Tariffs and Sectoral Allocation: Implications for Monetary Policy

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Abstract

Central banks around the world are grappling with the question of how to respond to the mix of inflationary and output implications of a looming trade war. Recent tariffs have impacted a wider cross-section of goods than was true in the previous tariff round, targeting a broad range of final consumption goods in addition to materials such as aluminum and steel. This paper studies the optimal monetary stabilization of tariffs using a New Keynesian model enriched with comparative advantage between multiple traded sectors that differ in terms of market structure and price rigidity. We find that, in the aggregate, the optimal monetary response is expansionary, supporting activity and producer prices at the cost of tolerating short-run headline inflation -- both in response to tariffs aimed at differentiated consumption goods and to tariffs on non-differentiated goods. The output and export dynamics arising from tariffs on each sector differ sharply, as do the motivations for an expansionary monetary response. Sectoral reallocation is an order of magnitude larger than predicted by multisector models featuring one tradable and one nontradable sector.

Keywords: tariff shock, tariff war, optimal monetary policy, comparative advantage, sectoral reallocation
JEL classification: F4

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1. Introduction

As the U.S. administration launches a new round of tariffs in the wake of the presidential election, central banks around the world are grappling with the question of how to respond. The question is often complicated by the fact that central bank objectives of stabilizing inflation and stabilizing employment and output can conflict in the presence of tariff shocks, as these shocks simultaneously produce inflationary and recessionary pressure. This question is further complicated by the fact that the new round of tariffs recently has been targeting different types of U.S. imports, ranging from differentiated final consumption goods to less differentiated materials such as aluminum and steel, the main targets in the first Trump administration.

This paper studies the Ramsey optimal monetary stabilization of tariff shocks using a two-country New Keynesian model enriched with elements from the trade literature, including global value chains in production and multiple traded sectors that differ in terms of market structure and price rigidity. In the trade literature, the study of tariffs has systematically focused on their implications for the reallocation of production across different sectors. In fact, tariff policies often are motivated by the goal of favoring such reallocation -- say, promoting domestic manufacturing. In contrast, the recent macroeconomic analysis of tariffs abstracts from sectoral reallocation, given that macro models typically feature only one traded sector. While a macroeconomic approach, featuring endogenous factor supplies and aggregate inflation dynamics, is appropriate for studying the macroeconomic implications of tariffs and the optional monetary response, we argue that addressing these macroeconomic questions cannot ignore the sectoral nature and implications of tariffs.

The analysis of this paper brings the issue of sectoral reallocation to the forefront in a macroeconomic context. The model builds on Bergin and Corsetti (2023), to our knowledge the first paper in the academic literature to study the question of optimal monetary policy response to tariff shocks, showing that an expansion is desirable even though it may worsen headline inflation. This point has been taken up further by other academics and policy analysts.[1] In this paper, we take the analysis a step further, focusing

[1] See in particular Bianchi and Coulibaly (2024), and Donnan et al. (2025).

on the effects of tariffs and policy on the comparative advantage of a country.[2] We model two traded sectors, adapting the market structure in Bergin and Corsetti (2020). One sector produces differentiated goods, which are typically associated with monopolistic competition, price markups, and rigidities in price setting. The other sector produces non-differentiated goods, associated with higher elasticities of substitution, perfect competition and flexible prices. These wide differences in market structure and price stickiness, imposed for analytical convenience, allow us to explore the scope for distinct macro dynamics produced by sectoral tariffs, and the distinct reaction of sectors to the monetary policy response to tariffs. Ramsey optimal monetary policy utilizes these distinctions to help manage the broader range of implications of surprise tariff shocks.

Our overall conclusion is that the optimal monetary response to tariffs is expansionary, supporting activity and producer prices at the expense of generating short-run headline inflation. This prescription of monetary expansion applies broadly, both for tariffs aimed at differentiated and non-differentiated goods, but with very different motivations in each of these two cases. As differentiated goods are typically supplied by monopolistically competitive firms and priced subject to nominal rigidities, the objective of monetary policy is to offset the distortionary impact of tariffs on the international relative prices between home and foreign goods via currency depreciation, and thereby counteracting the impact of tariffs on aggregate GDP and sectoral reallocation. In the case of non-differentiated goods traded in competitive markets, cross-country relative prices do not respond to currency movements. Yet, optimal monetary policy can improve welfare favoring a reallocation of demand toward the differentiated goods in compensation for the loss of output and income in the non-differentiated output. Remarkably, monetary policy promotes welfare by amplifying, rather than offsetting, the reallocation induced by the tariff. Nonetheless, we find that the allocative power of optimal policy is lower in a global economy where the country imposing the tariffs issue the dominant currency in global trade.

In greater detail, we find that, in response to tariffs imposed on a country's exports of differentiated goods, output falls overall but moves sectoral output in opposite

[2] The analysis of sectoral reallocation and comparative advantage was already included in the extended working paper version of Bergin and Corsetti (2023).

directions: production falls in the differentiated sector, but rises in the non-differentiated sector. Domestic welfare falls through multiple channels, including loss of efficiency gains associated with a contraction in variety of differentiated goods available to final users. The optimal monetary policy response is strongly expansionary, engineering currency depreciation with the objective to redress at least in part the relative price distortion induced by the tariff. The optimal policy thus stabilizes production at the cost of domestic inflation and depreciation. The welfare gains, relative to suboptimal monetary policy, are sensitive to the elasticity of substitution between the two sectors.

In response to tariffs on non-differentiated goods, the impact on home overall GDP is very similar to the case with a tariff on differentiated goods. The sectoral reallocation is precisely the opposite, with the tariff shifting home demand and exports toward differentiated goods. Absent monetary stabilization, the production of these goods, however, respond over time, due to the slow adjustment of sticky prices in the sector. As in the previous case, the monetary policy response is expansionary. This cannot prevent the fall in home production of non-differentiated goods. Yet, a monetary expansion cum currency depreciation can raise the home production of differentiated goods already in the short run. As noted above, a rise in differentiated production would takes place, in any case, although only gradually over time as prices in this sector adjust downward; monetary policy can optimally bring this process forward in time, reducing the need for a dynamic downward adjustment in prices. We conclude that the optimal monetary response to this tariff on non-differentiated goods and differentiated goods are both expansionary, trading off economic activity for inflation, but with distinct motivations.

We enrich the analysis allowing for a general model environment encompassing realistic features of the international economy. These include the facts that prices of exports are predominantly denominated by a single dominant currency and tariffs imposed by one country are likely to lead to retaliation. We show that a dominant currency in trade undercuts the effectiveness of monetary policy: if home differentiated sector export prices are sticky in the currency of the foreign buyer, exchange rate fluctuations have little impact on their international relative prices and thus cannot offset the tariff. This puts the country at a disadvantage in terms of welfare, although the optimal policy can still have desirable effects on aggregate economic activity. Further, we show that our main results continue to

hold in a symmetric trade war scenario, in which countries retaliate to foreign tariffs by hiking their own tariffs. In this context, a monetary expansion is optimal even if, given symmetry in policy, currency movements can no longer redress the effects of tariffs on relative prices.

The specification of multisector models featuring comparative advantage effects of tariffs is arguably key to lay the ground for theoretical and empirical analysis. We show that the sectoral allocation predicted by our model is an order of magnitude larger relative to a version of our model in which, conventionally, one tradable sector coexists with a nontradable sector. Remarkably, we show that the optimal policy prescriptions remain similar relative to our baseline (the home monetary optimal policy expands in response to tariff shocks), so are the implied aggregate dynamics under the optimal policy. The key difference is the intrasectoral dynamics, which are quite muted in the specification of the model abstracting from comparative advantage. Model assuming one tradable and one nontradable good sector may underestimate the reallocation effects of tariffs.

Much of the growing literature studying the macroeconomic effects of tariffs relies on either real models, or monetary models with a stylized monetary side.[3] We place the monetary dimensions of a trade war and the design of an efficient stabilization policy centerstage in our analysis. Related to our previous contribution, Auray et al. (2020) study how alternative monetary policies affect an endogenous, strategic tariff policy, turning our question, the choice of optimal monetary policy in the face of an exogenous tariff policy, around. More recently, Bianchi and Coulibaly (2024), also reconsider optimal monetary policy responses to tariffs in a New Keynesian model, stressing the efficiency of an expansionary response for a small open economy. While the results of the two papers largely coincide, one difference is that we consider globally efficient monetary rules, where spillovers are internalized. Most crucially, the model environment in this paper differs both in studying a constrained efficient policy for a global equilibrium, and in considering a

[3] See for example Bloom, et al. (2019), Born et al. (2019), Breinlich et al. (2017), Caliendo et al. (2017), Davies and Studnicka (2018), Dhingra et al. (2017), Sampson (2017), Steinberg (2019), and Van Reenen (2016). Some leading contributions posits standard monetary policy rules, e.g., Barattieri et al. (2021) and Erceg et al. (2018). Caldara et al. (2018) investigates the macroeconomic implications of trade policy uncertainty. Linde and Pescatori (2019) reconsiders the Lerner symmetry.

variety of trade features, including firm entry and multiple traded sectors, relevant for comparative advantage.

The paper proceeds as follows. The next section describes the model environment and calibration. Sections 3 and 4 use impulse responses to compare the macroeconomic effects of tariffs on, respectively, the differentiated and non-differentiated good sectors, using stochastic simulations to compute the optimal monetary policy response and welfare implications of each. Section 5 considers a richer model allowing for more general environments. Section 6 summarizes conclusions and policy implications.

2. Model

The theoretical framework builds upon the framework of Bergin and Corsetti (2023), augmented with two traded sectors as in the model of Bergin and Corsetti (2020). The model features two countries, home and foreign, each of which produce two types of tradable goods. The first type of good comes in differentiated varieties produced under monopolistic competition, where firm entry requires a sunk investment, and prices are subject to nominal rigidities. The second type of good is modeled according to the standard specification in real business cycle models, assuming perfect substitutability among producers within a country, but imperfect substitutability across countries. In the text to follow, we present the households' and firms' problems as well as the monetary and fiscal policy rules from the vantage point of the home economy, with the understanding that similar expressions and considerations apply to the foreign economy—foreign variables are denoted with a "*".

2.1. Goods consumption demand and price indexes

In the benchmark version of the model, households consume goods produced in both sectors, and of both domestic and foreign origin. The differentiated goods come in many varieties, produced by a time-varying number of monopolistically competitive firms in the home and foreign country, n_t and n_t^* respectively, each producing a single variety. Each variety is an imperfect substitute for any other variety in this sector, either of home or foreign origin, with elasticity ϕ. The non-differentiated goods come in a home and foreign version, which are imperfect substitutes with elasticity η. However, within each country,

all goods in this sector are perfectly substitutable with each other, and are produced in a perfectly competitive environment. We will refer to the differentiated sector as "manufacturing," and denote this sector with a *D*; we will denote the non-differentiated sector with a *N*.

Tariffs are specified as ad-valorem duties imposed at the dock. They directly enter the relative prices observed by consumers, and which enter the demand equations. Tariff revenue is collected by the government of the importing country and rebated to domestic consumers, thus canceling out in the consolidated national budget constraint.

