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Financial Frictions and International Capital Flows

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We incorporate entrepreneur capital mobility into the model of Antràs and Caballero (2009) and find that for a small country, different types of capital tend to migrate in opposite directions, which makes the question of whether trade integration and net capital inflow are complements or substitutes not so straightforward. Therefore, whether protectionism is an improper response to global imbalance as claimed by AC deserves further investigation. In addition, we find that the mode of capital mobility impacts the relative incomes of workers and capitalists, and threaten the existence of the small country's financially-constrained production sector.

Keywords: financial friction, trade friction, international capital flows
JEL classification: F41, F42

1 Introduction

Antràs and Caballero (2009) model a world economy where the difference in the extent of financial contractibility dubbed financial friction across countries induces international trade in goods and there is a relationship of complementarity between trade integration and capital inflows for a financially constrained country.[1] This complementarity contrary to the substitution in the classical Mundel proposition where no financial friction exists casts

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[1]The role of financial friction in determining the patterns of international trade and/or capital flows has been investigated by many theoretical works. As pointed out by Wynne (2005), that financial imperfection is a source of comparative advantage can explain the Tre-

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an important policy implication, that is, protectionism is against balanced global capital flows.[2] This highlighted complementarity in AC critically results from the simultaneous presence of three elements — financial frictions, trade frictions and capital mobility, while in the literature at least one of the three is usually set aside.[3]

Specifically, in AC's model there are a large country named North and a small country named South in the world. The two countries are identical except that the North has a smaller extent of financial friction and larger amounts of capital and labor although both countries are endowed with the same capital-labor ratio. Each country has two production sectors, 1 and 2, to manufacture good 1 and good 2, respectively. Firms hire homogenous labor services and borrow capital for production. Capital owned by entrepreneurs and by rentiers are called entrepreneur capital and rentier capital, respectively. Although all capital are homogenous in production, it is assumed that only entrepreneurs can establish firms in sector 1, that is, there exists an inalienability between entrepreneurship and production. This inalienability leads to a borrowing constraint which restricts the amount of capital borrowed by a firm in sector 1.[4] In contrast, any production by

fler's missing trade mystery and Leontief paradox which challenge the predictions of comparative advantage based on factor endowments or technological differences across countries. The analyses of Matsuyama (2005) and Ju and Wei (2011) on global capital flows, given that financial friction is present, also contribute to explain the phenomenons of Lucas's paradox and two-way capital flows.

[2]From the late 1990s, a lot amount of capital flowed from many less developed countries to the United States and many other advanced countries, resulting long term current account deficits in the latter countries while the opposite occurred in the former. This phenomenon is called global imbalance which raises debates on enchancing trade barriers to mitigate the global imbalance. See Faruqee et al. (2008).

[3]As pointed out by AC, a financial-friction related literature in international finance emphasizes the relationship between financial frictions and capital flows; while a trade literature focusing on financial development and the flows of commodities. Markusen (1983) considers trade and capital flows without financial frictions.

[4]The heterogenous financial frictions between sectors emphasizes that some sectors are more dependent on financial infrastructure than others as pointed out by Rajan and Zingales (1998). The entrepreneurs' borrowing constraints result from an ex post moral hazard problem, from limited commitment, or from adverse selection so that only a limited amount of borrowing can be contracted. The detailed microfoundation of the constraints is explained in AC's appendix A. In contrast, anyone can operate the production in sector 2 so that the

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rentier capital could be taken over by lenders without a loss so that a firm in sector 2 can borrow its desired amount of capital at the market price. Another important assumption is that the entrepreneur capital is immobile internationally. According to AC, financial frictions distort factor allocations in autarky so that as the economies participate in international transactions, the North exports good 1 and the South exports good 2 and rentier capital flows into the South from the North. It is emphasized that a rise in trade frictions will decrease the capital inflow for the South.[5]

One special feature of AC's model is that there are two types of capital in a country but only rentier capital can migrate abroad. However, some empirical researches such as Harrison and McMillan (2003), Harrison, Love, and McMillan (2004), Guariglia and Poncet (2008) and Héricourt and Poncet (2009), point out that a sector with financial frictions still can accommodate international capital flows, particularly, it attracts foreign capital and enterprises.[6] In addition, in AC's framework, since only rentier capital is able to move across border, we should expect a one-way capital flow, i.e., capital either flows in or flows out of a country. However, Prasad, Rajan,

firms in sector 2 will run the business without any asymmetric-information or commitment problem. Therefore, the sector 2 is free from financial constraints. Generally speaking, the sector that requires more sophisticated or specific knowledge in production tends to exhibit so called human capital inalienability in production and suffers from financial frictions.

[5]Specifically, a tariff imposed on southern exports or on northern imports reduces the quantity of rentier capital flowed into the South, and a sufficiently large one even causes rentier capital to flow into the North from the South. Therefore, to alleviate the global imbalance emerged in the late 20th century and to induce capital to migrate South, the world should promote free trade.

[6]For example, Harrison and McMillan (2003) using 1974–1987 years firm-level data for the Ivory Coast find that private domestic firms appear more credit constrained than foreign firms and they are crowded out by direct foreign investment and multinational firms' borrowing from domestic banks. In addition, according to firm-level panel data of 38 countries for the years 1988–1998 from Worldscope and cross-country time-series date, Harrison, Love, and McMillan (2004) show that direct foreign investment is the only kind of capital inflow that reduces financing constraints of local firms by providing an additional source of capital, and this effect is stronger in low income countries. Guariglia and Poncet (2008) and Héricourt and Poncet (2009) respectively using Chinese 1989–2003 years province data and 2000–2002 years firm-level data find that private firms' credit constraints are alleviated by way of foreign direct investment and the development of cross-border relationships with foreign firms.

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and Subramanian (2006) and Basu and Chau (2007) observe that a country's capital may exhibit diversified flowing directions when there are more than one type of capital, particularly, the pattern of capital flows depends on if a capital is categorized as foreign direct investment or not.[7] Motivated by these empirical observations, in this paper, the restriction on the mobility of entrepreneur capital is relaxed. If the entrepreneur capital is allowed to move across border in AC, how will it flow? Will the complementarity derived by AC still hold? Answers to these questions might result in different policy implications.

Results of this paper indicate that financial frictions stimulate these two types of capital to move in the opposite directions and the entrepreneur capital tend to migrate North. This result is consistent with the empirical observations of two-way capital flows by Prasad, Rajan, and Subramanian (2006) and Basu and Chau (2007). Trade frictions generally reduce the volume of rentier capital migration, however, impose no effect on entrepreneur capital movements. Therefore, it is ambiguous whether trade integration and net capital inflow are complements for the South. Especially, it is not effective to adjust trade frictions to affect southern entrepreneur capital migration, which suggests that some industrial policies instead of trade frictions should be investigated to avoid entrepreneur capital from flighting out of the South.[8]

We also find that wage rate and rates of return of capital in the South are sensitive to the mode of capital mobilities. Since we take mobile entrepreneur capital into consideration, the impact of the mobilities of different types of capital on the relative income among workers, rentiers and entrepreneurs is able to be uncovered. Let the equilibrium factor prices given free trade in goods and immobile capital be the benchmark. It is found that

[7]Prasad, Rajan, and Subramanian (2006) find that aggregate capital appears to flow from poor to rich countries, while FDI moves from rich to poor countries. The fastest growing group of non-industrial countries received the most FDI over the period 1970–2004, yet overall they exported capital on net. Basu and Chau (2007) find that, during 1989–1999, intertemporal increases in inward foreign direct investment exist alongside corresponding increases in capital flight originating from Latin American countries, East Asia and Pacific countries.

[8]It is found that sufficiently large trade frictions can change the trade pattern. The conditions for a change in trade pattern to occur will be pointed out in this paper, however, we mainly focus on the environments where trade frictions do not change the pattern of trade, i.e., South exports good 2 and imports good 1.

