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The macroeconomic effects of import tariffs in a model with multinational firms and foreign direct investment

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Abstract

Recent (de-)globalization tendencies and rising protectionist measures has created new interest in studying the effects of unilateral and world-wide tariffs. This paper contributes to this issue by taking into account that international transactions in goods and services increasingly take the form of foreign direct investment. We look at the effects of import tariffs in the context of a two-region DSGE model with both an exporting and an FDI sector. We find that the tariff jumping effect on FDI is largely outweighed by a cost effect if the tariff is imposed on all imports. This holds in the case of both tariffs imposed unilaterally and worldwide import tariffs. Our analysis confirms the aggregate positive welfare effects of a unilateral tariff, but also shows inefficiencies resulting from consumption and production distortions. This leads to lower GDP and real wages through the investment channel. However, governments can generate a tariff jumping effect by exempting imports of multinationals from tariffs. This reduces negative growth effects but also lowers welfare gains since there are less tariff revenues to support consumption. In the case of a world-wide tariff, exempting imports of multinationals reduces negative welfare effects.

Keywords DSGE · Macroeconomics · Foreign direct investment · Trade · USA · China

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1 Introduction

There is some evidence that after a long period of increasing globalization, the process has stalled somewhat since the Global Financial Crisis in 2008 and there are some signs that we have indeed even entered a period of de-globalization (see, for example, Herrero (2021)). This view is fueled by a slowdown of merchandise trade and protectionist measures implemented by various governments around the world as documented for example by Evenett and Fritz (2021). Large countries or trading blocs, in particular, may find it advantageous to impose import tariffs on trading partners aimed at increasing domestic welfare. The theory of optimal tariffs suggests that a (large) country can increase domestic welfare by imposing a tariff unilaterally, due to a terms of trade gain. The terms of trade (TOT) gain arise to the extent to which foreign goods are inelastically supplied. The literature shows that in this case, the TOT effect dominates negative effects implied by distortions to consumption and production resulting from a tariff increase. (see, e.g., Felbermayr et al. (2011) for a recent analysis on this).

In the USA, the Trumpian Trade Policy seen during 2017–2020 partly followed textbook traditional policy. Traditional optimal tariff analysis, with its focus on large open economies, typically considers the trade-off between a reduced world market offer price—in a tariff-ridden setting—and the loss of consumer surplus which occurs in the context of smaller import quantities which occur as a result of higher import tariffs. US President Trump suggested that the trade conflict between the USA and China would result in a net gain for the USA:

- The USA was a major net importer of goods and services so that a quasi-balanced tariff escalation between the USA and China, respectively, was bound to create a new benefit for the USA as the USA could always go at least one step further in terms of retaliatory measures than the larger Chinese side.
- Trump's trade policy was assumed to create sufficiently large additional US tariff revenues that US farmers from the mid-West—typically Republican voters—could be compensated for lower exports and profits from their business with China (e.g., in soya beans).
- To some extent, the Trump Administration also seemed to follow a tariff-jumping argument: Foreign firms facing reduced market access in the USA might instead consider producing on an enlarged scale within the USA itself which, in turn, would create new jobs and thus offer new opportunities for US workers in certain sectors.
- Whether or not the Trumpian import tariff policy could be deemed successful could, however, not be assessed within a partial equilibrium approach with a first FDI-related analysis from Welfens (2020, appendix to part IV) which emphasizes the role of foreign direct investment (FDI) and the fact that a monopsonist position of the USA implies, in the case of outward FDI, that the case of two large countries will bring about a lower stream of foreign profits accruing, for example, from US subsidiaries in China. There is also an interesting empirical LASSO-based approach which compares actual trade policy performance to the development that would have been expected from a “doppelgänger” country—a hypothetical twin country of the USA (Celebi and Welfens 2020).

It should be noted that foreign direct investment flows markedly increased over the period between 1990 and 2017 (UNCTAD, 2021, see appendix Tab. 1 which shows e.g. that the USA has witnessed an increase of the outward FDI Stock/USA capital stock ratio from 2.7% in 1990 to 12.9 in 2017), but this structural change in the world economy has rarely been considered in International Macroeconomics (Table 1). FDI has also not become a major topic in the international policy debates (e.g., at the IMF, G7 or the G20). In fact, the global rise of foreign direct investment raises new analytical perspectives (Roeger and Welfens 2021; Welfens 2020) and selected new aspects will be identified subsequently.

Most of the optimal tariff analysis is conducted with models which exclude FDI. However, FDI now plays an important role and is a constituent part of the

Table 1 Outward FDI stock/ source country capital stock , 1990–2017, sorted by descending order for 2017

Country	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017
LUX				0.620	1.225	0.988	0.624	0.831	0.918	0.891	0.970	1.212
IRL	0.094	0.071	0.095	0.228	0.380	0.362	0.426	0.515	0.593	0.812	0.691	0.760
NLD	0.092	0.109	0.187	0.309	0.286	0.288	0.280	0.282	0.526	0.442	0.537	0.608
BEL	0.050	0.078	0.159	0.334	0.184	0.183	0.190	0.215	0.208	0.210	0.205	0.238
SWE	0.061	0.069	0.116	0.200	0.232	0.229	0.218	0.214	0.192	0.165	0.159	0.167
DNK	0.016	0.043	0.117	0.112	0.140	0.139	0.145	0.145	0.126	0.121	0.118	0.134
UK	0.065	0.066	0.187	0.194	0.168	0.180	0.158	0.147	0.136	0.120	0.121	0.134
USA	0.027	0.044	0.072	0.076	0.093	0.087	0.099	0.116	0.112	0.105	0.108	0.129
FIN	0.019	0.025	0.091	0.120	0.140	0.131	0.139	0.134	0.108	0.088	0.098	0.111
FRA	0.027	0.073	0.069	0.086	0.105	0.107	0.107	0.104	0.096	0.092	0.090	0.096
AUT	0.007	0.012	0.026	0.066	0.112	0.111	0.107	0.113	0.100	0.088	0.080	0.092
EU Core (ø)	0.036	0.064	0.060	0.079	0.100	0.102	0.103	0.097	0.087	0.084	0.082	0.091
DEU	0.044	0.056	0.051	0.073	0.096	0.097	0.100	0.091	0.079	0.075	0.074	0.087
ESP	0.007	0.012	0.039	0.066	0.078	0.078	0.064	0.066	0.056	0.054	0.053	0.058
EST		0.001	0.005	0.025	0.040	0.031	0.038	0.041	0.036	0.035	0.036	0.042
ITA	0.012	0.016	0.024	0.030	0.044	0.042	0.037	0.037	0.032	0.029	0.027	0.033
PRT	0.001	0.004	0.020	0.041	0.036	0.036	0.032	0.036	0.027	0.027	0.025	0.029
HUN	0.000	0.001	0.003	0.016	0.023	0.026	0.034	0.032	0.032	0.027	0.018	0.021
SVN		0.003	0.004	0.013	0.027	0.025	0.021	0.018	0.016	0.014	0.014	0.016
CZE		0.000	0.001	0.003	0.009	0.007	0.009	0.010	0.009	0.009	0.009	0.014
LTU		0.000	0.000	0.005	0.011	0.013	0.014	0.014	0.012	0.012	0.011	0.013
POL	0.000	0.001	0.000	0.001	0.009	0.010	0.013	0.015	0.013	0.011	0.011	0.011
GRE	0.004	0.002	0.005	0.010	0.023	0.027	0.021	0.015	0.012	0.010	0.008	0.008
SVK		0.000	0.002	0.002	0.008	0.008	0.009	0.009	0.004	0.004	0.004	0.007
LVA		0.003	0.000	0.002	0.004	0.003	0.004	0.005	0.004	0.004	0.004	0.005