The overall consumption index is specified as follows:

$$C_t \equiv \left(\theta^{\frac{1}{\xi}} C_{D,t}^{\frac{\xi-1}{\xi}} + (1-\theta)^{\frac{1}{\xi}} C_{N,t}^{\frac{\xi-1}{\xi}} \right)^{\xi \frac{\xi}{\xi-1}},$$

where $$C_{D,t} \equiv \left(\int_0^{n_t} c_t(h)^{\frac{\phi-1}{\phi}} dh + \int_0^{n_t^*} c_t(f)^{\frac{\phi-1}{\phi}} df \right)^{\frac{\phi}{\phi-1}}$$

is the index over the endogenous number of home and foreign varieties of the differentiated manufacturing good, $c_t(h)$ and $c_t(f)$, and

$$C_{N,t} \equiv \left(\nu^{\frac{1}{\eta}} C_{H,t}^{\frac{\eta-1}{\eta}} + (1-\nu)^{\frac{1}{\eta}} C_{F,t}^{\frac{\eta-1}{\eta}} \right)^{\frac{\eta}{\eta-1}}$$

is the index over goods differentiated only by country of origin, $C_{H,t}$ and $C_{F,t}$ with $\nu \in [0,1]$ accounting for the weight on domestic goods. The corresponding welfare-based consumption price index is

$$P_t = \left(\theta P_{D,t}^{1-\xi} + (1-\theta)\left(P_{N,t}\right)^{1-\xi} \right)^{\frac{1}{1-\xi}}, \tag{1}$$

where

$$P_{D,t} = \left(n_t p_t(h)^{1-\phi} + n_t^* \left(p_t(f) T_{D,t} \right)^{1-\phi} \right)^{\frac{1}{1-\phi}} \tag{2}$$

is the index over the prices of all varieties of home and foreign manufacturing goods, $p_t(h)$ and $p_t(f)$, and

$$P_{N,t} = \left(\nu P_{H,t}^{1-\eta} + (1-\nu)\left(P_{F,t} T_{N,t}\right)^{1-\eta} \right)^{\frac{1}{1-\eta}} \tag{3}$$

is the index over the prices of home and foreign non-differentiated goods. In these indexes, $T_{D,t}$ represents the quantity of 1 plus the ad valorem tariff rate imposed by the home country on imports of foreign differentiated goods, and $T_{N,t}$ represents the quantity of 1 plus the ad-valorem tariff rate imposed by the home country on imports of foreign non-differentiated goods. In reporting results, we will distinguish between the "ex-tariff" price determined by an exporter, $p_t(f)$, and the "tariff-inclusive" price, $p_t(f)T_{D,t}$, paid by an importer.

The relative demand functions for domestic residents implied from our specification of preferences are listed below:

$$C_{D,t} = \theta \left(P_{D,t} / P_t \right)^{-\xi} C_t \tag{4}$$

$$C_{N,t} = C_{D,t} = (1-\theta)\left(P_{N,t} / P_t \right)^{-\xi} C_t \tag{5}$$

$$c_t(h) = \left(p_t(h) / P_{D,t} \right)^{-\phi} C_{D,t} \tag{6}$$

$$c_t(f) = \left(p_t(f) T_{D,t} / P_{D,t} \right)^{-\phi} C_{D,t} \tag{7}$$

$$C_{H,t} = \nu \left(P_{H,t} / P_{N,t} \right)^{-\eta} C_{N,t} \tag{8}$$

$$C_{F,t} = (1-\nu)\left(P_{F,t} T_{N,t} / P_{N,t} \right)^{-\eta} C_{N,t} \tag{9}$$

Note that demand functions for imports (Eqs. (7) and (9)) depend upon the tariff-inclusive price.

2.2 Home households' problem

The representative home household derives utility from consumption (C_t), and from holding real money balances (M_t/P_t); it suffers disutility from labor (l_t). The household budget consists of labor income from working at the nominal wage rate W_t; profits rebated from home firms denoted with (Π_t) in real terms and defined below, as well as interest income on bonds in home currency ($i_{t-1}B_{H,t-1}$) and foreign currency ($i_{t-1}^{*}B_{F,t-1}$), where e_t is the nominal exchange rate in units of home currency per foreign. Income is net of lump-sum taxes (T_t), used for monetary transfers and to rebate tariff payments on imports. It is assumed that consumers do not internalize the effects of their consumption decisions on government tariff rebates.

Household optimization for the home country may be written:

$$\max E_0 \sum_{t=0}^{\infty} \beta^t U\left(C_t, l_t, \frac{M_t}{P_t} \right)$$

where utility is defined by

$$U_t = \frac{1}{1-\sigma} C_t^{1-\sigma} + \ln \frac{M_t}{P_t} - \frac{1}{1+\psi} l_t^{1+\psi},$$

subject to the budget constraint:

$$P_t C_t + \left(M_t - M_{t-1} \right) + \left(B_{Ht} - B_{Ht-1} \right) + e_t \left(B_{Ft} - B_{Ft-1} \right) = W_t l_t + \Pi_t + i_{t-1} B_{Ht-1} + i_{t-1}^* B_{Ft-1} - P_t AC_{Bt} - T_t .$$

In the utility function, the parameter σ denotes risk aversion and ψ is the inverse of the Frisch elasticity. The constraint includes a small cost to holding foreign bonds

$$AC_{Bt} = \frac{\psi_B \left(e_t B_{Ft} \right)^2}{2 P_t p_{Ht} y_{Ht}},$$

scaled by ψ_B, which is a common device to assure long run stationarity in the net foreign asset position, and resolve indeterminacy in the composition of the home bond portfolio. The bond adjustment cost is a composite of goods that mirrors the consumption index, with analogous demand conditions to Eqs. (4)-(9).

Defining $\mu_t = P_t C_t^{\sigma}$, household optimization implies an intertemporal Euler equation:

$$\frac{1}{\mu_t} = \beta \left(1 + i_t \right) E_t \left[\frac{1}{\mu_{t+1}} \right] \tag{1}$$

a labor supply condition:

$$W_t = l_t^{\psi} \mu_t \tag{11}$$

a money demand condition:

$$M_t = \mu_t \left(\frac{1+i_t}{i_t} \right), \tag{12}$$

and a home interest rate parity condition:

$$\mathrm{E}_t \left[\frac{\mu_t}{\mu_{t+1}} \frac{e_{t+1}}{e_t} \left(1 + \mathrm{i}_t^* \right) \left(1 + \psi_B \left(\frac{e_t B_{ft}}{p_{Ht} y_{Ht}} \right) \right) \right] = \mathrm{E}_t \left[\frac{\mu_t}{\mu_{t+1}} \left(1 + \mathrm{i}_t \right) \right]. \tag{13}$$

The problem and first order conditions for the foreign household are analogous.

2.3 Home firm problem and entry condition in the differentiated goods sector

In the manufacturing sector, the production of each differentiated variety follows

$$y_t(h) = \alpha_D \left[G_t(h)\right]^{\zeta} \left[l_t(h)\right]^{1-\zeta}, \tag{14}$$

where α_D is productivity specific to the production of differentiated goods but common to all firms within that sector, $l_t(h)$ is the labor employed by firm h, and $G_t(h)$ is a composite of differentiated goods used by firm h as an intermediate input. $G_t(h)$ is specified as an index of home and foreign differentiated varieties that mirrors the consumption index specific to differentiated goods ($C_{D,t}$). If we sum across firms, $G_t = n_t G_t(h)$ represents economy-wide demand for differentiated goods as intermediate inputs. Given that the index is the same as for consumption, this implies demands for differentiated goods varieties, $d_{G,t}(h)$ and $d_{G,t}(f)$, analogous to Eqs. (6)–(7).[4]

Differentiated goods firms set prices $p_t(h)$ subject to an adjustment cost:

$$AC_{P,t}(h) = \frac{\psi_P}{2}\left(\frac{p_t(h)}{p_{t-1}(h)} - 1\right)^2 \frac{p_t(h) y_t(h)}{P_t}, \tag{15}$$

where ψ_P is a calibrated parameter governing the degree of price stickiness. For the sake of tractability, we follow Bilbiie et al. (2008) in assuming that new entrants inherit from the price history of incumbents the same price adjustment cost, and so make the same price setting decision.[5]

There is free entry in the sector, but, once active, firms are subject to an exogenous death shock. Since all differentiated goods producers operating at any given time face the same exogenous probability of exit δ, a fraction δ of them exogenously stop operating each period. The number of firms active in the differentiated sector, n_t, at the beginning of each period evolves according to:

$$n_{t+1} = (1-\delta)(n_t + ne_t), \tag{16}$$

where ne_t denotes new entrants.

To set up a firm, managers incur a one-time sunk cost, K_t, and production starts with a one-period lag. This cost is not constant but varies reflecting an entry congestion externality, represented as an adjustment cost that is a function of the number of new firms:

[4] See section 1 of the online appendix for the demand equations not listed here.

[5] The price index for adjustment cost is identical to the overall consumption price index, implying demands analogous to those for consumption in Eqs. (4)-(9). See section 1 of the online appendix for the demand equations not listed here.

$$K_t = \left(\frac{ne_t}{ne_{t-1}} \right)^{\lambda} \overline{K}, \tag{17}$$

where $\overline{K}$ indicates the steady state level of entry cost, and the parameter λ indicates how much the entry cost rises with an increase in entry activity. The congestion externality plays a similar role as the adjustment cost for capital standard in business cycle models, which moderates the response of investment to match dynamics in data. In a similar vein, we calibrate the adjustment cost parameter, λ, to match data on the dynamics of new firm entry.[6] The demands for varieties for use as entry investment, $d_{K,t}(h)$ and $d_{K,t}(f)$, are determined analogously to demands for consumption of differentiated goods.

We now can specify total demand facing a domestic differentiated goods firm:

$$d_t(h) = c_t(h) + d_{G,t}(h) + d_{K,t}(h) + d_{AC,P,t}(h) + d_{AC,B,t}(h) \tag{18}$$

which includes the demand for consumption ($c_t(h)$) by households, and the demand by firms for intermediate inputs ($d_{G,t}(h)$), investment (the sunk entry costs) ($d_{K,t}(h)$), and goods absorbed as adjustment costs for prices ($d_{AC,P,t}(h)$) and bonds holding costs ($d_{AC,B,t}(h)$). There is an analogous demand from abroad $d_t^*(h)$. We assume iceberg trade costs τ_D for exports, so that market clearing for a firm's variety is:

$$y_t(h) = d_t(h) + (1+\tau_D) d_t^*(h), \tag{19}$$

Firm profits are computed as:

$$\pi_t(h) = p_t(h) d_t(h) + e_t p_t^*(h) d_t^*(h) - mc_t y_t(h) - P_t AC_{p,t}(h). \tag{20}$$

where $mc_t = \zeta^{-\zeta}(1-\zeta)^{\zeta-1} P_{D,t}{}^{\zeta} W_t^{1-\zeta} / \alpha_D$ is marginal cost.

Thus the value function of firms that enter the market in period *t* may be represented as the discounted sum of profits of domestic sales and export sales:

$$v_t(h) = E_t \left\{ \sum_{s=0}^{\infty} \left(\beta(1-\delta) \right)^s \frac{\mu_{t+s}}{\mu_t} \pi_{t+s}(h) \right\},$$

[6] The value of steady state entry cost $\overline{K}$ has no effect on the dynamics of the model, and so will be normalized to unity.

where we assume firms use the discount factor of the representative household, who owns the firm, to value future profits. With free entry, new producers will invest until the point that a firm's value equals the entry sunk cost:

$$v_t(h) = P_{D,t} K_t \,. \tag{21}$$

By solving for cost minimization we can express the relative demand for labor and intermediates as a function of their relative costs:

$$\frac{P_{D,t} G_t(h)}{W_t l_t(h)} = \frac{\zeta}{1-\zeta} \,. \tag{22}$$

Managers optimally set prices by maximizing the firm value subject to all the constraints specified above. The price setting equation:

$$\begin{aligned} p_t(h) = {} & \frac{\phi}{\phi-1} mc_t + \frac{\psi_P}{2}\left(\frac{p_t(h)}{p_{t-1}(h)} - 1\right)^2 p_t(h) - \psi_P \frac{1}{\phi-1}\left(\frac{p_t(h)}{p_{t-1}(h)} - 1\right)\frac{p_t(h)^2}{p_{t-1}(h)} \\ & + \frac{\psi_P}{\phi-1} E_t\left[\beta \frac{\Omega_{t+1}}{\Omega_t}\left(\frac{p_{t+1}(h)}{p_t(h)} - 1\right)\frac{p_{t+1}(h)^2}{p_t(h)}\right] \end{aligned} \tag{23}$$

expresses the optimal pricing as a function of the stochastically discounted demand faced by producers of domestic differentiated goods,

$$\begin{aligned} \Omega_t = {} & \left[\left(\frac{p_t(h)}{P_{D,t}}\right)^{-\phi}\left(C_{D,t} + G_t + ne_t(1-\theta_K)K_t + AC_{P,D,t} + AC_{B,D,t}\right)\right. \\ & \left. + \left(\frac{(1+\tau_D)T^*_{D,t} p_t(h)}{e_t P^*_{D,t}}\right)^{-\phi}(1+\tau_D)\left(C^*_{D,t} + G^*_t + ne^*_t(1-\theta_K)K^*_t + AC^*_{P,D,t} + AC^*_{B,D,t}\right)\right] \Big/ \mu_t \,. \end{aligned}$$

This sums the demand arising from consumption, use as intermediate inputs, sunk entry cost, price adjustment costs, and bond holding costs.

