The Tariff Tax Cut: Tariffs as Revenue*

George Alessandria† Jiaxiaomei Ding‡ Shafaat Yar Khan§ Carter Mix¶

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Abstract: We evaluate the aggregate effects of a change in tariffs on the US economy when that revenue is redirected to reduce other taxes and these reforms are partly anticipated. We consider permanent and temporary tariffs with and without retaliation. We consider the effects when revenue is used to reduce taxes on capital, labor, or investment. Key to our analysis is the dynamic effects on export participation and capital accumulation. When increasing tariff by 20 percentage points, the revenue raised is largest when tariffs are temporary, unilateral, and used to subsidize investment, increasing by about 2.5 percent. However, in this case economic activity falls the most with tariffs in place. When tariffs are permanent, global, and also subsidize investment, tariff revenue rises to more than 2 percent of GDP in the first year but gradually falls back to about 1.3 percent by year 10. All policies met with retaliation reduce US welfare. Declining tariff revenue requires adjusting fiscal rates. Anticipation of these changes can stimulate the economy in advance of the reforms.

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†george.alessandria@rochester.edu, University of Rochester and NBER

‡jding9@ur.rochester.edu, University of Rochester

§skhan78@syr.edu, Syracuse University

¶carter.b.mix@frb.gov, Federal Reserve Board

1 Introduction

Many countries rely on tariff revenue to support fiscal objectives. In the US this was the main source of revenue until the introduction of the income tax in 1913. The introduction of the income tax was accompanied with a cut in the import tariff from bout 40% to 25%. There have been recent proposals to use tariffs to raise revenue. Here, we study the effect of using tariff revenue for tax relief in a multi-country dynamic general equilibrium model. Central to our analysis is allowing for the gradual substitution away from imports owing to firm-level investments in market access. This implies that the revenue collected is initially high and then falls gradually.

We study a rich set of income and trade taxes in a variation of the international RBC model developed by Mix (2023). The model nests the standard international real business cycle (IRBC) model (Backus et al., 1994) and the heterogeneous firm model for trade policy analysis (Melitz, 2003; Alessandria and Choi, 2014; Alessandria et al., 2021). Since Mendoza and Tesar (1998), several papers have studied tax policy in the IRBC model but abstracted from trade policy or firm heterogeneity. Households make forward-looking decisions about consumption, investment, and labor supply, and heterogeneous firms, which pay sunk costs to begin producing or exporting, make forward-looking investments in entry and export status. Expectations of future changes in fiscal policy, and their effects on the aggregate economy, determine households' and firms' current behavior.

Our model features several margins that are key to the study of fiscal policy but absent in studies of trade policy. Specifically, the model is a representative agent model with a labor-leisure decision, capital accumulation, and international trade. The trade side captures both the composition of trade split between capital, materials, and consumer goods and allows for gradual adjustment owing to firm level investments in market access. To model these features we have a sector in each country of monopolistically competitive intermediate good producers that produce differentiated inputs. These intermediate inputs are produced using capital, materials, and labor. The intermediates are then used to produce final consumption goods, capital goods, and materials. We allow for shipping costs that depending on the use of the intermediates to capture the composition of trade, with trade concentrated in intermediates and capital goods. Moreover, intermediate goods producers face fixed and variable costs of exporting based on past investments and their history of shocks. Through our parameterization of these trade costs, our model can capture key elements of the dynamics of exporting—namely the high persistence of exporting and the exporter lifecycle (Ruhl and Willis, 2017; Alessandria et al., 2021).

Two features are central to our analysis: the dynamics of revenue and the changes in real exchange rate. Both are largely determined by the trade elasticity—the change in trade from a change in tariffs. The revenue that can be raised by tariffs depends on the path of substitution between imports and domestic goods (or across sources with and without tariffs) and the demand for final goods produced intensively with imported goods. There is much disagreement about the magnitude of substitution across horizons. Recent papers by Alessandria et al. (2025b) on US-China imports and trade policy over a long horizon, find trade

substitution of about 3 in the first year that rises to twelve over a longer horizon. More closely related is evidence from the recent US China trade war, Hoang and Mix (2023) and Alessandria et al. (2024) find a trade elasticity of about 3 on impact, which has almost doubled five years later.

In line with these trade dynamics, our model implies that tariffs raise more revenue initially than in the long run as domestic households substitute away from imported goods. The speed of this adjustment is affected by the expected persistence of the tariff and foreign retaliation. When tariffs are perceived as permanent, revenue falls more quickly, as exporting firms in the tariffed country exit the market, causing prices to rise and trade to adjust quickly. By contrast, when tariffs are perceived as temporary, these same firms are more hesitant to leave the market, keeping prices lower and slowing the trade adjustment. Thus, tariff revenue falls more slowly.

The aggregate effects of widespread tariffs depend on persistence and on where the additional tariff revenue is allocated. The standard assumption in the trade literature is that tariffs are rebated lump sum to households. We consider additional cases where tariff revenue is used to (1) reduce labor income taxes, (2) reduce capital income taxes, or (3) subsidize investment in the capital stock. Each of these strategies yield different responses in trade and macroeconomic variables. Trade responds less, for example, when tariff revenue is used to subsidize investment, as the subsidies partially offset the additional cost to imported investment goods coming from the tariffs. As such, tariff revenue is persistently higher when revenues are used to subsidize investment than when revenues are used elsewhere. Using revenues to reduce taxes or subsidize investment also dampen the negative effects of the tariffs on economic activity relative to a lump sum rebate, as the distortionary effects of the tariffs are partially offset by a reduction in distortionary taxes elsewhere. The balance of negative effects of the tariffs and positive effects of reducing other taxes depends highly on the elasticity of substitution between domestic and foreign goods. For a lower elasticity, tariffs that increase the cost of foreign goods have stronger negative effects on the economy. In our calibration, tariffs met with foreign retaliation always reduce welfare.

In addition to the persistence of the tariff and the destination of tariff revenue, we also consider the aggregate effects when tariffs are applied unilaterally rather than globally. When the US raises tariffs without retaliation, the real exchange rate appreciates dampening the cut in imports and increasing the revenue available to cut taxes. In our calibration, it also makes the US wealthier, boosting consumption in the long run in all cases except when the tariff is rebated lump sum.

Our paper relates to several papers that study the tariffs revenue generated by tariffs. Lashkaripour (2021) studies these effects in a multi-sector static trade model with endogenous labor. Goulder et al. (1983) provide an early analysis of the importance of incorporating international interactions in the evaluation of domestic tax policy.

In section 2 we describe some salient features of tariffs, tariff revenue, and trade over a long-horizon for the US and more narrowly in the past ten years. In section 3 we describe the model and its calibration, including fiscal policies. In section 4 we study the impact of permanent changes in tariffs with and without

retaliation. In Section 5 we study the impact of temporary tariffs. In section 6 we consider a range of sensitivity related to country asymmetries and alternative models. Section 7 concludes.

2 Evidence

To get some sense of how tariffs determine tariff revenue and trade, we begin with a high level overview of the dynamics of tariffs, tariff revenue, and trade since 1929 in the United States.[1] In Figure 1a we plot the fall in the tariff rate, measured as customs duties as a share of imports of goods. This tariff series understates the changes in tariffs as it puts less weight on goods with high tariffs. It also ignores the effect of non-tariff barriers such as quotas, voluntary export restraints, or other quantitative restrictions.[2] Tariffs rose with the Smoot-Hawley tariffs in 1931 from about 13 percent to 19 percent of imports and then drifted down to 6 percent at the end of the war. Aside from a modest increase in the tariff rate in the mid 1950s, largely owing to the conversion of several quantitative restrictions into tariffs, tariff rates continued to fall from further GATT rounds and free trade agreements and were close to 1.5% of imports through 2017. After the onset of the tariff increases in 2018, the tariff rate rose to 3.1 percent in 2021 but has now fallen back to 2.5 percent through 2024. The recent reduction in tariff revenue reflects a shift away from high tariff Chinese imports.

With the high tariffs in the late 1920s and early 1930s, tariff revenue accounted for a high share of federal revenue. But the share fell sharply with the large rise in federal revenue in the 1930s through World War 2. By 1954, tariff revenue fell to just one percent of federal revenue. From 1954 to 1989 the growth in imports outpaced the decline in tariffs and tariff revenue tripled to about three percent of federal revenue before stabilizing at about 2 percent in the early 2000s. With the tariff increases of the first Trump administration, tariffs rose to as much as 3.7 percent of revenue but have fallen back to 2.7 percent through the end of 2024.

The high share of tariff revenue in the federal budget in the 1920s and 1930s reflects high tariffs and low taxation. In Figure 1b we plot tariff and federal revenue as a share of GDP and find that tariff revenue was about 0.45 percent of GDP in the 1930s when federal revenue was only three to five percent of GDP. Historically, tariff revenue has remained less than 0.5 percent of GDP.

The increase in tariffs in the early 1930s coincided with a drop in the trade share of GDP (measured in real terms as the ratio of the average of exports and imports to GDP) from about 4 percent 3 percent. Since the end of world war 2 trade has grown steadily along with the decline in tariffs reaching about 14 percent of GDP.

The amount of revenue raised by a tariff depends on the substitution away from high tariff sources and the horizon of that substitution. As we have seen tariff revenue actually rose even as the tariff rate fell through the mid 1980s. Likewise, the increase in tariffs in 2018 raised revenue temporarily, but revenue fell as households and firms substituted away from tariffed Chinese products. There are short-run increases in revenue in 1971q4 when President Nixon institutes an import surcharge that is lifted in four months.

[1] For a more concrete discussion of US tariffs see Irwin (1998).
[2] For instance, the US had an import embargo on China from 1951 to 1971 and then very high tariffs until 1980.

To isolate this substitution, we study the dynamics of tariffs, trade, and tariff revenue from 2015 to the 2024 with a particular emphasis on China. Specifically, we collect monthly disaggregate trade flows at the 10-digit Harmonized-System Level by source country from the Census. Figure 1c plots the path of the trade-weighted tariff for all US imports and separately for China and the rest of the world (ROW). We also plot the median tariff for China and the ROW. The median tariff on imports from China rises from about 3 percent to 25 percent, while the trade weighted tariff from China rises to about 12 percent. The median and trade-weighted tariffs from the ROW are fairly stable. The higher tariffs on China increased the aggregate trade-weighted tariff, but it has drifted back somewhat.

