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# An asset-pricing view of external adjustment

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ABSTRACT

Recent literature has argued that conventional measures of external sustainability – the trade balance and current account – are misleading because they omit capital gains on net foreign asset positions. We adjust the definition of the current account to include the capital gains and discuss how this may affect our thinking about external adjustment and sustainability. We do so in the context of a two-country macro-finance model of Pavlova and Rigobon (2008a) that allows exploration of the interconnections between equilibrium portfolios and external accounts' dynamics. We calibrate the model and find that it generates several testable implications, some of which have already been validated empirically. First, we establish dynamic properties of the capital-gains adjusted current account and show that they are fundamentally different from those of the conventional current account. Second, we find that capital gains have a stabilizing effect on the trade balance and the current account. Finally, we demonstrate that in response to a shock, the conventional and the capital-gains adjusted current accounts may move in opposite directions.



## 1. Introduction

An unprecedented rise in cross-border equity holdings over the past two decades[2] has generated a source of income previously disregarded in the national accounts: capital gains on equity holdings. The current practice incorporates capital gains only after they are redeemed, and this lack of marking to market may result in a significant misrepresentation of the extent of external imbalances worldwide — especially in the US, most of Europe, and Japan. The importance of correctly accounting for capital gains has been at the heart of a recent debate on the sustainability of the US current account deficit. The (conventionally-measured) current account deficits in the US have been unparalleled, indicating the need for a significant correction. However, income from the capital gains could have been financing consumption in the US, and so the imbalances could have been sustainable.[3] After the 2008 financial crisis some of the original arguments will require certain revision, but one central conclusion is undisputed: the growth of gross asset holdings during the last couple of decades must change significantly our understanding of how measures of sustainability have to be defined, and how the adjustment process needs to take place.

In this paper we respond to the critique of the conventional definition of the current account and define a *capital-gains adjusted current account* — a measure that explicitly accounts for capital gains on net foreign asset positions of a country. We investigate the properties of this measure in the context of a two-country macro-finance model of Pavlova and Rigobon (2008a) and compare it to other measures of external accounts. The model is solved in closed-form, which allows us to examine several analytical properties that link the external accounts and financial asset holdings. Moreover, because asset prices and portfolio holdings are all endogenous, it is possible to study the interconnections between external sustainability and portfolio decisions.

To evaluate the stochastic properties of the external measures of sustainability, we calibrate our model to reflect the current state of the US economy. In particular, through our parameter selection, we attempt to match the magnitudes of the trade balance and current account deficits in the US, home bias in asset holdings, net foreign debt of the US, and average cross-country correlations of consumption expenditures. We choose the parameters assuming that the current situation is one of equilibrium (as in our economy). In this environment, we first analyze separately the two elements that are missing from the conventional current account: the *expected* and the *unexpected* capital gains. We show that the former have a stabilizing property, offsetting the fluctuations in the trade balance and the traditional current account. Gourinchas and Rey (2007b) document a similar effect occurring in their dataset. It is the *unexpected* part of the capital gains, however, that is key to the dramatic differences in the dynamic properties of the traditional and the capital-gains adjusted

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[2] As documented in e.g., Gourinchas and Rey (2007a), Lane and Milesi-Ferretti (2001, 2007), and Tille (2003, 2008).

[3] See, e.g., Caballero et al. (2008), Hausmann and Sturzenegger (2006), and Gourinchas and Rey (2007b).

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current account in our model. The traditional current account follows a persistent process, while the capital-gains adjusted current account is highly volatile and serially uncorrelated. This is consistent with the evidence presented in Kollmann (2006) and Lane and Shambaugh (2007). In other words, the capital-gains adjusted current account behaves much like asset returns, whose short-term dynamics are also dominated by unexpected capital gains.

In order to understand the role of capital gains (valuation effects) in the external adjustment mechanism, we study impulse responses of our economy. The standard model of external adjustment is the one based on the canonical intertemporal approach to the current account. In that model, when a shock occurs, we first study its implications for output and consumption, and given those implications, we can trace their impact on the trade balance, the current account, the savings decisions, and ultimately on international positions. Our view in this paper is different. It starts by recognizing that agents already have wealth invested internationally. Therefore, the starting point – even before the shock shows up – is to determine the distribution of wealth and how it is invested (i.e., the composition of international portfolios). When a shock takes place, the first step is to track its impact on production and asset prices. Once these impacts are understood, we can track how the net foreign asset positions are going to be affected by the shock. That in turn will allow us to compute a new wealth distribution in the world economy. Agents' wealth will determine their consumption patterns, and given output, we can track the implications for the external accounts. Guided by this view of external adjustment, we do not find it surprising that our impulse responses show that following a shock, the conventional current account and the capital-gains adjusted current account may move in opposite directions.

Our work is related to the growing theoretical macro-finance literature that incorporates portfolio choice and asset pricing into models of open economy macroeconomics. Similarly to our approach here, Devereux and Sutherland (2008), Evans and Hnatkovska (2007), Ghironi et al. (2006), Kollmann (2006), and Tille and van Wincoop (2007) all base their analyses of external accounts on stochastic portfolio models with incomplete markets.[4] These papers employ various approximation techniques to study the behavior of their models around their steady states. By contrast, we base our analysis on an exact closed-form characterization of our equilibrium. Moreover, the steady state in our economy is stochastic.