øCore represents the unweighted mean figure for Germany plus France; 5-year intervals from 1990–2010, annual data thereafter. Source: Own calculations and representation of FDI stock data from UNCTAD and capital stock data from the Penn World Table, version 9.1, Feenstra, Robert C., Robert Inklaar and Marcel P. Timmer (2015), "The Next Generation of the Penn World Table" American Economic Review, 105(10), 3150–3182, available for download at www.gdpc.net/pwt

globalization process. It is therefore important to analyze the impact of an import tariff in the presence of FDI. Will a reduction in trade be compensated for via increasing FDI flows or is there co-movement between trade and FDI? Neither the theoretical nor the empirical literature is particularly clear on this issue. The so-called tariff jumping hypothesis suggests that an increase in [tariffs](#) will attract more FDI inflows. However, there are also arguments which run contrary to this proposition. These are based on the observation that subsidiaries of foreign multinationals face cost increases because of their dependence on imports from their foreign headquarters. There are other papers dealing with optimal tariffs in a policy environment where governments focus on protecting the domestic industry (see, e.g., [Blonigen and Cole 2011](#); [Cole and Davies 2011](#)).

In this body of literature, it is argued that the optimal tariff with FDI could be lower compared to the case of no FDI. An import tariff becomes less desirable if domestic firms become exposed to competition from foreign multinational companies (MNCs) or when the import tariff also protects foreign MNCs. [Blanchard \(2010\)](#) focusses on the effects of (exogenous) foreign equity holdings in both the export and import sector and argues that this can lower the optimal tariff because the tariff also provides a gain to foreign owners of domestic firms. Domestic MNCs setting up foreign subsidiaries with the purpose of exporting back to the domestic country may provide another reason to lower the import tariff. There is also a literature which links FDI to the threat of import tariffs (see [Bhagwati et al. \(1987\)](#)). For example, [Blonigen and Feenstra \(1997\)](#) find that the threat of protectionism had a significant and positive effect on greenfield FDI in the USA in the 1980s. However, recent work by [Görg and Labonte \(2011\)](#) presents evidence which goes in the other direction.

The protectionist measures of the Trump Administration constitute a recent event which is useful in order to study the impact of trade restrictions on FDI. There is one paper by [Chahinea et al. \(2021\)](#) which supports the tariff jumping hypothesis. However, [Posen \(2018\)](#) argues that Trump did not achieve his goal of attracting more FDI. [Van der Merve \(2021\)](#) provides a more nuanced picture. Total FDI inflows to the USA declined after 2016; however, they still remained high relative to post-2008 recession levels and—interestingly—greenfield investment has risen somewhat after 2016.

In this paper, we adopt a model perspective to shed some light on the relative importance of the two opposing effects induced by an import tariff on FDI, namely, tariff jumping on the one hand and higher tariffs imposed on the imports of foreign MNCs on the other. We look at the case of both unilateral tariffs and a world-wide increase of import tariffs. We use a two-sector, two-country model, where the two sectors differ mostly with respect to their international activities. One sector (sector 1) sells to foreign customers via exports, while firms in the other sector (sector 2) sell to foreign customers via foreign subsidiaries, i.e. sector 2 engages in [FDI](#) activities. Both types of firms solve intertemporal profit maximization problems and make decisions about production, domestic and foreign sales, domestic and foreign investment (in the case of sector 2), and labor input. This set up allows us to study domestic and foreign activities of firms engaging in exports and FDI respectively. Decisions are made subject to a neoclassical production function, where MNCs in sector 2 apply the same technology at home and abroad. We also assume that firms

in both sectors exercise market power and charge (identical) mark-ups across the two regions and sectors.

Our model allows us to look at the short-, medium-, and long-term effects of permanent tariff increases. Moreover, we can trace the impact of a tariff not only on imports and FDI inflows but also on exports and FDI outflows. This, in turn, allows us to trace the trade balance and primary balance effects of a tariff increase. We assume that labor is inelastically supplied in the foreign and domestic economy; thus, total consumption is a good measure of welfare gains and losses for the representative household. Since our model also calculates the real consumption wage, we can also measure how a (financially constrained) household entirely reliant on labor income benefits or loses from an increase in tariffs. Comparing aggregate consumption effects with the real consumption wage allows to consider the distributional effects between capital owners and workers. Since the welfare effects of a unilateral tariff are eventually the result of a trade-off between consumption and production distortions implied by the tariff and terms of trade gains, a model with a full production sector is useful since it accounts for the productivity effects of the tariff across sectors and regions.

The paper is structured as follows. In Section 2, we present the model (2.1) and the calibrations (2.2) while Section 2.3 presents results of a unilateral permanent tariff increase. In this section, we also provide some sensitivity analysis. Section 3 provides a brief outlook at further extensions in a modern and more realistic modeling environment with active MNC dynamics. Section 4 offers policy conclusions and ideas for further research.

2 Model

2.1 Households

We adopt an OLG framework (Blanchard, 1985) for modeling household savings and investment decisions, since this framework allows us to generate steady variations of the current account balance in the case of permanent shocks to savings and technology. The economy is populated by different age cohorts (born in period s). Members of each cohort, and across cohorts, otherwise have identical preferences and face a constant probability of death ($p = 1 - \gamma$).