The increase in tariffs on Chinese goods has gradually reduced imports from China. In Figure 1d we plot the share of imports and tariff revenue from China (both the raw series and a 12-month moving average to remove some seasonality). Prior to the increase in tariffs, Chinese imports were about 21 percent of US imports. That has fallen to about 12.5 percent at the end of 2024. Owing to relatively high tariffs on Chinese imports, the share of total U.S. tariff revenue that comes from Chinese imports exceeds the import share. It was about 40 percent prior to the imposition of tariffs. It rose to almost 70 percent and has now drifted down to about 60 percent as agents have substituted away from China.

These figures make clear that the substitution following the increase in tariffs is taking time. To look more carefully at the dynamics of this substitution we undertake a product-level analysis of trade flows around two large changes in tariffs on US imports from China. Specifically we use an event-study design to estimate the responses of imports from China to the changes in tariffs in 1980—when China was granted normal trade relations (NTR) status—and since 2017:

$$v_{jgt} = \sum_{t'=1974}^{2008} \beta_t^{NTR} 1\{t = t'\} 1\{j = \text{China}\} X_g + \delta_{jt} + \delta_{jg} + \delta_{gt} + u_{jgt}. \tag{1}$$

$$v_{jgt} = \sum_{t'=2015}^{2024} \beta_t^{TW} 1\{t = t'\} 1\{j = \text{China}\} X_g + \delta_{jt} + \delta_{jg} + \delta_{gt} + u_{jgt}. \tag{2}$$

The dependent variable is the log import value of good g from country j in year t. Our coefficients of interest, β_t, measure the elasticity of imports from China with respect to a change in tariffs, relative to the other countries with NTR status or no change in tariffs, and relative to a specific base year. We focus on two windows for China around the large tariff changes, from 1974 to 2008 and 2015 to 2024. We use the change in tariffs that takes place in 1980 and between 2017 and 2020 as our independent variable X_g. We include country-year fixed effects (δ_{jt}) to capture aggregate shocks to exporting countries, country-good fixed effects (δ_{jg}) to capture the average level of exports and time-invariant bilateral trade barriers, and good-year fixed effects (δ_{gt}) to capture good-level US demand shocks and good-specific trade barriers common to all exporters.[3] The elasticities are normalized to zero in the year before each reform. Our earlier sample uses goods aggregated to the SITC 5-digit while the later sample uses goods aggregated to the HS 6-digit level.

[3]This fixed-effects structure has been used frequently in the literature on China's NTR access, including by **?** and **?**.

Figure 2 plots the estimated trade elasticities over both time frames, each normalized to zero in the year before the relevant reform. The elasticity dynamics in the two episodes are similar. In both cases, five years following the tariff change the trade elasticity was about 4.5. With the 1980 reform, we see that the NNTR-gap elasticity rose to almost 11 in 2001, when China joined the WTO, suggesting there is much more room for substitution to the tariff changes in 2018.[4]

3 Model

We study trade and fiscal policy in an extension of the multi-country general equilibrium model of Mix (2023). This model builds on the international real business cycle model of Backus et al. (1994) and Alessandria and Choi (2007) to include firm and exporter dynamics, a roundabout production structure, a realistic composition of trade flows across good types, and multiple countries. These features are needed to most accurately capture the aggregate effects of changes in tariffs (Atkeson and Burstein, 2010; Alessandria and Choi, 2014). In Alessandria and Mix (2021) we use the model to study the effects of tariff phaseouts in the three GATT rounds. With no trade the model has the main features used in tax policy analysis (House and Shapiro, 2006).

In the model, the global economy is assumed to have $\mathcal{I}$ regions, indexed by i and j. In what follows, we describe the behavior agents in each region in detail. We start with the households problem and then move to the intermediate goods producers and then move to the final goods producers.

3.1 Households

Each region i contains a representative household with time endowment $\bar{L}_i$ that chooses how much of that time to spend working L_i. The household also chooses quantities to consume C_i and to invest in either physical capital K_i (with investments in physical capital denoted by X_i) or a risk-free internationally traded bond B_i, which is denominated in the consumption good of country 1. The household's budget constraint is

$$\begin{aligned} P_{Ci}C_i + P_{Xi}X_i + \frac{P_{C1}B_i{}'}{R^B} \leq\ & (1-\tau_i^L)W_iL_i + (1-\tau_i^K)(R_iK_i + \Pi_i) \\ & + \tau_i^K\delta P_{Xi}K_i - \tau_i^K(R^B_{-1}-1)P_{C1}B_i + P_{C1}B_i - P_{C1}\frac{\phi}{2}(\frac{B_i}{Y_i^N} - \frac{\bar{B}_i}{\bar{Y}_i^N})^2 + T_i \end{aligned} \tag{3}$$

and capital evolves according to

$$K_i' = (1-\delta)K_i + X_i\left[1 - \frac{\psi}{2}\left(\frac{X_i}{X_{i,-1}} - 1\right)^2\right], \tag{4}$$

[4] In Alessandria et al. (2025b) we argue that the dynamics of substitution are influenced by changes in expectations of the permanence of the reform. In Alessandria et al. (2025a) we show that reduced form estimates of the trade response to a change in tariffs are biased downwards by the stochastic nature of trade policy.

where the "prime" indicator on K_i and B_i denote quantities taken into the subsequent period; a subscript of -1 denotes the value of a variable in the previous period; P_{Ci} and P_{Xi} denote the region i prices of consumption and physical capital investment; R_B is the gross return on the risk-free bond; W_i is the nominal wage; R_i is the rental rate of physical capital; Π_i denotes profits earned by firms in the economy and rebated to households; T_i is a lump sum transfer to households from the government; τ_i^K is the tax on capital income including returns to bonds and profits; and τ_i^L denotes the labor income tax. In this framework, δ is the depreciation rate of physical capital; and ϕ and ψ determine the convex costs of adjustment in risk-free bond holdings and physical capital investment, respectively. The adjustment cost on risk-free bonds is included for computational reasons, and the cost is evaluated based on the value of bonds relative to nominal GDP Y_i^N relative to the same ratio in the initial equilibrium, denoted by $\bar{B}_i/\bar{Y}_i^N$.

Each period, the household in region i chooses consumption, leisure, and investment in capital and bonds to maximize its expected discounted lifetime utility subject to 3 and 4. The recursive representation of the household's problem is expressed recursively as

$$V^H(K_i, B_i, S) = \max_{C_i, L_i, X_i, B_i'} \frac{\left[C_i^{\mu}(\bar{L}_i - L_i)^{1-\mu}\right]^{1-\sigma} - 1}{1-\sigma} + \beta V^H(K_i', B_i', S')$$

subject to 3 and 4, where S is the aggregate state variable, which includes prices; β is the discount rate; $1/\sigma$ is the intertemporal elasticity of substitution; and μ determines the relative marginal utilities of consumption and labor in equilibrium.

3.2 Intermediate Goods Producers

In each region i, there is a continuum of mass N_i of monopolistically competitive firms that produce differentiated goods using labor and capital rented from domestic households and material inputs purchased from domestic final goods producers (discussed in the next section). Firms in region i must pay a sunk cost $f_{e,i}$ denominated in labor to begin producing and survive each period with probability n_s. Firms with a region i all share the same producitivity. Conditional on survival, firms may produce for the domestic market at zero cost, but exports to foreign markets are subject to both fixed and variable costs, both of which are heterogeneous across firms and depend on both the firm's export history and stochastic shocks. In particular, non-exporters pay higher fixed costs on average than exporters, leading to a delayed response of the extensive margin of trade to changes in trade costs. Furthermore, new exporters pay higher variable costs than experienced exporters on average. These features of the model parsimoniously capture features of the exporter life cycle from the data: that exporting exhibits strong hysteresis, and that exports grow with export tenure. More generally, these features imply a slower response of trade to changes in trade costs, in line with the trade literature that finds that the trade elasticity increases over time.

Export decisions and export costs across destinations j are determined independently. Each period, a firm in region i with export status $e_{ij} \in \{0, 1\}$ in destination j draws a fixed cost κ_{ij} that must be paid (in

labor terms) for the firm to export to j in the subsequent period. The fixed cost is drawn from a Generalized Pareto distribution

$$F_{i,e_{ij}}(\kappa) = 1 - \left(1 + \frac{\upsilon\kappa}{f_{e_{ij}}}\right)^{-\frac{1}{\upsilon}}.$$

With $\upsilon < 1$, the expected fixed cost draw of a firm with export status e_{ij} is $f_{e_{ij}}/(1-\upsilon)$. When matching moments related to exporter entry in calibration, we get $f_0 > f_1$, which implies that non-exporters ($e_{ij} = 0$) draw higher fixed costs on average than exporters ($e_{ij} = 1$).

Variable costs of exporting to destination j also depend on both export history and stochastic shocks. Exports from i to j of intermediates that will be used in the production of a final good G are subject to either a low iceberg cost ξ_{GLij} or a high iceberg cost ξ_{GHij}. All new exporters (defined as firms that export in the current period but not the previous period) face the high iceberg cost. Conditional on continued export participation, firms have a constant probability $1-\rho$ of switching to the other cost state. As such, new exporters export less than incumbent exporters on average.

As noted above, the iceberg costs on exports depend on the end-use of the export, whether it's used by final goods producers to produce consumption goods $G = C$, investment goods $G = X$, or material goods $G = M$. Heterogeneity in iceberg costs across good types allows the model to capture the relatively high intensity of trade in capital and material goods. Our calibration will map this composition into lower iceberg costs for capital and material goods and higher iceberg costs for consumption goods.

