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Trade reforms and current account imbalances☆

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ABSTRACT

This paper studies the effects of trade liberalization on capital flows in a dynamic Heckscher-Ohlin model and makes four contributions. First, we identify an interest rate over-determination problem in such a model, and solve it with an endogenous discount factor. Second, we show that a trade liberalization in a developing country generally leads to a greater current account surplus, which is the exact opposite of a common but partial equilibrium intu-

surplus. In 1989, a well-known article titled "Containing Japan" by James Fallows, in the Atlantic magazine, blamed import restrictions by Japan for its large trade surplus. In more recent years, media stories often blame import restrictions by China as a contributing factor to the latter's trade and current account surplus. Indeed, it is commonly assumed that, when a country liberalizes trade (i.e., reducing trade barriers on imports), its trade surplus would shrink. One key message of the current paper is that such an assertion is not correct. Instead, we will show that, for a typical developing country, reducing import barriers can be expected to improve (rather than worsen) its current account.

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To accomplish this, we propose a dynamic Heckscher-Ohlin framework, with a necessary modification of the standard setup to overcome the challenge of an interest rate over-determination - to be explained below, to study permanent shocks such as a permanent tariff cut.[1] Our calibration suggests that China's accession to the World Trade Organization in 2001, with the attendant reductions in its import barriers, is a significant contributor to the big surge in its current account surplus in the years following the reforms.

National trade barriers tend to be placed on products in which the country in question does not have a comparative advantage. For a typical developing (labor abundant) country, trade barriers are likely to be disproportionately on capital intensive goods. A reduction in the import barriers on the capital-intensive good reduces the domestic return to capital, all else equal. This is the intuition one obtains from the Stolper-Samuelson theorem in the static trade theory. If the pre-liberation return to capital was equal to the world interest rate (after adjusting for risk premium and transaction costs), the import liberalization upsets the equilibrium, by reducing the returns to the relatively scarce factor (i.e., capital) and thus rendering the domestic interest rate to be lower than its international counterpart. To restore the equilibrium, the country must export enough capital, i.e., running a current account surplus.

Trade liberalizations would generally induce an opposite current account response in a rich (or capital abundant) country. Reductions in trade barriers (of the labor-intensive good) in such a country should raise the return to capital by the logic of the Stolper-Samuelson theorem. As a result, the country would attract capital inflow, i.e., creating a current account deficit.

The paper aims to make four contributions. The first is to build a dynamic model with Heckscher-Ohlin (HO) features and use it to show that reductions in import tariffs generally lead to a capital outflow for a labor abundant economy. Specifically, we prove that the Stolper-Samuelson theorem that holds in a static HO model also holds in our dynamic setup, and this produces a general-equilibrium that is the opposite of the partial equilibrium effect. Jin (2012), using an overlapping generations (OLG) model with sector-specifi

such a setup. The new Stolper-Samuelson theorem provides a mechanism for the current account to react in a seemingly counter-intuitive way following a permanent shock to the trade policy.

The third contribution is to study the interaction between factor market reforms and trade reforms and their effects on the current account. Many trade reforms such as an accession to the WTO often involve domestic factor reforms as well. We investigate whether and how domestic capital market reforms reinforce or weaken the effect of trade reforms on the current account. This has important practical implications. For example, in the case of China's accession to the WTO, the country has agreed to a set of policy changes pertaining to the functioning of the domestic financial system, including increased openness to foreign banks, in addition to reducing import barriers. We show that, with financial market reforms, a given amount of tariff cut generates a bigger current account surplus. This theoretical result helps us to understand why the Chinese trade reform in the early 2000s produces a bigger current account response than the reforms in the 1980s and 1990s.

As a fourth contribution, we provide a new interpretation about the observed rise and fall of China's current account surplus since 2001. Using the lens of our framework, China's accession to the World Trade Organization at the end of 2001 (with massive cuts in the country's tariffs and, importantly, non-tariff import barriers) was a watershed event for both China and the rest of the world. Our model predicts that China would initially generate a current account surplus following the WTO accession. Because many trade reform measures were implemented in a phased manner, the current account surplus would rise for a number of years. Interestingly, the same model also predicts that the current account surplus would eventually shrink. This is because the economy will eventually converge to a new steady state in which the net foreign asset remains a constant, and the current account balance will also converge to zero after the trade reform. In other words, an inverse-V-shape of current account dynamics in response to tariff cuts emerges naturally in our model. (In all dynamic models, the effect of a shock on the current account would eventually disappear, but they do not always produce a rise-and-fall pattern following tariff cuts.)

This inverse-V-shape theoretical prediction is broadly consistent with the data. Fig. 1 traces out the trajectory of China's trade-

required China to unilaterally reduce the costs of imports from foreign partners, while its partner countries did not need to liberalize. (Except for the PNTR reform by the United States, other countries do not need to reduce their trade barriers to satisfy China's WTO membership. Even in the case of the United States, the reduction in trade barriers is smaller than the reduction in Chinese trade barriers on capital intensive goods.) This fact deviates greatly from the assumptions of the model. In Reyes-Heroles (2015), whether a country runs a surplus or a deficit is not determined by changes in trade costs per se, but by the initial position of the current account. Finally, Barattieri (2014 and 2018) argues that the interplay between the US comparative advantage in the service sector and the asymmetric trade liberalization process that focused on trade in goods in the last two decades can also lead to the global imbalance.

The empirical relationship between trade reforms and current accounts has been examined by Ostry and Rose (1992) and Ju, Wu, and Zeng (2010). They find the relationship to be ambiguous. But these papers do not examine interactions between a country's factor endowment pattern and trade reforms. Our theoretical model provides an explanation for this ambiguity as it shows that the effects of trade reform on the current account depend on whether a country is relatively labor abundant and

This paper is also related to several papers on the cause of global current account imbalances. Caballero, Farhi, and Gourinchas (2008) and Mendoza, Quadrini, and Rios-Rull (2009) highlight the role of differences in financial development between current account surplus and deficit countries. Countries with relatively weak financial development (e.g., China) cannot produce enough financial assets at home to absorb all the savings. As a result, they export a part of their savings to countries with better financial development (e.g., the United States). Song, Storesletten, and Zilibotti (2011) also feature financial sector imperfections in China in generating a current account surplus. It stresses the inability of productive domestic private sector firms to borrow from the formal financial sector as key friction. These firms have to save to finance their investment. As the share of these firms grows in the economy, so does the country's current account surplus. In these papers, when China's financial market develops (including improvement in access to finance by private firms), the country's current account surplus would decline rather than increase. In contrast, our theory in this paper will suggest that factor market reforms such as improvements in the domestic financial market will reinforce the effect of trade liberalization on the current account, i.e., making the surplus even bigger than without the improvement in the financial sector.

2.2. Some data patterns

Before we present a formal model, it is useful to look at more facts beyond the China example. To this end, we examine the current account experience of all countries that have experienced a major trade policy change in the last two decades. More precisely, we adopt a two-step procedure. First, we identify all episodes of large trade policy changes for all countries since 1990 (for which the relevant data are available). Second, for each country in the sample, we measure changes in the country's capital intensity and examine its relationship with changes in the country's current account.

We define a major trade reform as one that simultaneously satisfies two criteria: (a) a reduction in the country's average tariff rate (either simple tariff or trade-weighted average across products) by at least 3 percentage points cumulative over two consecutive years; and (b) an increase in the country's imports/GDP ratio by at least 3 percentage points from the year before the tariff cut to three years after the reform. The first criteria is to ensure that a chosen episode involves an actual change in the trade policy, and the second criteria is to ensure that the tariff cut is not offset by hidden increases in protectionism via non-tariff measures.