Each household in country c (domestic country, foreign country denoted by c^*) is maximizing an intertemporal utility function over a CES consumption aggregate C_t^c of domestic and foreign goods. There are four assets, a domestically traded bond B_t^c , an internationally traded bond BW_t^c , as well as stocks from sector 1 and sector 2—companies with market value V_t^1 and V_t^2 , respectively. BW_t^c is denominated in foreign currency, where E is the nominal exchange rate (expressed in units of domestic currency per unit of foreign currency) ($\Delta E_t > 0$: depreciation of the domestic currency). Individuals maximize utility with no concern for their heirs. That is, they write a contract with an insurance company which pays them a premium equal to pF_{st} each period, with the proviso that the insurance company receives the total financial wealth of the household in

the case of death. Due to the positive probability of dying, the effective discount rate exceeds the rate of time preference:

$$U_{s,0}^c = \sum_{t=0}^{\infty} (\beta\gamma)^t \log(C_{s,t}^c) \quad (1)$$

The budget constraint of the household is given by:

$$\begin{aligned} (B_{st}^W E_t + B_{st}^c + V_{st}^{c,1} + V_{st}^{c,2} - (1 + i_{t-1}^{c*}) B_{st-1}^W E_t = (1 + i_{t-1}) B_{st-1}^c \\ + \text{div}_{st-1}^{c,1} + V_{st-1}^{c,1} + \text{div}_{st-1}^{c,2} + V_{st-1}^{c,2} + p F_{st}^c - P_t^C C_{st}^c + W_t^c (L_{st}^{c,1} + L_{st}^{c,2} + L_{st}^{cf})) \end{aligned} \quad (2)$$

Total financial wealth (portfolio):

$$F_{st}^c = B_{st}^W E_t + B_{st}^c + V_{st}^{c,1} + V_{st}^{c,2} \quad (3)$$

The first-order conditions w. r. t. financial assets are given by:

$$\frac{\partial \mathcal{L}}{\partial C_{st}^c} = \frac{1}{C_{st}^c} - \lambda_{st} P_t^C = 0 \quad (4)$$

$$\frac{\partial \mathcal{L}}{\partial B_{st}^c} = -\lambda_{st} = \beta \lambda_{st+1} (1 + i_t^c) = 0 \quad (5)$$

$$\frac{\partial \mathcal{L}}{\partial V_{st}^{c,i}} = -\lambda_{st} = \beta \lambda_{st+1} (1 + \text{div}_t^{c,i}) = 0 \quad (6)$$

$$\frac{\partial \mathcal{L}}{\partial B_{st}^W} = -\lambda_{st} E_t + \beta \lambda_{st+1} (1 + i_t^{c*}) E_{t+1} = 0 \quad (7)$$

The first-order condition for the bond tradable amongst all domestic households defines a common discount factor across cohorts. The first-order conditions for stocks determine the discount factor applied by domestic corporations for maximizing the value of the firm. The first-order condition for internationally tradeable bonds, together with the first-order condition for domestically tradable bonds, determines the interest parity condition

$$(1 + i_t^c) = (1 + i_t^{c*}) (E_{t+1} / E_t) \quad (8)$$

Given the medium-term focus of our analysis, and in order to simplify the discussion of transmission channels of the diverse shocks, we assume an inelastic labor supply. This assumption also simplifies discussion of the welfare effects of a tariff.

2.2 Corporate sector

Sector 1: Firms engage in traditional trade and do not undertake FDI.

There are n^d domestic firms and n^f foreign firms active in sector 1. Each firm produces a variety of domestic and foreign goods, respectively. The number of varieties is exogenous; however, we allow for exogenous product innovation, in the form of an increase in the number of varieties. This is associated with new factories and plants, producing these additional varieties. Firm i in sector 1 faces a domestic and a foreign demand curve and serves both the domestic and foreign markets with products produced at home. The firm is monopolistically competitive and faces price elasticity ε_1^c in the domestic market and ε_1^{c*} in the foreign market. In order to simplify, we assume that the firm faces the same price elasticity in domestic and foreign markets, i.e. the firm charges the same mark-up in the domestic and foreign market. There is domestic cost pricing in export markets.

2.3 Demand for variety i

$$Y_{i,1}^c = \left(\frac{PC_1^c}{P_{i1}^c} \right)^{\varepsilon_1^c} Y_1^{D,c} + \left(\frac{PC_1^{c*}}{P_{i1}^c/E} \right)^{\varepsilon_2^{c*}} Y_1^{D,c*} \quad (9)$$

The elasticity of substitution between different varieties in sector 1 determines the mark-up $\mu_1^c = \frac{1}{\varepsilon_1^c}$

2.4 Supply

The production function with capital and labor as inputs is given by:

$$Y_{i1}^c = A_1^c L_{i1}^c{}^\alpha K_{i1}^c{}^{1-\alpha} \quad (10)$$

Aggregate production of sector 1:

$$Y_1^c = n_1^d Y_{i1}^c \quad (11)$$

A_1^c : total factor productivity (TFP)—all firms operating in sector 1 have the same country-specific level of TFP. All firms pay the country-specific wage, i.e. we assume no sector specific labor supply and full mobility of labor across sectors. Production is undertaken by corporations owned by domestic households. The corporation maximizes the present discounted value (PDV) of current and future expected cash flows using the discount factor of the domestic owner.

$$\begin{aligned} \text{Max } PDV_{1,0}^c &= \sum_{t=0}^{\infty} \prod_{k=0}^t \left(\frac{1}{1+i_{t+k}} \right)^k \left[p_{1t}^c (Y_{1t}^c) Y_{1t}^c - W_t^c L_{1t}^c - P_{1t}^c I_{1t}^c \right] \\ &\quad - \sum_{t=0}^{\infty} \prod_{k=0}^t \left(\frac{1}{1+i_{t+k}} \right)^k \lambda_{1t}^c \left[Y_{1t}^c - (A_1^c L_{1t}^c)^\alpha K_{1t}^c{}^{1-\alpha} \right] \\ &\quad - \sum_{t=0}^{\infty} \prod_{k=0}^t \left(\frac{1}{1+i_{t+k}} \right)^k q_{1t}^c \left[K_{1t}^c - I_{1t}^c - (1-\delta)K_{1t-1}^c \right] \end{aligned} \quad (12)$$

The first-order conditions of this maximization problem yield standard demand equations for capital and labor. The firm equates the marginal product of capital (adjusted for the mark-up) to capital cost:

$$\left(1 - \frac{1}{\varepsilon_1}\right) Y_{K1t}^c = \frac{P_t^{C^c}}{P_{1t}^c} (i_t^c + \delta - \pi_{t+1}^C) \quad (13)$$

The capital cost for the firm declines if the investment goods price declines in period t relative to the product price in sector 1. It increases with the domestic nominal interest rate and it declines with the expected inflation rate for investment goods. Labor demand is determined by equating the marginal value product of labor to the real wage costs:

$$\left(1 - \frac{1}{\varepsilon_1^c}\right) Y_{L1t}^c = \frac{W_t^c}{P_{1t}^c} \quad (14)$$

The equilibrium condition for sector 1 goods (domestic economy) is as follows:

$$Y_{1t}^c = C_{1t}^c + C_{1t}^{c*} + I_{11t}^c + I_{12t}^{c*} + I_{1f,t}^c \quad (15)$$

Sector 1 output is sold to domestic and foreign consumers (C_{1t}^c, C_{1t}^{c*}) and to domestic and foreign firms in sector 1 and sector 2 (I_{11t}^c, I_{12t}^{c*}) as well as to domestic FDI producers $I_{1f,t}^c$.