Because export decisions are made independently and we assume that production is constant returns to scale, we can consider the maximization problem of an intermediate goods producer for each destination separately. Let l_{ij}, k_{ij}, and m_{ij} be the inputs of labor, capital, and materials that a firm uses in the production of goods sold to country j, and let p_{Gij} be the price the firm charges for its good, conditional on the buyer's end use of the good G. Let $\xi_{ij} \in \{\infty, H, L\}$ denote the current cost-state of the firm: $\xi_{ij} = \infty$ denotes a non-exporter facing infinite iceberg costs, $\xi_{ij} = H$ denotes an exporter facing a high iceberg cost, and $\xi_{ij} = L$ denotes an exporter facing a low iceberg cost. As discussed previously, the draw of the fixed cost κ_{ij} depends on the firm's current export status e_{ij} where $e_{ij} = 0$ corresponds to non-exporters with cost-state $\xi_{ij} = \infty$, and $e_{ij} = 1$ correponds to exporters with cost-state $\xi_{ij} \in \{H, L\}$. The recursive maximization problem of this firm in aggregate state S is

$$\begin{aligned} V_{ij}(\xi_{ij}, \kappa_{ij}; F_{i,e_{ij}}, S) = \max_{e'_{ij}, p_{Gij}, l_{ij}, k_{ij}, m_{ij}} & e_j \left[\sum_G p_{Gj} G_{ij}(f) - W_i l_{ij} - R_i k_{ij} - P_{Mi} m_{ij}\right] \\ & - W_i e'_{ij} \kappa_{ij} + n_s \mathbb{E} D_i V_{ij}(\xi'_{ij}, \kappa'_{ij}; F_{i,e'_{ij}}, S') \end{aligned}$$

subject to the demand functions that arise from CES aggregation of intermediates by final goods producers,

which will be discussed in detail in later, and the production function

$$\sum_G \xi_{G\xi_{ij}ij} G_{ij}(f) = z_i (k_{ij}^{\alpha} l_{ij}^{1-\alpha})^{1-\alpha_m} m_{ij}^{\alpha_m},$$

where

$$D_i = \beta \frac{U'_{C_i}}{U_{C_i}} \frac{P_{Ci}}{P'_{Ci}}$$

is the subjective discount factor, $G_{ij}(f)$ is the firm's exports of goods used for end-use G, P_{Mi} is the price of materials, z_i is the common total factor productivity among all firms in region i, α is capital's share of value added in production, and α_m is the material share in total production.

The intermediate goods producer's problem can be broken into a static problem—choosing inputs and prices—and a dynamic problem—choosing tomorrow's export status. The static problem's solution is straightforward and common in the literature, as final goods producers' technology is CES. In particular, optimal prices are the familiar constant markup over marginal costs

$$p_{Gj} = \frac{\theta}{\theta - 1} \xi_{G\xi_j ij} MC_i = \frac{\theta}{\theta - 1} \xi_{G\xi_j ij} \frac{1}{z_i} \left(\frac{P_{Mi}}{\alpha_m} \right)^{\alpha_m} \left[\frac{\left(\frac{R_i}{\alpha}\right)^{\alpha} \left(\frac{W_i}{1-\alpha}\right)^{1-\alpha}}{1 - \alpha_m} \right]^{1-\alpha_m}. \tag{5}$$

The parameter θ that determines the size of the markup is the elasticity of substitution across varieties from the same source, which enters the intermediate goods producer's problem through the demand functions described later.

3.2.1 Dynamic exporting decision

A firm that decides to export in the next period not only receives revenue from foreign sales, but also a higher probability of lower fixed and variable costs going forward. Thus, part of the fixed cost paid to export is an investment in further market access. For ease of exposition, let $V_\xi(\kappa) = V_{ij}(\xi_{ij}, \kappa_{ij}; F_{i,e_{ij}}, S)$ for destination j for a firm in cost-state ξ with fixed cost κ. The dynamic problems for firms of each type can be written as

$$\begin{aligned}
V_\infty(\kappa) &= \max\{-W\kappa + n_s \mathbb{E} D V_H(\kappa'), n_s \mathbb{E} D V_\infty(\kappa')\}, \\
V_H(\kappa) &= \max\{-W\kappa + n_s \mathbb{E} D[(1-\rho) V_L(\kappa') + \rho V_H(\kappa')], n_s \mathbb{E} D V_\infty(\kappa')\}, \\
\text{and } V_L(\kappa) &= \max\{-W\kappa + n_s \mathbb{E} D[(1-\rho) V_H(\kappa') + \rho V_L(\kappa')], n_s \mathbb{E} D V_\infty(\kappa')\}.
\end{aligned}$$

The decision to export for a firm in cost-state ξ reduces to an evaluation of the fixed cost κ relative to a threshold κ^*_ξ, defined for each cost-state as

$$W\kappa^*_\infty = n_s \mathbb{E}D[V_H(\kappa') - V_\infty(\kappa')], \tag{6}$$

$$W\kappa^*_H = n_s \mathbb{E}D[(1-\rho)(V_L(\kappa') - V_\infty(\kappa')) + \rho(V_H(\kappa') - V_\infty(\kappa')], \tag{7}$$

$$\text{and } W\kappa^*_L = n_s \mathbb{E}D[(1-\rho)(V_H(\kappa') - V_\infty(\kappa')) + \rho(V_L(\kappa') - V_\infty(\kappa')]. \tag{8}$$

To solve for the expectation terms on the right-hand side of equations 6–8, we take the expected difference between the value of exporters of each type and the value of non-exporters. To be specific, let $\pi^*(\xi)$ be the expected profits of a firm with export cost state ξ where $\pi^*(\infty) = 0$. Let $dV_\xi \equiv \mathbb{E}(V_\xi(\kappa) - V_\infty(\kappa))$. Using the threshold values above, we can write these terms dV_ξ, which show up in the threshold fixed cost equations, as

$$\begin{aligned} dV_H = \pi^*(H) - W\left[\int_0^{\kappa^*_H} \kappa dF_1(\kappa) - \int_0^{\kappa^*_0} dF_0(\kappa)\right] \\ + n_s \mathbb{E}D\left[[\rho F_1(\kappa^*_H) - F_0(\kappa^*_\infty)]\, dV'_H + (1-\rho)F_1(\kappa^*_H) dV'_L\right] \\ dV_L = \pi^*(L) - W\left[\int_0^{\kappa^*_L} \kappa dF_1(\kappa) - \int_0^{\kappa^*_\infty} dF_0(\kappa)\right] \\ + n_s \mathbb{E}D\left[[(1-\rho)F_1(\kappa^*_L) - F_0(\kappa^*_0)]\, dV'_H + \rho F_1(\kappa^*_L) dV'_L\right]. \end{aligned}$$

Conditional on being in the same cost state, firms make identical decisions over inputs, prices, and future export status. This model outcome greatly simplifies the state space of the problem. Instead of tracking each firm over time, we need only keep track of the number of firms in each cost-state for each destination, which can be easily derived given the fixed cost thresholds.

3.2.2 Free entry

Intermediate goods producers exogenously exit the market with probability $1 - n_s$. Each period, there is an unbounded mass of potential firms that may begin producing in the subsequent period by paying fixed cost $f_{e,i}$, denominated in labor. In the first year of production, firms only serve the domestic market and begin drawing export fixed costs for all destinations. Potential firms enter until the cost of entry $W_i f_{e,i}$ equates to their expected lifetime profits:

$$W_i f_e = n_s \mathbb{E}D_i \left[V'_{dom,i} + \sum_{j \neq i} V'_{\infty,ij}\right],$$

where

$$V_{dom,i} = \pi_{ii} + n_s \mathbb{E}D'_i V'_{dom,i},$$

and π_{ii} is the optimal static profits from operating in the domestic region.

3.3 Final Goods Producers

Final consumption goods, C_i, investment goods, X_i and material inputs, M_i, are produced using intermediate goods produced domestically and abroad. Final goods producers in each sector $G \in \{C, X, M\}$ choose the optimal mix of inputs to maximize static profits subject to prices P_{Gi}. The production technology for final good G is a nested CES:

$$G_i = \left[\sum_{j \in \mathcal{I}} \left[\int_{f \in \Omega_{ji}} G_{ji}(f)^{\frac{\theta-1}{\theta}} \right]^{\frac{\theta}{\theta-1}\frac{\gamma-1}{\gamma}} \right]^{\frac{\gamma}{\gamma-1}}$$

where Ω_{ji} is the set of firms in source region j that export to region i, θ is the elasticity of substitution across varieties of a common source region, and $\gamma < \theta$ is the elasticity of substitution across varieties from different source regions.

The firm chooses inputs to maximize

$$\pi_{Gi} = \max P_{Gi} G_i - \sum_{j \in \mathcal{I}} \tau_{ji} \int_{f \in \Omega_{ji}} P_{Gji}(f) G_{ji}(f) df$$

subject to the production technology described above, with P_{Gi} being the Dixit-Stiglitz price index:

$$P_{Gi} = \left[\sum_{j \in \mathcal{I}} (\tau_{ji} P_{Gji})^{1-\gamma} \right]^{\frac{1}{1-\gamma}} \qquad \text{where} \qquad P_{Gji}^{1-\theta} = \int_{f \in \Omega_{ji}} P_{Gji}(f)^{1-\theta} df.$$

Tariffs τ_{ji} are source-destination specific but do not differ by good-type.

3.4 Government Budget Constraint and Fiscal Policy

The government collects tax revenue on imports. Tariff revenue TR_i is measured as

$$TR_i = \sum_{G \in \{C,X,M\}} \sum_{j \neq i \in \mathcal{I}} \tau_{ji} \int_{f \in \Omega_{ji}} P_{Gji}(f) G_{ji}(f) df$$

We assume that the government balances it budget each period, so the lump sum transfer is equal the sum over all sources of government revenue

$$T_i = \tau_i^L W_i L_i + \tau_i^K (R_i K_i - \delta P_i^K + \Pi_i + (R^B - 1) * P_{Ci} B_i) + TR_i$$

While it may seem extreme that the government balances its budget with lump-sum taxes we can abstract from this fiscal issue. Instead, we can focus on how tax revenue from tariffs can be used to offset other taxes.

3.5 Aggregation and Market Clearing

Because (i) inputs are freely adjustable, (ii) fixed cost draws are independently and identically distributed and depend only on a firm's previous export status, and (iii) destination-specific export decisions are independent, we can aggregate across individual firm decisions in each market to express the model using only aggregate variables. By doing so, we avoid the need to track distributions over time. Instead, we need to track only the number of firms in each market of each type.

