

International Trade and International Capital Flows: A Theoretical Perspective

September 15, 2010

1 Introduction

Trade and capital flows are both integral processes of globalization, yet until recently, there has been little study on how they interact. The conventional separation of international trade and international macroeconomics forecloses the possible impact macroeconomic dynamics exert on the structure of trade and the aggregate feedback effect of commodity trade. In the standard workhorse, open-economy, macroeconomic framework, either only intertemporal trade is present or an exogenously-rigged structure of trade is assumed.¹ Recent works have suggested that the separation is not always innocuous. Trade and capital flows jointly determine the global allocation of capital, and give markedly different predictions on the way shocks impinge on the world.

The interest in the relationship between commodity trade and capital flows harks back to the fundamental insights of the Heckscher-Ohlin framework. Under certain conditions, in a two-country, two-factor model, trade and capital flows are perfect substitutes: commodity trade is sufficient to ensure factor price equalization, and factor price equalization is sufficient to ensure commodity price equalization.² In other words, the ability to engage

¹One common example is that each country specializes in differentiated goods.

²We focus in this chapter on the case where countries incompletely specialize in goods.

in commodity trade can eliminate the need for capital to flow from the capital-abundant countries to the capital-scarce countries, since rate of return differences can be eliminated through trade alone. The implication is that trade liberalization reduces the need for capital to flow towards developing countries characterized by capital-scarcity.

Mundell (1957) puts this substitutability of trade and capital flows in a different way: an increase in trade impediments stimulates factor movements, and an increase in impediments to factors stimulates trade. An example helps illustrate these points. Suppose that Home is capital-abundant and Foreign is labor-abundant. If factors (labor and capital) are internationally immobile but trade impediments are absent, Home exports the capital-intensive good and Foreign the labor-intensive good. With factor price equalization, no capital flows will take place once barriers to capital mobility are removed. But now suppose that Foreign imposes a tariff on the capital-intensive good, causing its relative price to rise. Factors will move out of the labor-intensive sector and into the capital-intensive sector. At constant factor prices, the shift in production structure creates an excess supply of labor and an excess demand for capital. Consequently the marginal product of capital rises in Foreign compared to Home, and capital flows from Home to Foreign. This simple example points at the possible interaction between trade and capital flows: changes in the structure of trade, in this case led by an exogenous increase in tariffs, creates incentives for capital to move across borders.

While insightful, the Heckscher-Ohlin-Mundell framework (henceforth HOM) remains limited in its capacity to provide a comprehensive analysis of trade and capital flows and their interaction under a rich set of scenarios. One important drawback is that capital mobility in the static two-country, two-factor, two-country ($2 \times 2 \times 2$) framework is confined to the allocation of capital across countries, for a fixed level of world capital stock. A dynamic model in which capital flows are driven by the allocation of savings across countries becomes a relevant and important, extension. In other words, to scrutinize the relationship between trade and capital flows requires the marriage of an endogenous structure of trade and a rigorous macroeconomic framework in which intertemporal decisions are made. It is

also imperative to allow for simultaneous trade and capital mobility. The Heckscher-Ohlin model allows for only trade mobility, and arguments made for capital flows amount to simple comparisons of the return to capital across financially-insulated economies.³

This chapter examines new theoretical predictions arising from the integration of a factor-proportions-based structure of trade and macroeconomic dynamics. It focuses on isolating the impact of trade and specialization patterns as drivers of capital flows in a realistic, macroeconomic setting. Under certain circumstances, capital can flow *out* of countries experiencing a permanent increase in labor force/productivity, and it can also flow ‘upstream’ from capital-scarce to capital-abundant countries when economies integrate. These set of results are analyzed in Jin (2009). The chapter then discusses the relationship between trade and capital flows when they can interact with other types of market friction. When comparative advantages across countries are not determined only by factor-endowments, but also by financial heterogeneity, the HOM results of substitutability can turn into one of complementarity, as forcefully shown in Antras and Caballero (2009). Ju and Wei (2007) puts labor market frictions at center stage and examines the impact of labor market rigidity on current account adjustments. Their results generalizes the “intertemporal approach to current account” by allowing for an additional, intratemporal channel of adjustment.⁴

2 Specialization and Capital Flows

In the HOM setting, trade integration reduces the need for capital to flow from capital-abundant to capital-scarce countries. Likewise, there is less incentive for capital to flow towards countries experiencing a labor force/productivity boom if bestowed with the ability

³Under factor price equalization in a $(2 \times 2 \times 2)$ world, capital is indeterminate at the country level if there are no barriers to capital flows. Capital earns the same returns everywhere and can be located anywhere. One way of breaking factor price equalization and the resultant indeterminacy result is to assume some form of market friction. For instance, Mundell (1957) assumes impediments to trade. Jin (2009) assumes the existence of capital adjustment costs.