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workers gain while capitalists lose when only rentier capital is mobile; workers lose while capitalists gain when only entrepreneur capital is mobile; and workers and entrepreneurs gain while rentiers lose when both types of capital can move across border. As trade frictions emerges, wage rate and return rate of rentier capital are depressed but return rate of entrepreneur capital is unaffected by trade frictions. Therefore, our results suggest that income distribution in addition to global imbalance is also a consequence deserves attentions as markets present frictions.

In the following, section 2 introduces the benchmark model; section 3 discusses on the equilibrium; section 4 analyzes capital flows and section 5 concludes.

2 The Environment

Consider a closed economy which consists of a continuum of measure L workers and a continuum of measure one capitalists. Each worker supplies one unit of labor service inelastically. A fraction of μ of the capitalists are entrepreneurs who equally share μK units of capital; the rest of the capitalists are rentiers who equally share $(1-\mu)K$ units of capital. All agents have the same preferences. By consuming C_1 units of good 1 and C_2 units of good 2, a consumer can derive a utility level of U,

$$U = \left(\frac{C_1}{\eta}\right)^{\eta} \left(\frac{C_2}{1-\eta}\right)^{1-\eta}, \quad \eta \in (0,1), \tag{1}$$

subject to the budget constraint

$$I = C_1 + pC_2,$$

where p is the relative price of good 2 and I is income of the consumer.

Production technology in sector i, $i = 1, 2$, is given by

$$Y_i = z\,(K_i)^{\alpha}\,(L_i)^{1-\alpha}, \quad z > 0, \quad \alpha \in (0,1), \quad i = 1, 2,$$

where K_i units of capital and L_i units of labor are required to produce Y_i units of consumption good i. Labor and capital are freely mobile across sectors but only entrepreneurs are capable of operating the technology in sector 1. Let w, δ and R denote the wage rate, the rental rate of rentier capital and the rental rate of entrepreneur capital, respectively.

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All markets are perfectly competitive and financial frictions only occur in sector 1. Specifically, entrepreneurs can borrow capital but they at most can borrow a multiple $(\theta-1)$, $\theta > 1$, of their endowed entrepreneur capital. It is assumed that

$$\mu\theta < \eta$$

so that the financial friction distorts factor allocations comparing with the environment without financial frictions.[9]

The environment is extended to an open-economy framework by considering two countries, South and North, denoted respectively by S and N. In the following when making a national distinction is necessary, the notations with a superscript N refer to the North; and those with a superscript S or without a superscript refer to the South. Let $\theta^S = \theta < \theta^N$, $K^N > K^S$, $L^N > L^S$, and $K^N/L^N = K^S/L^S \equiv K/L$.[10] Since the North is a large country, the autarky equilibrium and the open-economy equilibrium are the same for the North.

3 The Equilibrium

The equilibriums (denoted by variables attached with a horizontal bar from above) derived according to AC's model are listed in Table 1. The autarky equilibrium in the South is the same as that in the left column of Table 1 but the superscript N is replaced by S. The t included in the southern trading equilibrium $\bar{p}$ represents the extent of trade frictions.[11] For simplicity, define $P^N \equiv \theta^N(1-(\bar{p}^N)^{1/\alpha}) + (\bar{p}^N)^{1/\alpha} > 1$, $P^S \equiv \theta(1-p^{1/\alpha}) + p^{1/\alpha} > 1$, $\Theta^N \equiv \mu\theta^N(1-(\bar{p}^N)^{1/\alpha}) + (\bar{p}^N)^{1/\alpha} = \mu\theta^N/\eta$ and $\Theta \equiv \mu\theta(1-p^{1/\alpha}) + p^{1/\alpha}$.

[9]Without financial frictions, the entrepreneurs' investment will be ηK. Thus, assuming $\mu\theta < \eta$ indicates that the entrepreneurs can invest $\mu\theta K$ only and the borrowing constraints are binding.

[10]As explained by AC, if $\theta^S = \theta^N$ or if there is no financial fricitons, there will be no trade and capital flows between the North and the South due to their similar economic environments. By the symmetric part of the setup, the role of financial frictions played in affecting the patterns of trade and capital flows is easier to understand.

[11]Assume an iceberg transportation cost such that a fraction τ_i of the good i is lost in transit. We can interpret τ_2 as the tariff on imported goods in the North and τ_1 as the tariff on imported goods in the South. The southern relative price after trade is p and $p = (\bar{p}_2/\bar{p}_1) = (\bar{p}_2^N(1-\tau_2)/\bar{p}_1^N(1+\tau_1)) = \bar{p}^N(1-t)$. An increase in t is interpreted

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Table 1: Equilibriums in AC's Model

Equilibrium in North	Equilibrium in South with trading in goods
$\bar{L}_1^N = \eta L^N$	$\bar{L}_1 = \mu\theta\Theta^{-1}L$
$\bar{L}_2^N = (1-\eta)L^N$	$\bar{L}_2 = (1-\mu\theta)p^{\frac{1}{\alpha}}\Theta^{-1}L$
$\bar{K}_1^N = \mu\theta^N K^N$	$\bar{K}_1 = \mu\theta K$
$\bar{K}_2^N = \left(1-\mu\theta^N\right)K^N$	$\bar{K}_2 = (1-\mu\theta)K$
$\bar{p}^N = \frac{\bar{p}_2^N}{\bar{p}_1^N} = \left[\frac{\mu\theta^N(1-\eta)}{\eta(1-\mu\theta^N)}\right]^\alpha < 1$	$\bar{p} = \bar{p}^N(1-t) \equiv p$
$\bar{C}_1^N = \eta z\left(\frac{\Theta^N K}{L}\right)^\alpha L^N$	$\bar{C}_1 = \eta z\left(\frac{\Theta K}{L}\right)^\alpha L$
$\bar{C}_2^N = (1-\eta)z\left(\frac{1-\mu\theta^N}{1-\eta}\frac{K}{L}\right)^\alpha L^N$	$\bar{C}_2 = (1-\eta)z\left(\frac{\Theta K}{L}\right)^\alpha L/p$
$\bar{\delta}^N = \alpha z\left(\bar{p}^N\right)^{\frac{1}{\alpha}}\left(\frac{\Theta^N K}{L}\right)^{\alpha-1}$	$\bar{\delta} = \alpha z p^{\frac{1}{\alpha}}\left(\frac{\Theta K}{L}\right)^{\alpha-1} > \bar{\delta}^N$
$\bar{w}^N = (1-\alpha)z\left(\frac{\Theta^N K}{L}\right)^\alpha$	$\bar{w} = (1-\alpha)z\left(\frac{\Theta K}{L}\right)^\alpha < \bar{w}^N$
$\bar{R}^N = \alpha z\left(\frac{\Theta^N K}{L}\right)^{\alpha-1} P^N$	$\bar{R} = \alpha z\left(\frac{\Theta K}{L}\right)^{\alpha-1} P^S$

Proposition 1. Given free trade in goods (i.e., $t = 0$), in the equilibrium $\bar{\delta} > \bar{\delta}^N$ and $\bar{R} < \bar{R}^N$.

Proof: See Appendix 1.

AC consider $\bar{\delta} > \bar{\delta}^N$ but do not discuss on the relationship between $\bar{R}^N$ and $\bar{R}$. Proposition 1 indicates that there exist an incentive for northern rentier capital to flow into the South as well as an incentive for southern entrepreneur capital to move toward the North under free trade.