Let $N_{i,t}$ represent the number of firms in country i at time t. Given the survival rate and the mass of entrants $N_{ei,t}$ in each period, the law of motion for the number of intermediate producers in the country is $N_{i,t} = n_s(N_{i,t-1} + N_{ei,t-1})$. Now, using the exporter fixed cost distributions F_{ei}, threshold fixed costs $\kappa^*_{\xi ij}$, and the probability of switching iceberg cost states ρ, we can define the law of motion for the number of high-iceberg cost exporters from country i exporting to country j:

$$\begin{aligned} N_{Hij,t} = n_s\rho N_{Hij,t-1}F_{1i}(\kappa^*_{Hij,t-1}) + n_s(1-\rho)N_{Lij,t-1}F_{1i}(\kappa^*_{Lij,t-1}) \\ + n_s(N_{i,t} - N_{Hij,t-1} - N_{Lij,t-1})F_{0i}(\kappa^*_{0ij,t-1}). \end{aligned}$$

The first term on the right-hand side represents the number of high-cost exporters from the previous period that survived, drew a sufficiently low fixed cost to continue exporting in the current period, and did not change their cost state. The second term is the number of *low-cost* exporters from the previous period that survived, drew a sufficiently low fixed cost, and did change their cost state. The final term is the number of nonexporters to j from the previous period that survived and drew a sufficiently low fixed cost to begin exporting at time t. The law of motion for low-cost exporters is similar but excludes the final term as we assume all new exporters begin in the high-cost state:

$$N_{Lij,t} = n_s\rho N_{Lij,t-1}F_{1i}(\kappa^*_{Lij,t-1}) + n_s(1-\rho)N_{Hij,t-1}F_{1i}(\kappa^*_{Hij,t-1}).$$

Conditional on cost-state ξ, firms choose the same quantities of labor $l_{\xi ij,t}$, capital $k_{\xi ij,t}$ and materials $m_{\xi ij,t}$ as inputs for production in any given period. Thus, the aggregate quantity of, say, capital demanded by firms for production, $K^p_{i,t}$, can be defined as

$$K^p_{i,t} = N_{i,t}k_{ii} + \sum_{i \neq j} N_{Hij,t}k_{Hij,t} + N_{Lij,t}k_{Lij,t},$$

where k_{ii} is the quantity of capital demanded by each firm for production in the domestic market. Definitions for production labor $L^p_{i,t}$ and materials $M^p_{i,t}$ are similar. In equilibrium, capital demanded for production must not exceed the current capital stock of households $K^p_{i,t} \leq K_{i,t}$. Similarly, materials demanded for production must not exceed the quantity of materials produced by final goods firms $M^p_{i,t} \leq M_{i,t}$.

The labor market has a similar restriction, except that labor demanded by firms includes both production

labor L_t^p and labor to use for payment of exporting and entry fixed costs. Labor demanded for fixed costs in region i can be expressed as

$$L_{i,t}^{fc} = \left[N_{ei} f_{ei} + \sum_{j \in J} N_{Hij} \int_0^{\kappa_{Hij}^*} \kappa dF_{1ij}(\kappa) + N_{Lij} \int_0^{\kappa_{Lij}^*} \kappa dF_{1ij}(\kappa) \right.$$
$$\left. + (N_i - N_{Hij} - N_{Lij}) \int_0^{\kappa_{0ij}^*} \kappa dF_{0ij}(\kappa) \right].$$

In equilibrium, we have the restriction that labor used in production or payment of fixed costs must not exceed the labor supplied by households in country i, $L_{i,t}^p + L_{i,t}^{fc} \leq L_{i,t}$.

Just as we have aggregated quantities, we can also aggregate prices across firms. Again, conditional on cost state, firms charge the same prices in foreign markets. Using the Dixit-Stiglitz price index, the aggregated price of the bundle of end-use goods being sold by country i to country j can be expressed as

$$P_{Gij} = \frac{\theta}{\theta - 1} MC_i \chi_{Gij}^{\frac{1}{1-\theta}}$$

where $\chi_{Gij} = \xi_{GHij}^{1-\theta} N_{Hij} + \xi_{GLij}^{1-\theta} N_{Lij}$. Finally, bonds are in zero net supply, $\sum_i B_i = 0$.

3.6 Initial Calibration

To explore the basic predictions of the model and set ideas, we start with two symmetric countries. Later, we extend our calibration to include asymmetries. We also can add other countries to evaluate alternative tariff schemes, but focus on a broad set of tariffs given the interest in using the tariff revenue for tax relief.

Our calibration strategy is a simplification of Mix (2023), and many parameters are kept the same. We set $I = 2$, and normalize the labor endowment $\bar{L}$ and productivity z in each country to 1. A period is one quarter. We set the discount factor $\beta = 0.99$, the depreciation rate $\delta = 0.025$, and the intertemporal elasticity of substitution $\sigma = 1$, all common values in the literature.

The materials share in intermediate goods production, α_m, is chosen to deliver a gross-output-to-value-added ratio of 2. The survival rate of intermediate goods producers is set to n_s =0.995 to match the labor share of exiting firms in the data.

We take the elasticities of substitution between varieties of the same ($\theta = 6$) and different ($\gamma = 3.7$) countries, with the latter chosen to match a short-run annual trade elasticity of 2.7. Together, γ and θ (along with calibrated exporter behavior, discussed below) imply a long-run elasticity of just over 6. We also use the same shape parameter $v = 0.65$ for the generalized Pareto distribution.

We calibrate the model to be consistent with aspects of the US economy from 2019-2024. We set initial tariffs to 4 percent.

The parameters that remain to be calibrated include source-destination-good type-cost state-specific iceberg costs ξ_{GTij}, source-specific scale parameters for the generalized Pareto distribution f_{ei}, the source-

specific probability of an exporter staying in the same cost state ρ_i, the relative preferences for consumption and labor μ, and the capital share of value added in intermediate production α. With our two-region symmetric model (so that the parameters are the same for each region), this list includes 11 parameters, 6 of which are iceberg costs. As in Mix (2023), we simplify the iceberg cost structure and impose the assumption that low-cost-state iceberg costs are proportional to high-cost-state iceberg costs $\xi_{GLij} = \zeta\xi_{GHij}$ with $\zeta < 1$. With this simplification, we reduce the parameters related to iceberg costs to 4 and the total parameters to be assigned to 9. We choose the parameters to jointly match the following moments in steady state:

1. Imports-to-GDP ratio = 0.14
2. Capital goods share of imports = 0.2
3. Material goods share of imports = 0.6
4. New exporter share of total exports = 0.05
5. Export share of exporters with five or less years of tenure = 0.4
6. Export participation rate = 0.2
7. Share of exporters that are new = 0.15
8. Frisch elasticity = 2
9. Labor share of value added = 0.66
10. Government spending = 20 percent of GDP
11. Marginal labor tax = 27.2 percent
12. Marginal capital tax rate = 14.7 percent

These moments are largely rough approximations from the data. The import share of 14 percent, for example, roughly matches the US import share in recent years. The split of imports between capital, material, and consumption goods is consistent with average bilateral flows data (Mix, 2023). Moments related to the importance of new exporters are approximations of average export churning statistics taken from the World Bank Exporter Dynamics Database, as described by Mix (2023) and Steinberg (2023).

While these parameters are calibrated jointly to match all moments, some parameters are more influenced by one or more moments. To summarize, the average level of iceberg costs is pinned down by the import share (1) while the good-specific differences are pinned down by the share of imports in capital and material goods (2 and 3). The ratio of low to high iceberg costs and the probability of shifting to the alternative cost state are pinned down by the export share of new exporters (4) and the speed with which new exporters grow, which is represented in the export share of exporters with five or less years of tenure (5). The average scale parameter is pinned down by the export participation rate (6), while their ratio is pinned down by the relative ease with which incumbent exporters continue to export, as illustrated in the share of exporters that are new (7). Finally, the relative preference for consumption μ is pinned down by the Frisch elasticity (8) and α is pinned down by the capital share of value added (9). Table 1 reports all assigned parameters. In

line with recent history, we set the share of real government purchase in GDP to 0.2. The initial income tax rates are assumed to be $\tau^L = 0.272$ and $\tau^K = 0.183$. These correspond to the effective marginal tax rates on wage and capital income estimate by the Congressional Budget Office (US Congress, CBO 2025) in 20205.

We assume the economy begins in an initial steady state in 2023Q4. At the start of the 2024Q1, we introduce an uncertain future change in policy to be implemented in 2025Q1. Specifically, we assume that tariffs will rise by 20 percent with a 50 percent probability. We then explore how alternative uses of the revenue are used to offset different taxes. Our model is solved with a shooting algorithm.

3.7 Fiscal Policies

We consider four uses of the tax revenue from trade taxes. We allow for tariff revenue, TR_t to either be rebated lump sum, used for a labor subsidy, capital subsidy, or investment subsidy. In each case, we finance the subsidy with the tariff revenue. The government runs a balanced budget.

Labor subsidy: After tax labor income is: $(1-\tau^L)(1+s_t^L)W_tL_t$ and then set the subsidy to equal

$$s_t^L = \frac{TR_t}{(1-\tau^L)W_tL_t}$$

Capital subsidy: After tax capital income is $(1+s_t^K)(1-\tau_t^K)(R_tK_t - \delta P_I K_t)$ and then we set the subsidy to

$$s_t^K = \frac{TR_t}{(1-\tau^K)(R_tK_t - \delta P_I K_t)}$$

Investment subsidy: Expenditure on investment equals $(1-s_t^I)R_tP_t^K K_t$ yielding a subsidy of:

$$s_t^I = \frac{TR_t}{p_I I_t}$$

3.8 Anticipation

We start the economy in steady state in 2023Q4. In 2023Q4 agents expect there is a 50 percent chance of a change in trade policy with an import tariff of 20 percent that is permanent and global. Prior to the imposition of the tariffs we assume that agents expect tariff revenue to be rebated lump sum. With the imposition of tariffs, we assume agents understand how the tariff revenue will be used to offset other taxes. We only report the results of the path where tariffs are realized.

Figure 3 plots the first eight quarters of an expected global permanent tariff of 20 percent. The first three quarters have the same path owing to our assumption that agents expect tariff revenue to be rebated lump sum. Focusing on these first three quarters, the expected future tariff leads to a boost in economic activity as investment expands in anticipation of the expected rise in capital goods prices. This actually leads trade to rise in advance of the tariff (as demonstrated by the decline in the domestic expenditure share).

Consumption falls slightly and labor rises owing to a negative wealth effect. There is a modest positive effect on employment, but a larger effect on GDP. The stronger effect on GDP is attributed to firms reallocating resources from investments in export participation and firm creation to production.

When the tariff is implemented and the nature of the tax reform is understood, the transitions diverge dramatically. There is a sharp increase in the domestic expenditure share and acceleration in the reduction in export participation. All policies lead to a sharp drop in GDP and consumption even as employment rises owing to the input costs as well as the increased investment in firm creation.

4 Permanent

We start by considering a permanent increase in tariffs and fiscal policy. We start by describing the effects of the permanent global trade war and then move to the unilateral increase in tariffs. Agents have perfect foresight about the permanence of the tariffs, retaliation, and the use of tariff revenue for fiscal relief once the tariffs are implemented.

4.1 Permanent Trade War

Figure 4 shows the aggregate response of several macroeconomic variables to a 20% increase in bilateral tariffs with one quarter of anticipation before the tariffs are applied. All variables are shown as the log point difference from steady state. We also include the response of fiscal and trade variables, including the subsidy rate and tariff revenue as a fraction of GDP.