Sector 2: Firms engage in FDI and do not export.

Firm i in sector 2 faces a domestic and a foreign demand curve but serves the domestic and foreign market with products produced both at home and abroad, respectively. The firm is monopolistically competitive and faces price elasticities of ε_2^c and ε_{fdi}^c , respectively. Here, we also restrict elasticities to be identical.

2.5 Demand

$$Y_{i,2}^c = \left(\frac{PC_2^c}{P_{i2}^c}\right)^{\varepsilon_2^c} Y_2^{D,c} + \left(\frac{PC_{fdi}^{c*}}{P_{ifdi}^c}\right)^{\varepsilon_f^c} Y_f^{D,c*} \quad (16)$$

2.6 Supply

Multinational firm i produces at home and abroad (via FDI) using an identical production technology:

$$Y_{ij}^c = A_{ij}^c L_{ij}^{c\alpha} K_{ij}^{c1-\alpha}, j = 2, f \quad (17)$$

Firms in sector 2 are also owned by domestic households. The MNC maximizes the PDV of current and future expected cash flows using the discount factor of the domestic owner. In this case, the multinational firm makes decisions about domestic and foreign production, domestic and foreign investment, and domestic and foreign

employment. The optimization is subject to a technological constraint and a capital accumulation constraint:

$$\begin{aligned}
 \text{Max } PDV_{2,0}^c = & \sum_{t=0}^{\infty} \prod_{k=0}^t \left(\frac{1}{1+i_{t+k}} \right)^k \left[P_{2t}^c (Y_{2t}^c) Y_{2t}^c - W_t^c L_{2t}^c - P_{2t}^{Cc} I_{2t}^c \right] \\
 & - \sum_{t=0}^{\infty} \prod_{k=0}^t \left(\frac{1}{1+i_{t+k}} \right)^k \lambda_{2t}^c \left[Y_{2t}^c - (A_{2t}^c L_{2t}^c)^{\alpha} K_{2t}^{c^{1-\alpha}} \right] \\
 & - \sum_{t=0}^{\infty} \prod_{k=0}^t \left(\frac{1}{1+i_{t+k}} \right)^k q_{2t}^c \left[K_{2t}^c - I_{2t}^c - (1-\delta) K_{2t-1}^c \right] \\
 & + \sum_{t=0}^{\infty} \prod_{k=0}^t \left(\frac{1}{1+i_{t+k}} \right)^k \left[P_{ft}^{c*} (Y_{ft}^{c*}) Y_{ft}^{c*} - W_t^{c*} L_{ft}^{c*} - P_{ft}^{Cc*} I_{ft}^{c*} \right] E_t \\
 & - \sum_{t=0}^{\infty} \prod_{k=0}^t \left(\frac{1}{1+i_{t+k}} \right)^k \lambda_{ft}^{c*} \left[Y_{ft}^{c*} - (A_{ft}^{c*} L_{ft}^{c*})^{\alpha} K_{ft}^{c*^{1-\alpha}} \right] \\
 & - \sum_{t=0}^{\infty} \prod_{k=0}^t \left(\frac{1}{1+i_{t+k}} \right)^k q_{ft}^{c*} \left[K_{ft}^{c*} - I_{ft}^{c*} - (1-\delta) K_{ft-1}^{c*} \right]
 \end{aligned} \tag{18}$$

First-order conditions with respect to output, investment, capital, and labor yield standard optimality conditions for capital and labor in the case of domestic and FDI production.

2.7 Domestic

The firm equates the marginal product of capital (adjusted for the mark-up) to capital cost:

$$\left(1 - \frac{1}{\varepsilon_2^c} \right) Y_{K2t}^c = \frac{P_{2t}^{Cc}}{P_{2t}^c} (i_t^c + \delta - \pi_{t+1}^C) \tag{19}$$

And the marginal product of labor to the real wage cost:

$$\left(1 - \frac{1}{\varepsilon_2^c} \right) Y_{L2t}^c = \frac{W_t^c}{P_{2t}^c} \tag{20}$$

2.8 FDI

The firm equates the marginal product of capital (adjusted for the mark-up) to capital cost adjusted for expected changes in the exchange rate:

$$\left(1 - \frac{1}{\varepsilon_f^{c*}} \right) Y_{Kft}^{c*} = \frac{P_{ft}^{Cc*}}{P_{ft}^{c*}} (i_t^c + \delta - \pi_{ft+1}^{C*} - \Delta E_{t+1}/E_t) \tag{21}$$

since the firm considers that distributed profits are paid to shareholders in domestic currency. Labor demand is given by:

$$\left(1 - \frac{1}{\varepsilon_f^{c^*}}\right) Y_{Kft}^{c^*} = \frac{W_t^{c^*}}{P_{tf}^{c^*}} \quad (22)$$

The equilibrium condition for sector 2 goods (domestic economy) is given as follows:

$$Y_{2t}^c = C_{2t}^c + I_{21t}^c + I_{22t}^c + I_{2f,t}^c + I_{2f,t}^{c^*} \quad (23)$$

Sector 2 output produced domestically is sold to domestic consumers C_{2t}^c and to domestic firms in sector 1 and sector 2 (I_{21t}^c, I_{22t}^c) as well as to domestic FDI producers $I_{2f,t}^c$ and to foreign subsidiaries of domestic sector 2 firms $I_{2f,t}^{c^*}$. The domestic sector is also supplying the foreign affiliate with investment goods.

The equilibrium condition for sector 2 (foreign affiliate) is given as follows:

$$Y_{ft}^{c^*} = C_{ft}^{c^*} + I_{f1t}^{c^*} + I_{f2t}^{c^*} \quad (24)$$

The foreign affiliates of sector 2 multinationals supply foreign consumers $C_{ft}^{c^*}$ and firms operating in the sectors 1 and 2 of the foreign economy ($I_{f1t}^{c^*}, I_{f2t}^{c^*}$). The domestic sector also supplies the foreign affiliate with investment goods.

2.9 Current account/net foreign assets

The current account consists of the trade balance in goods and services and the income balance. Here, we concentrate on the primary income and we break it down into income from direct investment on the one hand, and income from financial investment (portfolio investment, loans and deposits) on the other. Henceforth, we will call the net income from direct investment the primary income balance and the net income from financial investment the interest income balance.