It is easy to verify that the relative price of good 2 to good 1 is higher in the North than in the South under autarky (i.e., $\partial(\mu\theta(1-\eta)/\eta(1-\mu\theta))^\alpha/\partial\theta > 0$). It mainly comes from the more serious financial frictions resulting in the more distorted factor allocations in the South so that the production of sector 1 to sector 2 in the South is smaller than that in the North. Opening up to trade raises the relative price in the South, which positively affects the return rate of southern rentier capital. In addition, the southern sector 2 is enlarged by employing more labor to cope with the world demand for good 2 (due to financial frictions, the capital stock in sector 2 is not able to rise), resulting in a smaller capital-labor ratio in sector 2 which also contributes to increase the return rate of southern rentier

as an escalation in trade frictions.

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capital. The capital-labor ratio of sector 1 in the North is larger than that in the South due to $\theta^N > \theta^S$, while $\theta^N > \theta^S$ and the pattern of trade yield that the northern capital-labor ratio in sector 2 is smaller than the southern one. Therefore, we get $\bar{\delta} > \bar{\delta}^N$ and $\bar{R} < \bar{R}^N$ in Proposition 1. Intuitively speaking, international trade makes the southern rentier capital become relatively more precious because that there is a larger demand for good 2 but only a fixed amount of capital can be employed in sector 2. Due to the binding borrowing constraints in sector 1, capital will not be released to sector 2 from sector 1.

4 International Capital Flows

Let $F_e^{i\to j}$ and $F_r^{i\to j}$ denote respectively the volume of entrepreneur capital and the volume of rentier capital moved from country i to country j, $i = S, N$, $j = S, N$ and $i \neq j$.

Given free trade in goods and that rentier capital is the only type of capital mobile internationally, AC derive that, in the equilibrium,

$$\frac{F_r^{N\to S}}{K} = \frac{\left(\eta - \mu\theta^N\right)\left(\theta^N - \theta^S\right)}{\theta^N(1-\eta)}, \quad w = \bar{w}^N > \bar{w} \quad \text{and} \quad \delta = \bar{\delta}^N < \bar{\delta}. \tag{2}$$

In addition, we can show that, in the equilibrium,

$$R = \alpha z\left(\frac{\Theta^N K}{L}\right)^{\alpha-1} P^S < \bar{R} < \bar{R}^N. \tag{3}$$

Thus, opening up to rentier capital flows after free trade makes workers gain ($w > \bar{w}$) and capitalists lose ($\delta < \bar{\delta}$ and $R < \bar{R}$). It is also shown that with trade friction

$$\frac{d\bar{\delta}}{dt} < 0,$$

which implies that a larger trade barrier as presented by a larger t leads to a smaller gap of $\bar{\delta} - \bar{\delta}^N$. Therefore, protectionism hinders capital from flowing into the South and trade integration and capital inflows are complements for the South.[12]

[12]By Table 1, we have $\bar{p}^S < \bar{p}^N$ and $\bar{\delta}^S < \bar{\delta}^N$ in autarky; $\bar{p} = \bar{p}^N$ and $\bar{\delta} > \bar{\delta}^N$ under free trade. Since $(d\bar{\delta}/dt) = -z(K/L)^{\alpha-1}\bar{p}^N[\bar{p}^N(1-t)]^{1-\alpha/\alpha}[\mu\theta + \alpha(\bar{p}^N(1-t))^{1/\alpha}(1-\mu\theta)][\mu\theta + (\bar{p}^N(1-t))^{1/\alpha}(1-\mu\theta)]^{\alpha-2} < 0$, as long as the southern relative

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To explore more properties of international capital flows, we firstly consider the scenarios where only entrepreneur capital can migrate around the world and then investigate simultaneous flows of both types of capital.

Proposition 2. Given free trade in goods and that entrepreneur capital is the only type of capital mobile internationally, for a sufficiently large α such that $P^S < [((1-\eta)(1-\mu))/(1-\mu\theta^N)]^{1-\alpha} P^N$ is satisfied, in the equilibrium we have $F_e^{S\to N} = \mu K$, $w = \bar{p}^N(1-\alpha)z(K/L)^{\alpha}(1-\mu)^{\alpha} < \bar{w}$ and $\delta = \bar{p}^N \alpha z(K/L)^{\alpha}(1-\mu)^{\alpha-1} > \bar{\delta}$.

Proof: see Appendix 2.[13]

For a sufficiently large α, all southern entrepreneur capital migrates North, the southern capitalists gain ($\bar{R} < R = \bar{R}^N$ and $\delta > \bar{\delta}$) and the workers lose ($w < \bar{w}$) in comparison with the free-trade equilibrium. Furthermore, comparing Proposition 2 with the results in (2) and (3), we can say that in the South if only one type of capital is allowed to move across border, workers prefer mobile renter capital while capitalists prefer mobile entrepreneur capital.

For the small South, mobile southern entrepreneur capital seeking the return rate of $\bar{R}^N$ makes the southern sector 1 vanish and the South does not produce good 1 at all. Thus, all southern labor move to sector 2, leading to a rather low capital-labor ratio there, depressing the wage rate and raising the return rate of rentier capital at the same time. In contrast, mobile rentier capital reduces the capital-labor ratio in southern sector 2 but it does not help to alleviate the borrowing constraint in sector 1. Thus, southern labor benefits from rentier capital inflow to raise their marginal value of productivity while a rise in the supply of rentier capital discourages its rate of return.

Proposition 3. Given that $t \geq 0$ and entrepreneur capital is the only type of capital mobile internationally, we have $dR/dt > 0$, $w = \bar{p}^N(1-t)(1-\alpha)z(K/L)^{\alpha}(1-\mu)^{\alpha}$ and $\delta = \bar{p}^N(1-t)\alpha z(K/L)^{\alpha}(1-\mu)^{\alpha-1}$.

Proof: see Appendix 3.

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price with trading in goods, $\bar{p}^N(1-t)$, is no smaller than that in autarky, there exists a unique $\bar{t}$, $\bar{t} \in (0, 1-\bar{p}^S/\bar{p}^N)$, such that for $t < \bar{t}$ we have $\bar{\delta} > \bar{\delta}^N$; for $t > \bar{t}$ we have $\bar{\delta} < \bar{\delta}^N$.

[13] Appendix 2 also presents the solution of $F_e^{S\to N}$ for small α, which is too complex to derive more analytical results. Thus, we focus on the case of a large α in Proposition 2.

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Since $\bar{R}^N > R$ given $t = 0$ (as proved in Appendix 1) and $dR/dt > 0$, we know that a larger t reduces the gap of $\bar{R}^N - R$, however, as long as $\bar{R}^N > R$, all southern entrepreneur capital migrate North. It is shown in the Appendix 2 that even if $F_e^{S\to N} \to \mu K$ we still have $\bar{R}^N > R$, therefore, as long as the pattern of trade is not reversed, the trade frictions do not prevent entrepreneur capital from flowing out of the South and it hurts southern works and rentiers for certain by reducing w and δ, comparing with the scenario in Proposition 2.[14] This is because that the trade fraction reduces the southern relative price of good 2 and directly imposes a negative impact on the marginal values of rentier capital and labor in the South.

In the following, we consider the environment where both types of capital are mobile.

Proposition 4. Given free trade in goods and that both of rentier capital and entrepreneur capital are internationally mobile, in the equilibrium $F_e^{S\to N} = \mu K$, $F_r^{N\to S} = ((\eta - \mu\theta^N)/(1-\eta) + \mu)K$, $w = \bar{w}^N$ and $\delta = \bar{\delta}^N$.

Proof: see Appendix 4.