The effects of tariffs on trade, exporting, firm creation and tariff revenue are quite similar across all fiscal responses. The tariffs immediately shift expenditures towards domestic goods and then through the exit of exporters and increase in firm creation there is a second round of gradual substitution that ultimately increases domestic expenditures by a little over five percentage points.

In all cases, tariff revenue jumps sharply with implementation of the tariffs to at least 2 percent of GDP. Very quickly thereafter, however, tariff revenue as a fraction of GDP falls, despite a deepening contraction in GDP. This decline in revenue reflects the substitution of domestic firms and households away from the more expensive imported goods. The long run response of tariff revenue as a fraction of GDP is between 1 and 1.5 percent, with a larger long-run response when revenue is used to subsidize investment or reduce capital taxes. The stronger tariff revenue response when subsidizing the return on capital or price of investment arises because of a weaker import substitution. A subsidy on investment or capital goods directly offset the increase in the price of imported investment goods. Since trade is capital-intensive, the subsidies induce a smaller effect on trade given the changing composition of final demand.

A lump sum rebate lowers employment and GDP by the most. By reducing taxes or subsidizing labor, revenue can be used to reduce distortions in the economy elsewhere or encourage additional investment. Thus, GDP, consumption, investment, and labor, all fall less when tariffs are rebated to reduce taxes or

subsidize investment. That said, the various tax reductions and subsidies all have unique aspects of their affects on the economy.

Reducing capital taxes or subsidizing investment both have strong positive effects on GDP *after* the tariff is implemented before GDP falls again. This effect comes from the relatively high values of tariff revenue in the short run relative to the long-run. In the long run, new firms help to boost domestic capacity, so that we see the overshooting that is common in these models with dynamics trade adjustment and firm entry. A strong burst in investment with the subsidies on capital or investment crowd out consumption, so that consumption dips sharply. But, long-run consumption is highest with investment or capital subsidies, as the larger capital stock strengthens the economy.

Reducing labor taxes has a similar effect on labor, which jumps almost 5% with the implementation of the tariffs. Again, the effect of the tax reduction is largest on impact when tariff revenue is at it's highest. That said, labor still remains higher in the long run than for any other revenue destination. Subsidizing labor also reduces the cost of firm entry, so that reducing labor taxes yields the highest growth in the number of firms in the economy. Higher labor and a greater number of firms contribute to a stronger GDP response than in the lump sum rebate economy.

4.2 US Tariffs and No Retaliation

Figure 5 shows the aggregate response of several macroeconomic variables to a 20% increase in US import tariffs with one year of anticipation before the tariffs are applied. All variables are shown as the log point difference from steady state. We now include the trade balance and real exchange rate.

With a unilateral change in tariffs there is a larger increase in tariff revenue as the real exchange rate appreciates by about half the change in the tariff, leading to a smaller drop in imports. Compared to the global trade war, there is a smaller increase in employment but a larger increase in GDP. With the investment subsidy, GDP grows by almost 4 percent in the long-run.

The dynamics of the trade balance depend on the fiscal instrument used. In all cases, there is a large trade deficit of almost 2 percent of GDP in advance of the possible future tariffs. When the tariff is implemented this swings to surplus. With lump-sum or labor subsidies this is reversed more sharply with the implementation of the policy, while with capital or investment subsidies, the investment boom keeps the trade balance closer to balance a few more years.

In all cases, tariff revenue jumps sharply with implementation of the tariffs to almost 2.5 percent of GDP. It falls back a bit over time, but not nearly as much as in the permanent case. As before US tariff tax revenue to reduce taxes on capital and investment yield larger and more persistent revenue increases.

Figure 6 depicts the changes in the ROW from the unilateral tariffs under each fiscal scenario. With the implementation of the tariffs, the ROW GDP and Consumption fall while employment rises slightly. These effects are similar across fiscal scenarios.

5 Temporary

We now discuss the same aggregate responses when the tariff is temporary. We assume that tariffs are applied for four years and that all agents know the path of tariffs with perfect foresight. As before we consider global and unilateral changes in tariffs. The temporary nature of these tariff yields much larger swings in economic activity, particulalry in the US.

5.1 Trade War

We now move to discuss the same aggregate responses when the tariff is temporary. We assume for the sake of this exercise that tariffs are applied for four years and that all agents know the path of tariffs with perfect foresight. Results for this exercise are formatted similarly to the permanent global trade war and are found in Figure7.

The response of tariff revenue as a fraction of GDP on impact is very similar to the permanent trade war. Indeed, the short-run tariff elasticity in this model is simply γ, so that we would expect similar responses in both models. Over time, however, we see that tariff revenue holds up better when the tariffs are expected to be temporary. This finding relates to the trade adjustment, which happens more slowly than in the permanent trade war. The reason for this slow adjustment as that exporters, recognizes that tariffs are temporary, are reluctant to give up their export fixed cost advantage by leaving the market when they expect tariffs to be repealed soon. As such, more exporters stay in the market, which keeps the price of imported goods for the trading partner from rising too quickly.

While the temporary tariffs yield a more gradual response in tariff revenue trade, they yield much sharper movements in other aggregate variables. If revenue is not used to subsidize investment, then investment falls very sharply for the duration of the tariffs. Because trade is intensive in capital goods, the price of investment goods is more affected by tariffs. Because agents expect that the tariffs will be reversed soon and that the price of investment will reverse in turn, they optimize intertemporally by delaying capital investment. The one exception is when tariffs are used to subsidize investment. Then, the revenue offsets the increase in the price of investment and induces agents to increase investment sharply for the duration of the tariffs.

For many variables, including GDP, consumption, investment, and trade, the only revenue use that seems to be substantially different from the lump sum rebate is subsidies for investment. An exception to this is labor, where reduction in labor taxes boost labor sharply for the duration of the tariffs. Most of this labor seems to be used in the entry of new firms, which peaks at 2.5% above the steady state level, much higher than the peak for the lump-sum rebate.

5.2 US Tariffs with No Retaliation

We now consider a temporary unilateral tariff. Results are found in Figure 9. The unilateral temporary case leads to large swings in economic activity. Similar to the permanent unilateral case there is a large

appreciation and large swings in the trade balance. As before the US runs a larger trade deficit in advance of the temporary tariffs, but there is a sharp reversal with the tariffs as consumption falls off strongly. The swings in the trade balance are strongly influenced by the temporary nature of the reform. There are very large reversals in all cases by the investment subsidy.

6 Sensitivity

Here we study the importance of several assumption. We find that introducing initial trade deficits through asset positions have minor effects on our results. Likewise changing country sizes through differences in productivity, labor, or capital intensity yield similar results. There are much larger differences if we use standard trade models without trade dynamics.

6.1 Asset Asymmetries

We now adjust the model to allow for an asymmetry in net foreign asset to capture the persistent US trade deficit. Specifically, we assume the US has positive net foreign assets ($B > 0$) to generate a trade deficit of 3 percent annually. Figures 10 and 11 plots the impact of the unilateral permanent increase in tariff on the US and ROW. Qualitatively the results are quite similar to the case with balanced trade. The main difference is that now the average trade deficit is 3 percent prior to the possibility of the war. However, the swings in the trade balance in percentage terms are similar to the case with trade initally balanced.

6.2 Size differences

In addition to asymetries from different in initial assets, we now explore how differences in country sizes influence our findings. Specifically, we consider differences in country size from differences in productivity, employment or capital-output rations from differences in capital taxes. The results are plotted in Figures

6.3 Armington/Krugman Model

We now show that trade dynamics matter for our quantification. Specifically, we eliminate the margins that make trade participation dynamic. This yields a variation of Armington and Krugman model. Aside from adjusting the trade costs to maintain the same level and composition of trade, we do not change any other parameters. Importantly, and not surprisingly, the effects depend on our assumption of the trade elasticity. We focus on a case with the same short-run elasticity in our model, which yields much larger tariff revenue for the whole horizon and thus allows for much larger and more persistent investment subsidies.

7 Final Thoughts

We study the dynamic effect of using tariff revenue to offset other taxes in a dynamic heterogeneous firm model calibrated to the US economy and the rest of the world. Our model contains a realistic pattern of trade split between capital, intermediates, and consumption goods. It also contains firm-level trade frictions that lead to trade dynamics at the firm and aggregate level Owing to these dynamics of trade, the revenue raised is initially high and then falls, necessitating changes in the tax structure or government borrowing. Further work should consider how to smooth these swings in revenue through government borrowing.

The aggregate effects of increasing tariffs depend on the persistence of the policy, foreign retaliation, and the use of tax revenue. When the policies are temporary, these policies are recessionary. When there is no foreign retaliation, there are long-run benefits to the policy, particularly if the revenue is used to subsidized investment.

We have abstracted from several key international asymmetries related to net foreign asset positions and capital intensity that are likely to influence our quantitative results but are easily incorporated into our analysis. Preliminary work suggests these margins have small effects on our analysis.

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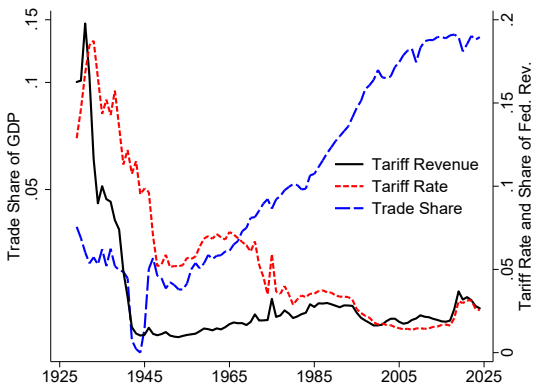
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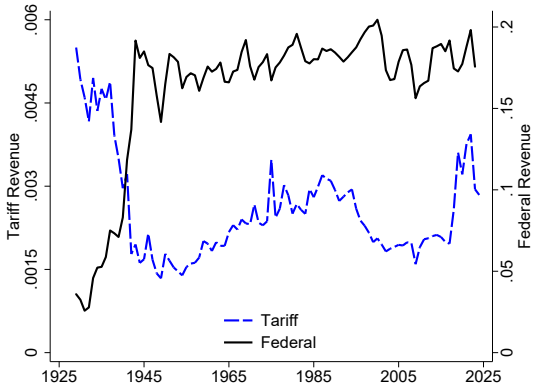
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Figure 1: Caption