Some trade reforms may result in a decline in the country's overall capital intensity of its production, while others may produce an increase in capital intensity. Our theory will suggest that the current account consequence of a given change in the trade policy differs in these two cases. We now perform a simple check on whether, following a major trade policy change, the change in a country's current account pattern is systematically related to the change in its capital intensity.

While it is relatively straightforward to measure a change in a country's current account, how do we measure a change in its capital intensity? Our approach is to measure the capital intensity of the country's export structure before and after the trade policy change. (Ideally, we would like to measure the capital intensity of the country's entire production structure, but we do not have as good data on the sector-level production as that on sector-level exports.) We do it in two steps. First, we use the 2002 US Standard Make and Use Tables (from the US Bureau of Economic Analysis) to compute the capital intensity of each HS 6-digit sector. Second, for a given country in the sample in any given year, we can compute the average capital intensity of its export bundle based on the shares of each HS 6-digit sector. Our maintained assumption is that the capital intensity of a sector is a technological feature that does not change across countries. (What we need is a weaker assumption: the ranking of sectors in terms of capital intensity, rather than the absolute values of capital intensity, is highly correlated across countries.)[5]

By our filtering criteria, there are 38 episodes, involving 31 distinct countries, that qualify as major trade reforms. Unfortunately, 8 of the episodes suffer from missing data on either trade intensity (Bangladesh 2007, Bhutan, Lesotho, Pakistan, Philippines, Syria, Zimbabwe) or current account (Lebanon). Two episodes appear to be obvious outliers (Belize and Guyana) as their changes in trade composition are substantially bigger than other country-episodes. A list of the 38 trade reform episodes is provided in Table 1, together with the changes in their tariff rates and the import/GDP ratios. An asterisk sign indicates that the data on capital intensity and current account are also available.

To control the effects of capital account opening on the current account, we adopt three capital account openness indices commonly used in the literature. The first is the Capital Control Index proposed by Fernandez, Klein, Rebucci, Schindler, and Uribe (2016). It measures the restrictions on inflows and outfl

Table 1
Episodes of trade reforms (1990–2010).

Country Name	Period	Tariff Change		Imports Change	Financial Deregualation		
		Simple Average	Weighted Average		fkrsu Capital Control Index	IMF Openness Index	Chinn-Ito Openness Index
Albania*	2001–2002	−3.21	−2.93	8.01	/	Unchanged	Unchanged
Algeria*	2001–2003	−3.44	−3.19	3.8	Close	/	Unchanged
Bangladesh*	2003–2005	−4.21	0.86	3.01	Unchanged	Unchanged	Unchanged
Bangladesh	2006–2007	−0.72	−8.62	3.51	Close	Close	Unchanged
Belize	1999–2001	−9.18	−0.48	6.31	/	Unchanged	Close
Bhutan	2005–2007	−0.24	−5.01	4.27	/	Unchanged	Unchanged
Brazil*	1989–1993	−30.01	−18.9	3.63	/	/	Unchanged
Brazil*	1998–2001	−1.76	−5.52	4.56	Open	Open	Open
Cambodia*	2003–2005	−2.14	−5.54	4.35	/	/	Open
Canada*	1995–1997	−3.3	−2.34	3.4	Open	/	Unchanged
China*	1992–1997	−24.57	−16.35	4.86	/	/	Open
China*	2001–2003	−4.52	−7.63	6.88	Unchanged	Unchanged	Unchanged
Georgia*	2002–2004	−3.1	−1.33	4.02	Unchanged	Unchanged	Unchanged
Guyana	1999–2001	−9.73	−3.59	6.14	/	Unchanged	Open
India*	2004–2008	−16.86	−16.55	4.93	Unchanged	Unchanged	Unchanged
Indonesia*	1989–1990	−3.48	0.36	3.55	/	/	Unchanged
Indonesia*	1995–1996	−2.99	−3.16	15.57	Open	/	Close
Indonesia*	1999–2001	−4.3	−1.74	3.03	Close	/	Close
Kenya*	2004–2006	−4.11	−3.44	3.1	Open	Open	Unchanged
Kyrgyz Republic*	2002–2003	−3.33	−2.52	7.92	Open	Unchanged	Unchanged
Lebanon	2000–2001	−8.72	−8.69	4.01	Close	Close	Close
Lesotho	2006–2007	0.05	−3.04	5.22	/	/	Unchanged
Malawi*	1996–1998	−6.67	−4.37	6.23	/	Open	Unchanged
Mauritius*	1995–1997	−0.99	−4.91	3.19	Close	/	Open
Mauritius*	2005–2006	−2.96	−3.5	7.05	Close	Unchanged	Unchanged
Morocco*	2006–2009	−6.13	−4.61	5.19	Unchanged	Open	Unchanged
Nigeria*	2001–2002	3.9	−3.02	8.15	Unchanged	Unchanged	Open
Pakistan	2001–2003	−3.01	−3.43	3.85	Open	Open	Unchanged
Paraguay*	2004–2006	−1.91	−5.21	5.6	Close	Close	Unchanged
Peru*	2006–2008	−4.11	−4.04	7.23	Close	Close	Unchanged
Philippines	1989–1990	−8.68	−7.66	3.02	/	/	Unchanged
Seychelles*	2005–2006	−3.64	−0.45	4.13	/	Unchanged	Unchanged
St Lucia*	2000–2001	−9.76	−4.25	4.16	/	/	Unchanged
Syrian Arab Republic	2009–2010	0	−4.03	4.61	/	/	/
Thailand*	1993–1995	−22.66	−21.7	6.39	/	/	Unchanged
Thailand*	2003–2005	−3.46	−4.15	6.94	Close	Close	Unchanged
Tunisia*	2002–2008	−12.4	−10.46	3.36	Unchanged	Unchanged	Unchanged
Zimbabwe	1996–2003	−25.1	−22.45	8.67	/	Unchanged	Close

Note: *denotes the countries for which data on current account and capital intensity are both avaiable. For capital account openness, open (close) means the capital account becomes more (less) liberalized after the trade reform.

We then perform the following simple regression:

$$\Delta\left(\frac{CA_j}{GDP_j}\right) = \alpha + \beta\Delta k_j + \theta X_j + \varepsilon_j \tag{2.1}$$

where $\Delta\left(\frac{CA_j}{GDP_j}\right)$ and Δk_j represent the change in country j's current account to GDP ratio, and the change in the average capital intensity of its export bundle, respectively, while X_j is a set of control variables including the change in financial openness and the change in the real exchange rate.

In Column 1 of Table 2, we report the basic regression result. The regression shows a negative and statistically significant relationship between the change in capital intensity and the change in current account. In other words, in episodes in which a trade policy change has led to a decline in the capital intensity of the country's exports (e.g., China after the WTO accession in 2002–2003), the current account balance tends to go up. Conversely, in episodes in which a trade policy change has led to an increase in capital intensity (such as India during 2005–2008), the current account balance tends to deteriorate.

In Column 2, we add the change in a country's real exchange rate over the same period of the trade policy change as a control variable. Because price (or inflation) information is missing for several countries in the sample, the regression sample is reduced to only 13 countries. In any case, the coefficient on the real exchange rate is negative and statistically significant, suggesting that a rise in the real exchange rate tends to be associated with a decline in a country's current account. Importantly, we continue to find a negative coefficient on capital intensity: a rise in a country's capital intensity tends to be associated with a deterioration in its current account.

In Columns 3–5, we include changes in capital account openness, measured, respectively, by the three indicators for capital account openness. It turns out that none of the capital account indicators is statistically significant. In other words, there is no statistical support for the hypothesis that an improved capital account openness leads to more capital outflow during the trade reform episodes.

