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Varieties and the Transfer Problem: The Extensive Margin of Current Account Adjustment
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ABSTRACT

Most analyses of the macroeconomic adjustment required to correct global imbalances ignore net exports of new varieties of goods and services and do not account for firms' entry in the product market. In this paper we revisit the macroeconomics of trade adjustment in the context of the classic 'transfer problem,' using a model where the set of exportables, importables and nontraded goods is endogenous. We show that exchange rate movements associated with adjustment are dramatically lower when the above features are accounted for, relative to traditional macromodels. We also find that, for reasonable parameterizations, consumption and employment (hence welfare) are not highly sensitive to product differentiation, and change little regardless of whether adjustment occurs through movements in relative prices or quantities. This result warns against interpreting the size of real depreciation associated with trade rebalancing as an index of macroeconomic distress.

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1 Introduction

Between 1997 and 2006, the U.S. current account deficit rose from 140 billion dollars, or 1.7 percent of U.S. output, to over 840 billion dollars, or 1.7 percent of *world* output. Regardless of whether one attributes the strong deterioration of the U.S. current account to internal factors (such as the investment boom of the mid-1990s accompanied by a secular decline in private saving and followed by the emergence of large public deficits) or to a 'saving glut' (and investment drought) in the rest of the world, the consensus is that the current imbalance is unsustainable and adjustment is in the cards.

The basic mechanism of adjustment is straightforward. A transfer of real resources from the U.S. to the rest of the world requires a decrease in U.S. spending relative to production, accompanied by a simultaneous relative movement in the opposite direction abroad. This implies a reallocation of purchasing power across countries through a change in relative prices, which can be sizable. For instance, influential contributions by Maurice Obstfeld and Kenneth Rogoff (2005, 2007) emphasize that the unwinding of the U.S. current account deficit may be associated with "the potential collapse of the dollar," and estimate the extent of real effective depreciation at 30 percent or more. As of 2006, official estimates by international organizations projected a 15 percent depreciation over a ten-year horizon under benign circumstances, but did not rule out sharp dollar spikes under more disruptive scenarios.[1]

How much real dollar depreciation should the world economy expect in the future? And will it come with a bang or a whisper? These are important questions, yet the quixotic emphasis on the quantitative forecast of dollar adjustment should not overshadow the fact that changes in international prices represent essential, but not exhaustive, steps towards global rebalancing. In fact, the complexities of the international adjustment mechanism have long been recognized in the literature, starting from the classic controversy on the macroeconomic effects of a transfer associated with Keynes (1919, 1929a,b,c) and Ohlin (1929a,b). Deteriorating terms of trade and real exchange rates in the debtor country played a crucial role in Keynes' analysis of German reparations after World War I. Ohlin criticized Keynes' emphasis on relative prices, arguing that income effects can make terms-of-trade adjustments redundant.[2] Subsequent contributions have explored the transfer problem in its many nuances. Nowadays, the textbook synthesis of the debate recognizes the validity

[1] See e.g. IMF (2006), Box 1.3. Similar estimates are discussed in Faruqee et al (2007).

[2] See Brakman and Van Marrewijk (1998, 2005) for a recent overview of the Keynes-Ohlin debate.

of the Ohlin position but concludes that "Keynes was right in practice."[3]

In our view, the current debate on global rebalancing provides compelling reasons for a modern revisitation of the transfer problem. This is certainly valid in light of recent theoretical developments in international trade and finance literature, as the received wisdom of classical open-economy macroeconomics can now be re-assessed within the framework of models with explicit and robust choice-theoretic foundations. But a more direct motivation can be found in a set of stylized facts that modern analyses of international trade adjustment can no longer afford to overlook.