⁴See Obstfeld and Rogoff (1992) Chapter 1 and Chapter 2.

to trade. We next examine how, under certain conditions, capital flows can entirely *reverse*—away from capital-scarce countries, and out of countries with the labor force/productivity boom—precisely economies with a relative low capital-labor ratio. This comes out of a realistic departure from the standard Hecksher-Ohlin framework. First, it allows for simultaneous mobility in trade flows and capital flows. The assumption of the existence of capital adjustment costs breaks factor price equalization temporarily and pins down the country-level capital stock. Second, a typical macroeconomic setup requires capital to adjust after one period; capital in each sector is augmented by investment, rather than through the reallocation of capital from other sectors. These features make capital effectively “sector-specific”.⁵ Third, the world capital stock is no longer fixed but can grow, and capital flows are determined based on the allocation of savings. The setup can be seen as a minimal departure from a standard, two-country growth model, augmented by multiple-tradable goods that feature factor intensity differences.

Consider now, two initially symmetric, open economies, Home and Foreign. Suppose that Foreign experiences an unexpected, permanent increase in the labor force. Now labor-abundant, Foreign specializes in labor-intensive goods and becomes a net importer of capital-intensive goods, and Home, a net importer of labor-intensive goods. The change in the structure of trade leads to attendant changes in the relative demand for capital in each country: Home sees a rise in the share of capital-intensive goods in total domestic production and hence a rise in its investment share of output. Note that in a setting where sectors are distinguished by their factor intensity, investment demand depends not only on the scale of the economy,⁶ but also on the *composition of production*. Industrial structures tilted towards capital-intensive sectors tend to see a higher investment demand, all else equal.

Ultimately, whether this trade-induced impact on Home’s investment will result in a net capital inflow depends on the relative strength of two effects that underly a unified

⁵See the specific-factors models of Neary (1978), Jones (1971) and Mussa (1978).

⁶By this we mean that countries that expand, either through size or productivity, will see greater investment demand.

framework of trade and capital flows. The first effect is driven by commodity trade, which, to recapitulate, induces capital to flow towards the country becoming more specialized in capital-intensive goods, a “composition effect”. The second effect is the standard impetus to capital flows in the basic macroeconomic framework, whereby capital tends to flow towards where it is relatively scarce, a “convergence effect”. The dominant of the two effects determines the direction of the flow. The neoclassical one-good case thus becomes a special case in this integrated framework. It is the case where sectors do not feature factor intensity differences and only the “convergence effect” is present. The next subsection discusses the special case that isolates the “composition effect” and demonstrates its disparate impact on capital flows.

2.1 The “Composition Effect”

Consider the same multiple sector setup, except that the most labor-intensive sector uses only labor as an input to the production technology. Assume, for simplicity, that there are no productivity differences across countries, and that labor is perfectly mobile across sectors. The wage for any country j , w^j , then, is pinned down by the price of the most labor-intensive good, p_1 . Since p_1 is equalized across countries under free trade, wages are equalized across countries at any point in time. *Labor* reallocation across sectors alone, within a country, is sufficient to equalize capital-labor ratios in each sector, across countries. Normally, both labor reallocation and the adjustment of capital stocks are necessary to bring about equalization of capital-labor ratios, and hence, factor prices. But in this special case, the need for “convergence” is effectively eliminated. How does Foreign with the labor force/productivity boom allocate its marginal unit of savings? Since returns to capital are equalized across countries, it is allocated to both countries. Exactly how much is apportioned to each country is pinned down by adjustment costs: if countries were originally symmetric, one half of saving would be allocated domestically and one half, abroad; if a country started out with a higher capital stock, it would receive proportionately more investment for the reason that

lower adjustment costs are incurred there per unit of investment. The important result is that investment always comoves across countries.