Under the assumption that firms preset prices in own currency, i.e., assuming producer currency pricing, the good price in foreign currency moves one-to-one with the exchange rate, net of trade costs:

$$p^*_t(h) = (1+\tau_D)\, p_t(h) / e_t \,, \tag{24}$$

where recall the nominal exchange rate, *e*, measures home currency units per foreign.

Note that, since households own firms, they receive firm profits but also finance the creation of new firms. In the household budget, the net income from firms may be written:

$$\Pi_t = n_t \pi_t(h) - ne_t v_t(h) \,.$$

In reporting our quantitative results, we will refer to the overall home gross production of differentiated goods defined as: $y_{D,t} = n_t y_t(h)$.

2.4 Home firm problem in the undifferentiated goods sector

In the second sector firms are assumed to be perfectly competitive in producing a good differentiated only by country of origin. The production function for the home non-differentiated good is linear in labor:

$$y_{H,t} = \alpha_N l_{H,t}, \tag{25}$$

where α_N is productivity specific to this country and sector. It follows that the price of the homogeneous goods in the home market is equal to marginal costs:

$$p_{H,t} = W_t / \alpha_N. \tag{26}$$

An iceberg trade cost specific to the non-differentiated sector implies prices of the home good abroad are

$$p^*_{H,t} = p_{H,t}(1+\tau_N)/e_t. \tag{27}$$

Analogous conditions apply to the foreign non-differentiated sector.

2.5 Monetary policy

To compute the cooperative Ramsey allocation, we posit that the monetary authority maximizes aggregate welfare of both countries:

$$\max E_0 \sum_{t=0}^{\infty} \beta^t \left(\frac{1}{2}\left(\frac{1}{1-\sigma} C_t^{1-\sigma} - \frac{1}{1+\psi} l_t^{1+\psi} \right) + \frac{1}{2}\left(\frac{1}{1-\sigma} C_t^{*1-\sigma} - \frac{1}{1+\psi} l_t^{*1+\psi} \right) \right)$$

under the constraints of the economy defined above. As common in the literature, we write the Ramsey problem by introducing additional co-state variables, which track the value of the planner committing to a policy plan.

For comparison, we also study three alternative nominal specifications. In the first one, we assume flexible prices and wages, so to characterize the natural allocation. In the second, we model monetary policy positing a constant money growth rule:

$$\frac{M_t}{M_{t-1}} = \upsilon, \tag{28}$$

which we label the 'no (stabilization) policy' case. In the last one, with replace the above with a Taylor rule of the form

$$1+i_t=(1+i_{t-1})^{\gamma_i}\left[(1+\bar{i})\left(\frac{p_t(h)}{p_{t-1}(h)}\right)^{\gamma_p}\left(\frac{Y_t}{\bar{Y}}\right)^{\gamma_Y}\right]^{1-\gamma_i}, \tag{29}$$

where terms with overbars are steady-state values. In this rule, inflation is defined in terms of differentiated goods producer prices, while Y_t is a measure of GDP defined net of intermediates as:[7]

$$Y_t=\left((1+n_t)^{(-1/(1-\sigma))}\int_0^{n_t}p_t(h)y_t(h)dh-P_{D,t}G_t+p_{H,t}y_{H,t}\right)/P_t\,. \tag{30}$$

Across these different specifications of monetary policy, we will abstract from public consumption expenditure, so that the government uses seigniorage revenues and taxes to finance transfers, assumed to be lump sum. Government transfers are also used to rebate to consumers the tariff duties paid to the government by consumers and firms on imported goods. The government budget constraint thus is specified as follows:

$$T_t=(M_{t-1}-M_t)+(T_{D,t}-1)n_{t-1}^{*}d_t(f)+(T_{N,t}-1)(C_{F,t}+AC_{P,F,t}+AC_{B,F,t})\,. \tag{31}$$

2.6 Shocks process and equilibrium definition

Shocks are assumed to follow joint log normal distributions:

$$\begin{bmatrix}\log T_{D,t}-\log\overline{T_D}\\ \log T_{D,t}^{*}-\log\overline{T_D^{*}}\\ \log T_{N,t}-\log\overline{T_N}\\ \log T_{N,t}^{*}-\log\overline{T_N^{*}}\end{bmatrix}=\rho_T\begin{bmatrix}\log T_{D,t-1}-\log\overline{T_D}\\ \log T_{D,t-1}^{*}-\log\overline{T_D^{*}}\\ \log T_{N,t-1}-\log\overline{T_N}\\ \log T_{N,t-1}^{*}-\log\overline{T_N^{*}}\end{bmatrix}+\varepsilon_{Tt}$$

with autoregressive coefficient matrix ρ_T, and the covariance matrix $E\left[\varepsilon_{Tt}\varepsilon_{Tt}^{'}\right]$.

To conserve space, the market clearing conditions to close the model are reported in section 2 of the appendix. A competitive equilibrium in our world economy is defined along the usual lines, as a set of processes for quantities and prices in the home and foreign country satisfying: (i) the household and firms optimality conditions; (ii) the market clearing conditions for each good and asset, including money; (iii) the resource

[7] For computational simplicity, the Taylor rule is specified in terms of deviations of GDP from its steady state value, which is distinct from the output gap.

constraints—whose specification can be easily derived from the above and is omitted to save space.

2.7 Welfare computation

We report the effects on welfare of a given policy regime configuration relative to the Ramsey allocation. The change in welfare customarily is computed in terms of consumption units that households would be willing to forgo to continue under the Ramsey policy regime. We posit identical initial conditions across different monetary policy regimes using the Ramsey allocation, and we include transition dynamics in the computation to avoid spurious welfare reversals.[8]

2.8 Model calibration

Where possible, parameter values are taken from standard values in the literature. Risk aversion is set at $\sigma = 2$; labor supply elasticity is set at $1/\psi = 1.9$ following Hall (2009). Consistent with a quarterly frequency, $\beta = 0.99$.

The price stickiness parameter is set at ψ_p =49, a value which implies in simulations of a productivity shock that approximately half the firms resetting price during the first year. [9] The firm death rate is set at δ =0.025. The mean sunk cost of entry is normalized to the value $\overline{K}$ =1, and the adjustment cost parameter for new firm entry, λ , is taken from Bergin and Corsetti (2020). The share of intermediates in differentiated goods production follows Bergin and Corsetti (2020) to a modest value of ζ =1/3.

To choose parameters for the differentiated and non-differentiated sectors we draw on Rauch (1999). We choose θ so that differentiated goods represent 55 percent of U.S. trade in value: ($\theta = 0.61$). We assume the two countries are of equal size with no

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[8] We adopt the methodology created by Giovanni Lombardo and used in Coenen et al. (2010), available from https://www.dropbox.com/s/q0e9i0fw6uziz8b/OPDSGE.zip?dl=0.

[9] As is well understood, a log-linearized Calvo price-setting model implies a stochastic difference equation for inflation of the form $\pi_t = \beta E_t \pi_{t+1} + \lambda mc_t$, where *mc* is the firm's real marginal cost of production, and where $\lambda = (1-q)(1-\beta q)/q$, with q is the constant probability that a firm must keep its price unchanged in any given period. The Rotemberg adjustment cost model used here gives a similar log-linearized difference equation for inflation, but with $\lambda = (\phi - 1)/\kappa$. Under our parameterization, a Calvo probability of q = 0.5 implies an adjustment cost parameter of ψ_P = 49.

exogenous home bias, $\nu = 0.5$, but allow trade costs to determine home bias ratios. To set the elasticities of substitution within the differentiated and non-differentiated sectors we draw on the estimates by Broda and Weinstein (2006), classified by sectors based on Rauch (1999). The Broda and Weinstein (2006) estimate of the elasticity of substitution between differentiated goods varieties is ϕ=5.2 (the sample period is 1972-1988). The corresponding elasticity of substitution for non-differentiated commodities is η = 15.3. We initially adopt a Cobb-Douglas specification for the aggregator function combining the two sectors ($\xi \to 1$), but sensitivity analysis will report results for alternative calibrations of this parameter.

To set trade costs, we calibrate τ_D so that exports represent 26% of GDP, as is the average in World Bank national accounts data for OECD countries from 2000-2017.[10] This requires a value of τ_D =0.44.[11] This is somewhat larger than the value of 0.25 used for trade costs in Obstfeld and Rogoff, (2001), but it is small compared to some trade estimates, such as 1.7 suggested by Anderson and van Wincoop 2004, and adopted by Epifani and Gancia (2017). We follow the standard assumption of trade models that the homogeneous good is traded frictionlessly (τ_N =0).

Calibration of policy parameters for the historical monetary policy Taylor rule are taken from Coenen, et al. (2010): γ_i =0.7, γ_p =1.7, γ_Y =0.1.

The process for tariff shocks is calibrated with a mean value of 1.02 (2 percentage point mean tariff rate) to match U.S. tariff data in Barattieri et al. (2021). The autoregressive parameter is set to 0.56, estimated from Barattieri et al. (2021).[12] The standard deviation of 6 percentage points is taken from Caldara et al. (2020), chosen to capture tariff increases that have been threatened on imports from China and on imports of autos and motor-vehicle parts in 2018-2019.

3. Baseline scenario: foreign tariff on home differentiated exports

[10] See https://data.worldbank.org/indicator/NE.EXP.GNFS.ZS?locations=OE.
[11] To coincide with standard accounting definitions, differentiated goods used as intermediates are included in the measure of exports, and excluded in the measure of GDP, as is appropriate.
[12] We do not adopt the standard deviation of shocks estimated in Barattieri et al (2021), as these estimates are based on a sample from normal times with low volatility in tariffs compared to the more recent period of Brexit and Trump tariffs.

Consider a tariff shock imposed by the foreign country on its imports of differentiated goods exported from the home country. Figure 1 reports impulse responses showing the macroeconomic effects on a selection of variables under different policy regimes, contrasting the Ramsey optimal policy (solid line), "Taylor rule" (dotted line), and "no-policy" (dashed line), where the latter is obtained by imposing a constant money growth rule.

3.1 Transmission under suboptimal policy

Consider first the case of money policy that does not respond to the tariff, but maintains a constant rate of money growth (dashed lines in Figure 1). Two impulse responses resonate with the headline case for protection in policy debates. A foreign tariff results in a foreign trade surplus (corresponding to the home trade deficit shown in the figure). The effect of the tariff on foreign GDP is expansionary, while home GDP falls (by a larger magnitude than the rise in foreign GDP). Looking deeper into the transmission of the tariff, however, the headline case for protection is not strong. Output also reflects the investment demand associated with the creation of new firms. The tariff has an undesired contractionary effect on firm entry in the foreign economy, while it favors entry in the home economy. Moreover, as discussed by Erceg et al. (2018), the GDP in the country that imposes the tariff (the foreign country in our experiment) may rise or fall, depending upon whether the fall in consumption demand due to intertemporal incentives is dominated by the rise in export demand due to the expenditure switching effect of relative prices. In our benchmark calibration the expenditure switching effect dominates.[13]

Holding monetary policy constant, a unilateral tariff on home differentiated exports causes the home exchange rate to depreciate slightly.[14] Observe that, in the no policy response scenario, the rate of depreciation is not large enough to offset the impact of the

[13] In our calibration the trade elasticity is somewhat higher than typical, since it is pinned down by the elasticity of substitution between any two varieties, be they home or foreign varieties. Experiments not pictured indicate that if we reduce this elasticity of substitution slightly, from 5.2 to 4, the expenditure switching effect abates enough that the response of the foreign GDP to the tariff is negative.

[14] The small magnitude of the currency movement makes it difficult to detect depreciation in Figure 4, given the scaling used in this figure

tariff on the relative price of home exports to home imports. This is in violation of the well-known "Lerner symmetry" result, predicting perfect offset.[15]

In the aggregate, the tariff lowers inflation in the home country, as the fall in demand and economic activity is associated with a fall in wages. Conversely, inflation rises in the foreign country, driven by sustained demand but especially by higher costs for imported intermediates.