Barattieri (2014, 2018) argues that the tariff reduction on goods trade would increase the trade surplus for those countries with a comparative advantage in manufacturing production, but produce an opposite change for those countries with a comparative advantage in the service sector. To account for this possibility, we construct a Revealed Comparative Advantage (RCA) index for manufacturing and services production, respectively, for each country in our sample, using the method in Barattieri (2018) and the merchandise and service trade flows data from the WTO world trade database. As shown in Columns (6)-(Caballero et al., 2008) of Table 2, we add the initial RCA in manufacturing sectors (i.e., in the first year of a trade reform episode) and the initial RCA in service sectors, respectively. There is support for the hypothesis that those countries with a strong RCA in manufacturing production tend to experience an improvement in the current account following trade reforms. Importantly, after controlling for the initial RCA, our results remain robust. Indeed, the capital intensity variable becomes more significant: those countries with a decline in the capital/labor ratio after a trade reform tend to exhibit an improvement in their current account. These patterns are consistent with the prediction of the dynamic Stolper-Samuelson theorem that we will develop in the next section.

While our sample consists of the universe of all major trade reforms since 1990, it is still a relatively small sample. As such, we are not able to have many control variables. We also do not investigate the potential endogeneity of the regressors. We, therefore, treat the empirical results as suggestive data patterns rather than definitive empirics. In the rest of the paper, we aim to provide a theory that is consistent with these patterns in the data.

3. The basic model

Our model, in a nutshell, marries a Heckscher-Ohlin structure (with two tradable sectors of different factor intensities) and a small open-economy intertemporal framework. Importantly, we also incorporate an endogenous discount factor (EDF) following Uzawa (1968), Obstfeld (1982), Mendoza (1991), Uribe (1997), Schmitt-Grohe (1998), and Choi, Mark, and Sul (2008), among others. The EDF has a built-in "keeping-up-with-the Joneses" feature - an economic agent tends to become more patient when others in the economy are more patient, and vice versa. Philosophically, this strikes us as having captured a realistic feature of

the problem of interest rate over-determination disappears. If a tariff change causes the interest rate to change due to the zero-profit conditions, the total consumption simply adjusts to accommodate that. It is useful to point out that the role of the endogenous discount factor here is not to provide stationarity to the model. There will be a small cost of adjusting the international bond holding which will provide stationarity as in the standard literature.

An endogenous discount rate means a discount rate that varies over time, for example, as a function of the economy-wide consumption per capita and income per capita. An individual may become more impatient when the average level of consumption in the economy goes up. In other words, people pay attention to status competition, where status is defined either by one's consumption relative to an economy-wide average or by one's own past consumption. This arguably captures a realistic aspect of human nature. Once we recognize this feature (and represent it in the utility function), we can resolve some seemingly puzzling features in models that impose a constant subjective discount rate. Uzawa (1968), which first introduced the concept of an endogenous discount factor in the literature, noted that a constant subjective discount rate and a constant interest rate would produce an unrealistic scenario in which the consumer would either save all the income or save nothing, except for the knife-edge case in which the subjective discount rate is equal to the interest rate. Uzawa shows that an endogenous discount factor would produce a more realistic scenario that moves away from the two extreme cases.

Obstfeld (1981) developed the first open-economy macro model that has incorporated an endogenous discount rate (but without HO features). In his model, the accumulation of external assets attains a stationary state when the (endogenous) discount rate reaches the level of an (exogenous) world interest rate. The endogenous discount rate ensures the existence of a stable perfect foresight equilibrium path that converges to the stationary state. Another important paper with an endogenous discount rate (but no HO features) is an open-economy real business cycles model developed by Mendoza (1991). That model produces a well-defined stationary equilibrium in an economy's holdings of foreign assets. In both open economy models, the endogenous discount rate is deployed to achieve stationarity. Neither model encounters this type of interest rate over-determination problem that we will describe below.

Epstein (1983) argued that an endogenous discount rate is a natural feature in a world with uncertain future incomes, and helps to ensure that consumption in every period is a normal good. Other papers have demonstrated that an endogenous discount rate can help resolve other seemingly puzzling observations such as a low real interest rate when the government spending is high (Devereux, 1991) or no country owns all the wealth in the world even if some countries are more patient initially (Daniel, 1997).

In short, an endogenous discount factor has a long intellectual history and has been found useful in understanding many macroeconomic phenomena including the dynamics of current account or foreign asset holdings. Our paper is the first that combines an endogenous discount factor with a dynamic HO model. By resolving the interest rate over-determination problem, this makes it possible for us to study the effects of a permanent shock to trade costs on the current account.

While interest rate over-determination is a unique problem to the dynamic HO framework, another technical challenge is common for small open economy models. This is the stationarity problem. As domestic residents have only access to a risk-free bond whose rate of return is exogenously determined abroad, the steady-state of the model depends on the country's initial net foreign asset position. This causes the equilibrium dynamics to possess a random walk component. This problem arises mainly because, in the steady state, the standard Euler equation is not sufficient to pin down the equilibrium. Schmit-Grohe and Uribe (2003) have reviewed the literature and proposed several alternative solutions, including a bond adjustment cost. We adopt a bond adjustment cost in our model.

In a standard model without HO features, either an endogenous discount factor or a bond adjustment cost is sufficient to solve the stationarity problem. However, in our setup, we cannot use an endogenous discount factor to address both the stationarity problem and the over-determination of the interest rate. Instead, we will have both an endogenous discount factor and costly bond adjustment.[6]

3.1. Household

The economy is inhabited by a continuum of identical and infinitely lived households that can be aggregated into a representative household. The representative household's preference over consumption flows is summarized by the following time-separable utility function

$$U = \sum_{s=t}^{\infty} \theta_s U(C_s) \tag{3.2}$$

where C_s is the household's consumption of a final good at date s, and θ_s is the discount factor between period 0 and s as given by

$$\theta_{s+1} = \beta\left(\widetilde{C}_s, \widetilde{Y}_s\right)\theta_s, s \geq 0 \tag{3.3}$$

[6] The interest rate over-determination problem exists regardless of if there is an international bond. This problem would not go away if there is a cost of adjustment in the bond market. On the other hand, the problem is solved if β is endogenous as we assume in the paper. A technical appendix provides more explanation on this point.

where $\theta_0 = 1$ and $\frac{\partial\beta(\widetilde{C}_s)}{\partial\widetilde{C}_s} < 0$ and $\frac{\partial\beta(\widetilde{Y}_s)}{\partial\widetilde{Y}_s} > 0$. We assume that the endogenous discount factor does not depend on the household consumption and income, but rather on the economy-wide average per capita consumption $\widetilde{C}_s$ and income $\widetilde{Y}_s$, which the representative household takes as given. The exact functional form of $\beta\left(\widetilde{C}_s, \widetilde{Y}_s\right)$ will be presented later when we solve the model. The household owns both factors of production, capital K and labor L. For simplicity, we assume a fixed labor supply.

The final good is produced by combining two intermediate goods. Each intermediate good is produced by combining capital and labor. The household supplies labor to both intermediate good sectors through a competitive spot market. In the benchmark model, both labor and capital are assumed to be freely mobile across sectors. Factor market frictions will be discussed later. The household can hold foreign asset B_t to smooth consumption. Following Neumeyer and Perri (2005), we assume that trade in foreign bonds is subject to small and convex portfolio adjustment costs. If the household holds an amount B_{t+1}, then these portfolio adjustment costs, denominated in units of the final good, are $\frac{\psi_b}{2}\left(B_{t+1}-\overline{B}\right)^2$, where $\overline{B}$ is an exogenous capacity level of foreign debt management. For simplicity, we assume $\overline{B} = 0$ in the analytical model.