An alternative way of understanding this result, not based on simple comparisons of the rate of return to capital, is examining a country's investment demand relative to its savings capacity. The following graphical illustration can help build intuition for the impact effect of shocks on capital flows. Figure 1 graphs the investment-GDP ratio, and the savings-GDP ratio, against the relative capital labor ratio of country j —defined as the ratio of j 's capital-labor ratio to that of the world. When j 's relative capital-labor ratio is 1, no comparative advantage differences exist across countries. In the first panel, featuring the multi-sector special case, country j 's investment share of GDP rises with its relative aggregate capital-labor ratio. The reason is that greater comparative advantage in capital, manifested by a high relative-capital-labor ratio, bids Home to specialize more in capital-intensive sectors. As a result of the changing industrial structure, the relative share of output attributed to investment increases, while the share of GDP attributed to labor income is reduced. As in Jin (2009), that the saving-GDP ratio is a downward sloping function comes out of a Diamond-type overlapping generations model, where saving derives solely from wage income of the young cohort. The important point is that investment demand can rise above its capacity to save as a country becomes more capital-intensive in production, inducing a net capital inflow from abroad. At the point where countries' capital-labor ratios are equalized, domestic savings is just enough to serve their domestic investment needs, and no net capital flows needs to occur between countries.

The one-sector case shows the opposite result. The investment-GDP curve is downward sloping, as drawn in the second panel, since lower capital-effective-labor ratio in any country requires greater investment in order for capital to 'scale up' with labor.⁷ The impact effect of a fall in capital-effective labor ratio in Foreign is thus a net capital inflow, in contrast to the net outflow in the multi-sector case. The striking difference between the two special

⁷On the other hand, the savings to GDP ratio is a constant. This comes from the assumption of log utility in the two-period OLG model. See Jin (2009) for a discussion.

cases is the slope of the investment demand curve, which is negative in the one-sector case but positive in the multi-sector case. These cases, of course, display the results of the composition and convergence effect in isolation, but when they coexist in the general setting, the investment-GDP curve lies somewhere in between—positively sloped when the composition effect is stronger and negatively sloped when the convergence effect is stronger. The main action stems from the behavior of investment rather than savings, which may exhibit different patterns for different assumptions of the structure of the economy and parameters.⁸

2.2 Implications

An important implication is that one cannot resort to comparing the autarky-state marginal product of capital to infer the direction of capital flows once the economies undergo financial and trade liberalization. The reason is that opening up to trade can have an impact effect on the marginal product of capital in both countries as each undergoes industrial restructuring. This relates to the point originally made by Lucas (1990), that large differences in capital-labor ratios may not imply vast differences in the marginal product of capital (MPK), as poor countries also have lower endowments of factors complementary with physical capital, such as human capital and total factor productivity. As such, it is plausible that very little capital flows from rich to poor countries. Yet, one cannot draw these conclusions when commodity trade is allowed. In integrating with the rest of the world, both in terms of trade and financial flows, capital-abundant, advanced economies become net exporters of capital-intensive goods and see a rise in the marginal product of capital. Under certain conditions, part of the saving derived from trade liberalization in developing economies can be allocated also to rich countries, reversing the flow of capital from capital-poor to capital-abundant economies.

⁸It is for this reason that the assumption of an overlapping generations model is not crucial, although most likely to be quantitatively important. The amount of capital flows that take place depends partly on the amount of saving generated by the country with the boom. In a representative-agent model, the saving generated would depend on the persistence of the shocks. Highly persistent labor/productivity shocks can lead to an initial fall in saving.

