



# On the connections between intra-temporal and intertemporal trades<sup>☆</sup>



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## ABSTRACT

This paper develops a new theory of international economics by introducing Heckscher–Ohlin features of intra-temporal trade into an intertemporal trade approach of current account. To do so, we consider a dynamic general equilibrium model with tradable sectors of different factor intensities, which allows for substitution between intertemporal trade (current account adjustment) and intra-temporal trade (goods trade). An economy's response to a shock generally involves a combination of a change in the composition of goods trade and a change in the current account. Flexible factor markets reduce the need for the current account to adjust. On the other hand, the more rigid the factor markets, the larger the size of current account adjustment relative to the volume of goods trade, and the slower the speed of adjustment of the current account towards its long-run equilibrium. We present empirical evidence consistent with the theory.

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## 1. Introduction

This paper aims to shed some new light on the connection between intertemporal trade (or net foreign borrowing), the usual subject of open-economy macroeconomics, and intra-temporal trade, the usual subject of international trade. The standard open-economy macro models feature either multiple tradable sectors with a common factor intensity or sometimes a single tradable sector. Such models do not feature Heckscher–Ohlin (HO) structure. In contrast, by incorporating a Heckscher–Ohlin (HO) structure into a fully dynamic general

equilibrium model and not imposing a balanced trade assumption, we show some novel connections between intra-temporal and intertemporal trade and uncover a natural role of domestic labor market rigidity in current account adjustment patterns.

The intertemporal approach to current account was developed in seminal work by Sachs (1981, 1982) and Svensson and Razin (1983), and codified in Obstfeld and Rogoff (1996). In spite of the theoretical appeal and some partial empirical support, actual current accounts do not seem to move as much as the standard theory predicts (as pointed out by Sheffrin and Woo, 1990; Otto, 1992; Ghosh, 1995; Obstfeld and Rogoff, 1996; Hussein and de Mello, 1999, among others). The Feldstein and Horioka (1980) puzzle that a country's saving and investment are highly correlated is another manifestation of sticky current accounts. Tesar (1991), Backus and Smith (1993), Backus et al. (1992, 1994), and Glick and Rogoff (1995) show, from different angles, that the actual current account in the data is less variable than in the textbook model.

By introducing two tradable goods and assuming complete specialization, Cole and Obstfeld (1991) provide a theoretical connection between intra-temporal trade and intertemporal trade. In particular, the terms of trade response alone can provide perfect insurance against output shocks such that gains from international portfolio diversification are small. Here the elasticity of intertemporal substitution and the elasticity of substitution between home and foreign goods are a key. With a unitary value for both elasticities of substitution, all adjustment is intra-temporal, irrespective of whether the shock is temporal or permanent. In further work by Corsetti et al. (2008) and Corsetti et al.

<sup>☆</sup> The paper is a substantial revision of an earlier paper, Ju and Wei (2007), "Current account adjustment: some new theory and evidence." We have replaced the OLG model in the earlier version with an infinity-horizon setup in this version and calibrated the model to study adjustments in both intertemporal trade and intra-temporal trade under technology shocks and preference shocks. We thank Joshua Aizenman, Rudolf Bems, Richard Clarida, Giancarlo Corsetti, Luca Dedola, Mick Deveraux, Marcel Fratzscher, Gordon Hanson, Jean Imbs, Olivier Jeanne, Aart Kraay, Nuno Limao, Akito Matsumoto, Jonathan Ostry, David Parsley, Ken Rogoff, Eric van Wincoop and the seminar/conference participants at Northwestern University, University of Lausanne, Graduate Institute for International Studies in Geneva, the IMF, the European Central Bank, SED Annual Meeting 2008, CEPR Conference on International Macroeconomics and Finance, Paris 2008, and Columbia–Tsinghua Conference on International Economics 2010, and 2013 NBER–CEPR ISOM conference for their helpful discussions and suggestions, and Chang Hong, Erik von Uexkull, and Xuebing Yang for their very capable research assistance.

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(2012), the current account response depends on the values of elasticities and persistence of shocks. For example, assuming a log utility function, if the intra-temporal elasticity of substitution is less than one, a temporary positive shock to net output worsens the terms of trade and induces the economy to run a current account deficit; if the intra-temporal elasticity of substitution is greater than one, the opposite happens. On the other hand, a near permanent shock to productivity, a news shock, or a growth shock would all keep the current account in deficit even when the intra-temporal trade elasticity is sufficiently large. In this literature, current account dynamics are driven by demand side effects and depend on a combination of the size of the elasticities and the persistence of shocks. In contrast, current account dynamics in our model are driven by supply side effects, and depend on differences of factor intensities and the mobility of labor across sectors but not qualitatively on trade elasticity.

We preview some of our key results here. First, with a flexible factor market, many shocks that normally would require a current account response in the standard intertemporal model could be accommodated by a change in the composition of output and intra-temporal trade with no need for a current account adjustment. The intuition behind this apparently major departure from the standard intertemporal approach can be understood by appealing to the Heckscher–Ohlin (HO) theory of goods trade. Consider a shock that would have produced a desire to import capital in the classic intertemporal model. Instead of adjusting the current account and importing capital directly, a country can adjust the total amount of investment by altering the composition of the two sectors, for example, importing capital indirectly via importing more of the capital-intensive product and at the same time exporting more of the labor-intensive product. In other words, the capital flow that would have taken place is substituted by a change in the composition of goods trade. It is important to note that this result depends neither on the values of the elasticities nor on the persistence of shocks. Second, in general, if an economy's factor markets are partially flexible, its response to a shock is a combination of a change in the current account (i.e., the intertemporal trade channel) and a change in the composition of output and goods trade (i.e., the intra-temporal trade channel). Intuitively, if factors are not completely mobile across sectors, then domestic output composition cannot change fully in response to a shock. So some of the adjustment must go through the current account channel. The relative importance of the current account channel depends on the degree of domestic labor market rigidity. Using a dynamic general equilibrium model, we show that as the domestic labor market becomes more rigid, the size of current account adjustment relative to the classic trade volume will become larger and the speed of adjustment towards the steady state equilibrium will be lower. Third, we present a series of empirical evidence on the connections between the degree of labor market rigidity and current account adjustment patterns that is consistent with our theory.