When both of rentier capital and entrepreneur capital are internationally mobile, all entrepreneur capital migrate North for any $\alpha \in (0, 1)$. The inflow of rentier capital is larger than that when only rentier capital is internationally mobile, i.e., $((\eta - \mu\theta^N)/(1-\eta) + \mu)K > ((\eta - \mu\theta^N)(\theta^N - \theta^S))/(\theta^N(1-\eta))K$. In fact, the inflow of rentier capital and the outflow of entrepreneur capital reenforce each other. It is easy to show that $dR/dF_r^{N\to S} < 0$ and $d\delta/dF_e^{S\to N} > 0$, which imply that a larger inflow of rentier capital reduces R and induces more outflow of entrepreneur capital and, at the same time, a larger outflow of entrepreneur capital raises δ and induces more inflow of rentier capital. That labor is freely mobile across sectors is critical to the reenforcement effect. A decline (rise) in the capital-labor ratio of a sector induces labor to move out of (into) this sector. On the one hand, the outflow of entrepreneur capital induces labor to move toward sector 2 and results in a smaller capital-labor ratio in sector 2, encouraging rentier capital to flow in. On the other hand, the inflow of rentier capital also induces labor to move toward sector 2, which puts a downward pressure on the return rate of entrepreneur capital due to a higher capital-labor ratio in sector 1 and, therefore, stimulates entrepreneur capital to flow out.

[14] A sufficiently large t may lead to a change in trade pattern as shown in Appendix 3.

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The South is small and its entrepreneur capital is limited by μK, however, the North is large and it affords any required amount of rentier capital to flow into the South. Thus, the reenforcement effect pushes all southern entrepreneur capital to the North and induces enough rentier capital to the South to equalize factor prices. When there is no restriction on commodity trade and capital flows, factor prices equalize across countries and the two countries share the same capital-labor ratio in sector 1. Furthermore, by the wage rates in Table 1 and in Propositions 1 and 3, we know that opening up to all capital flows after free trade only hurts southern rentiers since the rise in the supply of rentier capital depresses its rental rate. Comparing with Proposition 2, now a conflict of interest is among the firms instead of between workers and firms.

Finally, we consider trade frictions and free capital flows.

Proposition 5. Given that $T \equiv (\eta(1-\mu\theta^N))/(\eta(1-\mu\theta^N)+(\eta-\mu\theta^N)(\theta^N/\theta-1)) \in (0,1)$, $t \geq 0$ and both of rentier capital and entrepreneur capital are internationally mobile, consider three cases in the equilibrium:

Case 1: for $(1-t)^{1/\alpha} < T$, we get that $\delta < \bar{\delta}^N$, $R = \bar{R}^N$, $F_r^{S\to N} = (1-\mu)K$, $F_e^{S\to N} = [1-(\mu\theta^N/\eta)(P^N)^{1/\alpha-1}]K$ and $w = (1-\alpha)z(K/L)^{\alpha}[\mu-(1/K)+(\mu\theta^N/\eta K)(P^N)^{1/\alpha-1}]^{\alpha}$;

Case 2: for $(1-t)^{1/\alpha} = T$, we have $\delta = \bar{\delta}^N$, $R = \bar{R}^N$, $(F_e^{S\to N}/K)[(\theta-1)(\bar{p}^N)^{1/\alpha}T-\theta]+(\bar{p}^N)^{1/\alpha}T(F_r^{N\to S}/K) = (\mu\theta^N/\eta)T^{1/1-\alpha}-\mu\theta-(\bar{p}^N)^{1/\alpha}T(1-\mu\theta)$ and $w = (1-\alpha)z[(K/L)(\mu\theta^N/\eta)^{\alpha}](1-t)^{1/1-\alpha}$;

Case 3: for $(1-t)^{1/\alpha} > T$, we have $\delta = \bar{\delta}^N$, $R < \bar{R}^N$, $F_r^{N\to S} = [(1-\mu\theta^N/1-\eta)(1-t)^{1/1-\alpha}-1+\mu]K$, $F_e^{S\to N} = \mu K$ and $w = (1-\alpha)z[(K/L)(\mu\theta^N/\eta)^{\alpha}](1-t)^{1/1-\alpha}$.

In addition, for all t such that $(1-t)^{1/\alpha} \geq T$ and given $F_e^{S\to N} = \mu K$, the flowing direction of rentier capital depends on t, i.e., $t > (=,<)t^*$ then $F_r^{S\to N} > (=,<)0$, where $(1-t^*)^{1/\alpha} = [((1-\mu)(1-\eta))/(1-\mu\theta^N)]^{1-\alpha/\alpha}$.

Proof: see Appendix 5.

For Case 1, a sufficiently large t resulting in $(1-t)^{1/\alpha} < T$ changes the trade pattern, particularly, southern sector 2 vanishes due to all rentier capital migrate North, i.e., $F_r^{S\to N} = (1-\mu)K$, so that the South cannot

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export good 2 anymore. Thus, both types of capital migrate North. On the one hand, the trade friction deteriorates the southern relative price of good 2 so much so that it is not profitable to export good 2. On the other hand, southern sector 1 restricted by financial constraints is not able to have comparative advantage. Thus, the South exports capital and will use repatriated returns to finance consumptions.

In Case 2, $(1-t)^{1/\alpha} = T$ and there are infinitely many possible solutions to $F_r^{N\to S}$ and $F_e^{S\to N}$. Since $(\theta-1)(\bar{p}^N)^{1/\alpha}T < \theta$, we know that $F_r^{N\to S}$ is increasing in $F_e^{S\to N}$. When $F_e^{S\to N} = \mu K$, $F_e^{S\to N}$ attends its maximum and $F_r^{N\to S}$ satisfies

$$\frac{F_r^{N\to S}}{K} = \frac{1-\mu\theta^N}{1-\eta}(1-t)^{\frac{1}{1-\alpha}} - 1 + \mu. \tag{4}$$

In Case 3, $(1-t)^{1/\alpha} > T$ and an increase in t reduces southern rentier capital inflow. Since the $F_r^{N\to S}$ in (4) is no greater than that in Case 3 and all rentier capital migrate North in Case 1, we can say that net rentier inflow and trade integration is complements for the South. Notice that this claim is true even if $F_r^{N\to S}$ is negative. It is shown in Appendix 5 that $F_r^{N\to S}$ is negative for a sufficiently large t. In that case, both types of capital flows out of the South. For a small trade friction, a reduction in trade friction raises the relative price of good 2 and draws in more labor to sector 2, therefore, a decline in capital-labor ratio raises capital reward and attracts more northern capital flows into southern sector 2 till $\delta = \bar{\delta}^N$.

When $(1-t)^{1/\alpha} > T$, trade frictions have no impact on the movement of southern entrepreneur capital. It is because that a sufficiently large amount of southern labor is attracted to sector 2 even with the trade friction, resulting in a rather high capital-labor ratio in sector 1 although the financial friction is more serious in the South. This high capital-labor ratio reduces the return rate of entrepreneur capital in the South so that $R < \bar{R}^N$ and entrepreneur capital migrate North. Thus, entrepreneur capital does not apply for a complementarity between trade integration and net capital inflow for the South. In addition, for $(1-t)^{1/\alpha} \geq T$, an increase in trade friction will not change the income of capitalists since by way of capital migrations all rentiers get a rental rate of $\bar{\delta}^N$ and all entrepreneurs get $\bar{R}^N$, however, southern workers suffer from a lower wage rate due to the deteriorated export price and a rise in capital-labor ratio in sector 2 by capital inflows.

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4.1 Discussion on Capital-Flow Friction

In this paper, capital is either mobile freely or immobile across countries. We might take an adjustment cost of capital flow into account. A simple way of introducing the adjustment cost is to specify it as a reduction in the rental rate of capital. For example, the rental rate of entrepreneur capital migrating North becomes $\bar{R}(1-\varepsilon)$ instead of $\bar{R}$ for $\varepsilon \in (0, 1)$. However, it is easy to see that this linear adjustment cost ε will not affect the main results of our paper. We also conduct an exercise to consider a quadratic adjustment cost of capital flow. We also find that incorporating adjustment costs of capital flows into our model will weaken the impact of financial friction on capital migration but the capital flows are still consistent with our result that the two types of capital migrate in opposite directions and reinforce each other.