2.10 Imports of household consumption goods and services and firm investment goods

Domestic firms (and households) have a domestic bias concerning the origin of investment goods (related to the domestic import share) while FDI producers mimic the investment composition of the country of origin. It is assumed that the composition of consumption and investment of domestic/foreign households and domestic/foreign firms in sectors 1 and 2 is identical.

$$Z_t^c = (C_t^c, I_{1t}^c, I_{2t}^c)$$

$$Z_t^c = \left[s^{d\frac{1}{\sigma}} Z_t^{c,D\frac{\sigma-1}{\sigma}} + s^{m\frac{1}{\sigma}} Z_t^{c,M\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}} \quad (25)$$

$$Z_t^{c,D} = \left[s^{d1\frac{1}{\sigma^d}} Z_t^{c,D1\frac{\sigma^d-1}{\sigma^d}} + s^{d2\frac{1}{\sigma^d}} Z_t^{c,D2\frac{\sigma^d-1}{\sigma^d}} \right]^{\frac{\sigma^d}{\sigma^d-1}} \quad (26)$$

$$Z_t^{c,M} = \left[s^{m\frac{1}{\sigma^m}} Z_t^{c,M1\frac{\sigma^m-1}{\sigma^m}} + s^{fdi\frac{1}{\sigma^m}} FDI_t^{c,FDI\frac{\sigma^m-1}{\sigma^m}} \right]^{\frac{\sigma^m}{\sigma^m-1}} \quad (27)$$

It is further assumed that the foreign subsidiary of the domestic multinational has the identical structure of investment as the parent company.

$$I_{ft}^c = \left[s^{d\frac{1}{\sigma}} I_{ft}^{c,M\frac{\sigma-1}{\sigma}} + s^{m\frac{1}{\sigma}} I_{ft}^{c,D\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}} \quad (28)$$

$$I_{ft}^{c,M} = \left[s^{d1\frac{1}{\sigma^d}} I_{ft}^{c,M1\frac{\sigma^d-1}{\sigma^d}} + s^{d2\frac{1}{\sigma^d}} I_{ft}^{c,M2\frac{\sigma^d-1}{\sigma^d}} \right]^{\frac{\sigma^d}{\sigma^d-1}} \quad (29)$$

$$I_{ft}^{c,D} = \left[s^{m\frac{1}{\sigma^m}} I_{ft}^{c,D1\frac{\sigma^m-1}{\sigma^m}} + s^{fdi\frac{1}{\sigma^m}} I_{ft}^{c,D2\frac{\sigma^m-1}{\sigma^m}} \right]^{\frac{\sigma^m}{\sigma^m-1}} \quad (30)$$

While households and firms operating in sectors 1 and 2 of the home country have a home country bias concerning consumption and investment, FDI subsidiaries operating in a specific country have a foreign bias.

The local FDI producer mimics exactly the investment pattern of sector 2 in the source country and imports a large fraction of investment goods from both sector 1 and sector 2 of the source country and only demands a small part of its investment from the local sectors 1 and 2. Since it mirrors the investment pattern of the foreign parent company, it does not demand investment goods produced locally by itself, but uses investment goods produced by the local sector 2. Therefore, the domestic FDI producer also demands investment goods from the domestic sector 2. This can be physical investment goods produced in sector 2 but can also be license fees for intellectual property which the foreign affiliate has to pay to the parent company. Note, these payments are not part of FDI profit but are an export of services of the parent company to the foreign affiliate and appear in the trade balance.

$$TB_t^c = (P_{t1}^c X_{t1}^c - P_{t1}^{c*} E_t M_{t1}^c) + (P_{t2}^c X_{t2}^c - P_{t2}^{c*} E_t M_{t2}^c) \quad (31)$$

All international financial investments are summarized by an internationally tradable bond (denominated in foreign currency).

$$IntY_t^c = i_{t-1}^{c*} BW_{t-1}^c E_t \quad (32)$$

Net primary income is equal to distributed profits of foreign subsidiaries (revenue minus wage costs minus current investment expenditures):

$$PRB_t^c = (\text{PROFIT}_{t,fdi}^c E_t - \text{PROFIT}_{t,fdi}^{c*}) \quad (33)$$

The current account balance:

$$CA_t^c = TB_t^c + IntY_t^c + PRB_t^c \quad (34)$$

The current account can be rewritten as an asset accumulation equation for the internationally tradable bond BW_t^c

$$BW_t^c E_t = (1 + i_{t-1}^{c*}) BW_{t-1}^c E_t + P_{t1}^c X_{t1}^c - P_{t1}^{c*} E_t M_{t1}^c + P_{t2}^c X_{t2}^c - P_{t2}^{c*} E_t M_{t2}^c + \text{PROFIT}_{t,fdi}^c E_t - \text{PROFIT}_{t,fdi}^{c*} \quad (35)$$

2.11 Tariffs

We assume that the domestic government imposes uniform ad valorem tariffs on imports of consumption and investment goods. Thus, the price for consumers and producers differs from the producer price for goods produced by the foreign sector 1.

$$PM_{t1}^c = (1 + t^c) P_{t1}^{c*} E_t \quad (36)$$

As the foreign multinational firm is also exporting sector 2 goods to its subsidiary, the subsidiary also faces higher prices for its sector 2 imports

$$PM_{t2}^c = (1 + t^c) P_{t2}^{c*} E_t \quad (37)$$

The government redistributes tariff revenues to domestic households in a lump sum fashion.

3 Calibration

We consider a two-country model of the world economy with countries of equal size. The two countries are identical concerning preference and technology parameters. The country size assumption has various advantages. Firstly, it reflects the fact that we are considering a large country/region which is imposing a tariff and, secondly, the total world effect of a unilateral tariff for the individual variables reported in this paper is simply given by the sum of the domestic and foreign effect. The economy is initially in a steady state with a

zero current account balance. To be realistic, we allow for home-country bias, i.e., the share parameters in CES aggregates for C and I are consistent with an import share of 20%. The share parameters in the CES aggregate for imports and FDI production are consistent with a share of FDI production of 12%. We allow for one strong asymmetry between domestic producers and subsidiaries of foreign MNCs. Domestic firms have a home bias in the composition of investment goods with an import share of 20%, while foreign MNCs import about 80% of their investment goods, because they use their own technology.

Concerning savings, we set the rate of time preference to 0.01 and the household planning horizon to 40 years. Firms in all sectors use a Cobb–Douglas production function with output elasticities of capital and labor of 0.4 and 0.6, respectively. The depreciation rate on capital is set to 5%. We set the adjustment cost parameter to 2.5 which ensures that investment is between 2 and 3 times as volatile as GDP. There is monopolistic competition with a mark-up of 10%. Concerning the labor market, we assume labor is inelastically supplied in both regions. This simplifies welfare comparisons by allowing us to identify welfare effects with private consumption. By comparing the effects of consumption and the real consumption wage, we can also approximately measure the distributional effects of tariffs.