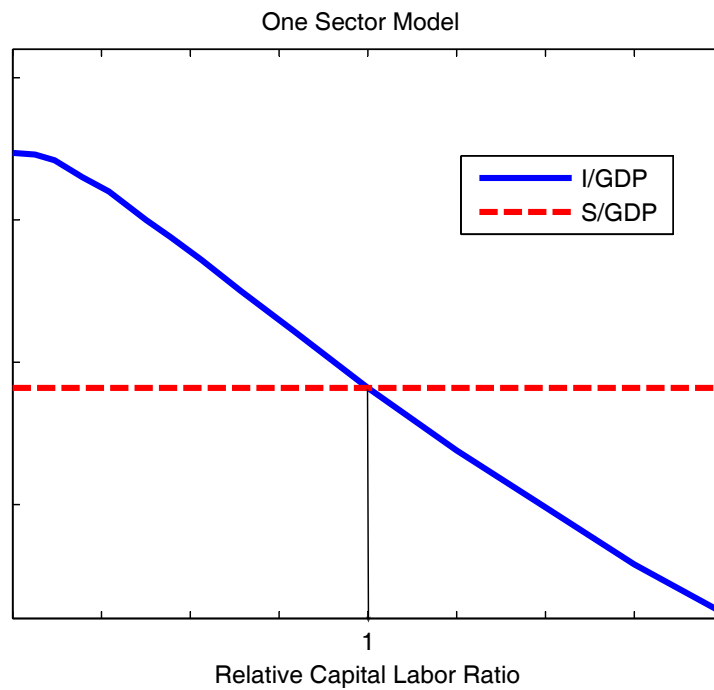
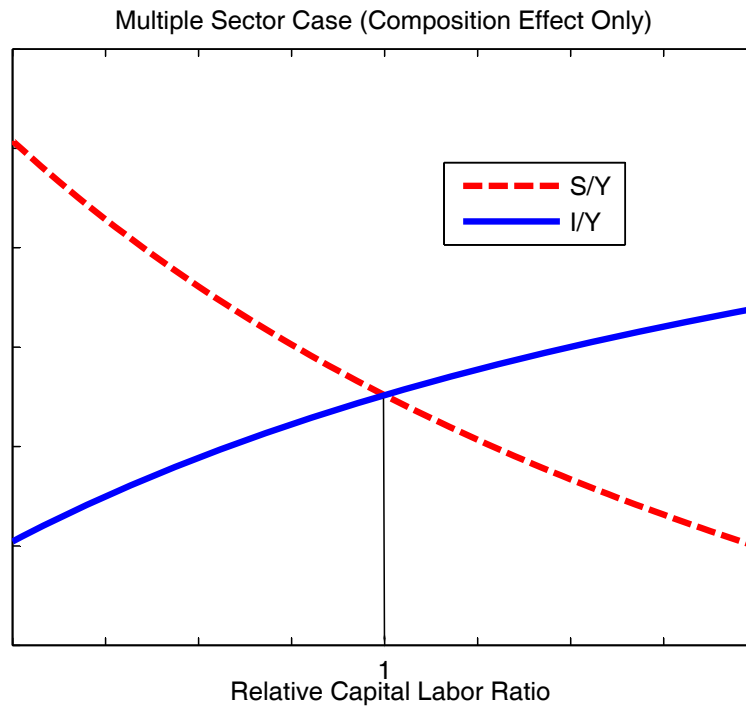


Figure 1: Savings/GDP and Investment/GDP ratio as a function of a country's relative capital-labor ratio.

Another implication is that the sequencing of liberalization can also have differential impact on developing countries in such a process. While simultaneous liberalization may lead to a capital outflow in South, trade liberalization preceding financial liberalization may prevent such an outflow.

3 Trade and Capital Flows with Frictions

Antras and Caballero (2009) explores the relationship between trade and capital flows in the presence of financial heterogeneity. Motivated by empirical evidence, the paper assumes that countries differ in financial development and sectors differ in financial dependence. A borrowing constraint in one sector limits the amount of capital allocated to that sector. The tightness of the borrowing constraint can vary across countries.

In the benchmark case, which consists of a two-factor, two sector, general equilibrium model, sectors are initially symmetric (no factor intensity differences) except for the presence of a borrowing constraint in the financially-constrained sector, and countries are also initially symmetric except for the tightness of the borrowing constraint. One can think of a developing “South” as having a lower level of financial development, and advanced “North” as having a higher level of financial development.

It is useful to first consider the autarkic equilibrium, in which goods and factor markets have to clear domestically. In South, with the worse financial institutions, disproportionately more capital is apportioned to the unconstrained sector, whose output becomes oversupplied and its relative price depressed.⁹ The high capital-labor ratio in the unconstrained sector leads to relatively depressed wages and rental rates of capital in South. If international capital flows are now allowed, capital will move away from South towards North with the better financial development.

⁹The financial friction, however, does not distort the allocation of labor across sectors.

The implications on capital flows change when international trade in goods is allowed. When South opens itself up to trade, it will see an increase in the price of the unconstrained sector’s output, causing it to specialize (incompletely) in the unconstrained sector, in which it has a comparative advantage. It becomes a net importer of the financially-dependent sector’s output. Trade integration thus allows South to allocate a disproportionate number of workers in the unconstrained sector, thereby increasing the marginal product of capital and its equilibrium rental rate. By allowing South to specialize in a sector with lower financial frictions, international trade reduces the negative impact of financial underdevelopment on the rental rate of capital. In fact, the rate of return to capital becomes higher in South—trade integration not only reduces the difference in the real return to capital in North and South, but actually overturns it. The implication is thus that, in the presence of financial differences, trade integration increases capital flows from the North to South. These results carry over to the extension with HO determinants of trade and when countries feature differences in aggregate capital-labor ratio.¹⁰ Thus, the complementarity between trade and capital flows is drawn into stark contrast with the substitutability nature featured in Mundell (1957), whereby a process of trade integration necessarily lowers the rental rate of capital in capital-scarce countries, as these countries become more specialized in labor intensive goods and sees a fall in the demand for capital.