Intuitively speaking, the adjustment costs of capital flows perform a function of reducing the incentive for capital from migrating abroad while financial friction is the factor that stimulates capital outflow, therefore, adjustment costs of capital flows more or less offset the impact of financial friction on capital migration. It is possible to find ad hoc parameters regarding an adjustment cost of capital flow so that the impact of the adjustment costs overcomes the impact of financial frictions on capital flows. Our study indicates that considering adjustment costs leads to mathematical complexity, however, it does not offer more insight on the interaction between capital flows and trade. In our view, a meaningful analysis by incorporating capital-flow friction requires setting up a clear agenda on the specific type of capital flow friction and demands sufficient data or empirical observations to pin down the values of the parameters and their relationship which may not be a linear function or a quadratic function; otherwise it provides little insight on our analysis of the effect of financial friction on capital flows.

In comparison, in this paper (without adjustment cost of capital flow) the North and the South are specified as symmetric except in the factor endowments and the extent of financial friction, that is, $K^N/L^N = K^S/L^S$, $K^N > K^S$ and $\theta^N > \theta^S$. A merit of this specification is that all capital and commodity flows between the two countries are due to these two kinds of differences in the national economic environments, no matter how small or how large the differences are. This makes it easy to identify the impact of financial friction on capital flow and trade integration, which is the focus of our analysis.

Many existing works that study the determination of international cap-

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ital flows also set aside adjustment costs of capital flows. For example, Caballero, Farhi, and Gourinchas (2008) highlight the role of asset-supply in shaping global capital flows when different regions of the world differ in their capacity to generate financial assets from real investments. Gourinchas and Jeanne (2013) using Penn World Table (PWT) data show that the pattern of capital flows is driven by national saving and is also related to the pattern of accumulation of international reserves. The model of Ju and Wei (2011) specifies two countries differ in the quality institutions which generates heterogenous patterns of flow between different types of capital. Finally, Gertler and Rogoff (1990) present a North-South framework that relates patterns of international capital movements and investment to cross-country differences in the efficiency of capital markets.

5 Concluding Remarks

Antràs and Caballero (2009) point out an economic environment where financial friction is the key to induce international trading in goods and capital migration. Their work emphasizes that trade friction is the crucial element to affect the balance of global capital flows. Motivated by empirical observations, we incorporate mobile entrepreneur capital into their framework where entrepreneur capital is not able to move across border. This paper shows that the property of entrepreneur capital flows is quite different from that of rentier capital flows and, therefore, enables us to discover that income distribution and the establishment of the financially-constrained production sector are also issues stimulated in this framework.

We find that the entrepreneur capital generally move toward a direction opposite to that of the rentier capital migration and the entrepreneur capital flows are not response to small changes in trade frictions. Therefore, the entrepreneur capital do not complement or substitute to trade integration, leading to an ambiguous relationship between protectionism and balancing global capital flows.

In addition, the result that the trade frictions do not affect entrepreneur capital flows raises the issue of the existence of sector 1 in the South. If the South intends to establish production in sector 1, it should not allow entrepreneur capital to migrate overseas. This can not be achieved by modulating trade frictions but requires some industrial policies which is not in the scope of this paper but might deserve further research.

Another issue that can not be uncovered without taking mobile en-

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trepreneur capital into consideration is the relative incomes among agents. We find that different modes of capital mobilities induce different impacts on factor prices, and therefore, raise the issue of income distribution among workers, rentiers and entrepreneurs. If the South targets at a particular type of income distribution, it needs to impose a corresponding mode of capital mobilities to go with the target.

Appendix 1

Suppose that $t = 0$ and we can denote $\bar{p}^N$ by p.

According to the solutions to $\bar{\delta}$ and $\bar{\delta}^N$ in Table 1, by $\Theta^N = \mu\theta^N(1 - p^{1/\alpha}) + p^{1/\alpha}$, $\Theta \equiv \mu\theta(1 - p^{1/\alpha}) + p^{1/\alpha}$ and $\theta < \theta^N$ we get $\bar{\delta} > \bar{\delta}^N$.

We can show that $\bar{R} < \bar{R}^N$ under free trade. According to Table 1, we have

$$\bar{R}^N = \alpha z \left(\frac{K}{L}\right)^{\alpha-1} \left[\mu\theta^N \left(1 - p^{\frac{1}{\alpha}}\right) + p^{\frac{1}{\alpha}}\right]^{\alpha-1} \left[\theta^N \left(1 - p^{\frac{1}{\alpha}}\right) + p^{\frac{1}{\alpha}}\right] \text{ and}$$

$$\bar{R} = \alpha z \left(\frac{K}{L}\right)^{\alpha-1} \left[\mu\theta \left(1 - p^{\frac{1}{\alpha}}\right) + p^{\frac{1}{\alpha}}\right]^{\alpha-1} \left[\theta \left(1 - p^{\frac{1}{\alpha}}\right) + p^{\frac{1}{\alpha}}\right].$$

Thus, given p, the difference between $\bar{R}^N$ and $\bar{R}$ lies in the gap between θ^N and θ. Since North is the large country and p will not be affected by South, we then, given the world relative price p, derive

$$\frac{d\bar{R}^N}{d\theta^N} = \alpha z \left(\frac{K}{L}\right)^{\alpha-1} \left(\frac{\mu\theta^N}{\eta}\right)^{\alpha-2} \left(1 - p^{\frac{1}{\alpha}}\right) \left[\alpha\mu\theta^N \left(1 - p^{\frac{1}{\alpha}}\right) + p^{\frac{1}{\alpha}} (\alpha\mu + 1 - \mu)\right] > 0.$$

By $\theta < \theta^N$, $\mu < 1$ and $p < 1$ we get $\bar{R} < \bar{R}^N$.

Appendix 2

Suppose that entrepreneur capital is the only type of capital which can move internationally given free trade in goods. Since $\bar{R} < \bar{R}^N$ under free trade, there is an incentive for southern entrepreneur capital to move toward North.

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Given that a volume of $F_e^{S\to N}$ southern entrepreneur capital moved to North, the firms' problem in sector 1 is

$$\begin{aligned}\max_{K_1,L_1}\ & \pi_1 = zK_1^{\alpha}L_1^{1-\alpha} - \delta K_1 - wL_1 \\ \text{st. }\ & K_1 \le \theta\left(\mu K - F_e^{S\to N}\right).\end{aligned} \tag{5}$$

and the firms' problem in sector 2 is

$$\max_{K_2,L_2} \pi_2 = pzK_2^{\alpha}L_2^{1-\alpha} - \delta K_2 - wL_2. \tag{6}$$

The first order conditions of (5) are

$$\begin{aligned}\alpha z\left(\frac{K_1}{L_1}\right)^{\alpha-1} = \delta + \lambda,\ (1-\alpha)z\left(\frac{K_1}{L_1}\right)^{\alpha} w \quad \text{and} \\ K_1 = \theta\left(\mu K - F_e^{S\to N}\right),\end{aligned} \tag{7}$$

where λ is the Lagrange multiplier corresponding to the financial constraint $K_1 \le \theta(\mu K - F_e^{S\to N})$. The first order conditions of (6) are

$$p\alpha z\left(\frac{K_2}{L_2}\right)^{\alpha-1} = \delta \quad \text{and} \quad p(1-\alpha)z\left(\frac{K_2}{L_2}\right)^{\alpha} = w. \tag{8}$$

Equating wage rates in both sectors and employing $L = L_1 + L_2$ and $K_2 = (1-\mu)K - (\theta-1)(\mu K - F_e^{S\to N})$, we get

$$\begin{aligned}L_1 &= \frac{\theta\left(\mu K - F_e^{S\to N}\right)}{\Omega}L \quad \text{and} \\ L_2 &= \frac{p^{\frac{1}{\alpha}}\left[(1-\mu\theta)K + (\theta-1)F_e^{S\to N}\right]}{\Omega}L,\end{aligned}$$

where

$$\Omega \equiv \theta\left(\mu K - F_e^{S\to N}\right) + p^{\frac{1}{\alpha}}\left[(1-\mu\theta)K + (\theta-1)F_e^{S\to N}\right].$$