The elasticity of substitution between domestic and foreign tradables is important for the adjustment of the exchange rate. Here, we follow the recent literature and set it to 2. This is based on empirical evidence provided by Boehm et al. (2020). These values have also been used by Klein and Linnemann (2020), Benigno and Thoenissen (2008), and Kim and Shikher (2017). In all our simulations, we use uniform values for the elasticity of substitution (EoS) between domestically produced sector 1 goods and imports of sector 1 goods, the EoS between sector 1 and sector 2 imports and the EoS between sector 1 imports and sector 2 goods produced by foreign MNCs in the domestic economy. This is because sector 1 and sector 2 in our model are not strictly identical to tradable (T) and non-tradable (NT) sectors, where often, a low EoS is assumed. The two sectors we are studying may provide goods which are equally substitutable than domestically produced (“tradable”) goods and imports (example: sector 1 contains car manufacturers which are exporting, while sector 2 contains car manufacturers which prefer to produce abroad).

4 Scenarios: effective tariff for tradables increased by 1 percentage point

In this section, we discuss both the impact of a unilateral and a world-wide increase of import tariffs. In all experiments, we assume a non-anticipated permanent 1 p.p. tariff increase. In order to disentangle the tariff jumping effect

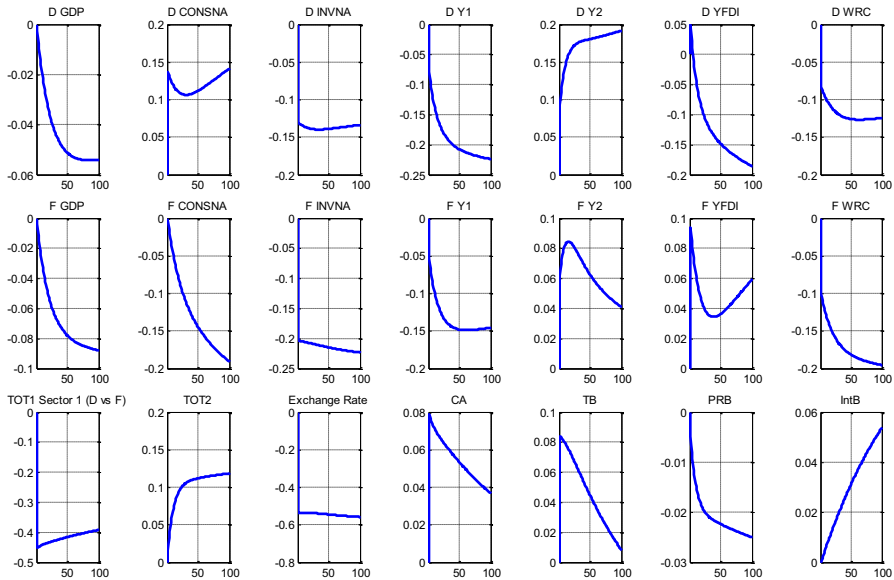


Fig. 1 Unilateral tariff by region D on all imports. D: domestic; F: foreign. GDP: real GDP; ConsNA: private consumption; INVNA: total investment; Y1: output sector 1; Y2: domestic output sector 2; D YFDI: output of subsidiary of domestic sector 2; F YFDI: output of subsidiary of foreign sector 2; WRC: real consumption wage; TOT1: price of sector 1 output relative to import price of sector 1 (incl. import tariff); TOT2: output price of foreign subsidiary of domestic sector 2 relative to the price of foreign sector 2; exchange rate: real exchange rate ($E_t PC_t^c / PC_t^c$); CA: current account (% of GDP); TB: trade balance (% of GDP); PRB: primary income balance (% of GDP); IntB: interest income balance (% of GDP). All deviations are in %, except for variables in % of GDP, which are in pp. Source: own representation

from the cost effect for MNCs, we consider two cases. In a first scenario, it is assumed that import tariffs are levied on all imports, including investment goods imports of foreign MNCs. In a second scenario, investment goods imports of MNCs are exempt from tariffs. We distinguish between a domestic region (region D) and the rest of the world (region F). The unilateral tariff is levied by region D (Fig. 1).

4.1 Unilateral tariff scenarios:

4.1.1 Exchange rate and terms of trade effects

The tariff leads to a decline of the TOT of sector 1, despite an appreciation of the exchange rate. The appreciation of the exchange rate is the major reason for the welfare gain and a consequence of an inelastic supply of foreign goods, due to an inelastic supply of labor in the Rest of the World (RoW). The price effect shifts consumption and investment demand towards domestic goods produced in sector 1. The import tariff induces a price distortion. The price distortion is larger

for the RoW compared to the domestic economy. RoW consumer and investment prices increase relative to RoW producer prices. Notably, this leads to an increase in the capital cost of firms operating in the RoW. Thus, capital formation and total output drop more in the RoW compared to the domestic economy.

4.1.2 Trade balance

There is a slight improvement of the trade balance. The effect is not large due to offsetting effects. Domestic imports decline because of a relative price effect. However, this effect is mitigated by increased domestic consumption. Furthermore, exports decline due to declining foreign income and a TOT effect.

4.1.3 FDI effects

The production of the foreign subsidiaries of domestic MNCs is declining (Welfens 2019). There is a competitiveness loss (TOT2) since the foreign subsidiaries of domestic multinational firms produce with a higher share of imported investment goods. Moreover, there is less demand as foreign income is declining. Interestingly, the decline of output of domestic MNCs abroad is stronger in absolute terms compared to the increase of output of foreign MNCs in the domestic economy. The tariff jumping effect is largely outweighed by the cost effect from higher tariffs on imports of foreign investment goods.

4.1.4 Primary income balance

Noteworthy is that the primary income balance becomes negative, which is due to increased economic activity of foreign MNCs in the domestic economy and reduced economic activity of domestic MNCs abroad. The current account improves because the trade balance effect is larger than the primary balance effect (in absolute terms). This leads to an accumulation of internationally traded (financial assets) and increases interest income from holding these assets.

4.1.5 Current account balance

The current account balance improves persistently. In a model with a risk premium on net foreign debt, the effects on the domestic economy would be stronger because of a decline of the risk premium.