Over the past few decades, the strong expansion in the volume of international trade has been accompanied by a vast change in its composition, in favor of differentiated goods. Following the methodology by Rauch (1999), Tang (2006) reports that U.S. imports of differentiated products rose from 47.4 percent in 1975 to 75.5 percent in 2000 while the proportion of U.S. exports of differentiated goods increased from 61.3 to 78.6 percent between 1979 and 2000. Recent literature has also provided pervasive estimates of the fraction of trade growth which occurs at the extensive margin (export of new varieties), as opposed to a rise in the volume of trade in existing goods and services. Over the medium or long term (the time horizon of a current account adjustment), the macroeconomic implications of firms' entry and exit in the tradable sector are substantial (Broda and Weinstein (2004, 2006, 2007)). Hummels and Klenow (2005) show that the extensive margin can account for about two thirds of the difference in trade across countries of different size. Yi (2003), Kehoe and Ruhl (2003), and Ruhl (2005) show that trade liberalization results in a significant increase of the extensive margin.

Using highly disaggregated product-level data, Debaere and Mostashari (2005) report that, for around 80 percent of the countries, over 40 percent of all goods categories exported to the U.S. in 1998-2000 were in newly traded goods, that is, goods that were not exported in 1989-91. While tariff reductions help to explain such increases in the extensive margin of trade, other factors captured by country fixed effects (possibly reflecting macroeconomic conditions) account for the lion's share of why goods are newly traded. The role of product varieties in international trade is also emphasized in Gagnon (2003) which — building on Krugman's (1989) notion that economic growth is channelled into product proliferation — provides evidence on the strong correlation between the growth of U.S. bilateral manufactured imports between 1972 and 2000 and the average growth rate of GDP of the exporting countries. Of particular relevance for our purposes is the evidence discussed by IMF (2007), suggesting that economies where the cost of starting and closing a firm, and of hiring and

[3] Krugman and Obstfeld (2006), p.98.

firing labor, have experienced smaller movements in real effective exchange rates during current account adjustment episodes.[4]

The traditional analysis of the international transfer problem typically abstracts from the possibility of trade in new varieties as a potential engine of international adjustment.[5] For this reason, it provides an incomplete framework for the analysis of global current account rebalancing. Regrettably, existing projections (from back-of-the-envelope estimates to model-based scenario analyses) of the forthcoming dollar depreciation build to our knowledge on foundations that all but ignore this point. To what extent does trade at the extensive margin influence the macroeconomics of transfers? In this paper, we address this issue using a stylized yet rigorous analysis of the different margins of adjustment, stressing changes in relative prices and employment as well as product differentiation. In the model, firms in each sector produce under constant returns to scale, and introduce new product varieties sustaining a fixed entry cost which depends on the number of existing varieties in the sector. Households in each country consume domestically produced nontradables, domestically produced import-competing goods, and imports. Trading costs allow us to map the international macroeconomics of current account adjustment depending on the degree of 'insularity' of national economies. Hence, relative to comparable analyses such as Obstfeld and Rogoff (2005, 2007) and Dekle et al. (2007) — the latter focused on bilateral trade relations in a multi-country simulation exercise — we analyze current account adjustment in an environment where the number of product varieties is endogenous, labor supply is elastic, and labor can be reallocated between sectors, so that the level and composition of traded and nontraded output are endogenous.

A notable baseline result from our analysis is that, for a given constant cost of introducing new varieties, a transfer has no impact on the terms of trade — which is the extreme version of the case Ohlin was defending against Keynes. This is remarkable in light of the fact that our model allows for home bias in consumption, due to the presence of trade costs and a nontradable sector. Home bias in spending is traditionally a building block of the standard argument according to which a transfer should be expected to affect the terms of trade. In our model with monopolistic competition and love for variety, however, the effect of home bias on demand is compensated for the creation of new varieties in response to a transfer, which then attenuates or eliminates altogether the need for a relative price change.

In our quantitative simulations, the model is calibrated to U.S. data and used to assess the effects of improving net exports from a deficit as high as 6.5 percent of GDP to a balanced

[4] IMF (2007), pp. 103-104.

[5] A relevant exception worth emphasizing is the work by Brakman and van Marrewijk (1995, 1998).

position. We compare our results with those of a conventional 'fixed-variety' model in which there is no entry and adjustment occurs exclusively at the intensive margin. We conduct several experiments checking robustness by varying the key parameters of the calibration.