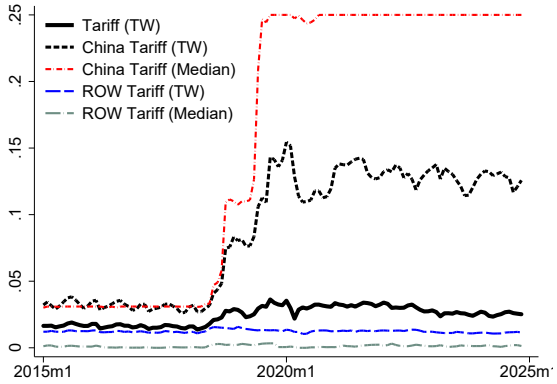
(a) US Tariffs, Trade, and Revenue



(b) Tariff and Federal Revenue



(c) Tariff and Federal Revenue



(d) Tariff and Federal Revenue

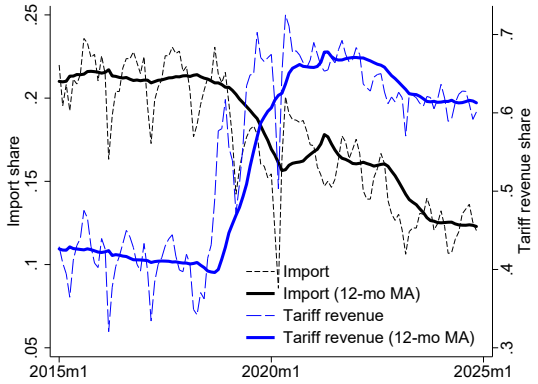
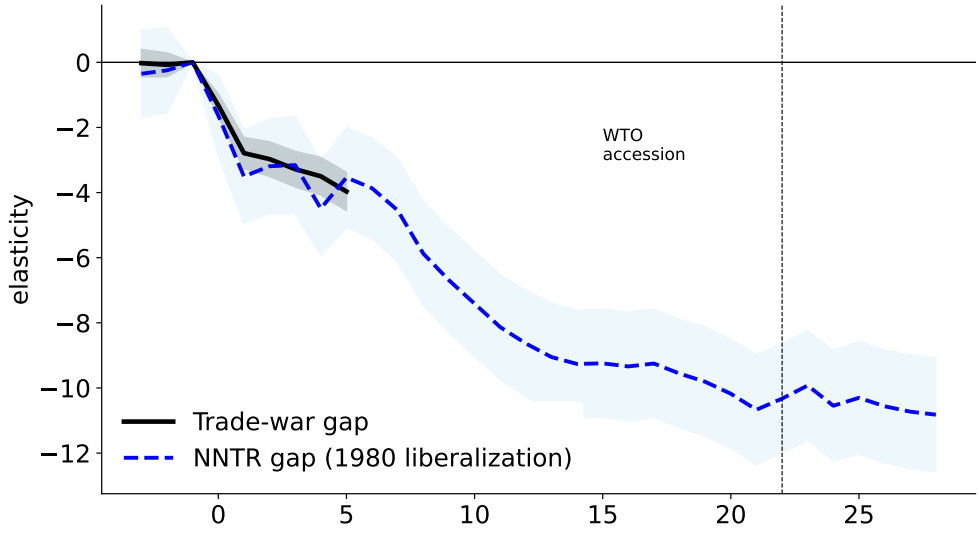


Figure 2: Elasticity to Trade war and 1980 NTR grant



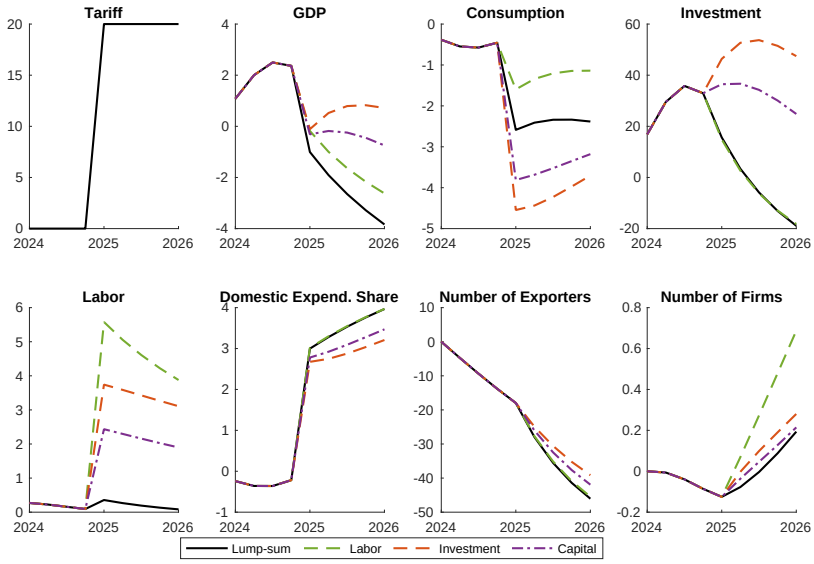


Figure 3: Anticipatory effects to Global Permanent Tariffs of 20%

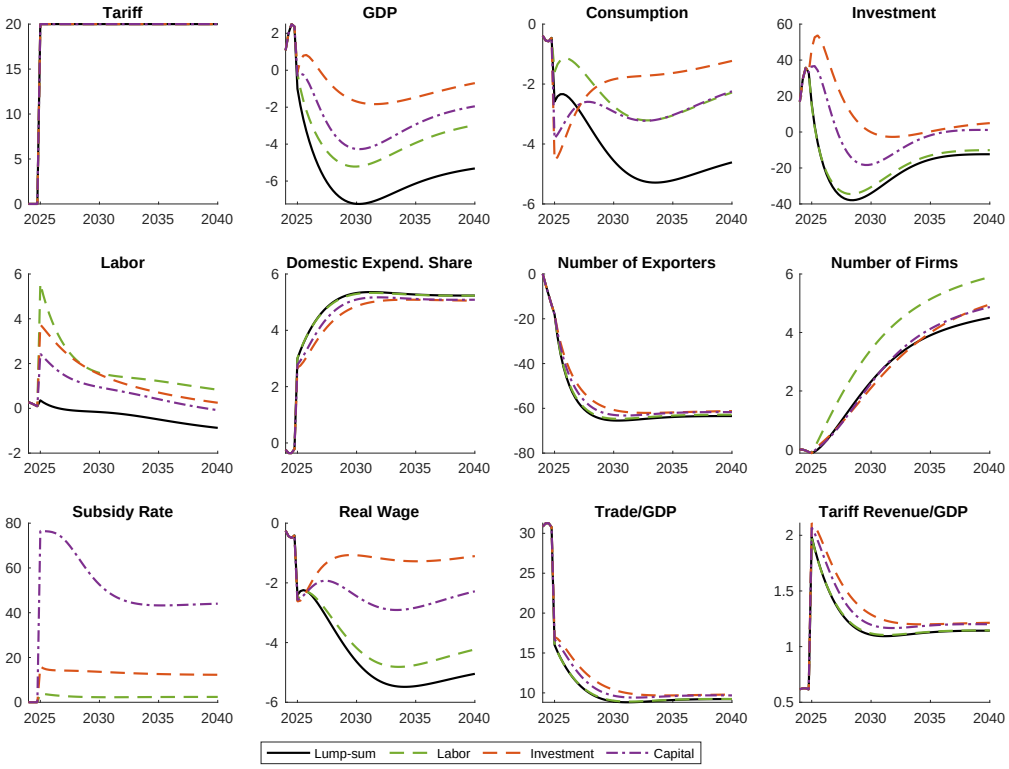


Figure 4: 20% Global Permanent Tariffs with Different Revenue Uses

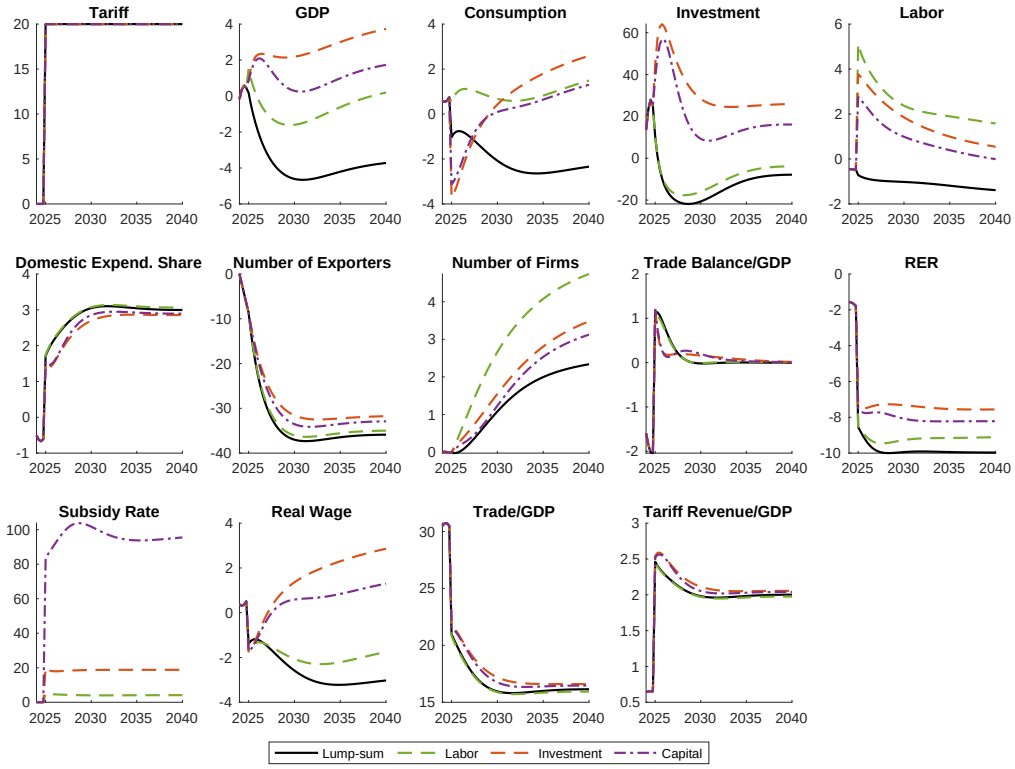


Figure 5: 20% Unilateral Permanent Tariffs with Different Revenue Uses (US)