4.1.6 Welfare effects

Given that labor is inelastically supplied, welfare is a positive function of the discounted stream of consumption. Domestic consumption increases on impact and remains positive permanently, while foreign consumption declines gradually. The consumption loss in the RoW exceeds the consumption gain in the

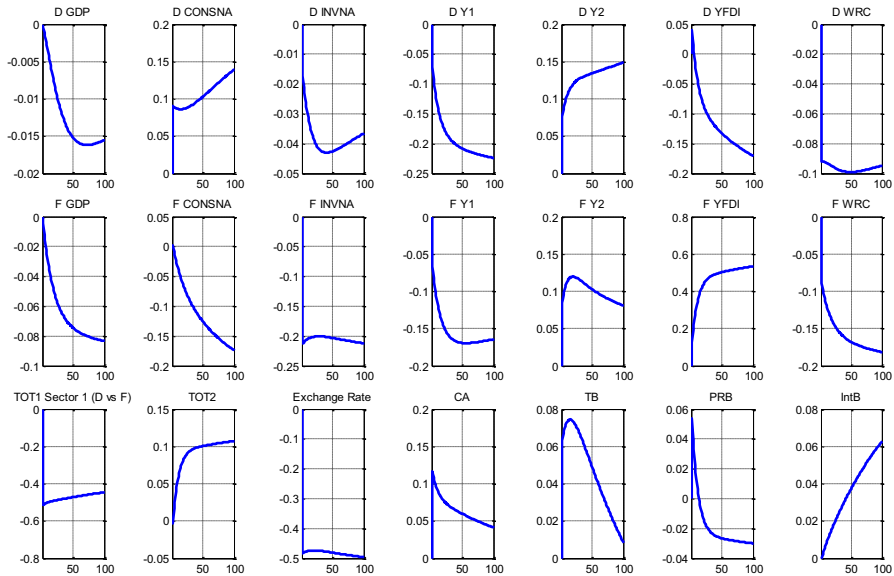


Fig. 2 Unilateral tariff by region D on all imports except imports of MNCs

domestic economy in the medium and long run. Thus, the unilateral tariff increase reduces world welfare. The difference in consumption dynamics is explained by the permanent increase of lump sum transfers for domestic households. Though aggregate domestic welfare increases—which is in line with the optimal tariff hypothesis—the real consumption wage declines both in the domestic (D) and foreign (F) economy. This suggests that for wage income, the consumption and production distortions outweigh the TOT effect.

Figure 2 shows that in the absence of a tariff on imports for foreign MNCs, the tariff jumping effect becomes more significant. In this scenario, the domestic economy experiences an inflow of FDI capital which leads to an increase of production of FDI subsidiaries of foreign MNCs (F YFDI). The inflow of FDI capital is also reflected by the primary income balance, which turns positive initially because of higher investment activity of foreign MNCs. However, higher FDI capital leads to higher profits flowing to the RoW in the long-term and thus reduces the primary income balance. The current account improves slightly more in this case. The FDI activities of domestic firms decline, because aggregate demand declines in the RoW. It might be difficult for governments to exempt imports of foreign MNCs from tariffs; however, a tariff jumping effect can be generated by the domestic government if tariffs are concentrated on consumer goods.

Assuming that the domestic government can target imports of MNCs, a comparison of scenario 1 and 2 allows to see the economic consequences of these two alternative strategies. If the government pursues a GDP target, then it would be preferable to exempt MNC imports from tariffs. This would also limit the decline of real consumption wages. Both the GDP and wage effect

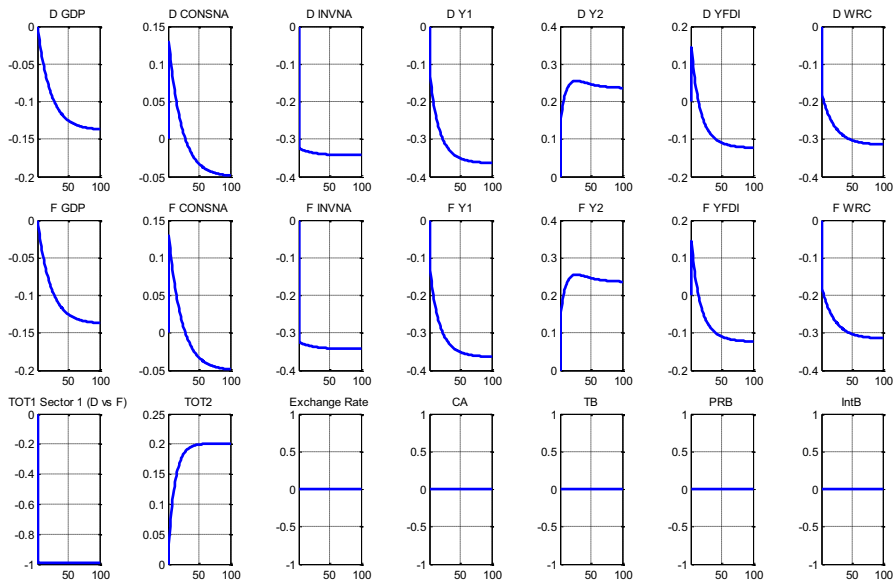


Fig. 3 World-wide tariff on all imports

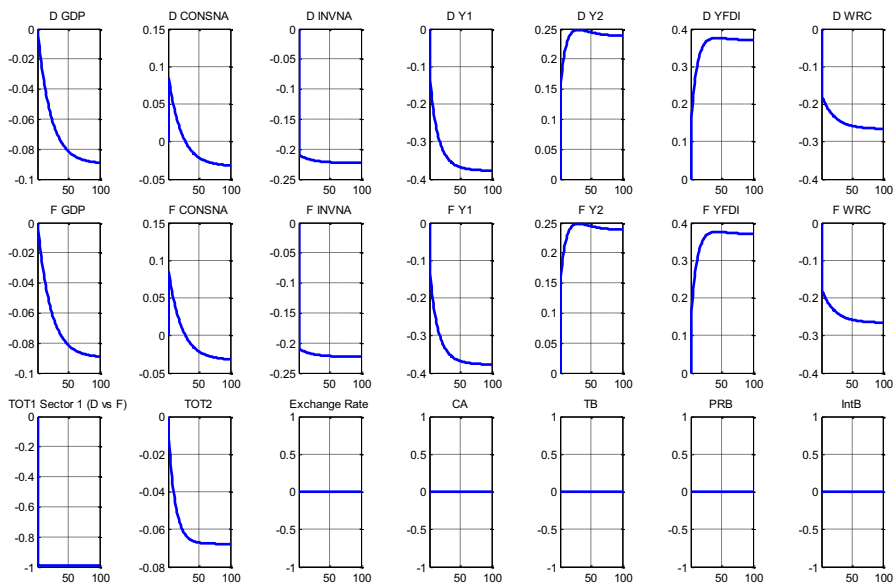


Fig. 4 World-wide tariff on all imports except imports of foreign MNCs

are due to higher investment associated with no tariffs on MNC imports. However, this does not translate one to one into welfare. Here, we can see that channeling revenues from import tariffs on MNCs lead to a higher path of private consumption.

4.2 World-wide tariff scenarios:

Due to the symmetry between the domestic and foreign economy, the tariff has no effect on the current account and the trade balance. Moreover, the real exchange rate remains unaffected. However, there is a global price distortion since the price of imported sector 1 goods increases relative to domestically produced sector 1 goods (TOT1) and the price of FDI producers increase relative to the price of domestic sector 2 producers (TOT2). In this case, we have opposing effects on FDI. Import tariffs increase the price of imports relative to domestically produced goods (Fig. 3). This reduces the exports of sector 1 firms and therefore also production in sector 1. Globally, there is a shift of demand towards domestically produced sector 2 goods. FDI producers also suffer demand losses vis-à-vis domestically produced sector 2 goods as their costs have a higher import content. However, FDI producers gain relative to sector 1 exporters since the tariff only affects a fraction of their cost.