In our benchmark calibration of the 'fixed-variety' model, closing the external imbalance requires a fall in long-run consumption by around 6 percent, and an increase in employment by 3 percent; the real exchange rate and the terms of trade depreciate by 17 and 21.9 percent, respectively. This is a reasonable scenario, well in line with related exercises in the literature allowing for some output flexibility.[6]

The equilibrium exchange rate movements caused by transfers can however be dramatically lower when adjustment occurs at the extensive margin. In our baseline calibration with endogenous-variety effects, the possibility of adjustment at the extensive margin does not affect the impact of the transfer on employment and consumption: total hours still grow at 3 percent, and aggregate consumption falls. Yet, the equilibrium movement in the above international prices are only 1.1 and 6.4 percent, respectively. These results are driven by a large expansion in the varieties of home goods produced for the export markets (+24 percent), matched by a substantial rise in import competing goods (+12 percent). The number of varieties of nontraded goods instead contract, although at a much lower rate (-2.1 percent), and much less than imports from abroad (-13 percent). The fall in consumption is driven mainly by the overall changes in the basket of products available to domestic households.[7]

As the size of the dollar adjustment has been in the spotlight as a key indicator of macroeconomic stress, an important question is whether the welfare costs of adjustment would be lower if this occurred mostly at the extensive margin. Our benchmark calibration suggests a negative answer. The welfare costs for the country making the transfer do not change much across simulations in spite of vastly different changes in international prices. In other words, the equilibrium movement in international relative prices is obviously a function of the specific features of macroeconomic adjustment: there are different possible combinations of quantity and price adjustment that are consistent with a given correction in

[6] For instance, these figures are comparable with experiments by Obstfeld and Rogoff (2007) in which output of tradables is increased parametrically by 20 percent.

[7] Past evidence provides some guidance in this respect. Freund and Warnock (2007) look at 26 episodes between 1980 and 2003 in which the current account deficit was at least 2 percent of GDP before going through a reversal (i.e., a reduction by at least two percentage points over three years). During such reversals, countries on average experience slow GDP growth, increasing unemployment, and a real depreciation. Real export growth and declining consumption and investment spur adjustment. Focusing on persistent deficits (above 2 percent of GDP for more than 5 years), the resolution of large deficits does not require a more extensive depreciation, nor it is more likely to be associated with an exchange rate crisis. If anything, large and persistent deficits involve less depreciation than average. Similar results are reported by Fratzscher, Juvenal and Sarno (2007) in a time-series analysis of the U.S. case.

relative wealth and welfare. In our simulations where transfers have large entry/exit effects, the 'competitiveness position' of the rest of the world deteriorates substantially even though changes in the terms of trade and relative labor costs are contained.

The degree of economic flexibility, indexed by the cost of entry, affects the magnitude of relative price movements: a higher convexity of the cost of product differentiation has only a minor impact on employment and consumption, but clearly magnifies real exchange rate movements relative to quantity adjustment. However, our results stress that the overall macroeconomic allocation is reasonably sensitive to variations in the elasticity of labor supply. In our experiments with a low labor elasticity, with and without extensive margins, the response of employment to the transfer is only 1.1 percent. However, the fall in consumption is three times as large in the specification with endogenous varieties than in the economy with fixed varieties: -10 percent against -3 percent. A low response of employment translates into a sharp fall in the production of nontradables: the number of goods varieties in this sector falls by 3.5 percent. As in our benchmark specification, the difference in the terms of trade and real exchange rate movement is quite dramatic.

This paper is organized as follows. Section 2 introduces the model. Section 3 analyzes endogenous changes in consumption and output in response to a transfer, contrasting the case in which varieties are endogenous with the traditional 'fixed-variety' setup. Section 4 presents a quantitative assessment. Section 5 concludes.