The effect on activity at the aggregate level discussed above, however, masks a large sectoral reallocation. The percentage fall in the production of differentiated goods in the home country is three times the percentage fall in GDP. This sectoral contraction is matched by a *rise* in home production of non-differentiated goods of a similar magnitude. In the foreign country, sectoral productions mirror this adjustment, moving in the opposite direction.

A standard Taylor rule (dotted line in Figure 1) improves somewhat the allocation. The calibrated Taylor rule calls for a modest monetary expansion in the home country, and a somewhat stronger contraction in the foreign rate, causing a home currency depreciation. The home monetary expansion is sufficient to eliminate the deflation in the country, but it is too small to moderate the fall in output and the sectoral reallocation in any appreciable way. The dynamics of production overall and in the two sectors remain close to the one under the fixed monetary growth rule. The currency movement---enhanced by the rise in the foreign interest rate (in response to the rise in own inflation---partly redress the distortionary effects of the tariff on relative price.

3.2 Transmission under optimal policy

In Figure 1, economic dynamics under the optimal (cooperative) policy are depicted with a solid (red) line. The policy response, in opposite directions for the two countries, is much stronger. The cut in home interest rate and the rise in the foreign one are now substantial, and so is the ensuing home currency depreciation. Note that the currency movement offsets half of the rise in home terms of trade in the "no-policy" case, halving the fall in home GDP and reducing by more than two thirds the sectoral reallocation.

[15] Linde and Pescatori (2019) have pointed out that, in its stronger form, Lerner symmetry fails in many macroeconomic contexts, depending on the structure of financial markets and nominal rigidities.

However, the strong monetary expansion turns the inflationary response in the home county from negative to positive---the foreign contraction moderates inflation without changing its sign. The policy in the foreign country serves to further support home policy in countering the effects of the tariff, as a foreign monetary contraction aims to reduce the rise in foreign inflation.

The economics of this result is straightforward. In our model, monetary policy move two relative prices. The first is the relative price between the home and the foreign differentiated goods; the second is the relative price between differentiated goods, which have sticky prices, and non-differentiated goods, which have flexible prices. Balancing different margins, the home optimal monetary policy calls for a deeper interest rate cut than implied by the Taylor rule, so as to reduce the tariff-induced loss in both comparative advantage and aggregate production.

The optimal policy however is not sufficient to fully restore home GDP to the pre-tariff level, especially over time (more so, if the persistence of the tariff shock exceeds that of price stickiness). Yet the required cut in home interest rate tends to over-stimulate home consumption---and cause a significant aggravation of overall inflation in the home country.

3.3 Welfare implications

In Table 2, we report the welfare loss from sticking to a suboptimal policy (Taylor Rule) relative to adopting the Ramsey optimal policy, measured in units of steady state consumption. To compute these implications, we conduct a stochastic simulation of the model in which unilateral tariff shocks are mean zero (shocks include both hikes and cuts in tariff rates), and can impact either country (home and foreign tariffs are equally likely and are uncorrelated across countries).[16] Given that either country can in principle experience a tariff shock, implications for unconditional moments and welfare are symmetric, and the values in the table apply to both countries.

Relative to the optimal policy, the welfare under a Taylor rule for the benchmark case discussed above is lower by 0.105 percentage points of steady state consumption (column (1)). A modest value is typical of welfare calculation of business cycles. The table also reports unconditional means of variables, showing that the loss in welfare is associated with a fall in

[16] Perturbation solution methods require that shocks be mean zero.

the level consumption but a rise in the mean level of employment (lower leisure). This welfare loss is associated with a loss of efficiency arising from a large percentage contraction in the number of active firms and goods varieties available to consumers.

Column (2) of the table suggests that the welfare loss rises (to 0.14%) if the substitutability between the two sectors is greater (phi raised from ϕ=1.0 to 1.4).

4. Contrasting the effects of tariffs on differentiated and non-differentiated goods

In Figure 2, we bring our model to bear on the case of a foreign tariff on the home exports of the non-differentiated good, in contrast to the differentiated good. As shown in this figure, under the no-policy case, the impact on home GDP is very similar to the case with a tariff on differentiated goods in Figure 1. But the sectoral reallocation induced by the tariff is precisely the opposite, with the tariff shifting home demand and production and exports away from non-differentiated goods toward differentiated goods.

Different from Figure 1, also, the dynamics of differentiated production are positive *and* smoother over time, due to the slow adjustment of the sticky prices in the sector. Namely, contrast the dynamics under flexible and sticky prices (under no policy). Under price flexibility, the producers of differentiated goods would adjust good prices upward immediately in line with the relative increase in demand. The supply response would correspondingly be faster but also lower. Nominal rigidities delay the price increase, hence translate into a stronger and sustained response in output. This output response feeds more firm entry, which further sustains the dynamics of the sector as it takes time for new firms to enter. The number of firms grows gradually and persistently after the tariff, more so with sticky than with flexible prices.

Under the optimal policy, the direction of optimal policy is the same whether the tariff is levied on differentiated and non-differentiated sectors. Yet magnitude and motivation are distinct. In figure 2, the cut in home interest rate is an order of magnitude smaller relative to the case of a tariff on differentiated goods shown in Figure 1. The optimal policy does not aim to offset the relative price distortions of the tariff sustaining the production of non-differentiated goods. The prices of these goods are flexible, hence a monetary expansion mostly causes a price rather than a quantity response in this sector. Rather, the goal of the policy is to compensate for the effect of the tariff on the

international demand of non-differentiated goods facilitating the rise in differentiated production that would also occur under flexible prices. We conclude that the optimal monetary responses to a tariff on non-differentiated goods and a tariff on differentiated goods both are expansionary, but with quite different motivations.

Quantitatively, while in Figures 1 and 2 the rise in GDP is about the same under optimal monetary policy, in Figure 2 the sectoral reallocation is larger. The monetary policy has little or no moderating effect on the fall in home production of non-differentiated goods, but it does raise home production of differentiated goods substantially. As noted above, this rise in differentiated production would take place in any case over time as prices adjust, but the monetary expansion and currency depreciation serves to bring this process forward in time.

The degree of expansion mandated by the Taylor rule, aimed at stabilizing inflation in the face of the deflationary impact of the tariff, is not too far from the optimal policy. The macro dynamics are thus similar under a Taylor rule and the optimal policy.
In view of this, the difference in welfare under the two policies is not dramatic. Indeed, Column (6) of Table 1 shows that the welfare benefits of the optimal policy are commensurately smaller for a tariff on non-differentiated goods, about half the size of the gains from optimal policy in the case of a tariff on differentiated goods.

5. Richer and alternative model specifications: dominant currencies, tariff retaliation and non-tradables

We now reconsider our baseline, modifying the model specification to allow for "realistic" features of the international economy and cross-border policy interactions. First, we consider an environment where exports are predominantly priced in a dominant currency, the dollar. Second, we study the implication of tariff retaliation, eventually leading to a trade war. To conclude our analysis, we contrast our results explicitly focusing on the effects of tariffs and policy on comparative advantage, with the results of models which assume, more conventionally, a tradable and a non-tradable sector.

5.1 A dominant currency

Is the optimal policy very different if, realistically, tariffs are imposed in a world in which the dollar is the dominant currency in international trade? A common approach in the literature to assume that the prices of all exported goods are sticky in dollar units, regardless of the trading countries. Correspondingly, we can amend our model by assuming that the home exports are sticky in the currency of the buyer (local currency pricing) rather than the producer currency, as assumed in the benchmark model. (See the Appendix 3 for details of the specification.)

Figure 3 shows that if the home country exporters set prices in dollars, this severely limits the ability of monetary authorities to counter a U.S. tariff on its exports of differentiated goods. Note that the dynamics under the no-policy case are almost the same as under the benchmark case in Figure 1.

Under the optimal policy, like in our baseline, the home country employs a significant monetary stimulus, lowering interest rate and depreciating the currency. Yet, in contrast to our baseline, the optimal policy has minimal effect on the dynamics of the trade flows and other macro aggregates. While an expansionary stance drives *domestic* relative prices and thus the composition of *domestic* demand and output in the home economy, the associated currency depreciation does not redress the distortionary effect of the tariff on the price faced by U.S. consumers. The tariff is charged on top of border prices that are sticky in dollars, so the full effect of the tariff still is felt (as in the no policy case).

The asymmetry in price stickiness thus puts the home country at a disadvantage in terms of the welfare implications of tariffs. As shown columns (3) and (4) of Table 2, home welfare is lower than foreign even when home and foreign tariffs are imposed in a symmetric manner.[17]

5.2 Symmetric tariff war

It is a distinct possibility that central banks will be called upon to deal with a situation in which the home country reciprocates U.S. tariffs with tariffs of its own in a symmetric tariff war. Figure 5 shows the case of symmetric tariff hikes imposed on the differentiated goods exports of both countries. The fall in home aggregate economic

[17] Appendix Figure 1 shows the additional case when local currency pricing (LCP) is applied symmetrically to both home and foreign countries. Monetary policy in either country has almost no effect on trade flows.

activity is similar to the benchmark case in Figure 1, but the fall now applies to the foreign country (U.S.) as well. In addition, the contraction in activity is largely driven by the fall in differentiated goods production. The production of non-differentiated goods actually rises somewhat, but not enough to compensate for the fall in overall output coming from the differentiated sector. In a symmetric tariff war, there is no shift in comparative advantage across countries---rather, the tariff distortions result in a shift in the sectoral composition of output at a global level.

The optimal monetary policy stance is expansionary in both countries, despite the inflationary impact of the tariff. Hence it is strongly at odds with the Taylor rule mandating a contraction. Given that a symmetric tariff war cannot be remedied by a currency depreciation, the optimal policy aims at resolving the distortion created by the tariff between differentiated and non-differentiated prices within each country. An expansionary monetary stance mitigates the contraction in the differentiated good sector, driving up overall aggregate demand as well as the prices of non-differentiated goods, which are flexible.[18]

Table 2 (see column 7) suggests that the welfare loss of a symmetric tariff war is lower than for tariffs that are not coincident (comparing column (5) to (1)). This can be attributed to the fact that a symmetric tariff does not imply a large asymmetric sectoral reallocation across countries associated with a shift in comparative advantage, as found in the case of a unilateral tariff in the analysis above.

Column (8) shows a similarly diminished welfare loss is associated with a symmetric tariff war launched on exports of non-differentiated goods of both countries. See Appendix Figure 4 for impulse responses in this case.

5.2 Sectoral reallocation dynamics: the importance of modelling comparative advantage

The literature that studies inter-sectoral reallocation from tariffs typically assumes that a tradable sector and a sector producing goods that are not internationally traded---a leading instance is Caliendo et al. (2017). To appreciate the difference between our and

[18] Appendix Figure 3 show the case of a symmetric trade war where firms in both countries set export prices in local currency (LCP stickiness). Monetary policy has minimal impact on trade flows.

this, more conventional, approach, we modify our model by assuming that the goods produced by the non-differentiated sector are not traded internationally ($\nu = 1$). Simulation results are reported in Appendix Figure 2. The economic effects of a tariff are quite different relative to our baseline: as there is no shift in comparative advantage, the effect on the production of non-differentiated goods is an order of magnitude smaller compared to the case in which these goods are traded internationally. In the aggregate, nonetheless, differences are less striking. Optimal policy still calls for expansion at home, engineering a domestic currency depreciation. The welfare loss associated with a Taylor rule relative to the optimal policy is 0.135%, similar to the benchmark two-sector case discussed above.

6. Conclusion

Central banks around the world are grappling with the question of how to respond to the mix of inflation and output implications of a new round of Trump tariffs, with the potential of igniting a trade war across and within geopolitical regions. The question is compounded by the fact that the new round of tariffs may fall on a very broad range of goods, from final consumption goods to materials such as aluminum and steel, and tariff rates may be set quite high.

Using a New Keynesian model enriched with elements from the trade literature, including global value chains in production, and comparative advantage between multiple traded sectors that differ in terms of market structure and price rigidity, we find that the optimal monetary response is expansionary, supporting activity and producer prices at the expense of aggravating short-run headline inflation. This prescription of monetary expansion applies broadly, both for tariffs aimed at differentiated consumption goods with sticky prices and for non-differentiated commodities with flexible prices, but with very distinct motivations in each case.