Then by (7) and (8), we derive

$$\begin{aligned}&K_1 = \theta\left(\mu K - F_e^{S\to N}\right),\ \ K_2 = (1-\mu\theta)K + (\theta-1)F_e^{S\to N}, \\ &w = (1-\alpha)z\Omega^{\alpha}L^{-\alpha},\ \delta = p^{\frac{1}{\alpha}}\alpha z\Omega^{\alpha-1}L^{1-\alpha} \quad \text{and} \\ &\lambda = \alpha z\left(\frac{K_1}{L_1}\right)^{\alpha-1} - \delta = \alpha z\left(\frac{\Omega}{L}\right)^{\alpha-1}\left(1 - p^{\frac{1}{\alpha}}\right).\end{aligned}$$

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Since the rate of return of entrepreneur capital R equals

$$R = (\delta + \lambda)\theta - (\theta - 1)\delta = \delta + \lambda\theta,$$

we can also get

$$R = \alpha z \left(\frac{K}{L}\right)^{\alpha-1} \left(\frac{\Omega}{K}\right)^{\alpha-1} \left[\theta\left(1 - p^{\frac{1}{\alpha}}\right) + p^{\frac{1}{\alpha}}\right]. \tag{9}$$

To determine the equilibrium value of $F_e^{S\to N}$ (the $F_e^{S\to N}/K$ is exogenous currently), we derive

$$\frac{dR}{d\frac{F_e^{S\to N}}{K}} = \alpha z \left(\frac{K}{L}\right)^{\alpha-1} \left(\frac{\Omega}{K}\right)^{\alpha-2} (1-\alpha)\left[\theta\left(1 - p^{\frac{1}{\alpha}}\right) + p^{\frac{1}{\alpha}}\right]^2 > 0.$$

Thus R rises as the outflow of entrepreneur capital increases. Since $R > \delta$, we also know that entrepreneur capital will not go to sector 1 as the outflow of entrepreneur capital increases.

If $F_e^{S\to N} = \mu K$, we should have $R|_{F_e^{S\to N}\to\mu K} < \bar{R}^N$. By (9), we can write

$$R|_{F_e^{S\to N}\to\mu K} = \alpha z \left(\frac{K}{L}\right)^{\alpha-1} \left[\theta\left(1 - p^{\frac{1}{\alpha}}\right) + p^{\frac{1}{\alpha}}\right]\left[p^{\frac{1}{\alpha}}(1-\mu)\right]^{\alpha-1}.$$

Comparing $R|_{F_e^{S\to N}\to\mu K}$ with $\bar{R}^N$ and employing $p^{1/\alpha} = (\mu\theta^N(1-\eta))/(\eta(1-\mu\theta^N))$, we get that if

$$\theta\left(1 - p^{\frac{1}{\alpha}}\right) + p^{\frac{1}{\alpha}} < \left[\frac{(1-\eta)(1-\mu)}{1-\mu\theta^N}\right]^{1-\alpha}\left[\theta^N\left(1 - p^{\frac{1}{\alpha}}\right) + p^{\frac{1}{\alpha}}\right] \tag{10}$$

then $R|_{F_e^{S\to N}\to\mu K} < \bar{R}^N$. Equation (10) implies that

$$\frac{\mu\theta^N(1-\eta)}{\eta\left(1-\mu\theta^N\right)}(1-\theta) + \theta < \frac{\mu\theta^N(1-\eta)}{\eta\left(1-\mu\theta^N\right)}\left(1-\theta^N\right) + \theta^N \quad \text{given} \quad \alpha = 1. \tag{11}$$

Given $\alpha \in (0, 1)$, since $((1-\eta)(1-\mu))/(1-\mu\theta^N) < (1-\eta)/(1-\mu\theta^N) < 1$ and α only appears on the RHS of (10), i.e.,

$$\frac{\mu\theta^N(1-\eta)}{\eta\left(1-\mu\theta^N\right)}(1-\theta) + \theta < \left[\frac{(1-\eta)(1-\mu)}{1-\mu\theta^N}\right]^{1-\alpha} \left[\frac{\mu\theta^N(1-\eta)}{\eta\left(1-\mu\theta^N\right)}\left(1-\theta^N\right) + \theta^N\right],$$

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(10) can be satisfied for a sufficiently large α.

Assuming that α is large so that (10) is satisfied, we, therefore, by (11) get $R|_{F_e^{S\to N}\to\mu K} < \bar{R}^N$ and $F_e^{S\to N} = \mu K$. Once $F_e^{S\to N} = \mu K$, South specializes in the production of good 2 and

$$K_1 = 0, \quad K_2 = (1-\mu)K,$$

$$w = (1-\alpha)z\left(\frac{K}{L}\right)^{\alpha} p(1-\mu)^{\alpha} \quad \text{and} \quad \delta = p\alpha z\left(\frac{K}{L}\right)^{\alpha}(1-\mu)^{\alpha-1}.$$

Comparing w with $\bar{w}$ and δ with $\bar{\delta}$, we get

$$\frac{w}{\bar{w}} = \left[\frac{p^{\frac{1}{\alpha}}(1-\mu)}{p^{\frac{1}{\alpha}}(1-\mu\theta)+\mu\theta}\right]^{\alpha} < \left[\frac{p^{\frac{1}{\alpha}}}{p^{\frac{1}{\alpha}}(1-\mu\theta)+\mu\theta}\right]^{\alpha} < \left[\frac{p^{\frac{1}{\alpha}}}{p^{\frac{1}{\alpha}}}\right]^{\alpha} < 1$$

and

$$\frac{\delta}{\bar{\delta}} = \left[\frac{p^{\frac{1}{\alpha}}(1-\mu)}{p^{\frac{1}{\alpha}}(1-\mu\theta)+\mu\theta}\right]^{\alpha-1} > 1.$$

If (11) is not satisfied, we have $F_e^{S\to N} < \mu K$ and $F_e^{S\to N}$ is determined by $R = \bar{R}^N$. Equating R with $\bar{R}^N$, we can write

$$\frac{F_e^{S\to N}}{K} = \left[\frac{\mu\theta\left(1-p^{\frac{1}{\alpha}}\right)+p^{\frac{1}{\alpha}}}{\theta\left(1-p^{\frac{1}{\alpha}}\right)+p^{\frac{1}{\alpha}}}\right] - \left[\frac{\mu\theta^N\left(1-p^{\frac{1}{\alpha}}\right)+p^{\frac{1}{\alpha}}}{\theta\left(1-p^{\frac{1}{\alpha}}\right)+p^{\frac{1}{\alpha}}}\right] \left[\frac{\theta\left(1-p^{\frac{1}{\alpha}}\right)+p^{\frac{1}{\alpha}}}{\theta^N\left(1-p^{\frac{1}{\alpha}}\right)+p^{\frac{1}{\alpha}}}\right]^{\frac{1}{1-\alpha}}.$$

Appendix 3

By (9) in Appendix 2 and $F_e^{S\to N} < \mu K$, we can write

$$R = \alpha z\left(\frac{K}{L}\right)^{\alpha-1}\left[\left(\bar{p}^N\right)^{\frac{1}{\alpha}}(1-t)^{\frac{1}{\alpha}}(1-\mu\theta)\right]^{\alpha-1} \left[\theta + \left(\bar{p}^N\right)^{\frac{1}{\alpha}}(1-t)^{\frac{1}{\alpha}}(1-\theta)\right].$$

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We can derive

$$\frac{dR}{d(1-t)^{\frac{1}{\alpha}}} = R\left[\frac{\alpha-1}{(1-t)^{\frac{1}{\alpha}}} + \frac{\left(\bar{p}^N\right)^{\frac{1}{\alpha}}(1-\theta)}{\theta + \left(\bar{p}^N\right)^{\frac{1}{\alpha}}(1-t)^{\frac{1}{\alpha}}(1-\theta)}\right] < 0$$

$$\text{for} \quad t \leq 1.$$

Thus, we know that R is decreasing in p (where $p = \bar{p}^N(1-t)$) and increasing in t. The proof regarding w and δ is the same as that in the Appendix 2.