2 The transfer problem revisited: product varieties and relative prices in the global economy

2.1 Structure of the model

The world economy consists of two countries, Home and Foreign — Foreign variables are denoted with a star. In each country households consume all varieties of goods available in the market, both domestically produced and imported. They supply labor in a competitive market to domestic firms only, but own claims on firms' profits worldwide. There are L households in the Home country and L^* households in the Foreign country. In both countries, firms operate either in the nontradables or in the tradables sector. Firms in the tradables sector either produce import-competing goods for the domestic market, or export their production.

Each firm produces a single good variety and operates under conditions of monopolistic competition. The number of varieties produced is endogenously determined in the model. There is free entry, but firms face fixed entry costs to start production of a particular variety. The entry costs consist of wages paid to the labor employed in setting up a firm.

In the Home country varieties (and firms) in the nontradables sector are defined over a continuum of mass n_N and indexed by $h_N \in [0,\, n_N]$. Home tradables (import-competing) varieties produced for the domestic market are indexed by $h_D \in [0,\, n_D]$. Similarly, Home varieties produced for the export market are indexed by $h_X \in [0,\, n_X]$ By the same token, in the Foreign country nontradables varieties are defined over the continuum $f_N \in [0,\, n_N^*]$, import-competing varieties are indexed by $f_D \in [0,\, n_D^*]$ and export varieties are indexed by $f_X \in [0,\, n_X^*]$.

2.2 Firms

Firms have access to a linear technology in labor, which is the only input in production. The production function of the representative Home firm producing a specific variety is:

$$Y(h_i) = \ell(h_i) \quad i = N, D, X \tag{1}$$

where $Y(h_i)$ is the output of variety h_i, $\ell(h_i)$ is labor used in its production.

To start the production of a variety h_i, a firm needs to pay a fixed cost $q(h_i)$, defined in terms of Home labor costs:

$$q(h_i) \equiv w c_i n_i^{\gamma} \tag{2}$$

where w is the wage rate and $c_i n_i^{\gamma}$ are units of labor used in the activities required to introduce a variety in the i sector.[8] For $\gamma > 0$, the cost function is convex: the cost of creating an additional variety is an increasing function of the number of existing varieties in the sector. The idea underlying our specification of the cost function is that a higher number of existing varieties on the market makes it more difficult for firms to differentiate their products relative to the competition, raising the costs of marketing and advertising associated with the introduction of a new variety or brand. The parameter γ measures the sensitivity of these costs to the number of sectoral varieties.

In addition, shipping goods abroad entails transportation costs, denoted by τ and expressed in units of the export good — thus modelled as 'iceberg' costs. The resource constraints for each variety of Home goods are therefore:

$$Y(h_N) \geq LC\,(h_N) \qquad Y(h_D) \geq LC\,(h_D) \qquad Y(h_X) \geq (1+\tau)\, L^* C^*\,(h_X) \tag{3}$$

where $C\,(h_N)$ is per-capita consumption of good h_N in the Home country, (h_D) is per-capita consumption of good h_D by the representative Home resident, and $C^*\,(h_X)$ is consumption of good h_X by the representative Foreign resident. As domestic households provide labor

[8] Corsetti et al (2007) discuss the case in which entry costs are subject to shocks.

both for firms' start-up and production activities, the resource constraint in the Home labor market is:

$$L\ell \geq \sum_i \left(\int_0^{n_i} Y(h_i)\, dh_i + c_i n_i^{1+\gamma} \right) \tag{4}$$