In the case of tariffs targeting differentiated final consumption goods, typically characterized with monopolistic competition and price stickiness, a specific objective of monetary policy is to redress the distortionary effects of tariffs on relative prices between home and foreign goods, at least in part, via currency depreciation. An expansion with depreciation counteracts the impact of tariffs on both aggregate GDP and sectoral reallocation. In the case of non-differentiated goods, their price flexibility implies that a

currency depreciation cannot significantly redress the distortionary effects of the tariff on relative prices, and an expansion will induce a strong price rather than a quantity response by firms in the sector. However, monetary stabilization can compensate the loss of production due to the fall in the foreign demand for non-differentiated goods (due to the tariff) by raising the demand and production of differentiated goods. Indeed, by pursuing an optimal expansion cum depreciation to hasten the reallocation toward the differentiated goods, monetary policy promotes welfare by amplifying the reallocation induced by the tariff rather than offsetting it. As a note of caution, however, we find that the role for optimal policy is limited when the country imposing the tariffs has the advantage of a currency dominant in global trade. Sticky dollar prices in exports reduce the ability of domestic central bank to affect the international demand for domestic output via currency depreciation.

References

Anderson, James E. and Eric van Wincoop, 2004. "Trade Costs," *Journal of Economic Literature* 42, 691-751.

Auray, Stéphane, Michael B. Devereux, and Aurélien Eyquem, 2024. "Trade Wars and Currency Wars," Review of Economic Studies, doi:10.1093/restud/rdae075.

Barattieri, Alessandro, Matteo Cacciatore, and Fabio Ghironi, 2021. "Protectionism and the Business Cycle," forthcoming in *Journal of International Economics*.

Bergin, Paul R. and Giancarlo Corsetti, 2020. "Beyond Competitive Devaluations: The Monetary Dimensions of Comparative Advantage," *American Economic Journal: Macroeconomics* 12(4), 246-86.

Bergin, Paul R. and Giancarlo Corsetti, 2023. "The macroeconomic stabilization of tariff shocks: What is the optimal monetary response?" *Journal of International Economics* 143, 103758.

Bianchi, J. and L. Coulibaly, 2024. "The Optimal Monetary Policy Response to Tariffs," mimeo. https://www.dropbox.com/scl/fi/hqf1mbf3772prsevyui2k/MonetaryPolicy_Tariffs.pdf?rlkey=zl3tz0xzdue1oxwjjrflouux2&dl=0

Bilbiie, Florin O., Fabio Ghironi, and Marc J. Melitz, 2008. "Monetary Policy and Business Cycles with Endogenous Entry and Product Variety," in Acemoglu, D., K. S. Rogoff, and M. Woodford, eds*., NBER Macroeconomics Annual 2007*, Univ. of Chicago Press, Chicago, 299-353.

Bloom, Nicholas, Philip Bunn, Scarlet Chen, Paul Mizen, Pawel Smietanka, and Gregory Thwaites, 2019. "The Impact of Brexit on UK Firms," NBER Working Papers 26218, National Bureau of Economic Research, Inc.

Born, B., G. J. Müller, M. Schularick, P. Sedláček, 2019. "The Costs of Economic Nationalism: Evidence from the Brexit Experiment," *The Economic Journal* 129: 2722-2744.

Breinlich, H., E. Leromain, D. Novy, and T. Sampson, 2017. "The Consequences of the Brexit Vote for UK Inflation and Living Standards: First Evidence", LSE mimeo.

Broda, Christian and David E. Weinstein, 2006. "Globalization and the Gains from Variety," *The Quarterly Journal of Economics* 121, 541-585.

Caldara, Dario, Matteo Iacoviello, Patrick Molligo, Andrea Prestipino and Andrea Raffo, 2020. "The Economic Effects of Trade Policy Uncertainty," *Journal of Monetary Economics* 109, 38-59.

Caliendo, L., R. C. Feenstra, J. Romalis, and A. M. Taylor, 2017. "Tariff Reductions, Entry, and Welfare: Theory and Evidence for the Last Two Decades," working paper.

Coenen, G., G. Lombardo, F. Smets and R. Straub, 2010. "International Transmission and Monetary Policy Cooperation," in Jordi Galí and Mark J. Gertler, eds. *International Dimensions of Monetary Policy,* Chicago: University of Chicago Press, 157-192.

Davies, R. B. and Z. Studnicka, 2018. "The Heterogeneous Impact of Brexit: Early Indications from the FTSE." *European Economic Review*, Vol. 110, pp. 1-17

Dhingra, S., H. Huang, G. Ottaviano, J. P. Pessoa, T. Sampson, and J. Van Reenen, 2017. "The consequences of Brexit for UK trade and living standards," *Economic Policy* 32(92), 651-705.

Donnan, S., Saraiva, C, "and Murray B., 2025, "Trump's tariffs hit US Growth Before, and Threaten to Again, Bloomberg, January 2028.

Erceg, Christopher, Andrea Prestipino, and Andrea Raffo, 2018. "The Macroeconomic Effects of Trade Policy," Board of Governors of the Federal Reserve System International Finance Discussion Papers, Number 1242.

Epifani, P. and G. Gancia, 2017. "Global Imbalances Revisited: The Transfer Problem and Transport Costs in Monopolistic Competition," *Journal of International Economics* 108, 99-116.

Hall, Robert E., 2009. "By How Much Does GDP Rise If the Government Buys More Output?" *Brookings Papers on Economic Activity* 2, 183–231.

Lindé, Jesper and Andrea Pescatori, 2019. "The Macroeconomic Effects of Trade Tariffs: Revisiting the Lerner Symmetry Result," *Journal of International Money and Finance* 95(C), 52-69.

Obstfeld, Maurice and Rogoff, Kenneth, 2001. "The Six Major Puzzles in International Macroeconomics: Is There a Common Cause?" in: NBER Macroeconomics Annual 2000, Volume 15, pages 339-412 National Bureau of Economic Research, Inc.

Rauch, James E., 1999. "Networks Versus Markets in International Trade," *Journal of International Economics* 48, 7–35.

Sampson, T., 2017. "Brexit: The Economics of International Disintegration," *Journal of Economic Perspectives*, 31(4), 163-184.

Steinberg, J. B., 2019. "Brexit and the Macroeconomic Impact of Trade Policy Uncertainty." *Journal of International Economics* 117, 175-195.

World Bank, 2017. "World Bank National Accounts Data: Exports of Goods and Services (% of GDP)." https://data.worldbank.org/indicator/NE.EXP.GNFS.ZS?locations=OE (accessed September 16, 2019).

Van Reenen, J., 2016. "Brexit's Long-Run Effects on the UK Economy," *Brookings Papers on Economic Activity* 47(2), 367-383.

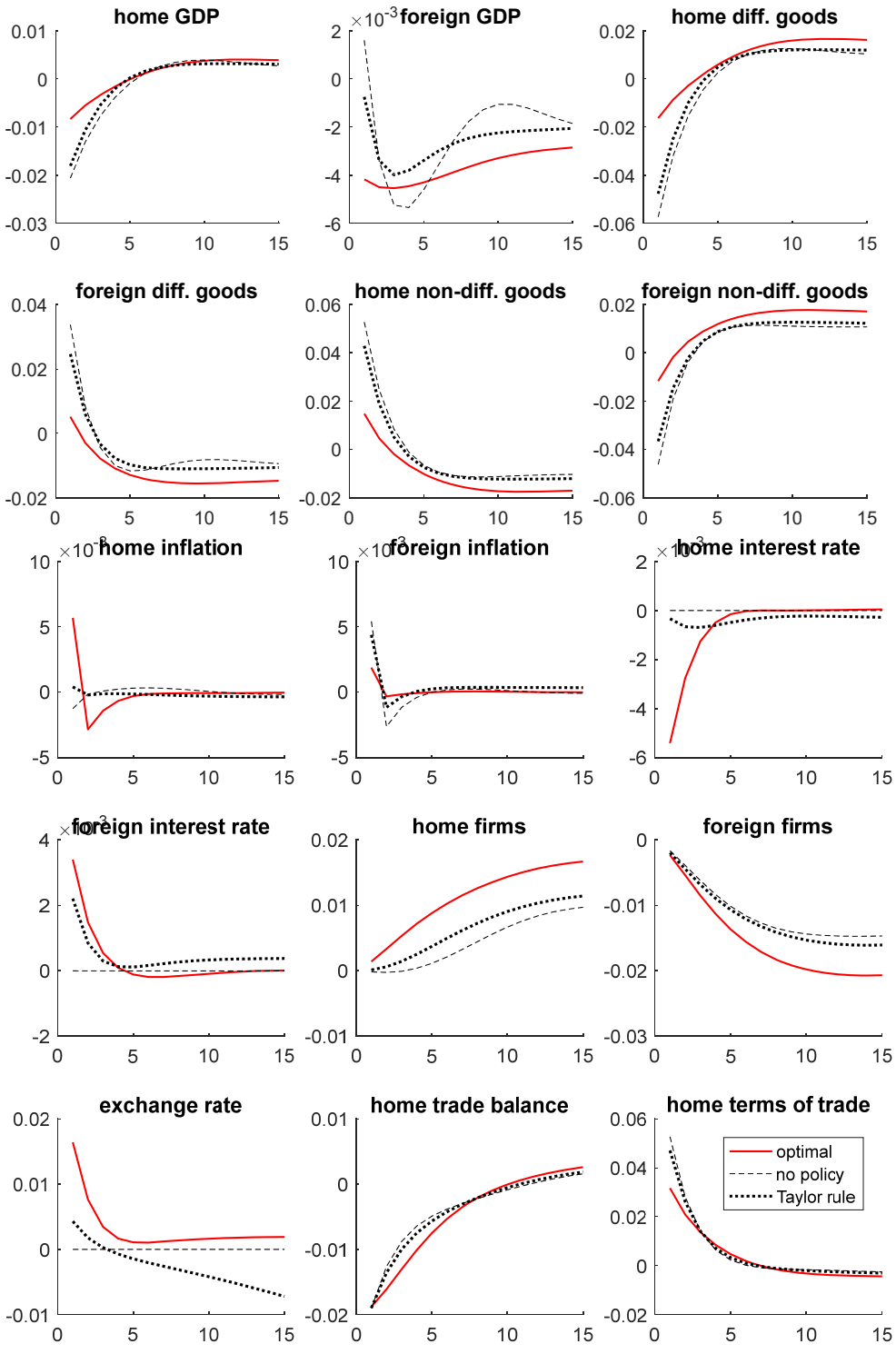
Table 1. Benchmark Parameter Values

Preferences	
Risk aversion	$\sigma = 2$
Time preference	β =0.99
Labor supply elasticity	$1/\psi = 1.9$
Differentiated goods share	$\theta = 1,\quad 0.61$
Non-differentiated goods home bias	$\nu = 0.5$
Differentiated goods elasticity	ϕ = 5.2
Non-differentiated goods elasticity	$\eta = 15.3$
Substitution between sectors	$\xi = 1$
Technology	
Firm death rate	$\delta = 0.1$
Price stickiness	$\psi_P = 49$
Intermediate input share	$\varsigma = 1/3$
Differentiated goods trade cost	τ_D =0.44
Non-differentiated goods trade cost	τ_N =0
Mean sunk entry cost	$\overline{K} = 1$
Firm entry adjustment cost	$\lambda = 0.10$
Bond holding cost	ψ_B =1xe-6
Tariff means	$\overline{T_D} = \overline{T_N} = 1.02$

Table 2. Moments of variables and welfare:
Comparing Taylor Rule policy to Ramsey