Therefore, the budget constraint and the capital accumulation equation faced by the representative household are given, respectively, by

$$P_t\left[C_t + \frac{\psi_b}{2}\left(B_{t+1}-\overline{B}\right)^2\right] + B_{t+1} + I_t = w_t L + r_t K_t + \left(1+r^*\right)B_t + TR_t$$

$$K_{t+1} = (1-\delta)K_t + I_t - \frac{1}{2}\psi_k\left(\frac{I_t}{K_t}-\delta\right)^2 K_t$$

where I_t is investment in period t, and w_t and r_t are the wage and the domestic return to capital, while r^* is the world interest rate, δ the capital appreciation rate and ψ_k is the aggregate capital adjustment cost coefficient. The tariff revenue, TR_t is rebated in a lump-sum to the representative consumer, which is taken as exogenous by the consumer.[7]

The first order conditions with respect to C_t, I_t, K_{t+1}, and B_{t+1}, are, respectively,

$$\frac{U_c'(C_t)}{P_t} = \Omega_t$$

$$\Lambda_t\left(1-\psi_k\left(\frac{I_t}{K_t}-\delta\right)\right) = \Omega_t$$

$$\Lambda_t = \beta\left(\widetilde{C}_t, \widetilde{Y}_t\right)\left[\Lambda_{t+1}\left(1-\delta+\frac{\psi_k}{2}\left(\frac{I_{t+1}}{K_{t+1}}-\delta\right)\left(\frac{I_{t+1}}{K_{t+1}}+\delta\right)\right) + \Omega_{t+1}r_{t+1}\right]$$

$$\Omega_t\left[1+\psi_b P_t\left(B_{t+1}-\overline{B}\right)\right] = \beta\left(\widetilde{C}_t, \widetilde{Y}_t\right)\left[\Omega_{t+1}\left(1+r^*\right)\right]$$

where Ω_t and Λ_t are Lagrangian multipliers for the budget constraint and the law of motion for capital, respectively.

3.2. Production

The production function for the final good is $D_t = G(D_{1t}, D_{2t})$, where D_{it} is the usage of intermediate good i by the final good producer. The production function for the intermediate good $i(=1,2)$ is $X_{it} = f_i(A_{it}L_{it}, K_{it})$ where A_{it} measures labor productivity. $A_{it}L_{it}$ can be understood as units of *effective labor*. All production functions are assumed to be homogeneous of dttLe(in)-179.1(g)13.eF41

3.3. Equilibrium

In equilibrium, trade in intermediate goods equalizes (tariff-inclusive) good prices between the home country and the rest of the world in every period. Without loss of generality, we assume that sector 1 is labor-intensive while sector 2 is capital-intensive. Considering a labor abundant country which exports labor intensive good 1, we have:

$$P_{1t} = P_{1t}^*, P_{2t} = (1+\tau)P_{2t}^*, \tag{3.12}$$

where P_{it}^* denotes the world price and is exogenously given, and τ is the import tariff. Following the standard assumptions in the Heckscher-Ohlin model, we assume that production functions (and unit cost functions) in all countries are the same (although labor-augmenting productivity can be different). Therefore, in the foreign country we also have:

$$P_1^* = \phi_1\left(\frac{w^*}{A_1^*}, r^*\right), P_2^* = \phi_2\left(\frac{w^*}{A_2^*}, r^*\right) \tag{3.13}$$

For simplicity, we assume that the rest of the world is in steady state so the return to capital, r^*, is a constant. We will leave out the time subscript for all foreign variables from now on. We have the following market clearing conditions in the home country

$$K_t = K_{1t} + K_{2t} \tag{3.14}$$

$$L_t = L_{1t} + L_{2t} \tag{3.15}$$

$$D_t = C_t + \frac{I_t}{P_t} + \frac{\psi_b}{2}\left(B_{t+1} - \overline{B}\right)^2 \tag{3.16}$$

Eq. (3.16) implies that the final good is used not only for consumption and investment, but also for covering the costs of adjusting the international asset position. The current account balance over period t is defined as $CA_t = B_{t+1} - B_t$; thus, noting that $P_{it}X_{it} = w_tL_{it} + r_tK_{it}$ and using eqs. (3.11) and (3.16), we can rewrite the budget constraint as

$$CA_t = P_{1t}^*(X_{1t} - D_{1t}) + P_{2t}^*(X_{2t} - D_{2t}) + r^*B_t \tag{3.17}$$

That is, the current account balance is equal to the trade balance (evaluated at the world prices) plus the interest income from the net foreign asset position. For future reference, we define the gross domestic product as $Y_t = \frac{P_1X_{1t} + P_2X_{2t}}{P_t}$.

4. Equilibrium analysis

To study the equilibrium explicitly, we adopt the following standard functional forms for preference and technology. The utility function is $U(C_t) = \frac{C_t^{1-\gamma}}{1-\gamma}$, where γ is the inverse of the elasticity of intertemporal substitution. The production function for the final good is $G(D_{1t}, D_{2t}) = \frac{1}{\omega^\omega(1-\omega)^{1-\omega}} D_{1t}^{\omega} D_{2t}^{1-\omega}$, where ω is the expenditure share on good D_1 in the final good production. The production function for good i is $f_i(A_{it}L_{it}, K_{it}) = \frac{1}{\alpha_i^{\alpha_i}(1-\alpha_i)^{1-\alpha_i}} K_{it}^{\alpha_i}(A_{it}L_{it})^{1-\alpha_i}$, where α_i is the capital share in producing intermediate good i. We let $\alpha_1 < \alpha_2$ so that sector 1 is labor intensive. The endogenous discount factor takes the following function form:

$$\beta\left(\widetilde{C}_t, \widetilde{Y}_t\right) = \beta\left(\frac{\widetilde{C}_t}{\overline{C}}\right)^{-\psi_1}\left(\frac{\widetilde{Y}_t}{\overline{Y}}\right)^{\psi_2} \tag{4.18}$$

where $\psi_1 > 0$ and $\psi_2 > 0$. $\overline{C}$ and $\overline{Y}$ are, respectively, the average consumption and output levels in the initial steady state with tariff τ_0. This form is a variant of Choi, Mark, and Sul (2008). When the economy-wide average consumption $\widetilde{C}_t$ falls relative to the initial steady state value, the representative agent becomes more patient. That is the implication of this type of discount factor. In the new steady state after a tariff reform, the endogenous discounted factor would deviate from the constant β. To make the model parsimonious, we assume $\psi_1 = \psi_2 = \psi$.