Without loss of generality, in each country domestic labor units are the *numeraire* in terms of which all prices are measured. We let $p(h_N)$, $p(h_D)$ and $p(f_X)$ denote the Home prices of, respectively, Home nontradables, Home import-competing varieties and Home imports. A similar notation holds in the Foreign country. Wages in both countries are $w = w^* = 1$, and ε denotes the exchange rate, defined as Home labor per unit of Foreign labor. Using the above notation, the operating profits of Home firms are, respectively:

$$\Pi(h_N) \equiv p(h_N)\, LC(h_N) - w\ell(h_N) \leq (p(h_N) - 1)\, Y(h_N) \tag{5}$$

$$\Pi(h_D) \equiv p(h_D)\, LC(h_D) - w\ell(h_D) \leq (p(h_D) - 1)\, Y(h_D) \tag{6}$$

$$\Pi(h_X) \equiv \varepsilon p^*(h_X)\, L^* C^*(h_X) - w\ell(h_X) \leq \left(\frac{\varepsilon p^*(h_X)}{1+\tau} - 1 \right) Y(h_X) \tag{7}$$

Similar expressions hold for the Foreign country.

2.3 Households

In the Home country the utility of the representative household is a positive function of consumption C and a negative function of labor effort ℓ:

$$U = \log C - \frac{1}{1+\xi} \ell^{1+\xi} \tag{8}$$

where ξ is the inverse of the Frisch elasticity. C is a Cobb-Douglas index of tradables and nontradables varieties sold in the country:

$$C = \frac{C_T^{\delta} C_N^{1-\delta}}{\delta^{\delta} (1-\delta)^{1-\delta}} \tag{9}$$

where $1 - \delta$ is the share of nontradables in consumption, and the baskets C_T and C_N are defined as:

$$C_T = \left[\int_0^{n_D} C(h_D)^{1-\frac{1}{\sigma}}\, dh_D + \int_0^{n_X^*} C(f_X)^{1-\frac{1}{\sigma}}\, df_X \right]^{\frac{\sigma}{\sigma-1}} \tag{10}$$

$$C_N = \left[\int_0^{n_N} C(h_N)^{1-\frac{1}{\sigma}}\, dh_N \right]^{\frac{\sigma}{\sigma-1}} \tag{11}$$

In the expressions above σ denotes the elasticity of substitution across varieties, as well as the elasticity of substitution between import-competing goods h_D and imports f_X. We assume that this elasticity is higher than the elasticity of substitution between the tradables and nontradables baskets, that is $\sigma > 1$.

The budget constraint of the representative Home household is:

$$\int_0^{n_N} p\left(h_N\right) C\left(h_N\right) dh_N + \int_0^{n_D} p\left(h_D\right) C\left(h_D\right) dh_D + \int_0^{n_X^*} p\left(f_X\right) C\left(f_X\right) df_X + I \leq \ell + \Pi - F/L \tag{12}$$

Home households earn labor incomes $w\ell$ (recall that wages are normalized to one) and spend on consumption goods. They finance the fixed costs of setting up firms and introducing goods varieties (I in our notation), receive dividends revenue from the firms they own (Π) and pay F/L to Foreign households, where F is the aggregate resource transfer to the rest of the world. For tractability, we posit that households are endowed with a well-diversified international portfolio of claims on firms' profits, so that they finance the same fraction of the cost of creating new varieties in each country.[9] Formally, Home households invest in a portfolio of firms worldwide:

$$I \equiv \frac{1}{L + L^*} \left(\sum_i \int_0^{n_i} q\left(h_i\right) dh_i + \varepsilon \sum_i \int_0^{n_i^*} q\left(f_i\right) df_i \right) \tag{13}$$

and in return receive an equal share of profits:

$$\Pi \equiv \frac{1}{L + L^*} \left(\sum_i \int_0^{n_i} \Pi\left(h_i\right) dh_i + \varepsilon \sum_i \int_0^{n_i^*} \Pi^*\left(f_i\right) df_i \right) \tag{14}$$