The rest of the paper is organized as follows. Section 2 briefly describes the model. Section 3 defines the capital-gains adjusted current account and explores some links between external accounts and financial asset holdings. Section 4 studies dynamic properties of the capital-gains adjusted current account, contrasting them to those of the conventional current account. Section 5 discusses the external adjustment mechanism in our model. Section 6 offers some concluding remarks and directions for future research. The online appendix gives further theoretical background for our expressions.

## 2. The model

### 2.1. The economic setting

For the purposes of our investigation, we adopt the model from Pavlova and Rigobon (2008a). We briefly review it here for completeness.

We work with a pure-exchange finite-horizon continuous-time economy populated by two countries: Home and Foreign. The Home country represents a large industrialized country, while Foreign stands for the rest of the world. Each country is endowed with a Lucas tree producing a strictly positive amount of a country-specific perishable good:

$$dY(t) = \mu_Y(t)Y(t)dt + \sigma_Y(t)Y(t)dw(t) \quad \text{(Home)}, \tag{1}$$

$$dY^*(t) = \mu_{Y^*}(t)Y^*(t)dt + \sigma_{Y^*}(t)Y^*(t)dw^*(t) \quad \text{(Foreign)}, \tag{2}$$

where $w$ and $w^*$ are the (independent) Brownian motions representing Home and Foreign output shocks, respectively, and $\mu_Y$, $\mu_Y^*$, $\sigma_Y > 0$, and $\sigma_Y^* > 0$ are the mean growth rates and volatilities of output. The prices of the Home and Foreign goods are denoted by $p$ and $p^*$, respectively. We fix the world numeraire basket to contain $a \in (0,1)$ units of the Home good and $(1-a)$ units of the Foreign good, and normalize the price of this basket to be equal to unity. The terms of trade, $q$, are defined as the price of the Home good relative to that of the Foreign good: $q \equiv p/p^*$. Our modeling of financial markets is standard. The Home and Foreign stocks $S$ and $S^*$, are claims to the Home and Foreign trees, respectively. They are available for trade by all investors and are in fixed supply of one share each. There is also the "world" bond $B$ in zero net supply, which is a money market account locally riskless in units of the numeraire.

The Home country's representative consumer starts with an endowment of $\bar{s}_H^S$ shares of the Home stock, $\bar{s}_H^{S^*}$ shares of the Foreign stock and a (negative) position in the bond. The Foreign consumer owns the remaining shares of the stocks and an offsetting (positive) position in the bond, denoted by $\bar{b}$. Later in this paper we calibrate the model so that Home represents the US economy, whose net bond position is large and negative. This is the rationale for giving the countries initial bondholdings. The initial wealth of the Home resident is thus $W_H(0) = \bar{s}_H^S S(0) + \bar{s}_H^{S^*} S^*(0) - \bar{b}$ and that of the Foreign resident is $W_F(0) = S(0) + S^*(0) - W_H(0)$. A representative consumer in each country $i$, $i \in \{H,F\}$, chooses nonnegative consumption of each good ($C_i(t)$, $C_i^*(t)$) and a portfolio of the available securities $s_i(t) \equiv (s_i^S(t), s_i^{S^*}(t))$, where $s_i^j$ the number of shares of asset $j$ held by consumer $i$. The dynamic budget constraint of each consumer has the standard form

$$dW_i(t) = s_i^B(t)dB(t) + s_i^S(t)(dS(t) + p(t)Y(t)dt) + s_i^{S^*}(t)(dS^*(t) + p^*(t)Y^*(t)dt) - p(t)C_i(t)dt - p^*(t)C_i^*(t)dt, \tag{3}$$

where $W_i(T) \geq 0$, $i \in \{H, F\}$. Preferences of consumer $i$, are represented by a time-additive utility function defined over consumption of both goods:

$$E\left[\int_0^T e^{-\rho t} u_i(C_i(t), C_i^*(t))dt\right], \quad \rho > 0, \quad i \in \{H, F\}, \tag{4}$$

where

$$u_H(C_H(t), C_H^*(t)) = \alpha_H(t)\log C_H(t) + \beta_H(t)\log C_H^*(t),$$

$$u_F(C_F(t), C_F^*(t)) = \beta_F \log C_F(t) + \alpha_F \log C_F^*(t).$$

Stochastic processes $\alpha_H$ and $\beta_H$ in the utility of the Home country represent preference shifts toward the Home and Foreign good, respectively. For generality, the innovations to $\alpha_H$ and $\beta_H$ are given by a combination of supply shocks $w$ and $w^*$ as well as two independent standard Brownian motions $w^\alpha$ and $w^\beta$. Without the last two Brownian motions, financial markets are complete. But if the preference shifters display nontrivial dependence on $w^\alpha$ and $w^\beta$, the existing investment opportunity cannot span the uncertainty in the model, and hence the possibilities of hedging against the preference shifts is impaired and risk sharing in the world economy becomes imperfect. The main focus of this paper is on the Home country, which is why we assume away any

[4] Also related, but, unlike ours, cast in the context of production economies, are elegant analyses of Devereux and Saito (2006), and Kraay and Ventura (2000). Coeurdacier et al. (2008) primarily focus on equity home bias, but do also report implications for NFA dynamics similar to ours. Other important contributions to this literature, but with a different focus than ours, include Engel and Matsumoto (2006) and Mendoza et al. (2007).