4.1. The effects of trade liberalizations

For simplicity, we assume that $A_1 = A_2 = 1$. In equilibrium, given the production functions, from Eq. (3.10), we have

$$\frac{w_t}{A_{1t}}^{1\check{S}\ 1} r_t^{\ 1} \frac{1}{4} P_1, \quad \frac{w_t}{A_{2t}}^{1\check{S}\ 2} r_t^{\ 2} \frac{1}{4} \delta 1 \beta \quad \text{IP}_2 \qquad \delta 4{:}19\text{P}$$

which give

$$r_t \frac{1}{4} r \quad \frac{A_{1t}}{A_{2t}}^{\delta 1\check{S}\ 1 \text{I} \delta 1\check{S}\ 2\text{P}} \frac{1}{\delta 1 \beta \quad \text{P}^{\delta 1\check{S}\ 1\text{P}}}^{\frac{1}{1\check{S}\ 2}} \qquad \delta 4{:}20\text{P}$$

$$w_t \frac{1}{4} w \quad \left[\frac{A_{1t}^{\delta 1\check{S}\ 1\text{P}\ 2}}{A_{2t}^{\ 1\delta 1\check{S}\ 2\text{P}}} \frac{1}{\delta 1 \beta \quad \text{P}^{1}}\right]^{\frac{1}{2\check{S}\ 1}} \qquad \delta 4{:}21\text{P}$$

Three comparative statics can be immediately seen: (a) $\frac{r_t}{} > 0$, (b) $\frac{r_t}{A_{1t}} < 0$, and (c) $\frac{r_t}{A_{2t}} > 0$: By inequality (a), trade liberalization in a labor-abundant country (a reduction in) reduces the return to capital. Inequalities (b) and (c) pertain to sector-biased productivity shocks. While technological progress in the labor-intensive sector reduces the return to capital, the same change in the capital-intensive sector produces the opposite effect. It can be veri ed that as long as there is faster technology progress in the labor-intensive sector relative to the capital-intensive sector ($\frac{A_{1t}}{A_{2t}}$ increases), the return to capital declines.

These results (in a dynamic setting) are consistent with the Stolper-Samuelson theorem in a static HO model. That is, an increase in the price of a good increases the return to the factor used more intensively in that good, and reduces the return to the other factor. A tariff reduction in the capital intensive sector implies a decrease in the price of capital intensive goods, therefore, r_t decreases but w_t increases.[8]

It is worth emphasizing that the discussion points to a natural asymmetry between developed (capital abundant) and developing (labor abundant) countries. Trade liberalizations tend to reduce the domestic return to capital for a developing country but to raise it for a developed country.

4.1.1. Net foreign asset positions

We consider two cases of the effects on net foreign asset positions, B_t. First, in the transitional dynamics, we assume that the investment adjustment cost $_k$ is zero. Using eqs. (3.7), (3.8) and (3.9), we obtain:

$$B_{t\beta 1} \frac{1}{4} \frac{1}{{}_bP_t} \frac{r \check{S}\ r_{t\beta 1} \beta}{1 \beta\ r_{t\beta 1}\check{S}} \qquad \delta 4{:}22\text{P}$$

The holding of foreign bond B_{t+1} is a function of r_{t+1} and $\frac{B_{t\beta 1}}{r_{t\beta 1}} < 0$. Second, in the steady state, using rst order conditions (3.7), (3.8) and (3.9), we obtain:

$$B \frac{1}{4} \frac{1}{{}_bP} \frac{r \check{S}\ r \beta}{1 \beta\ r\check{S}} \qquad \delta 4{:}23\text{P}$$

That is, when the return to capital in the country decreases, capital ows out so that the net foreign asset increases in the steady state. Note that the result for net foreign asset positions does not depend on the assumption of an endogenous discount factor, $\hat{e}_{t,}\hat{Y}_t$:

4.1.2. Steady state

Using the Euler equation in the steady state (3.8) and the function of endogenous discount factor (4.18), we solve for the ratio of consumption to income.

$$c_y = \frac{\overline{C}}{\overline{Y}}[\beta(1+r-\delta)]^{\frac{1}{\psi}} \tag{4.24}$$

where $c_y = \frac{C}{Y}$. $\overline{C}$ and $\overline{Y}$ are the consumption and income level in the initial steady state, respectively. Clearly, $\frac{\partial c_y}{\partial r} > 0$. Note that the interest rate is determined by the production side (along the demand curve of capital). A decrease in the interest rate implies that the combined size of capital stock and foreign asset holding in the new steady state is larger, which requires that the household becomes more patient and consumes less relative to income.

The return to factors (r, w) and the holding of foreign asset (B) are given by eqs. (4.20), (4.21) and (4.23). Given that, we can solve for the demand for the final good, D, consumption, C, investment, I, Gross Domestic Product, Y and sectoral outputs X_1 and X_2 from the set of equations listed in Appendix 7.1. We can write the sectoral outputs as below

$$P_1X_1 = \frac{wL-(1-\alpha_2)(1+\tau)\left(\zeta PD-r^*B\right)}{(1-\alpha_1)-(1+\tau)(1-\alpha_2)} \tag{4.25}$$

$$P_2X_2 = \frac{(1-\alpha_1)(1+\tau)\left(\zeta PD-r^*B\right)-(1+\tau)wL}{(1-\alpha_1)-(1+\tau)(1-\alpha_2)} \tag{4.26}$$

where $\zeta = \omega + \omega/(1+\tau)$. The optimization conditions for the final good producer yield $P_1D_1 = \omega PD$. Thus the exports of intermediate good 1 are given by

$$NX_1 = P_1(X_1-D_1) = P_1X_1-\omega PD \tag{4.27}$$

Finally, the factor usages and capital intensities in sector i are given by

$$K_i = \alpha_i\frac{P_iX_i}{r}, L_i = (1-\alpha_i)\frac{P_iX_i}{w}, \text{and} \tag{4.28}$$

$$\frac{K_i}{L_i} = \frac{\alpha_i}{1-\alpha_i}\frac{w}{r} \tag{4.29}$$

A tariff cut in the capital intensive sector will lead to an expansion of the labor-intensive sector, and a contraction of the capital-intensive sector. As a result, labor and capital flow from the capital-intensive sector to the labor-intensive sector, and both exports and imports go up.

4.2. Calibrations in the basic model

To calibrate the basic model, we follow the standard approach (as in Backus, Kehoe, and Kydland, 1992, 1994; and Kehoe and Perri, 2002) as much as possible. The parameter values are summarized in Table 3. We set the steady state discount factor $\beta = 0.99$, which implies a 4% annual world interest rate. The inverse of the elasticity of intertemporal substitution $\gamma = 2$, which is also widely used in the literature. We assume an equal share of the intermediate goods in the final good production, so $\omega = 0.5$.[10] We choose $\alpha_1 = 0.33$ and $\alpha_2 = 0.7$ so that both the average labor share and the average dispersion of the labor shares in the model economy are the same as those estimated from China's input-output Table in 2002.[11] We set capital adjustment cost $\psi_k = 4$ in the benchmark so the elasticity of Tobin's Q with respect to the investment capital ratio is 0.1, which is within the range reported in

[10] From the Chinese Input-Output Table, we can obtain the domestic consumption of each industry, which is the sum of consumption of private sector and government sector. The ratio of consumption from exporting industry to consumption from importing industry is close to 1.03. For simplicity, we set $\omega = 0.5$.

[11] In the Chinese firm-level data, for labor compensation, the firms only report wage payments; they do not provide information on non-wage compensation. The median labor share in plant-level data is roughly 30%, which is significantly lower than the aggregate labor share in the national accounts (roughly 50%). Following Hsieh and Klenow (2009), we, therefore, assume that non-wage benefits are a constant fraction of a plant's wage compensation, where the adjustment factor is calculated such that the sum of imputed benefits and wages across all plants equals 50% of aggregate value-added.

Table 3
Parameter Values in Calibration.

β	discount factor in steady state	0.99
γ	inverse of the elasticity of intertemproal substitution	2
α_1	capital share in sector 1	0.33
α_2	capital share in sector 2	0.7
ω	share of good 1 in final good	0.5
δ	capital depreciation rate	0.025
ψ_k	capital adjustment cost	4
ψ_b	bond adjustment cost	0.0063
ψ	parameter of endogenous discount factor	0.0688
t_c	initial trade cost	0.1
τ	initial import tariff	0.15
τ^{ss}	import tariff in new steady state	0.1
A_1^0	initial productivity for sector 1	0.0546
A_2^0	initial productivity for sector 2	0.0225
A_1^{ss}	productivity for sector 1 in new steady state	0.1028
A_2^{ss}	productivity for sector 2 in new steady state	0.0250

the literature. This parameter only affects the dynamic path, in the quantitative analysis, we vary the value of ψ_k for robustness check. We set the annual depreciation rate of capital at 10%, which implies $\delta = 0.025$..