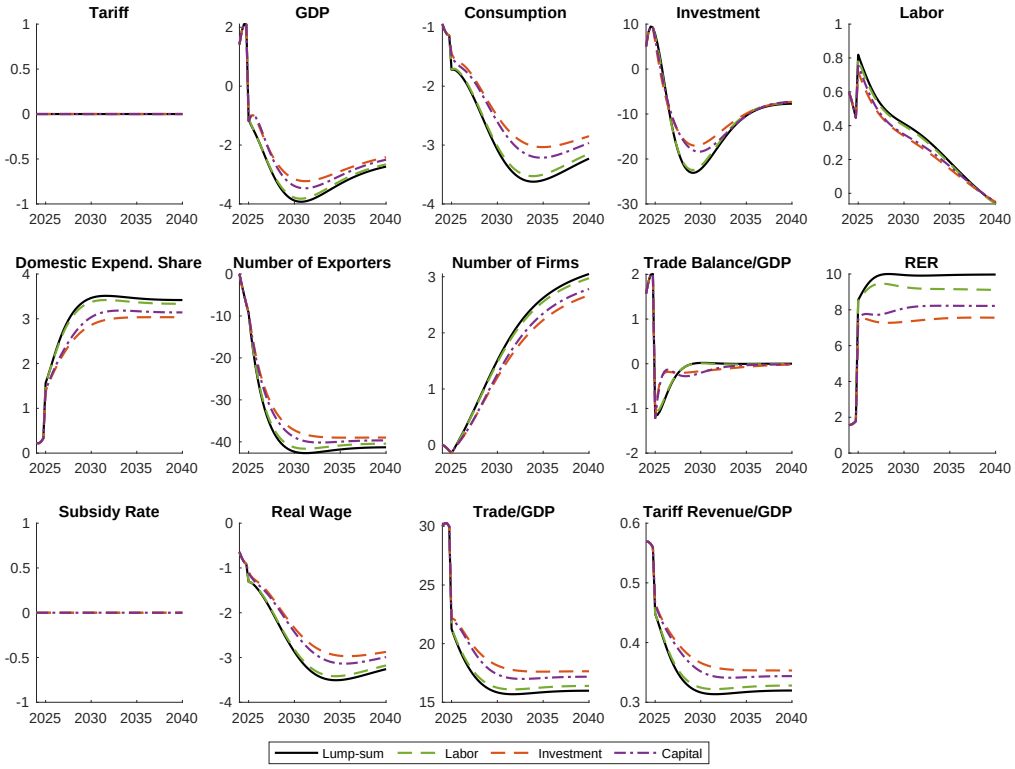


Figure 6: 20% Unilateral Permanent Tariffs with Different Revenue Uses (ROW)

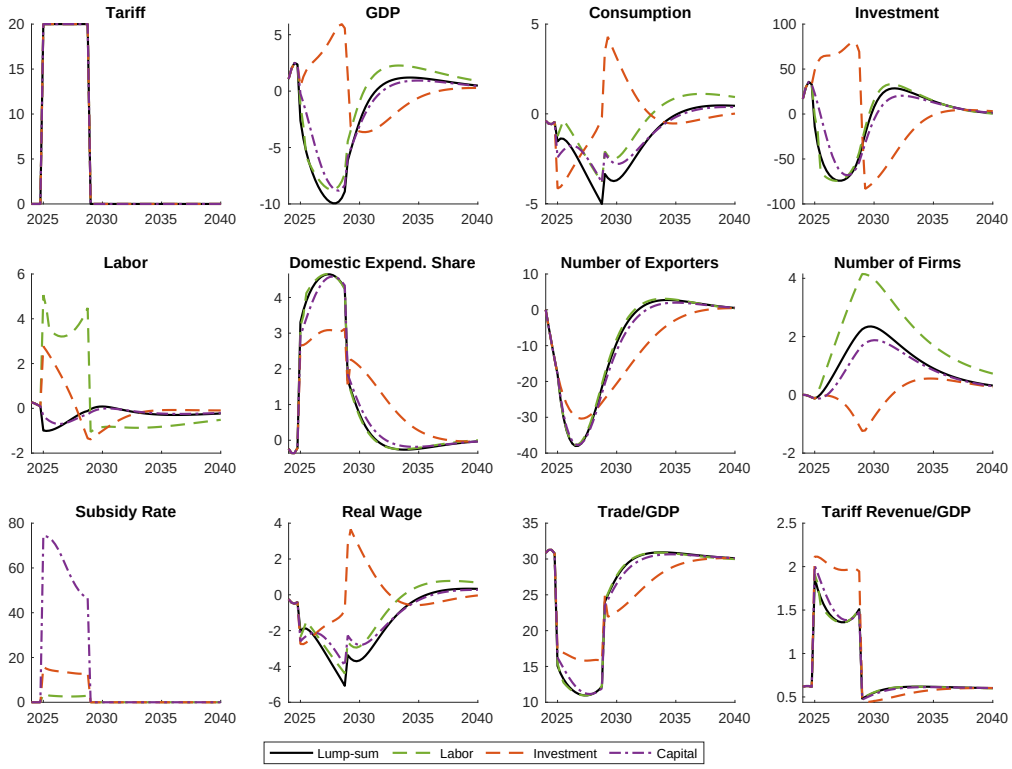


Figure 7: 20% Global Temporary Tariffs with Different Revenue Uses

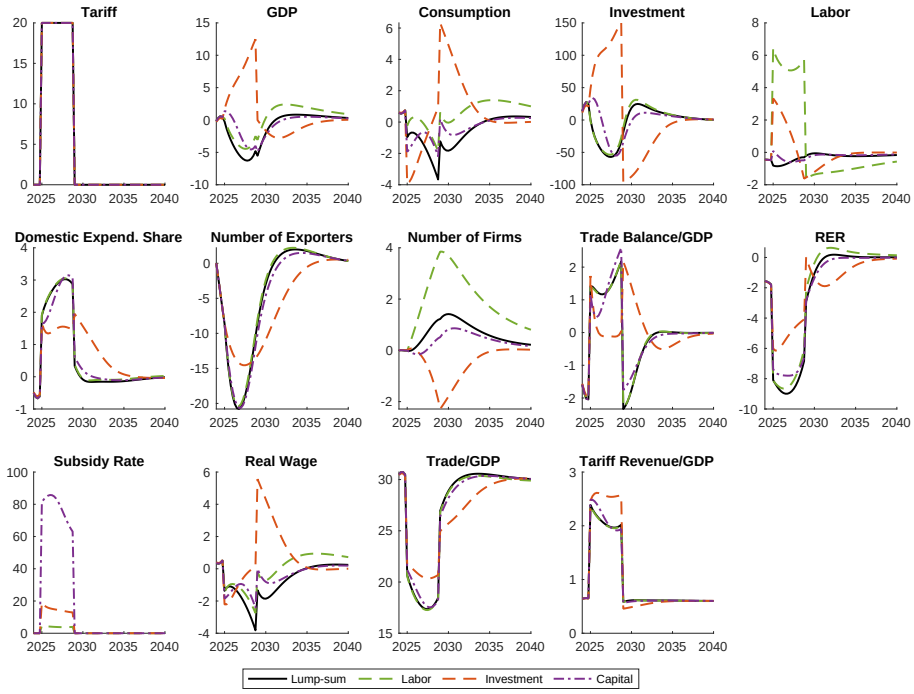


Figure 8: 20% Unilateral Temporary Tariffs with Different Revenue Uses (US)

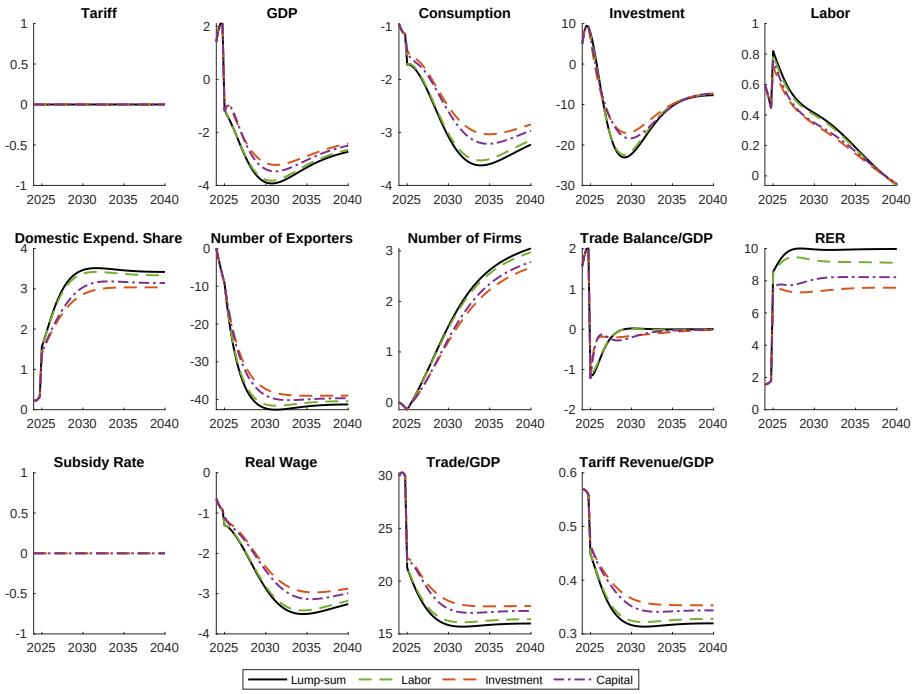


Figure 9: 20% Unilateral Temporary Tariffs with Different Revenue Uses (ROW)

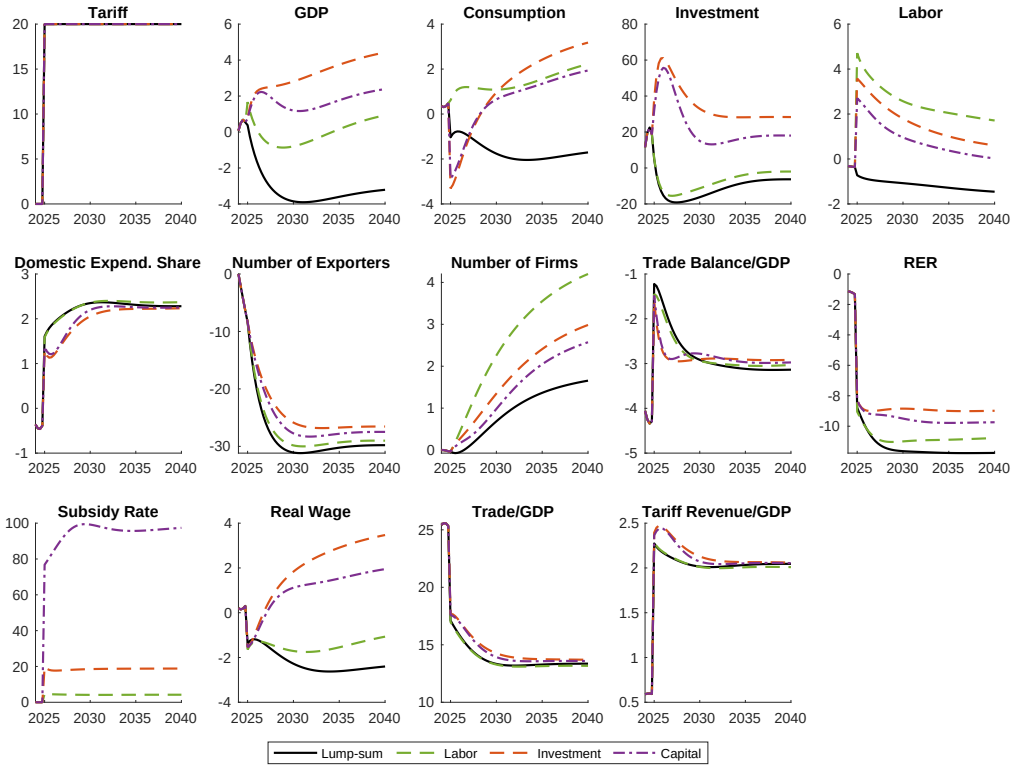


Figure 10: 20% Unilateral Permanent Tariff with initial Trade Deficit & by Revenue Use (US)