Optimal consumption demand satisfies:

$$C(h_N) = \left(\frac{p\left(h_N\right)}{P_N} \right)^{-\sigma} C_N, \qquad C(h_D) = \left(\frac{p\left(h_D\right)}{P_T} \right)^{-\sigma} C_T, \quad C\left(f_X\right) = \left(\frac{p\left(f_X\right)}{P_T} \right)^{-\sigma} C_T, \tag{15}$$

$$PC = \frac{P_T C_T}{\delta} = \frac{P_N C_N}{1 - \delta} \tag{16}$$

where P, P_T and P_N are the utility-based consumer price indexes, defined as the minimum expenditures required to purchase one unit of the respective baskets:

$$P = P_T^{\delta} P_N^{1-\delta}, \qquad P_N = \left[\int_0^{n_N} p\left(h_N\right)^{1-\sigma} dh_N \right]^{\frac{1}{1-\sigma}} \tag{17}$$

$$P_T = \left[\int_0^{n_D} p\left(h_D\right)^{1-\sigma} dh_D + \int_0^{n_X^*} p\left(f_X\right)^{1-\sigma} df_X \right]^{\frac{1}{1-\sigma}} \tag{18}$$

and optimal labor supply implies:

$$w = 1 = \ell^{\xi} PC \tag{19}$$

Note that, as a result of our choice of numeraire, consumption increases when its price P falls (with unit elasticity) and when labor ℓ decreases (with elasticity ξ). Similar expressions hold in the Foreign country.

[9] This is in contrast with the standard assumption that households only own and finance domestic firms. As long as free entry is assumed, positing complete home bias in equity portfolio would not alter our results.

2.4 Prices

The prices charged by Home firms take the standard form of markups over marginal costs, equal in our setup to labor costs per unit of product:

$$p\left(h_N\right) = p\left(h_D\right) = \frac{\sigma}{\sigma - 1} \equiv p \tag{20}$$

$$\varepsilon p^*\left(h_X\right) = \frac{\sigma}{\sigma - 1}\left(1 + \tau\right) = p(1 + \tau) \tag{21}$$

Similar expressions hold in the Foreign country. Given that the two countries have identical labor productivities and demand elasticities, it must be the case that $p = p^*$. It follows that the equilibrium price indexes are:

$$P_N = p n_N^{\frac{1}{1-\sigma}} \qquad P_T = p B^{\frac{1}{1-\sigma}} \qquad P_N^* = p^* n_N^{*\frac{1}{1-\sigma}} \qquad P_T^* = p^* B^{*\frac{1}{1-\sigma}} \tag{22}$$

where:

$$B \equiv n_D + n_X^* \phi \varepsilon^{1-\sigma}, \qquad B^* \equiv n_D^* + n_X \phi \varepsilon^{\sigma-1} \qquad \phi \equiv (1+\tau)^{1-\sigma} \tag{23}$$

Borrowing a notation convention commonly adopted by the trade literature, the index of trade costs ϕ is positive and less than one; the case $\phi = 0$ corresponds to infinite trade costs, the case $\phi = 1$ to zero trade costs.

2.5 Free entry, balance of payments and equilibrium

To characterize the equilibrium in our model, we first rewrite the operating profits earned by Home firms as follows:

$$\Pi\left(h_N\right) = p\frac{L}{\sigma}C(h_N) = \frac{1-\delta}{\sigma}\frac{L\ell^{-\xi}}{n_N} \tag{24}$$

$$\Pi\left(h_D\right) = p\frac{L}{\sigma}C(h_D) = \frac{\delta}{\sigma}\frac{L\ell^{-\xi}}{n_D + n_X^*\phi\varepsilon^{1-\sigma}} \tag{25}$$

$$\Pi\left(h_X\right) = p\left(1+\tau\right)\frac{L^*}{\sigma}C^*\left(h_X\right) = \frac{\delta}{\sigma}\frac{\phi L^*\ell^{*-\xi}\varepsilon^{\sigma}}{n_D^* + n_X\phi\varepsilon^{\sigma-1}} \tag{26}$$

Other things being equal, a higher number of firms (and varieties) in a sector reduces the profits of each firm operating in that sector. In the tradables sector, transportation costs partially shield local firms' profits from foreign competition: if ϕ is close to zero both $\Pi\left(h_D\right)$ and $\Pi\left(h_X\right)$ depend only on the number of import-competing firms, n_D and n_D^* respectively.