We set $t_c = 0.1$, which implies that the trade cost for both exports and imports equals 10% of the total trade value. This estimate is based on the difference between the CIF (cost, insurance and freight) and FOB (free on board) values of trade flows reported by the custom authorities. The difference varies across trading partners, and 10% is close to the weighted average with bilateral trade volume as the weights.

For the initial steady state, we assume that 15% tariff is imposed on the capital intensive sector, and the ratio of foreign asset position to GDP ($\overline{B}/\overline{Y}$) and the ratio of consumption to GDP ($\overline{C}/\overline{Y}$) equal to their corresponding values in 2000, respectively. To back out the values of the two parameters, we use the following information: China's export share in GDP in 2000 is approximately 10%, and China's aggregate TFP level relative to that of the world in 2000 from the Penn World Table is 0.36.

For the new post-reform steady state, we allow B and C/Y to deviate from $\overline{B}$ and $\overline{C}/\overline{Y}$, respectively. The import tariff is reduced to 10% and the trade cost in the export sector is reduced to 0.08.[12] The steady state is jointly determined by four parameters: ψ_b, ψ, A_1^{ss} and A_2^{ss}. To calibrate their values, we use the following information. First, China's aggregate TFP relative to the rest of the world in 2007 is 0.51 (from the Penn World Table 9.1). Second, the ratio of total consumption (both private and government) to GDP in 2007 is about 60% (from the Penn World Table 9.1). Third, the capital rent declined by 1.1 percentage points from 2000 to 2004 (from the Penn World Table 9.1). Fourth, China's foreign asset position as a share of GDP in 2007 is 29%.

We consider two policy experiments: a reduction in the tariff rate by 5 and 10 percentage points, respectively. In columns 2, 3, and 4 of Table 4, we report the values for both the initial steady state (when the tariff = 15%) and the new steady states (when the tariff = 10% and 5%, respectively).[13] The price variables, aggregate quantity variables, sectoral variables, and balance-of-payments (BOP) variables are organized in four panels.

The results confirm Proposition 1. In particular, the return to capital, $r_1 = r_2$, declines while the wage rate, $w_1 = w_2$, rises. In the new steady state after the tariff cut, aggregate consumption C, investment I, and GDP Y all increase. The labor-intensive sector (Sector 1) expands so that K_1, L_1, and X_1 all increase, while the capital intensive sector (Sector 2) contracts. Both exports (NX_1) and imports ($-NX_2$) expand. The trade volume to GDP ratio, TV/GDP, increases by 2.1 percentage points. Most interestingly, the exports expand faster than the imports, and capital flows out of the country so that the cumulative increase in the foreign asset holding reaches 22% of GDP. In other words, a relatively moderate tariff reduction (from 15% to 10%) results in a significant capital outflow.

In the second policy experiment, a more substantial (but still realistic) tariff reduction by 10 percentage points (from 15% to 5%) leads to an even greater increase in foreign asset holdings to 32.8% of GDP.

There are also interesting by-products of the trade reforms. In particular, consumption as a share of GDP declines while the investment to GDP ratio increases. To be precise, both consumption and output expand from the old to the new steady state (see the row labeled as "C" in Table 4), so the decline in the ratio of consumption to GDP comes from uneven speeds of expansion, not from a decline in consumption in the steady level. This is an interesting bonus finding. Chinese data in recent years exhibit a declining ratio of consumption to GDP, and it is commonly interpreted to be a result of some policy distortions (either exchange rate manipulation or financial repression). Our calibration generates such a feature as a result of a reduction in policy distortions (tariffs).

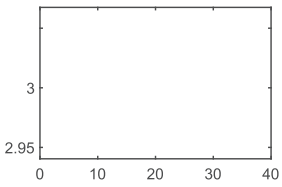
In Fig. 2, we report the dynamic paths of the economy from the initial to the new steady state after a 5 percentage points cut in the tariff (from 15% to 10%). We assume that the trade liberalization starts to hit the economy in period 1. We find that the structural adjustment takes place immediately. In particular, sector 1 (the labor-intensive sector) expands immediately with an

[12] The reduction in the export cost is motivated by the removal of tariff uncertainty in the United States after the US granted permanent normal trading relations (PNTR) to China in 2000. Handley and Limao (2016) estimated that the PNTR reform is equivalent to a permanent reduction in the US tariff rate on imports from China by 13 percentage points (on mostly labor-intensive products). From 2001 to 2007, the Chinese exports to the US are about 15% of China's total exports on average. Therefore, we assume that the PNTR reform is equivalent to a reduction on Chinese export cost by 2%.

[13] In the benchmark case, the sectoral productivity in both sectors and the trade cost remain unchanged at their initial steady state level.

increase in K_1, L_1, and X_1, while sector 2 contracts immediately, with a decline in K_2, L_2, and X_2. As a result, both the export share *sx* and import share $-sm$ increase immediately. As noted, the consumption response is interesting. After a decline in the first several periods, consumption rises gradually. Intuitively, because the domestic return to capital declines after the trade reform, the endogenous discount factor specification implies that the representative household must become more patient. This in turn causes the household to have a lower ratio of consumption/income (or a higher savings rate) both during the transition and in the new steady state. (It is important to reiterate that we can see, from Table 4, that the absolute level of consumption does go up in the new steady state. In other words, trade reforms do raise consumption, but not the ratio of consumption to GDP.)

In Fig. 3, we report the dynamic paths for some key balance-of-payments items. From the top-left graph, we observe that the



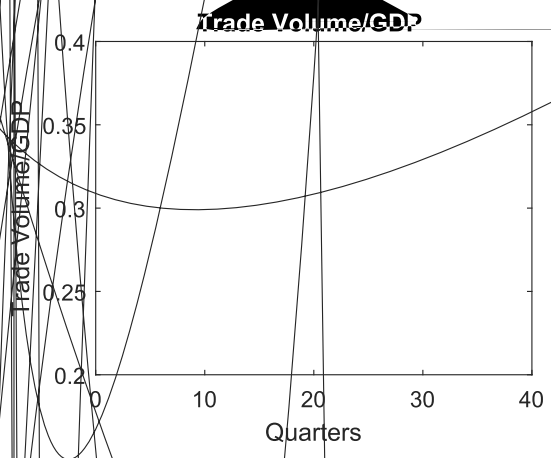
trade reform, while the investment rate goes up slowly and reaches a peak at the 10th quarter. The gap between savings and investment is always equal to the current account indicated by the thick line in the upper right graph. Note that the domestic investment (as a share of GDP) can go either up or down, depending on the relative strengths of two opposite effects. First, in the face of a tariff cut, the return to capital declines, which leads to a rise in the capital-labor ratio in each sector and contributes to an increase in the aggregate investment; Secondly, the expansion of the labor intensive sector and the contraction of the capital intensive sector after the tariff cut generate a composition effect, which results in lower domestic demand for investment.

In Fig. 4, we report the dynamic responses of the trade volume and the balance of payment to a simultaneous reduction of import tariff by 5 percentage points and of export costs by 2%. With an additional cut in the export costs (the PNTR reform in the United States), the initial trade volume/GDP increases from 37% to 43%, and the initial current account/GDP increases slightly from 3% to 3.7%. For the foreign asset holdings in the new steady state, it increases from 22% to 24%. The overall effect of the export cost reduction is quantitatively small relative to that of the tariff reduction. This is because the tariff reduction applies to all imports whereas the export cost reduction is only for the US market.