Our approach differs from the international real business cycle (IRBC) literature that also addresses the phenomenon of sticky current accounts. Obstfeld (1986), Mendoza (1991), and Baxter and Crucini (1993) show that a strong positive correlation between savings and investment can result from a persistent productivity shock in a dynamic general equilibrium model with no HO features. In such a model, a large transitory shock typically leads to a large current account response (i.e., no sticky current account). In comparison, our explanation is more general in the sense that a sticky current account is compatible with most shocks, including a large one-time (transitory) productivity shock. Our approach also generates different (and testable) predictions from other papers that have considered labor market frictions and trade barriers. Backus et al. (1992) show that trade frictions lower the variability of net exports. Raffo (2008) argues that a class of preferences that embeds home production helps to explain countercyclical net exports. Fernandez de Cordoba and Kehoe (2000) incorporate frictions in the domestic labor market that impede resource reallocation between the non-tradable and tradable sectors. In their model, the

greater the labor market frictions, the smaller the current account change. In contrast, in our model, an increase in labor market frictions could augment rather than dampen the current account change.

Some papers in the literature feature tradable and non-tradable sectors. The current account adjustment mechanism in our paper differs from that literature. In particular, a generalized Stolper–Samuelson mechanism is at work in our model, verified by us in a fully dynamic setting with an endogenous savings decision. This mechanism is responsible for some of our key results, but is not available in existing models with tradable and non-tradable sectors that do not emphasize cross-sector differences in factor intensity. We highlight our idea in a setting without a non-tradable sector, but adding a non-tradable sector will not fundamentally alter our results.

Cunat and Maffezzoli (2004) introduce a Heckscher–Ohlin structure into a DSGE model, but do not explore interactions between goods trade and capital flows and do not look into the role of labor market frictions in current account adjustments. The relationship between goods trade and capital flows is also examined by several recent papers. Antras and Caballero (2009) study the effect of credit constraints on international trade and capital flows and show that in less financially developed economies, trade and capital mobility are complements. Ju and Wei (2010, 2011) study the quality of the financial system as a source of comparative advantage and as a motivation for two-way capital flows.<sup>1</sup> Jin (2012) discusses the effect of a change in industrial composition on the direction of capital flows, and argues that when the composition effect dominates, capital tends to flow towards countries that become more specialized in capital-intensive industries.<sup>2</sup> Costinot et al. (2011) study how a country can use the saving tax to manipulate its terms of trade. These papers do not study how frictions in the domestic labor market can fundamentally alter the way the current account responds to shocks.

This paper is also related to the literature on dynamic Heckscher–Ohlin models pioneered by Oniki and Uzawa (1965), Bardhan (1965), Stiglitz (1970), and Deardorff and Hanson (1978). Other contributions in recent years include Chen (1992), Baxter (1992), Nishimura and Shimomura (2002), Bond et al. (2003), Bajona and Kehoe (2006), and Caliendo (2011). Ventura (1997) studies trade and growth with a model of one final good, two intermediate goods, and labor-augmenting technology. As this literature typically focuses on the question of income convergence across countries, current account adjustment is not usually studied (and a balanced trade is often assumed).

The theory presented in this paper is related to an empirical literature in open-economy macroeconomics that estimates the speed of adjustment of the current account towards the long-run equilibrium (Milesi-Ferretti and Razin, 1998; Freund, 2000; Freund and Warnock, 2005; Clarida et al., 2005). This line of research typically finds that the current account has a tendency to regress back to its long-run equilibrium, with a speed of adjustment that is heterogeneous across countries. The reason behind the cross-country heterogeneity in the adjustment speed is usually unexplained in existing studies. Our theory provides a micro-foundation to understand these patterns.

<sup>1</sup> In Antras and Caballero (2009), financial underdevelopment is defined by the limited supply of entrepreneurial capital, which is a necessary input in one sector but not in the other sector. In their model, a less financially developed country exports the unconstrained good but imports the constrained good. As trade liberalization makes the less financially developed country produce more unconstrained goods and use more unconstrained capital, it leads to an inflow of unconstrained capital. Ju and Wei (2010, 2011) show that while FDI flows from financially developed countries to less financially developed countries, financial capital flows in the opposite direction. In this paper, we do not distinguish between constrained entrepreneurial capital and unconstrained capital, or between FDI and financial capital. Our focus in this paper is the current account balance, or the net borrowing (lending) of a country. In other words, we focus on the net capital flow, rather than the composition of gross capital flows.

<sup>2</sup> Our paper differs from Jin (2012) in both the setup and the research question asked. While she employs an OLG model, we use an infinite-horizon setup. While we focus on how factor market frictions affect the substitutability between goods trade and capital flows, she does not discuss factor market frictions.

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