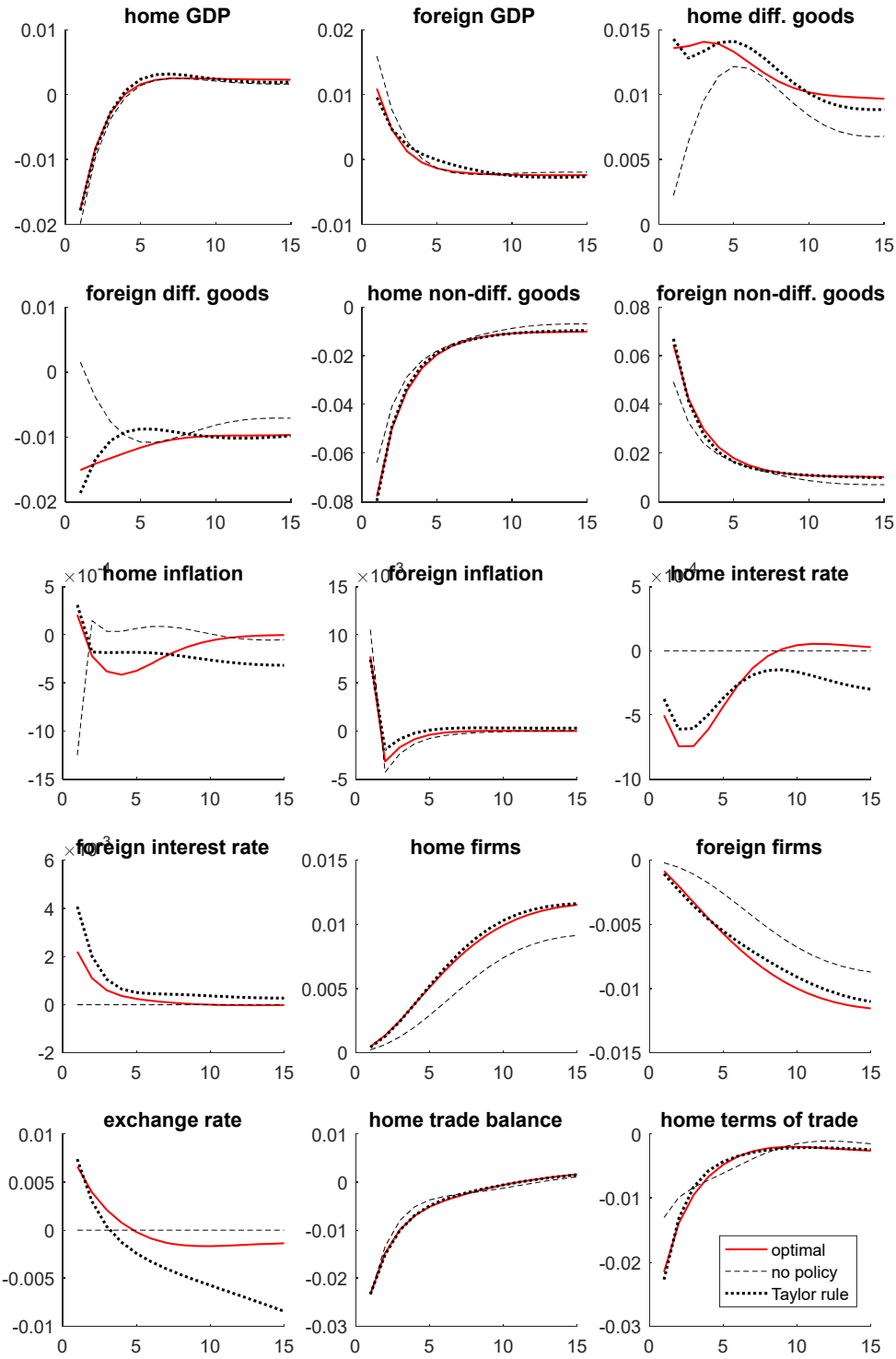
	tariff on differentiated goods					non-differentiated goods	
	independent shock				common shock	independent	common
	benchmark	substitutes	dominant currency		benchmark	benchmark	benchmark
			home	foreign			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
standard deviations in percent (difference from Ramsey case)							
GDP	0.01	-0.99	0.17	-0.16	0.65	-0.03	0.24
employment	-0.01	-0.71	0.00	-0.07	0.44	0.00	0.18
consumption	-0.34	-0.71	-0.23	-0.31	0.10	-0.02	-0.02
firm entry							
investment	-9.64	-2.37	-6.50	-8.78	4.23	-0.31	2.89
number of firms	-3.81	-2.40	-2.95	-3.23	0.50	-0.22	0.21
inflation	-0.15	1.05	-0.28	0.31	-0.34	-0.05	-0.09
real exch. rate	-0.99	-1.61	-0.82	-0.82	0.00	-0.03	0.00
unconditional means of variables (percent change from Ramsey case)							
GDP	0.082	0.865	0.049	-5.463	0.013	0.011	0.003
employment	0.052	0.532	-0.032	0.113	0.007	0.019	0.008
consumption	-0.037	-0.709	0.037	-0.100	0.000	-0.022	-0.010
firm entry							
investment	-0.479	-6.484	0.263	-0.999	-0.008	-0.162	-0.077
number of firms	-0.479	-6.484	0.263	-0.999	-0.008	-0.162	-0.077
Welfare (percent change from Ramsey case, conditional, in consumption units):							
	-0.105	-0.139	0.098	-0.265	-0.023	-0.052	-0.032

Figure 1. Impulse responses to a rise in foreign tariff on home differentiated exports



Vertical axis is percent deviation (0.01=1%) from steady state levels. Horizontal axis is time (in years).

Figure 2. Impulse responses to a rise in foreign tariff on home non-differentiated exports



Vertical axis is percent deviation (0.01=1%) from steady state levels. Horizontal axis is time (in years).

Table 3. Impulse responses to a rise in foreign tariff on home differentiated exports, foreign currency dominant

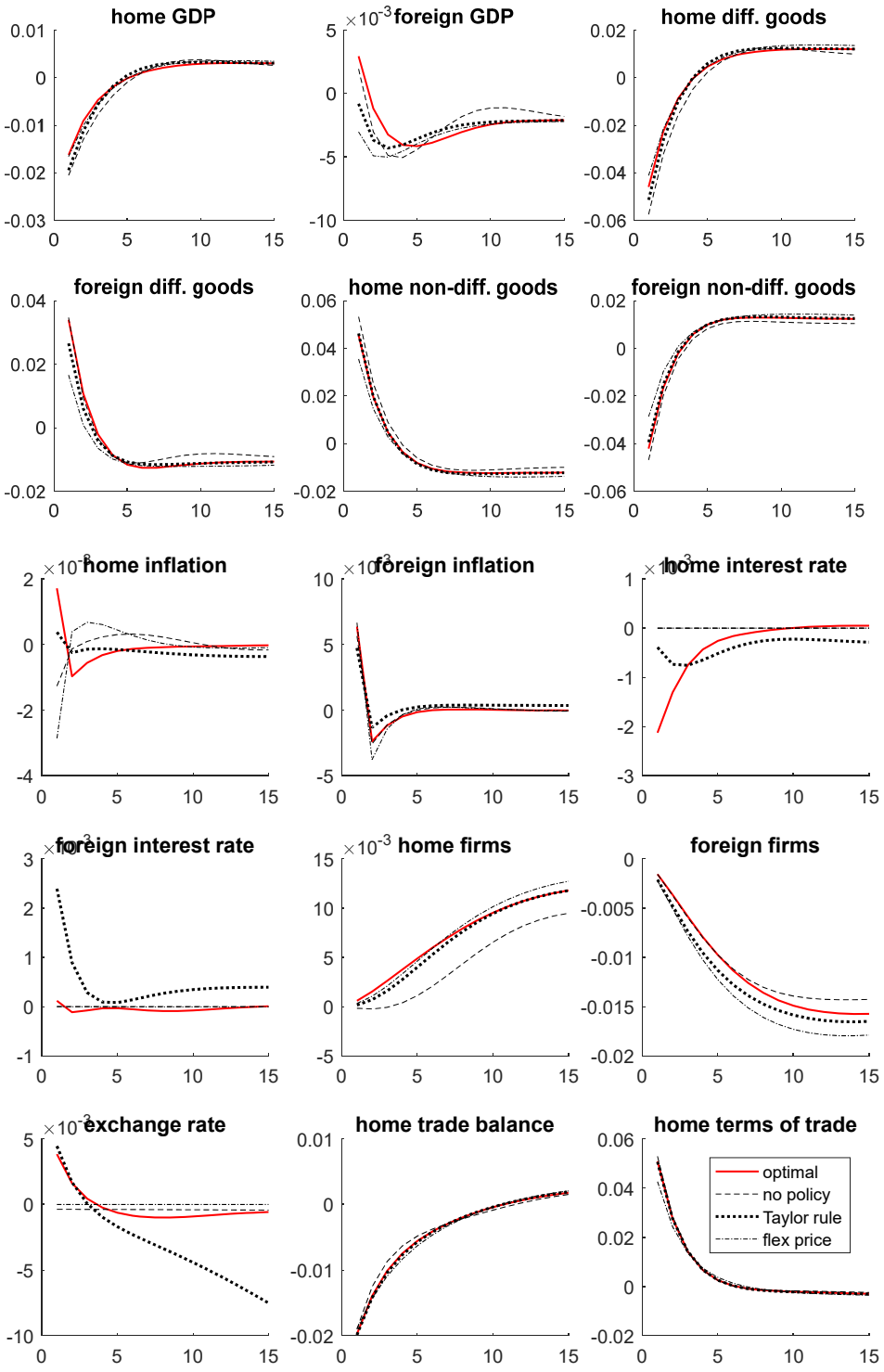
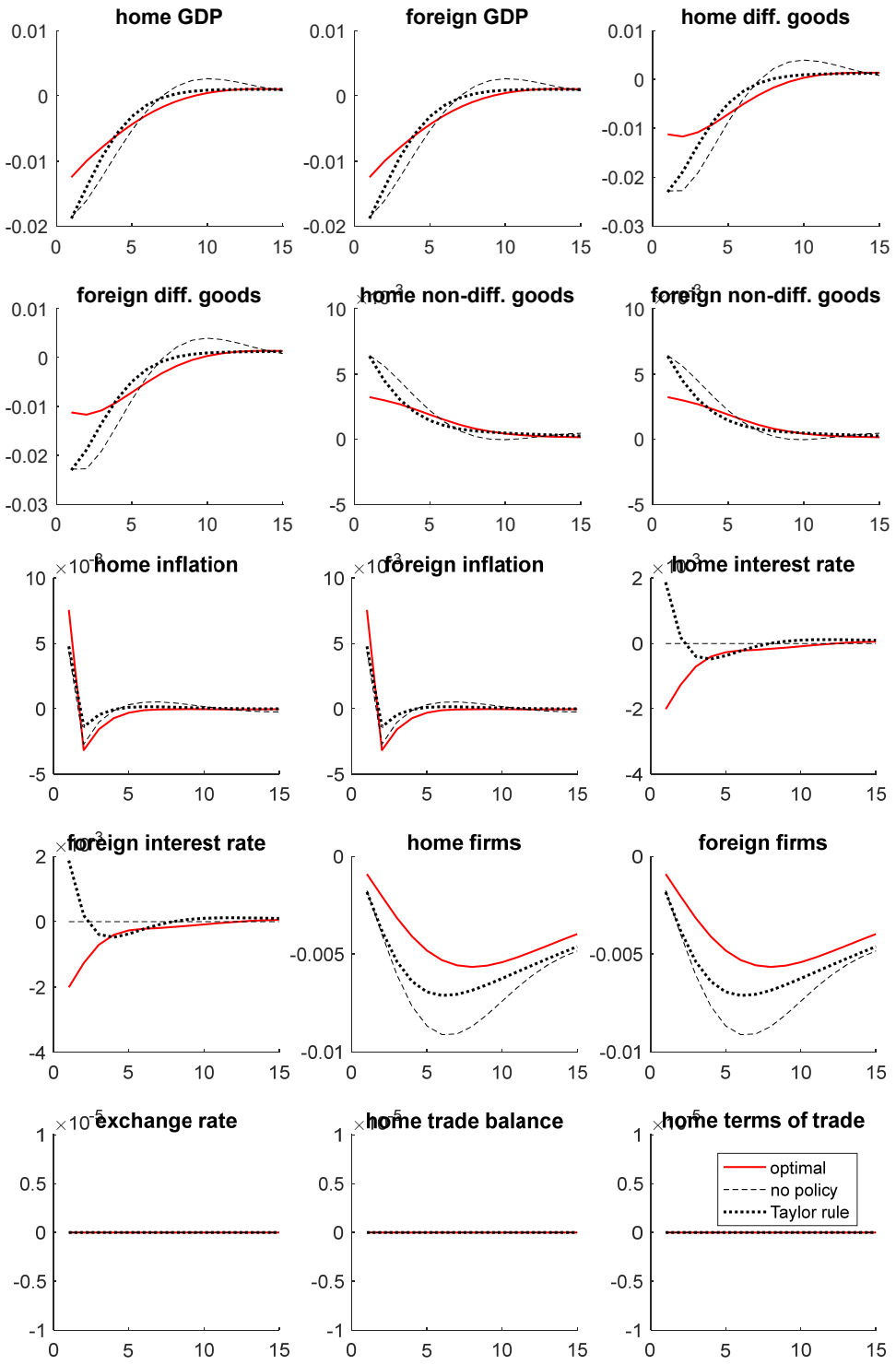


Figure 4. Impulse responses to a rise in tariff on differentiated goods in both countries



Vertical axis is percent deviation (0.01=1%) from steady state levels. Horizontal axis is time (in years).