Unlike Antras and Caballero (2009), Ju and Wei (2007) puts labor market rigidity at center stage in a dynamic Hecksher-Ohlin framework. The setting is the same two-country, two-sector general-equilibrium model, in which, added to labor adjustment costs, are trade costs and costs to capital flows. Unlike Jin (2009), capital can be costlessly and instantaneously adjusted across sectors, within a country. Labor, rather than capital, becomes the ‘specific factor’.

Ju and Wei (2007) shows that the degree of labor market frictions in a country affects

¹⁰More precisely, the result that trade integration raises the rental rate of capital in South even when there are factor intensity differences across sectors, holds as long as South continues to command a comparative advantage in the unconstrained sector.

the size of the current account response to shocks and the speed of adjustment to its long-run level. When there is some degree of mobility in both trade and capital, an economy's adjustment to shocks involves a combination of a change in the composition of goods trade (intratemporal trade) and in the current account (intertemporal trade). In the extreme case that labor is immobile across sectors, all adjustment to shocks takes place through intertemporal trade.¹¹ Thus, a relatively more rigid labor regulation induces a larger response of the current account, and slows down the speed of adjustment of the current account towards the long-run equilibrium. They provide three pieces of supporting empirical evidence: a rigid labor market is associated with a lower churning of its trade structure, a higher rigidity of the labor market reduces the speed of convergence of the current account to its long-run equilibrium, and a country with a rigid labor market is likely to exhibit a higher variance of current account to total trade.

4 Conclusion

This chapter has highlighted some recent progress in understanding the relationship between trade and capital flows under a set of more realistic assumptions and a rich set of environments. Incorporating an endogenous structure of commodity trade into rigorous macroeconomic settings can lead to markedly different theoretical implications. With deepening trade and financial ties, the necessity for integrating these two dimensions of globalization becomes apparent, and moreover is reinforced by the fact that it provides new, and often surprising, insights. Not only do these predictions extend to the widely-debated issues of global imbalances, there are also profound implications for asset prices, risk sharing, international business cycles, and policy and welfare implications for each type, and the timing, of liberalization. The joint analysis of trade and macroeconomic dynamics is particularly perti-

¹¹This result resonates with the HOM prediction in the context of prohibitive trade.

ment when shocks or structural changes under investigation fundamentally change a country's comparative advantage, and therefore its structure of trade, which can affect macroeconomic aggregates, as reviewed in this chapter. Demographics, globalization, productivity changes and financial market developments are best examples of such scenarios, and in the world we observe today, incontrovertibly relevant.

These issues, until now, remain principally interesting theoretical inquiries. The empirical relevance of the interaction between trade and capital flows, and between trade and market frictions, has yet to be tested. An obviously important question is to what extent and through what channel can trade affect capital flows? Can we exploit differing experiences and the timing of trade and financial liberalization across countries, and various other shocks, to test these theories? The literature that bridges trade and macroeconomics promises to be a fertile ground for further research, but in the absence of parallel advances in empirics, its scope remains limited and its impact conceivably bounded by the perimeters of a purely theoretical construct.

References

- [1] **Cuñat, Alejandro, and Marco Maffezzoli.** 2004. "Heckscher-Ohlin Business Cycles." *Review of Economic Dynamics*, 7/3: 555-585.
- [2] **Jin, Keyu.** 2009. "Industrial Structure and Capital Flows", mimeo, Harvard University.
- [3] **Jones, Ronald.** 1971. "A Three-Factor Model in Theory, Trade, and History", in *Trade, Balance of Payments, and Growths: Essays in Honor of Charles P. Kindleberger*, edited by Jagdish N. Bhagwati et al. Amsterdam: North-Holland.
- [4] **Ju, Jiandong, and Shangjin Wei.** 2007. "Current Account Adjustment: Some New Theory and Evidence." NBER Working Paper No. 13388.

- [5] **Neary, Peter.J.** 1978. "Short-Run Capital Specificity and the Pure Theory of International Trade", *Economic Journal*, 88: 488-510.
- [6] **Mundell, Robert.** 1957. "International Trade and Factor Mobility", *The American Economic Review*, 47: 321-335.
- [7] **Mussa, Michael.** 1978. "Dynamic Adjustment in the Hecksher-Ohlin-Samuelson Model", *Journal of Political Economy*, 86(5): 775-91.
- [8] **Neary, Peter.J.** 1978. "Short-Run Capital Specificity and the Pure Theory of International Trade", *Economic Journal*, 88: 488-510.