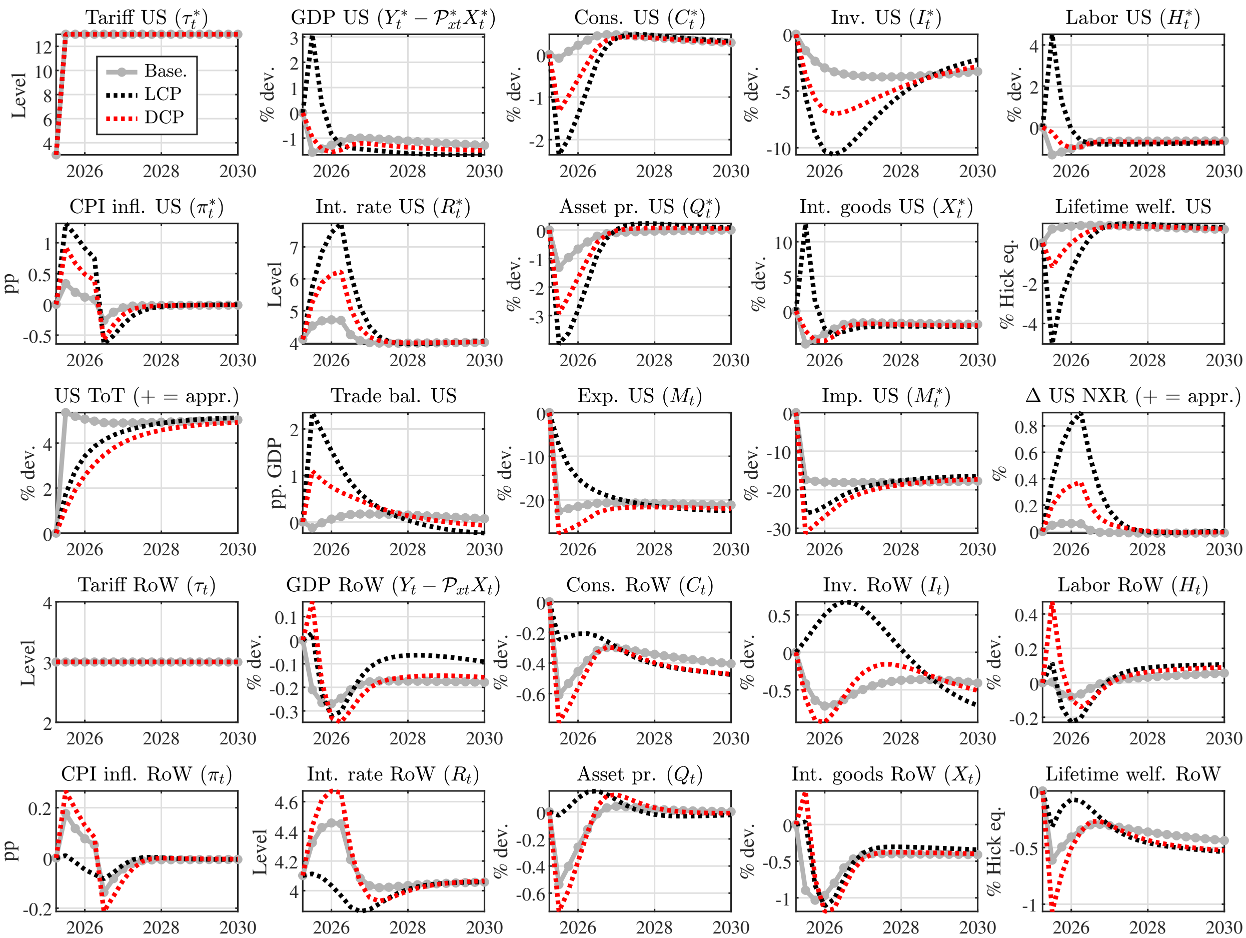
Dominant currency (dollar) pricing. Under dominant currency pricing Home (rest of the world) firms adopt LCP while Foreign (US) firms adopt PCP. So the only difference with the LCP model is that the NKPC for the Home price of Foreign goods – the one determining the dynamics of π_{ft} – is now replaced by the law of one price ($\Phi^*_t = 1$) $\pi_{ft} = S_t/S_{t-1}\pi^*_{ft}$,which implies, in levels, that $\mathcal{S}_t = S_t P^*_{ft}/P_{ht}$. Further the NKPC for Foreign produced goods is now back to its PCP version:

$$\theta + \phi\epsilon^{-1}\left(\pi^*_{ft}\left(\pi^*_{ft} - 1\right) - \mathbb{E}_t\left\{\omega^*_{t+1}\pi^*_{ft+1}\left(\pi^*_{ft+1} - 1\right)\frac{Y^*_{t+1}}{Y^*_t}\right\}\right) = \mathcal{MC}^*_t. \tag{A.18}$$

Alternative pricing assumptions in the unilateral case. Figure 12 reports the effects of a unilateral 10pp increase in US import tariff under alternative pricing assumptions.

The assumptions of DCP and LCP to a larger extent delays the adjustment of terms of trade, leading to a slower decline (or even large increase under LCP) of US GDP while imports are immediately affected by the tariff, leading consumption and investment to fall by much more.

Figure 12: Unilateral US tariff shock — Alternative pricing assumptions



Note: US 10pp tariff hike in the US with a baseline calibration vs. alternative pricing assumptions.

Further, both assumptions imply a much larger adjustment of US inflation, leading to an amplified monetary policy response. As a result the dynamics of the trade balance is reversed and a large trade surplus arises. However the short-run welfare losses of the US are extremely large in this case, and only under DCP are they larger for the rest of the world.