Appendix

For
"What is the Optimal Monetary Policy Response to Trump Tariffs 2.0?"

by
Paul R. Bergin
and
Giancarlo Corsetti

1. Demand equations not listed in text

The composition of expenditure on adjustment costs, both for prices and bond holding, follows the same preferences as for consumption, and the associated demands mirror Eqs. (4)-(9). Adjustment costs for bond holding are as follows:

$$AC_{B,D,t} = \theta P_t AC_{B,t} / P_{D,t}$$

$$AC_{B,N,t} = (1-\theta) P_t AC_{B,t} / P_{N,t}$$

$$d_{AC,B,t}(h) = \left(p_t(h) / P_{D,t}\right)^{-\phi} AC_{B,D,t}$$

$$d_{AC,B,t}(f) = \left(p_t(f) T_{D,t} / P_{D,t}\right)^{-\phi} AC_{B,D,t}$$

$$AC_{B,H,t} = \nu \left(P_{H,t} / P_{N,t}\right)^{-\eta} AC_{B,N,t}$$

$$AC_{B,F,t} = (1-\nu)\left(P_{F,t} T_{N,t} / P_{N,t}\right)^{-\eta} AC_{B,N,t}.$$

The economy-wide demand for goods arising from price adjustment costs sums across the demand arising among *n* home firms: $AC_{P,t} = n_t AC_{P,t}(h)$. This is allocated as follows:

$$AC_{P,D,t} = \theta P_t AC_{P,t} / P_{D,t}$$

$$AC_{P,N,t} = (1-\theta) P_t AC_{P,t} / P_{N,t}$$

$$d_{AC,P,t}(h) = \left(p_t(h) / P_{D,t}\right)^{-\phi} AC_{P,D,t}$$

$$d_{AC,P,t}(f) = \left(p_t(f) T_{D,t} / P_{D,t}\right)^{-\phi} AC_{P,D,t}$$

$$AC_{P,H,t} = \nu \left(P_{H,t} / P_{N,t}\right)^{-\eta} AC_{P,N,t}$$

$$AC_{P,F,t} = (1-\nu)\left(P_{F,t} T_{N,t} / P_{N,t}\right)^{-\eta} AC_{P,N,t}.$$

The demand for differentiated goods for use as intermediates in production mirrors Eqs. (6)-(7), as follows:

$$d_{G,t}(h)=\left(p_t(h)/P_{D,t}\right)^{-\phi}G_t$$

$$d_{G,t}(f)=\left(p_t(f)T_{D,t}/P_{D,t}\right)^{-\phi}G_t.$$

The demand for differentiated goods for use in the sunk entry investment of new firms mirrors Eqs. (6)-(7), as follows:

$$d_{K,t}(h)=\left(p_t(h)/P_{D,t}\right)^{-\phi}ne_tK_t$$

$$d_{K,t}(f)=\left(p_t(f)T_{D,t}/P_{D,t}\right)^{-\phi}ne_tK_t.$$

2. Market clearing conditions not listed in the text

Market clearing for the non-differentiated goods market requires:

$$y_{H,t}=C_{H,t}+AC_{P,H,t}+AC_{B,H,t}+\left(1+\tau_N\right)\left(C^*_{H,t}+AC^*_{P,H,t}+AC^*_{B,H,t}\right)$$

$$y_{F,t}=\left(1+\tau^*_N\right)\left(C_{F,t}+AC_{P,F,t}+AC_{B,F,t}\right)+C^*_{F,t}+AC^*_{P,F,t}+AC^*_{B,F,t}.$$

The market clearing condition for the manufacturing goods market is given in Eq. (19) in the main text.

Labor market clearing requires:

$$\int_0^{n_t} l_t(h)dh+l_{H,t}=l_t.$$

Bond market clearing requires:

$$B_{Ht}+B^*_{Ht}=0$$

$$B_{Ft}+B^*_{Ft}=0.$$

Balance of payments requires:

$$\int_0^{n_t} p^*_t(h)\left(d^*_t(h)\right)dh-\int_0^{n^*_t} p_t(f)\left(d_t(f)\right)df+P^*_{Ht}\left(C^*_{H,t}+AC^*_{P,H,t}+AC^*_{B,H,t}\right)$$
$$-P_{F,t}\left(C_{F,t}+AC_{P,F,t}+AC_{B,F,t}\right)-i_{t-1}B^*_{H,t-1}+e_ti^*_{t-1}B_{F,t-1}=\left(B^*_{H,t}-B^*_{H,t-1}\right)+e_t\left(B_{F,t}-B_{F,t-1}\right).$$

3. Price-setting equations assuming stickiness in the local currency

Under the assumption that home firms set separate prices in the two markets, in units of domestic currency for sale in the domestic market, and in units of foreign currency for sale in the foreign market, the price setting equation (Eqn. 23) is replaced by the following:

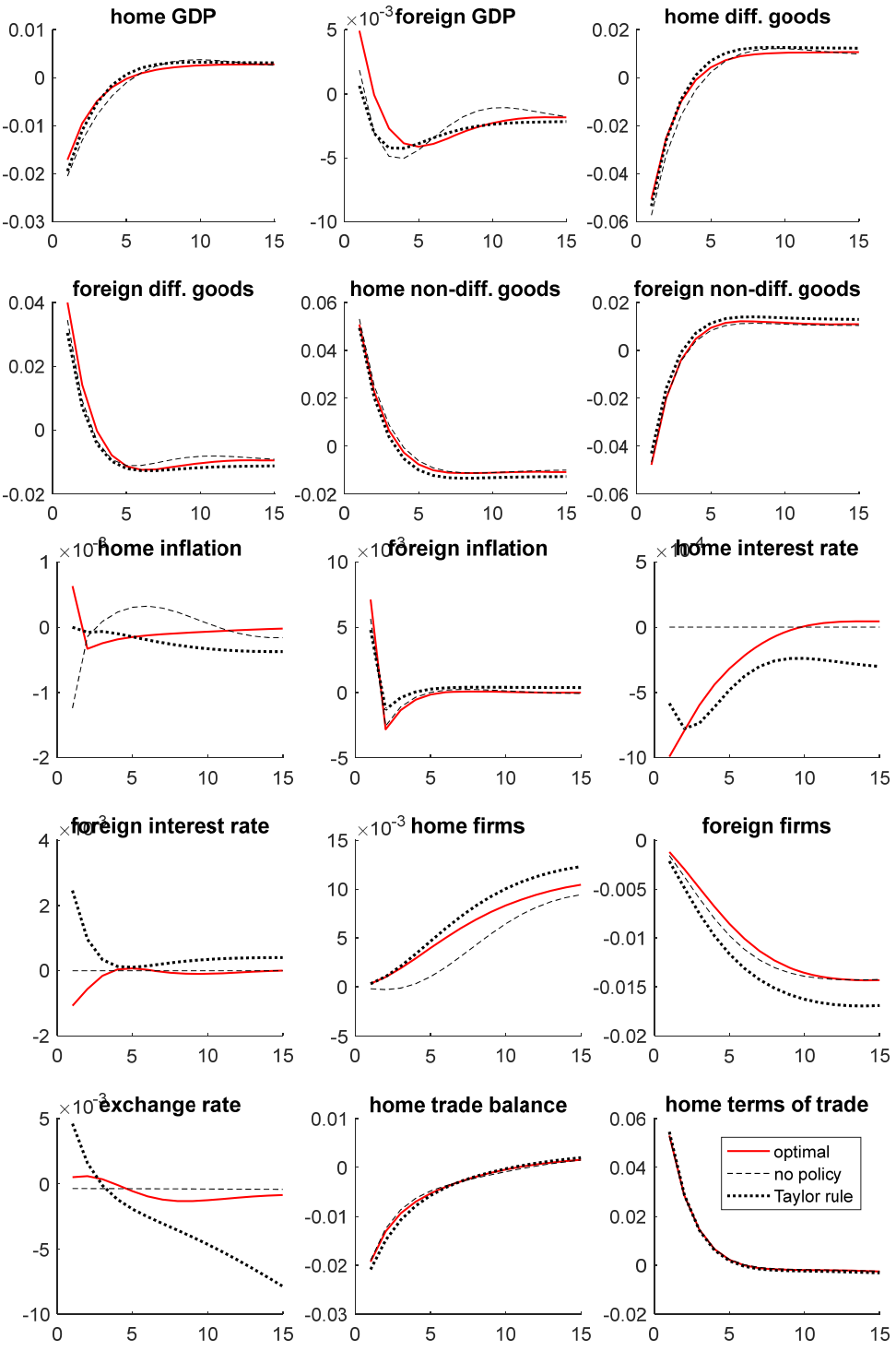
$$p_t(h) = \frac{\phi}{\phi-1} mc_t + \frac{\psi_P}{2}\left(\frac{p_t(h)}{p_{t-1}(h)} - 1\right)^2 p_t(h) - \psi_P \frac{1}{\phi-1}\left(\frac{p_t(h)}{p_{t-1}(h)} - 1\right)\frac{p_t(h)^2}{p_{t-1}(h)}$$
$$+ \frac{\beta\psi_P}{\phi-1} E_t\left[\frac{\mu_t}{\mu_{t+1}}\frac{\Omega_{H,t+1}}{\Omega_{H,t}}\left(\frac{p_{t+1}(h)}{p_t(h)} - 1\right)\frac{p_{t+1}(h)^{2-\phi}}{p_t(h)^{1-\phi}}\right] \quad \text{and}$$

$$p_t^*(h) = \frac{\phi}{\phi-1}\frac{mc_t(1+\tau_{Dt})}{e_t} + \frac{\psi_P(1+\tau_{Dt})}{2}\left(\frac{p_t^*(h)}{p_{t-1}^*(h)} - 1\right)^2 p_t^*(h) - \frac{1}{\phi-1}\psi_P(1+\tau_t)\left(\frac{p_t^*(h)}{p_{t-1}^*(h)} - 1\right)\frac{p_t^*(h)^2}{p_{t-1}^*(h)}$$
$$+ \beta\frac{\psi_P}{\phi-1} E_t\left[\frac{\mu_t}{\mu_{t+1}}\frac{\Omega_{H,t+1}^*}{\Omega_{H,t}^*}\left((1+\tau_{Dt+1})\left(\frac{p_{t+1}^*(h)}{p_t^*(h)} - 1\right)\frac{e_{t+1}}{e_t}\frac{p_{t+1}^*(h)^{2-\phi}}{p_t^*(h)^{1-\phi}}\right)\right]$$

where $\Omega_{H,s} = \left(\frac{p_s(h)}{P_{D,s}}\right)^{-\phi}\left(C_{D,s} + G_s + ne_s(1-\theta_K)K_s + AC_{P,D,s} + AC_{B,D,s}\right)\frac{1}{\mu_s}$, and