If the imports of MNCs are exempt from tariffs, the tariff jumping effect becomes clearly visible. The tariff imposed on sector 1 goods shifts demand towards domestically and FDI-produced sector 2 goods. There is even a small gain of FDI production relative to domestic sector 2 production, since domestic sector 2 producers are more exposed to sector 1 imports than FDI producers, which are exempt from tariffs and thus from their sector 2 imports.

A comparison between scenarios 3 and 4 shows the relative welfare loss of an economy-wide tariff versus a tariff concentrated on sector 1 (Fig. 4). In both scenarios, consumption initially increases since investment drops immediately and the labor supply is inelastic. However, consumption declines permanently, i.e. there is a permanent welfare loss associated with a tariff. The welfare loss of a general tariff exceeds the welfare loss of tariffs levied on sector 1 goods only as can be seen by a stronger permanent decline of consumption in both regions.

5 Further research and policy conclusions

This paper looks at the relationship between import tariffs and FDI in the context of a two-country DSGE model with both an exporting and an FDI sector. We find that the tariff jumping effect is largely outweighed by a cost effect if the tariff is imposed on all imports at the same rate. This holds both for tariffs imposed unilaterally and world-wide import tariffs. Our analysis confirms the aggregate positive welfare effects of a unilateral tariff, but they also show inefficiencies resulting from consumption and production distortions. These are evidenced by a lower real consumption wage both in the domestic and foreign economy. With trade and FDI the trade-off between additional revenue and efficiency losses associated with tariffs becomes more complicated. Governments have a choice concerning the coverage of the tariff, in particular they can exempt MNCs from import tariffs. Our results show that not imposing tariffs on MNC imports reduces negative growth and real wage effects, since in this case, there is a tariff jumping effect. In the case of a unilateral tariff, the

government can still generate a positive welfare effect in case private households receive tariff revenues as lump sum transfers. In the case of a world-wide tariff, exempting MNC imports would reduce negative welfare effects.

The model presented shows real income losses due to tariffs—ultimately through investment channels; in an enhanced model with endogenous innovations, the income losses might become even greater. With endogenous innovations, one might also consider in a more realistic way the question as to whether a higher FDI intensity goes along with a smaller global trade intensity. To the extent that the FDI-based sector has a higher technology intensity than sector 1, a declining global trade intensity would not necessarily signal a problematic economic development with respect to global economic welfare.

The economic policy relevance of our approach is crucial as not only does it mean that the USA-China, USA-EU, or EU-China trade conflicts can be better understood within the new framework, but policymakers with a traditional—almost exclusive—focus on trade aspects of protectionism alone will overlook other critical aspects, effects, and policy options in many scenarios. If one has an adequate understanding of economic protectionism, this should—as a mirror view of protectionism—also lead to a more refined understanding of sustained economic liberalization; that is, an economic globalization that can be expected to be rather stable. This naturally leads to a consideration of certain aspects of economic liberalization which cannot be covered here, but the analysis presented could be picked up in the ongoing debate by using CES production functions and inequality aspects in the modeling of the supply side; for contributions to the traditional, and more recent, debate see, for example, Jaumotte et al. (2008) and Dorn et al. (2021).

The analysis presented herein offers a new framework with which to consider an old question, and obviously, one can find many arguments that the trade conflicts discussed at the WTO; the IMF and the World Bank (or indeed regional development banks) cannot adequately be modeled without a careful look at both trade and foreign direct investment dynamics. With FDI expansion growing strongly, not only in OECD countries but in Newly Industrialized Countries too, the MNC-related issues considered can no longer be neglected if the topic of protectionism is to be analyzed. Some of the FDI-related protectionist issues that have come onto the WTO's negotiation agenda in recent years, partly with a focus on international property rights, are rather special and at the same time are linked to trade in both intermediate and final goods trade. Thus, there is a rich future research agenda emphasized here—with Schumpeterian innovation links, including those with a focus on digital modernization, expected to play a key role in the future.

As regards further research, one could, from a New Political Economy Perspective, come up with a novel question as to which set of policy parameter changes have to be adequately adjusted: facing the vivid debate of economic globalization, a new future key challenge could be to make sure that both countries (within our two-country setting) should realize benefits in both sectors in the medium run; and that real wage increases must occur in at least one sector of every country in the long run, namely, in such a way that the compensation of “real wage losers” in the other sector

is possible. This is a more refined debate than the standard Rodrik (1998) argument that European social market economies are able to absorb high globalization dynamics because government offers considerable income redistribution in comparison to the USA (an extension could be two types of labor, used in different proportions in the two sectors).

As product innovation will be easier in a world economy with positive growth rates, and hence opportunities to exploit global economies of scale, the strategy of import protectionism is all the less convincing, the higher the outward share of MNCs' value-added of subsidiaries from the protectionist country is. Real income losses from subdued product innovation rates should be considerable—compared to process innovations—since product innovations always imply a quality-adjusted (hedonic) global real income gain; process innovations could also raise real income but the mechanism is somewhat different since real output and real wages, respectively, will increase. To the extent that product innovations and process innovations are intertwined, a rise of the product innovation rate should be expected to give rise to an argument to be considered in future research—the more important the role of economies of scale in key sectors of the economy is, the more that mark-ups will increase. Mark-ups in turn are largely linked to market imperfections.

Labor market imperfections could naturally also be included in a future model extension. One key question will concern the issue of the price adjustment frequency in an adequately modified Phillips curve. Another crucial extension beyond endogenous growth aspects could be a three-country, large economy setting (reflecting, e.g., the USA, the EU, and China). Here, one would witness key new issues which, incidentally, seem to have derailed the Trump Administration's net gain expectations from introducing import tariffs: not only were the gains from FDI-related tariff jumping and thus positive supply-side rather modest, but there were also indirect market share gains for EU firms which could improve their market position in many US markets as the US growth of competing Chinese firms—facing high US import protection—were impaired. True, the technological overlap of EU and Chinese firms were smaller than those of EU and US firms, but there is little doubt that enhanced EU MNCs' market positioning in the USA is likely to have reinforced the US profits of European firms which, in turn, will have an effect on the transatlantic and overall US primary balance. To the extent that this three-country setting implies that part of the US tariff induced tradables surplus in China translates into higher Chinese exports in key sectors to Europe, not only will EU firms in the EU28 market have suffered, but the profits of US subsidiaries in the EU single market will have suffered as well.

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