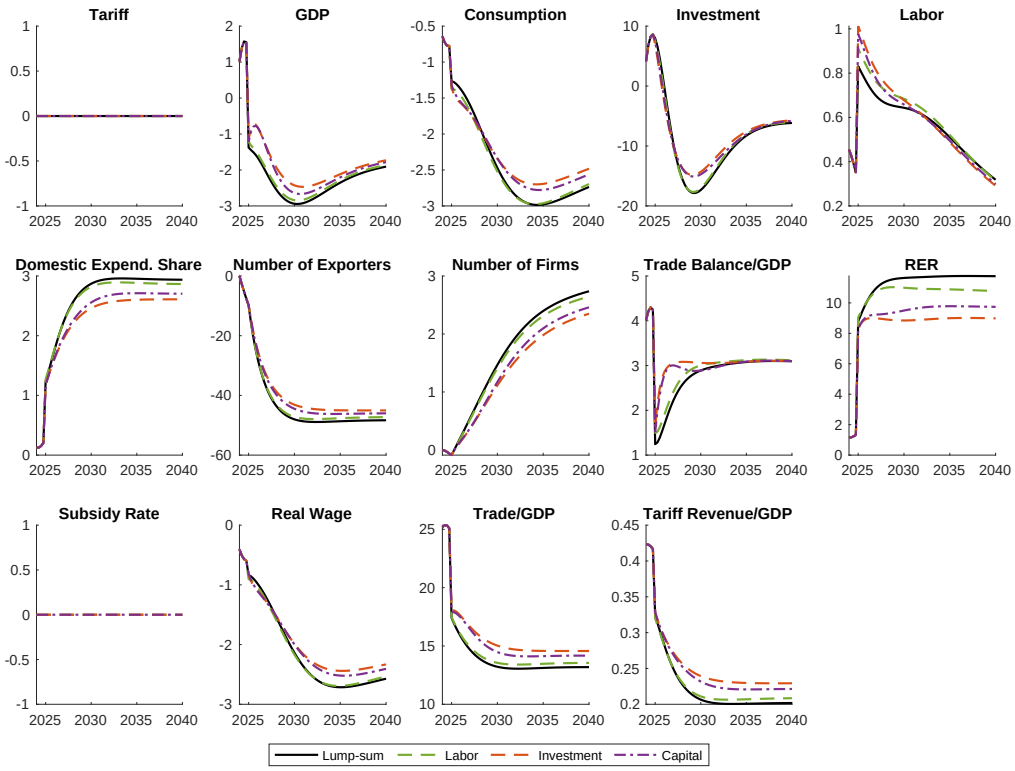


Figure 11: 20% Unilateral Permanent Tariff with initial Trade Deficit & by Revenue Use (ROW)

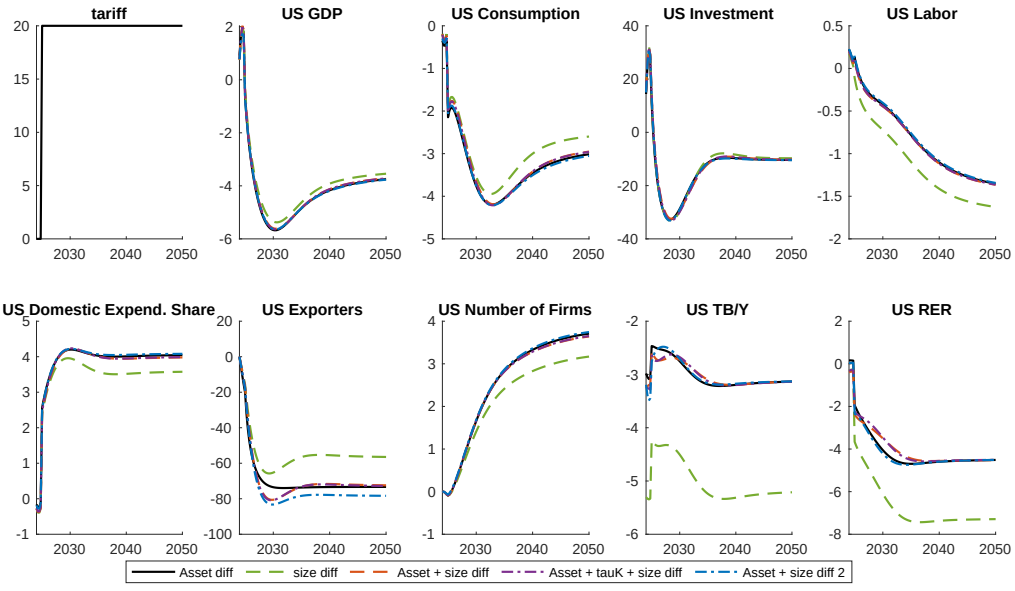


Figure 12: Aggregate effects of country size differences with lump sum redistribution

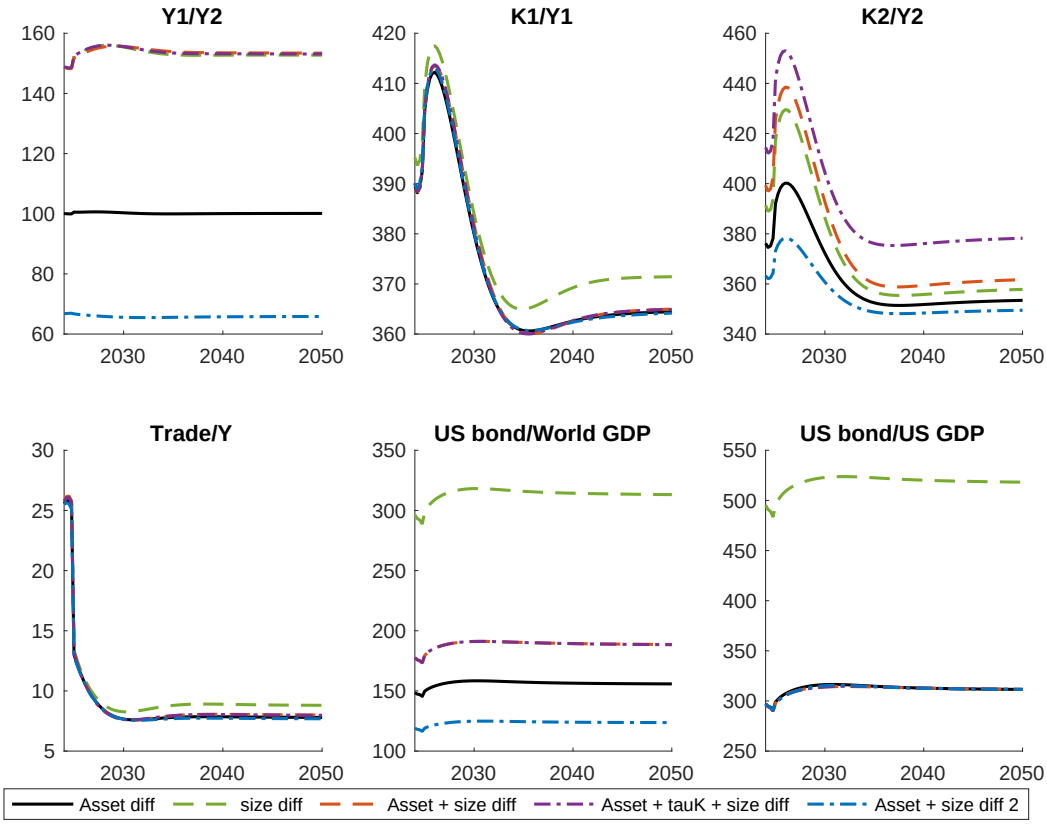


Figure 13: Aggregate effects of country size differences

Table 1: Quarterly calibration

Panel A: Externally Calibrated Parameters			
Param	Description	Value	Target
β	discount factor	0.99	
δ	capital depreciation rate	0.025	
σ	CRRA parameter	1	
γ	Armington elasticity	3.75	One-year trade elasticity = 2.7
θ	Elasticity of substitution between varieties	6	Markup = 20%
n_s	Firm survival rate	0.9950	Surviving labor share
α_m	Share of materials in intermediate production	0.6	Gross output/value added in X and M
α_C	Share of materials in C production	0.99	Gross output/value added in C
$\bar{L}_i$	Labor endowment	1	Normalization
Panel B: Internally Calibrate Parameters			
μ	Relative preference C vs. L	0.49	Average Frisch elasticity=2
f_e	Entry cost	10.26	Average $N_i = \bar{L}_i$
α	Capital share of value added	0.19	Average WL/VA = 66%
f_0	Fixed cost scale (nonexporters)	23.23	Fraction exporters = 0.2
f_1	Fixed cost scale (exporters)	0.030	Incumbent export share = 0.95
ν	Fixed cost shape parameter	0.65	Churning and export volume relationship
ξ_{LH}	Ratio ξ_{GL}/ξ_{GH}	0.58	Share of exports contributed by firms with up to five years of tenure
ξ_{CH}	Consumption-good iceberg cost	3.54	End-use trade flows
ξ_{XH}	Investment-good iceberg cost	1.10	End-use trade flows
ξ_{MH}	Material-good iceberg cost	2.38	End-use trade flows
ρ	Persistency of efficiency state	0.92	Target jointly with other parameters
τ_k	Marginal Capital Tax	0.147	OMB (01/25)
τ_l	Marginal Labor Tax	0.272	OMB (01/25)