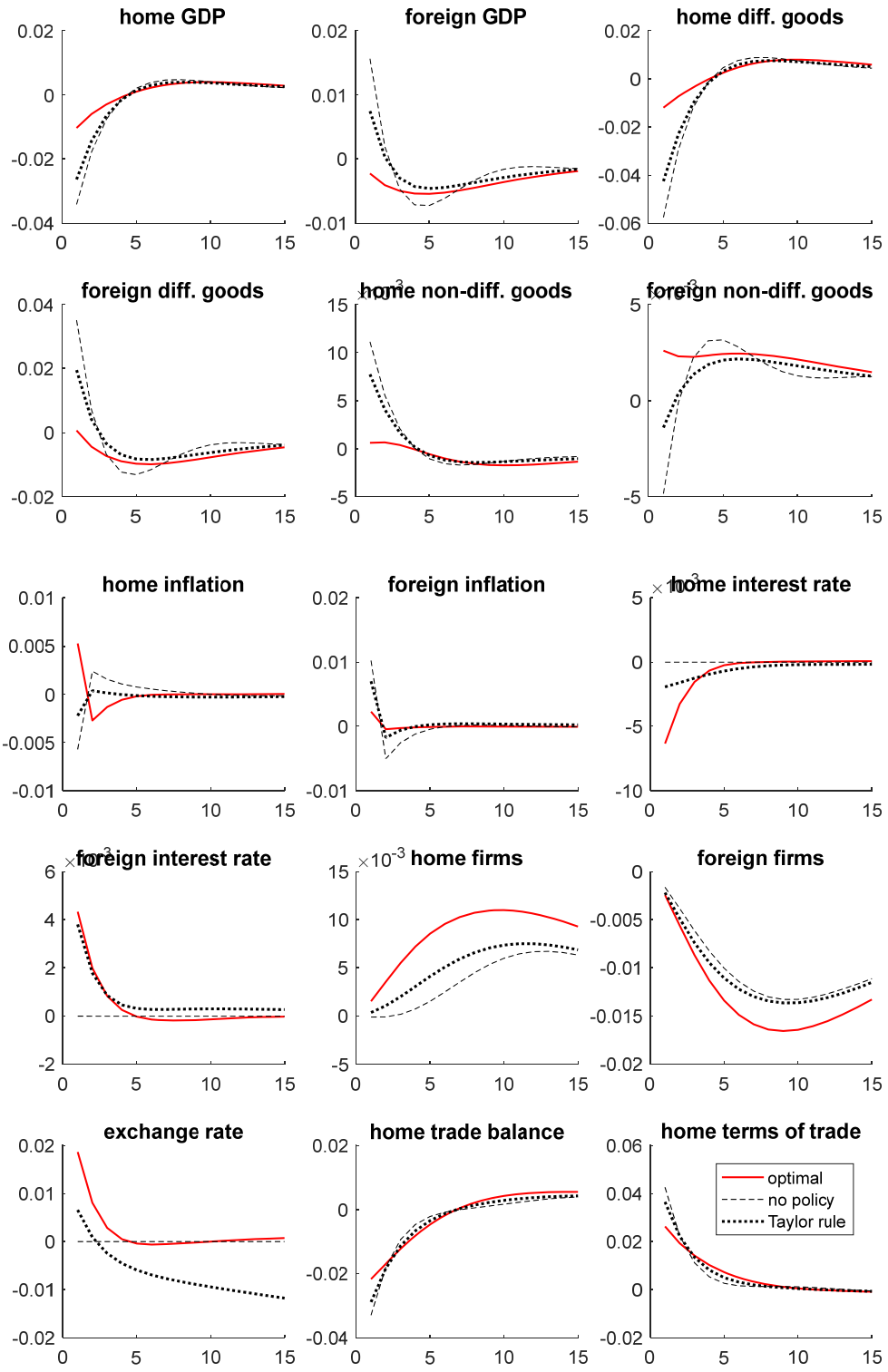
$$\Omega_{H,s}^* = \left(\frac{(1+\tau_D)p_s(h)}{e_s P^*_{D,s}}\right)^{-\phi}(1+\tau_D)\left(C^*_{D,s} + G_s^* + ne_s^*(1-\theta_K)K^*_s + AC^*_{P,D,s} + AC^*_{B,D,s}\right)\frac{1}{\mu_s}.$$

Appendix Figure 1. Impulse responses to a rise in foreign tariff on home differentiated exports, LCP in both countries

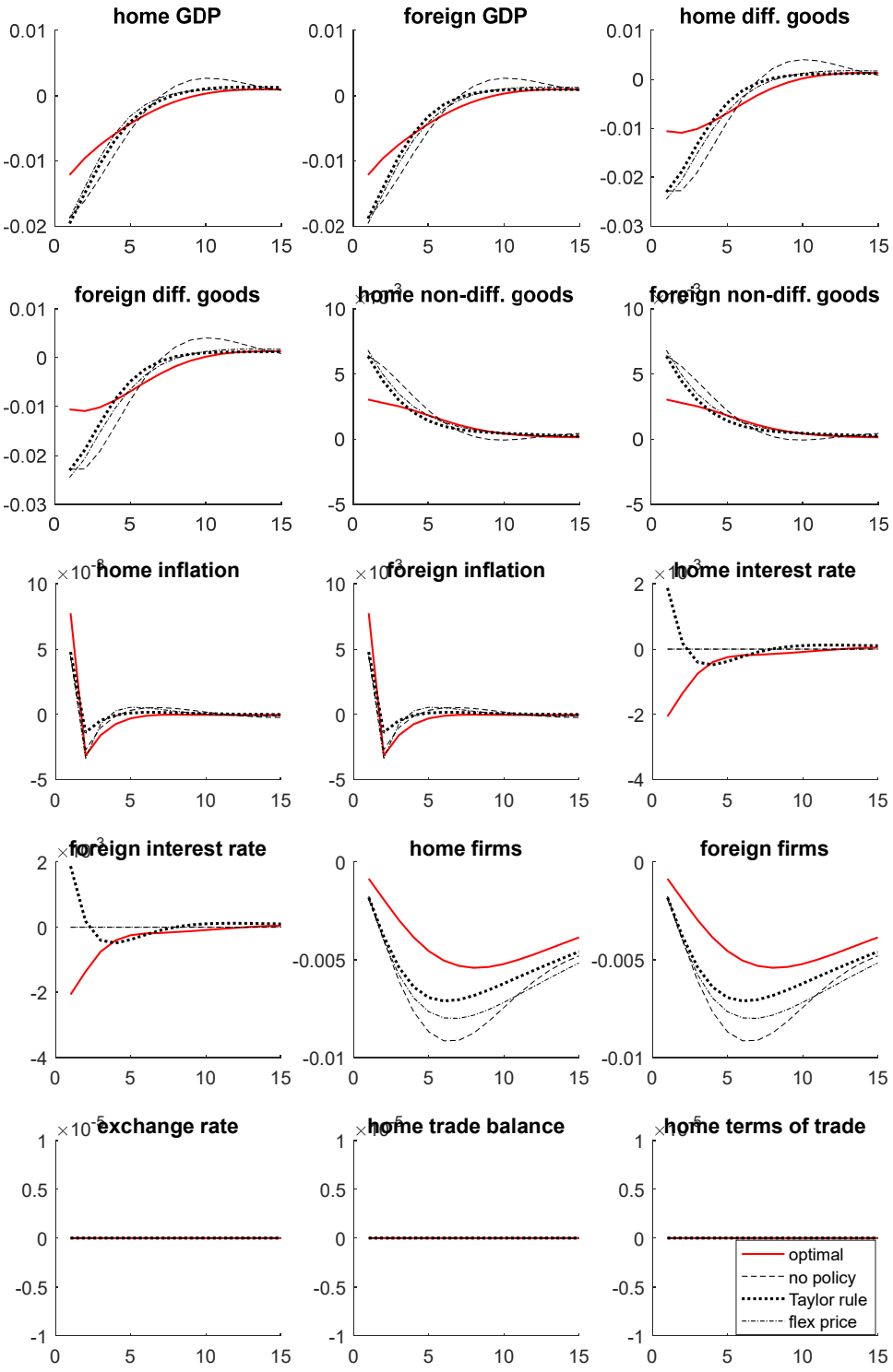


Vertical axis is percent deviation (0.01=1%) from steady state levels. Horizontal axis is time (in years).

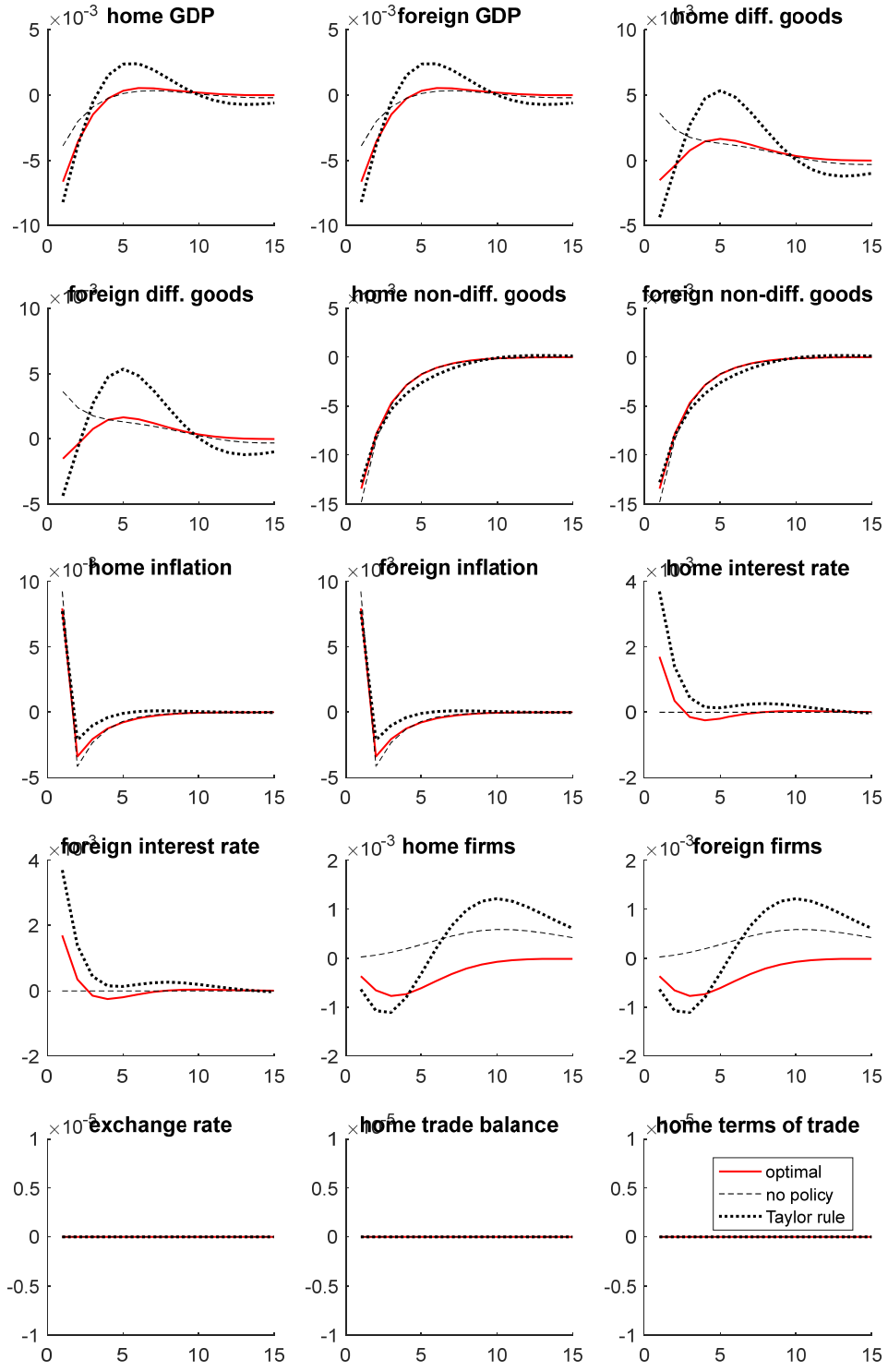
Appendix Figure 2. Impulse responses to a rise in foreign tariff on home differentiated exports, with a nontraded non-differentiated sector



Appendix Figure 3. Impulse responses to a rise in tariff on differentiated exports in both countries, Local Currency Pricing (LCP) for both countries



Appendix Figure 4. Impulse responses to a rise in tariff on non-differentiated exports in both countries



Vertical axis is percent deviation (0.01=1%) from steady state levels. Horizontal axis is time (in years).