If a sufficiently large t results in $p = \bar{p}^N(1-t) < \bar{p}^S$ ($\bar{p}^S$ is the southern autarky price) then South imports good 2 and it may finance the imports by exporting good 1 or exporting capital. Anyway, the trade pattern changes.

Appendix 4

Suppose that there is free trade in goods and that both of rentier capital and entrepreneur capital are internationally mobile. Given $F_e^{S\to N}$ and $F_r^{N\to S}$, the firms' problem in sector 1 and that in sector 2 are the same as those in Appendix 3. By similar derivations, we get that

$$L_1 = \frac{\theta\left(\mu K - F_e^{S\to N}\right)}{\Omega}L,$$

$$L_2 = \frac{p^{\frac{1}{\alpha}}\left[(1-\mu\theta)K + F_r^{N\to S} + (\theta-1)F_e^{S\to N}\right]}{\Omega}L,$$

$$K_1 = \theta\left(\mu K - F_e^{S\to N}\right), \quad K_2 = (1-\mu\theta)K + F_r^{N\to S} + (\theta-1)F_e^{S\to N},$$

$$w = (1-\alpha)z\Omega^{\alpha}L^{-\alpha} \quad \delta = p^{\frac{1}{\alpha}}\alpha z\Omega^{\alpha-1}L^{1-\alpha},$$

$$\lambda = \alpha z\left(\frac{\Omega}{L}\right)^{\alpha-1}\left(1-p^{\frac{1}{\alpha}}\right) \quad \text{and}$$

$$R = \alpha z\left(\frac{K}{L}\right)^{\alpha-1}\left(\frac{\Omega}{K}\right)^{\alpha-1}\left[\theta\left(1-p^{\frac{1}{\alpha}}\right) + p^{\frac{1}{\alpha}}\right],$$

where

$$\Omega \equiv \theta\left(\mu K - F_e^{S\to N}\right) + p^{\frac{1}{\alpha}}\left[(1-\mu\theta)K + F_r^{N\to S} + (\theta-1)F_e^{S\to N}\right].$$

Consider three cases given free trade in goods:

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Case 1.

In equilibrium, $\delta = \bar{\delta}^N$ and $\bar{R}^N = R$. The equalized capital returns imply that

$$\frac{\Omega}{K} = \frac{\mu\theta^N}{\eta} \quad \text{if} \quad \delta = \bar{\delta}^N;$$

$$\left(\frac{\Omega}{K}\right)^{\alpha-1}\left[\theta\left(1-p^{\frac{1}{\alpha}}\right)+p^{\frac{1}{\alpha}}\right] = \left(\frac{\mu\theta^N}{\eta}\right)^{\alpha-1}\left[\theta^N\left(1-p^{\frac{1}{\alpha}}\right)+p^{\frac{1}{\alpha}}\right] \text{ if } R = \bar{R}^N. \tag{12}$$

That $\delta = \bar{\delta}^N$ and $\bar{R}^N = R$ hold at the same time contradicts with $\theta^N > \theta$.

Case 2.

In equilibrium, $\delta \neq \bar{\delta}^N$ and $\bar{R}^N = R$.

The two conditions in (12) imply that if $\bar{R}^N = R$ then $\delta > \bar{\delta}^N$. However, North is a large country which is willing and able to migrate rentier capital to South if $\delta > \bar{\delta}^N$ given $\bar{\delta}^N$ fixed. Thus, $\delta > \bar{\delta}^N$ will not be in the equilibrium.

Case 3.

In equilibrium, $\delta = \bar{\delta}^N$ and $\bar{R}^N \neq R$.

The two conditions in (12) imply that if $\delta = \bar{\delta}^N$ then $\bar{R}^N > R$. Thus, in equilibrium we should have $F_e^{S\to N} = \mu K$. That $\delta = \bar{\delta}^N$ indicates

$$\frac{F_r^{N\to S}}{K} = \frac{\eta-\mu\theta^N}{1-\eta} + \mu > 0. \tag{13}$$

Recall that, given only rentier capital is mobile, AC derive

$$\frac{F_r^{N\to S}}{K} = \frac{\left(\eta-\mu\theta^N\right)\left(\theta^N-\theta^S\right)}{\theta^N(1-\eta)} = \frac{\eta-\mu\theta^N}{1-\eta}\left(1-\frac{\theta^S}{\theta^N}\right),$$

which is smaller than $(\eta - \mu\theta^N/1-\eta) + \mu$. In addition, we get $\Omega = (\mu\theta^N/\eta)K$,

$$w = (1-\alpha)z\left(\frac{K}{L}\right)^{\alpha}\left(\frac{\mu\theta^N}{\eta}\right)^{\alpha} = \bar{w}^N > \bar{w} \quad \text{and}$$

$$\delta = p^{\frac{1}{\alpha}}\alpha z\left(\frac{K}{L}\right)^{\alpha-1}\left(\frac{\mu\theta^N}{\eta}\right)^{\alpha-1} = \bar{\delta}^N < \bar{\delta}.$$

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Appendix 5

With trade friction, we should have $\bar{p} = \bar{p}^N(1-t) \equiv p$ which South takes as given. By Appendix 4, Table 1 and given $t > 0$, we have

$$(1-t)^{\frac{1}{\alpha}} \left(\frac{\Omega}{K}\right)^{\alpha-1} = \left(\Theta^N\right)^{\alpha-1} \quad \text{if} \quad \delta = \bar{\delta}^N \quad \text{and}$$

$$(1-t)^{\frac{1}{\alpha}} \left(\frac{\Omega}{K}\right)^{\alpha-1} P^N + \Delta = \left(\Theta^N\right)^{\alpha-1} P^N \quad \text{if} \quad R = \bar{R}^N, \tag{14}$$

where

$$\begin{aligned}\Omega \equiv{}& \theta\left(\mu K - F_e^{S\to N}\right) + \left(\bar{p}^N\right)^{\frac{1}{\alpha}} (1-t)^{\frac{1}{\alpha}} \\ & \left[(1-\mu\theta)K + F_r^{N\to S} + (\theta-1)F_e^{S\to N}\right] \quad \text{and} \\ \Delta \equiv{}& \theta\left(1-(1-t)^{\frac{1}{\alpha}}\right) + \left(\theta-\theta^N\right)(1-t)^{\frac{1}{\alpha}}\left(1-\left(\bar{p}^N\right)^{\frac{1}{\alpha}}\right).\end{aligned}$$

When t satisfies

$$(1-t)^{\frac{1}{\alpha}} = \frac{\eta\left(1-\mu\theta^N\right)}{\eta\left(1-\mu\theta^N\right) + \left(\eta-\mu\theta^N\right)\left(\theta^N/\theta - 1\right)} \equiv T \tag{15}$$

we get $\Delta = 0$. For any t such that $(1-t)^{1/\alpha} > (<)T$, we get $\Delta < (>)0$.