We now perform some sensitivity analysis. First, we investigate the transitional dynamics when we vary the parameter value of aggregate capital adjustment cost ($\psi_k = 4$, 8, and 12, respectively.) The results are presented in the top row of Fig. 5. Although the steady state is not affected by changes in ψ_k, the trade volume, the current account and the foreign asset position in the transition dynamics become (moderately) larger when ψ_k becomes smaller. The overall dynamics of the balance of payments does not appear to be very sensitive to perturbations in the parameter value of aggregate capital adjustment costs.

Second, we investigate the BOP dynamics at different values of the bond adjustment cost.[14] In the second row of Fig. 5, we report the transitional dynamics under the assumption of two alternative values of ψ_b, 0.005 and 0.008, in addition to the benchmark value of 0.0063. In all cases, the qualitative results stay the same. In particular, the country still runs a current account surplus after a tariff cut.

We then assess and compare the relative contributions of sectoral productivity changes, tariff cut, and export cost reduction to observed capital outflows for China during 2000–2007. The total capital outflow in the data is measured by the cumulative current account surplus during that period, which is about 18% of GDP. Table 5 summarizes simulation results.



One important takeaway is a comparison of the effects of a trade reform versus a TFP increase on capital outflow. As shown in the table, the TFP increase in the export sector leads to capital outflow while the TFP increase in the import sector generates capital inflow. This is consistent with our theory. The net TFP effect can account for more than 76.7% of the capital outflow.[15] The tariff reduction and the lower export cost can explain 62.8% and 11% of the capital outflow, respectively. (Note that these effects do not add up to 100% due to interaction effects among them.) Quantitatively, trade reforms such as a tariff cut at home and the PNTR reform in the partner country are as important as a TFP change in explaining capital outflows.

5. Factor market frictions

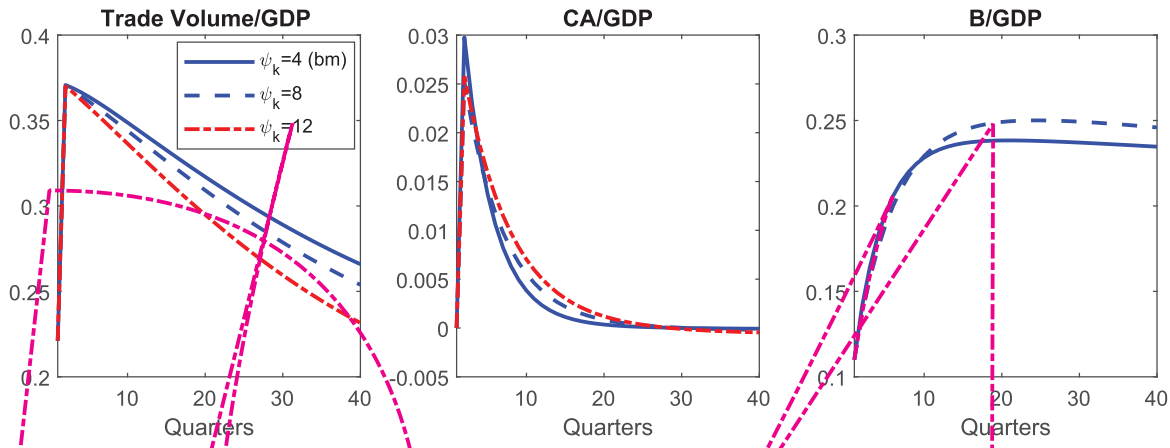
Factor market reforms can affect how a country's current account responds to a given trade reform. Logically, factor market frictions that block or reduce the extent of the reallocation of factors across sectors can also block or reduce the current account response to trade reforms. We now turn to this topic. We start with financial frictions in the form of credit constraints.

5.1. Financial frictions

Following Antras and Caballero (2009), we make the simplifying assumption that financial frictions are asymmetric in the two sectors: while firms in the importing sector can employ any desired amount of capital at the equilibrium interest rate, firms in the exporting sector face credit constraints. Credit constraints are introduced through the following (admittedly artificial) setting. Each capitalist owns one unit of capital so that the capital stock K is owned by a total K of capitalists. A proportion ξ of K are endowed with "entrepreneurial ability" and labeled "entrepreneurs". Only the "entrepreneurs" know how to operate in the exporting sector. However, each entrepreneur can borrow only up to θ amount of her own capital. Thus the total amount of capital employed in the exporting sector is given by,

$$K_t \leq (1+\theta)\xi K_t = \mu_k K_t \tag{5.30}$$

where $\mu_k = (1 + \theta)\xi$. We focus on the case in which financial frictions are binding (or μ is sufficiently small) so that $\mu_k K$ is less than the



Therefore, the first order conditions with respect to C_t, K_{t+1}, B_{t+1}, and L_{it} in the consumer's maximization problem now remain the same as conditions (3.6), (3.8), and (3.9) except that we now replace r_{t+1} by

$$r^C_{t+1} = \mu_k r_{1,t+1} + (1-\mu_k) r_{2,t+1} \tag{5.33}$$

5.1.1. The steady-state equilibrium

The steady-state equilibrium in the case of financial frictions is represented by 15 equations with 15 variables, and is summarized in Appendix 7.3. Similar to eq. (4.23), in the steady state we have

$$B = \frac{1}{\psi_b P} \frac{r^* - r^C + \delta}{1 + r^C - \delta} \tag{5.34}$$

Thus, $r^C = \mu_k r_1 + (1 - \mu_k) r_2$, is a key variable in determining the country's net foreign asset holding, B.

Because we are not able to obtain an analytical solution, we will resort to numerical results. Here we offer some intuition for the numerical results. In face of a tariff cut, the exporting sector is expected to expand while the import-competing sector shrinks. However, due to financial frictions, the exporting sector cannot expand as much. In such a case, the return to capital in the exporting sector, r_1, rises while that in the import-competing sector, r_2, declines. Therefore, the average return to capital, r^C, will decrease less than that in the case without financial frictions. From (5.34), we should observe a smaller B. That is, financial frictions impede the expansion of the exporting sector, a given trade reform produces a smaller capital outflow.

Several recent papers (Caballero, Farhi, and Gourinchas, 2008; Mendoza, Quadrini, and Rios-Rull, 2009; Ju and Wei, 2010; and Song, Storesletten, and Zilibotti, 2011) have shown that a low level of financial development in a developing country can produce a financial capital outflow to developed countries. Therefore, a tighter financial friction would lead to more current account surplus in a developing country. Our paper, however, suggests the opposite. When credit constraint is asymmetric across sectors, for example, when there is a credit rationing in one sector but not in another sector, similar to the setup in Antras and Caballero (2009), we show that a tighter credit constraint induces capital inflow (or a smaller current account surplus). The two parts of the literature can be reconciled when one realizes that the first set of papers emphasizes the effect of financial frictions on the supply side of capital (financial frictions reduce the return on savings and generate incentives to move savings out of the country), while the current paper and Antras and Caballero (2009) stress the demand side effect (credit constraints could increase demand for capital by firms in the unconstrained sector). Our model is different from Antras and Caballero (2009) in that trade liberalization always leads to capital outflow (current account surplus) under credit constraints, although the amount of capital outflow could be made smaller by a tighter credit constraint.

5.2. Labor market frictions

We can model labor frictions in a similar fashion and obtain qualitatively similar results. Assume that labor employed in the exporting sector requires "exporting skills", and the amount of labor with "exporting skills" does not exceed a certain proportion of the total amount of labor. In other words, when the labor-intensive sector expands, not all labor previously working in the importing sector can successfully function in the exporting sector. As an example, when the textile industry expands but the steel mills are shut down, not all former steel-workers can be productive textile workers. Formally, we model the frictions by the following inequality:

$$L_{1t} \leqslant \mu_L L \tag{5.35}$$

Similarly, the budget constraint (3.4) now becomes

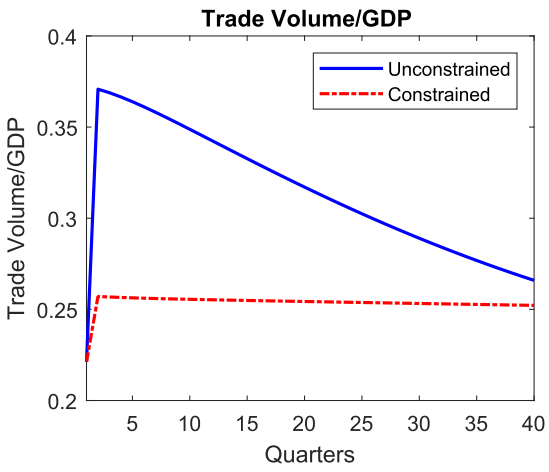
$$\begin{aligned} &P_t\left[C_t + \frac{\psi_b}{2}\left(B_{t+1} - \overline{B}\right)^2\right] + B_{t+1} + I_t \\ &\quad = [\mu_L w_{1t} + (1-\mu_L) w_{2t}]L + r_t K_t + \left(1 + r^*\right) B_t + TR_t \end{aligned} \tag{5.36}$$

and all the analysis in the basic model goes through except that now we replace w_t by $w_t^c = \mu_L w_{1t} + (1 - \mu_L) w_{2t}$. Labor market frictions impede the expansion of the exporting sector. Thus a given trade reform produces a smaller response in both the trade volume and the current account.

5.3. Numerical results

For numeri2.7(at)al dmilu9.5(l)118.6(l)15.5(i)13on(n)0(t)23.9(t)-361.4(w)0(.6(e)-282(no16.1(o)14c)20.6)0(m)s349.4(9)14.3(n)-356

constraint, and thin lines to represent the case of no credit constraint. From the upper left graph, it is clear that credit constraints



the mother of all trade reforms. Second, the accession protocol also obligates China to engage in a series of financial sector reforms over a five-year transition period after the accession. These reforms have also greatly facilitated the economic adjustment in the direction of expanding China's comparative advantage sectors and reducing its comparative disadvantage sectors.

The difference between the trade reforms in the 1990s and those associated with the WTO accession can be seen from the time series of the import-to-GDP ratio. The tariff cuts before 2001 had led to only a small change in the import/GDP ratio. In comparison, the WTO accession was followed by a large and sustained increase in the imports from 5% of GDP in 2001 to close to 30% of GDP by 2007. Interpreted in light of our model, the combination of trade reforms and factor market reforms brought out by the WTO accession has the effect of producing a large and positive current account response. Because both trade reforms and financial reforms were conducted over a multi-year phase, the current account response gains strength overtime in the first few years after the WTO accession before it peters out.

Our theory also sheds new light on the relative decline in China's current account surplus after 2007. A common explanation for the current account contraction is a temporary reaction to the contraction of global trade associated with the global financial crisis. The implication is that the Chinese current account surplus could return to its pre-2007 level once the world economy is out of recession. However, our model provides an additional explanation. In our model, the current account response to a trade policy shock is temporary (even though it can last for 20 quarters). Therefore, part of the decline of the current account surplus could result from the end of major trade reforms. The change in current account due to this factor is not likely to be reversed.

The end of the import quotas on textiles and garments by the United States and Europe in 2004 represents another important event that reduces trading costs. Since this was a reduction in trade barriers on a labor-intensive product in the United States, our theory would predict that the U.S. responds by running a current account deficit. More importantly, because textiles and garments are an important comparative advantage sector for China, the end of quotas in 2004 represented a big decline in the export costs for Chinese exporting firms. Therefore, this event also reinforces the rise of China's current account surplus in recent years.

Because Europe is commonly said to have a less flexible labor market, our theory would predict a smaller current account response to the trade policy response, which appears to be consistent with the pattern in the data.

We do not wish to claim that trade reforms are the only factor that matters for the evolution of a country's current account. Rather, it is an important contributing factor that is thus far neglected in the discussion of current account imbalances. Such omission could incorrectly color one's understanding of the source of current account imbalances and appropriate policy responses. To put it simply, if a portion of the current account imbalances is caused by efficient trade reforms, we do not need to view it as a problem that needs a policy correction.

The basic general equilibrium logic linking trade reforms and capital flows is not unique to China. We will see many more trade policy changes in both developed and developing countries (not always in the direction of reducing trade barriers). We will also see many more changes in factor markets around the world that could either enhance or reduce their flexibility. This paper provides a way to think about the general equilibrium implications of trade reforms for international capital flows.

7. Appendix

7.1. Equations for the Steady State

Given the factor prices (w, r) and the holding of foreign asset B, the output Y, consumption C, investment I, aggregate demand D, and sectoral outputs X_1 and X_2 can be determined by the following six equations.

$$\frac{C}{Y} = \frac{\overline{C}}{\overline{Y}}[\beta(1 + r - \delta)]^{\frac{1}{\psi}} \tag{7.1}$$

$$D = C + \frac{I}{P} + \frac{\psi_b}{2}B^2 \tag{7.2}$$

$$PY = P_1X_1 + P_2X_2 \tag{7.3}$$

$$\alpha_1 P_1 X_1 + \alpha_2 P_2 X_2 = r\frac{I}{\delta} \tag{7.4}$$

Using the expressions for X_1 and D_1, we have

$$sx = \frac{wL - PD\,(1-\alpha_2)(1+\tau)\zeta + \omega}{}$$

$$\left(\frac{w}{A_1}\right)^{1-\alpha_1} r_1^{\alpha_1} = P_1^* \tag{7.21}$$

$$\left(\frac{w}{A_2}\right)^{1-\alpha_2} r_2^{\alpha_2} = (1+\tau)P_2^* \tag{7.22}$$

$$\frac{K_1}{K_2} = \frac{\mu_k}{1-\mu_k} \tag{7.23}$$

$$L_1 + L_2 = L \tag{7.24}$$

$$r_1 K_1 = \alpha_1 P_1 X_1 \tag{7.25}$$

$$r_2 K_2 = \alpha_2 P_2 X_2 \tag{7.26}$$

$$wL_1 = (1-\alpha_1)P_1 X_1 \tag{7.27}$$

$$wL_2 = (1-\alpha_2)P_2 X_2 \tag{7.28}$$

$$r^C = \mu_k K_1 + (1-\mu_k)K_2 \tag{7.29}$$

$$P_1 D_1 = \omega PD \tag{7.30}$$

$$P_2 D_2 = (1-\omega)PD \tag{7.31}$$

$$D = C + \frac{\delta(K_1 + K_2)}{P} + \frac{\psi_b}{2}B^2 \tag{7.32}$$

$$P_1 X_1 + P_2 X_2/(1+\tau) + r^* B = \zeta PD \tag{7.33}$$

$$\frac{C}{Y} = \frac{\overline{C}}{\overline{Y}}\left[\beta\left(1 + r^C - \delta\right)\right]^{\frac{1}{\psi}} \tag{7.34}$$

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