According to Appendix 4, we also have

$$\begin{aligned} w &= (1-\alpha)z\Omega^{\alpha}L^{-\alpha} \\ &= \frac{(1-\alpha)z}{L^{\alpha}} \\ &\quad \left\{\theta\left(\mu K - F_e^{S\to N}\right) + \left(\bar{p}^N\right)^{\frac{1}{\alpha}}(1-t)^{\frac{1}{\alpha}}\right. \\ &\quad \left.\left[(1-\mu\theta)K + F_r^{N\to S} + (\theta-1)F_e^{S\to N}\right]\right\}^{\alpha} \end{aligned} \tag{16}$$

and

$$\begin{aligned}\delta &= p^{\frac{1}{\alpha}}\alpha z\Omega^{\alpha-1}L^{1-\alpha} \\ &= \left(\bar{p}^N\right)^{\frac{1}{\alpha}}(1-t)^{\frac{1}{\alpha}}\alpha z \\ &\quad \left\{\left(\bar{p}^N\right)^{\frac{1}{\alpha}}(1-t)^{\frac{1}{\alpha}}\left[(1-\mu\theta)K + F_r^{N\to S} + (\theta-1)F_e^{S\to N}\right]\right\}^{\alpha-1} L^{1-\alpha}.\end{aligned} \tag{17}$$

Consider three cases:

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Case 1. $\delta \neq \bar{\delta}^N$ and $\bar{R}^N = R$ in the equilibrium.

By conditions in (14), we get that if $\Delta > 0$ then $\delta < \bar{\delta}^N$; $\Delta < 0$ then $\delta > \bar{\delta}^N$. $\delta > \bar{\delta}^N$ will not be in the equilibrium because that more northern rentier capital should flow into South. $\delta < \bar{\delta}^N$ means that $F_r^{S\to N} = (1-\mu)K$ which makes southern sector 2 vanish.

When $\bar{R}^N = R$ and $\delta < \bar{\delta}^N$, no rentier capital flow into South but entrepreneur capital might flow into or out of South. We can write $K_1 = K - F_e^{S\to N}$, $L_1 = L$ and $\alpha z(K - F_e^{S\to N}/L)^{\alpha-1} = \bar{R}^N$ (the first order condition from profit maximization in sector 1) which gives

$$\frac{F_e^{S\to N}}{K} = 1 - \frac{\mu\theta^N}{\eta}\left(P^N\right)^{\frac{1}{\alpha-1}} > 0.$$

Since $(\mu\theta^N/\eta) < 1$ and $P^N > 1$, we know that $F_e^{S\to N}$ is positive. Since sector 2 vanishes, the trade pattern changes due to t. Equation (16) implies that

$$w = (1-\alpha)z\left(\frac{K}{L}\right)^{\alpha}\left[\mu - \frac{1}{K} + \frac{\mu\theta^N}{\eta K}\left(\theta^N\left(1-\left(\bar{p}^N\right)^{\frac{1}{\alpha}}\right) + \left(\bar{p}^N\right)^{\frac{1}{\alpha}}\right)^{\frac{1}{\alpha-1}}\right]^{\alpha} < (1-\alpha)z\left(\frac{K}{L}\right)^{\alpha}\mu^{\alpha}. \tag{18}$$

Case 2. $\delta = \bar{\delta}^N$ and $\bar{R}^N = R$ in the equilibrium.

By the two conditions in (14), we get that $\Delta = 0$ and $(1-t)^{1/\alpha} = T$. Then by (14), we get

$$\frac{F_e^{S\to N}}{K}\left[(\theta-1)\left(\bar{p}^N\right)^{\frac{1}{\alpha}}T - \theta\right] + \left(\bar{p}^N\right)^{\frac{1}{\alpha}}T\frac{F_r^{N\to S}}{K} = \frac{\mu\theta^N}{\eta}T^{\frac{1}{1-\alpha}} - \mu\theta - \left(\bar{p}^N\right)^{\frac{1}{\alpha}}T(1-\mu\theta). \tag{19}$$

Since $(\theta-1)(\bar{p}^N)^{1/\alpha}T < \theta$, $F_r^{N\to S}$ is increasing in $F_e^{S\to N}$ and, when $F_e^{S\to N} = \mu K$, $F_e^{S\to N}$ attends its maximum which gives

$$\frac{F_r^{N\to S}}{K} = \frac{1-\mu\theta^N}{1-\eta}(1-t)^{\frac{1}{1-\alpha}} - 1 + \mu.$$

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Equations (16), (17) and (19) imply that

$$w = (1-\alpha)z\left(\frac{K}{L}\frac{\mu\theta^N}{\eta}\right)^{\alpha} T^{\frac{\alpha}{1-\alpha}} \quad \text{and}$$
$$\delta = \left(\bar{p}^N\right)^{\frac{1}{\alpha}} \alpha z \left(\frac{\mu\theta^N}{\eta}\frac{K}{L}\right)^{\alpha-1} = \bar{\delta}^N. \tag{20}$$

Case 3. $\delta = \bar{\delta}^N$ and $\bar{R}^N \neq R$ in the equilibrium.

By conditions in (14), we get that if $\Delta > 0$ then $R > \bar{R}^N$; if $\Delta < 0$ then $R < \bar{R}^N$. The former will not be in the equilibrium as argued in Appendix 4 and the latter means that $F_e^{S\to N} = \mu K$. Equations (16), (17) and (19) imply that

$$w = (1-\alpha)z\left(\frac{K}{L}\frac{\mu\theta^N}{\eta}\right)^{\alpha} (1-t)^{\frac{1}{1-\alpha}} \quad \text{and}$$
$$\delta = \left(\bar{p}^N\right)^{\frac{1}{\alpha}} \alpha z \left(\frac{\mu\theta^N}{\eta}\frac{K}{L}\right)^{\alpha-1} = \bar{\delta}^N. \tag{21}$$

By $(1-t)^{1/\alpha}(\Omega/K)^{\alpha-1} = (\Theta^N)^{\alpha-1}$ and $F_e^{S\to N} = \mu K$, we get

$$\frac{F_r^{N\to S}}{K} = \frac{1-\mu\theta^N}{1-\eta}(1-t)^{\frac{1}{1-\alpha}} - 1 + \mu. \tag{22}$$

When $t = 0$, we get $(F_r^{N\to S}/K) = (\eta - \mu\theta^N/1-\eta) + \mu > 0$ as that shown in (13) and we also have $\Delta < 0$. Since $F_r^{N\to S}$ is decreasing in t, an increase in t reduces rentier capital inflow but it will not change $F_e^{S\to N} = \mu K$ (i.e., when $\Delta < 0$ still holds). $F_e^{S\to N}$ can be less than μK when t is increased to a level such that $(1-t)^{1/\alpha} = T$ and $\Delta = 0$ which indicates the Case 2.

For Case 3, $F_r^{N\to S}$ is decreasing in t so that $F_r^{N\to S}$ can be negative (i.e. $F_r^{S\to N}$ can be positive) for a sufficiently large t. According to (22), $F_r^{N\to S} = 0$ if there exists a t^* such that

$$\left(1-t^*\right)^{\frac{1}{\alpha}} = \left[\frac{(1-\mu)(1-\eta)}{1-\mu\theta^N}\right]^{\frac{1-\alpha}{\alpha}}. \tag{23}$$

Thus, we have if $t > (=, <)t^*$ then $F_r^{S\to N} > (=, <)0$ for all t satisfy $(1-t)^{1/\alpha} > T$.

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金融摩擦和國際資本流動

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本文探討一小型國家的企業家資本與一般資本的流向。我們發現貿易摩擦增強會使一般資本流出, 但是這兩種資本流向相反。因此, 無法斷言淨資本流入與貿易整合的關係是爲互補或替代。同時, 是否能以貿易自由化來解決全球國際收支失衡亦值得再研究。另外, 我們發現此小型國家的資本流動型態會影響其勞工和資本家的相對所得, 其具金融摩擦的生產部門可能會因爲資本流出而消失。

關鍵詞: 金融摩擦, 貿易摩擦, 國際資本流動
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