With free entry, optimal investment in new varieties equates the value of a firm to the cost of creating a variety, which in equilibrium will then be equal to the value of operating profits. Competition in the goods market thus implies the following *free entry conditions*:

$$\Pi\left(h_i\right) = c_i n_i^{\gamma} \qquad i = N, D, X \tag{27}$$

From (5-7) and (20-21) it follows immediately that profits for all firms are proportional to sales. Thus, using (28) the level of entry costs pins down firms' size:

$$Y(h_i) = (\sigma - 1)\, c_i n_i^{\gamma} \qquad i = N, D, X \tag{28}$$

Combining these expressions with (4),[10] (12) and (27), the aggregate budget constraint can be written as:

$$PC = \ell - F/L \tag{29}$$

Together with the equilibrium wage rate (19), the previous expression implies that Home labor effort is univocally determined as a function of the transfer:

$$\ell^{-\xi} = \ell - F/L \tag{30}$$

The aggregate budget constraint (29) corresponds to the Home aggregate balance of payments:

$$\phi\delta \left[\frac{n_X L^* \ell^{*-\xi} \varepsilon^{\sigma}}{n_D^* + n_X \phi \varepsilon^{\sigma-1}} - \frac{n_X^* L \ell^{-\xi} \varepsilon^{1-\sigma}}{n_D + n_X^* \phi \varepsilon^{1-\sigma}} \right] - F = 0 \tag{31}$$

The first two terms are Home exports less Home imports measured in Home labor units, both inclusive of trade costs.

Similar expressions hold for the Foreign country. In particular, Foreign labor effort in equilibrium is:

$$P^* C^* = \ell^{*-\xi} = \ell^* + F/L^* \tag{32}$$

Given ℓ and ℓ^* from (30) and (32), and accounting for (24-26), the system of free entry conditions (27), their Foreign analogs, and the balance of payments (31) jointly determine the exchange rate ε, the number of varieties n_N, n_D, n_X, and their Foreign analogs as functions of exogenous variables (L, c_N, c_D, c_X and their Foreign analogs). The price indexes are then determined according to (17-18) and Foreign analogs, and consumption levels are determined according to (30) and (32).

In a symmetric equilibrium with $L = L^*$ and $F = 0$, our model is solved by $\ell = \ell^* = 1$ and $\varepsilon = 1$. Aggregate GDP is therefore equal to $L = L^*$. In what follows, it is convenient to define a measure of trade openness θ such as:

$$\theta \equiv \left(\frac{c_D}{c_X} \right)^{\frac{1}{\gamma}} \phi^{\frac{1+\gamma}{\gamma}} \tag{33}$$

θ depends on both transport costs and the relative fixed cost of entry on export markets. It is straightforward to show that in a symmetric equilibrium with balanced trade, the ratio

[10] Note that Home per-capita employment is $\ell = \sigma \left(c_N n_N^{\gamma+1} + c_D n_D^{\gamma+1} + c_X n_X^{\gamma+1} \right) / L$.

of exports (or imports) to GDP is equal to $\delta\theta/(1+\theta)$, and the ratio of exportable varieties to import-competing varieties in the tradables sector is $n_X/n_D = \theta/\phi$.[11]

3 Domestic and international implications of current account adjustments

3.1 The macroeconomics of extensive margins

Consider now a current account adjustment experiment among lines similar to Obstfeld and Rogoff (2005, 2007): the Home country makes a transfer ΔF to the Foreign country. The experiment abstracts from the specific reasons why the country has an external imbalance to start with,[12] and focuses on the macroeconomic equilibrium response after all short-run and business cycle dynamics are exhausted. As shown by Ferrero et al. (2007) and Faruqee et al. (2007), the core results of this exercise remain valid, both in qualitative and quantitative terms, in the context of full-fledged dynamic simulations.

For sufficiently small values of $\Delta F/L$ we can approximate the effects of the transfer with the equilibrium multipliers in the neighborhood of the symmetric equilibrium. In what follows, for any generic variable x we adopt the notation:

$$\widehat{x} = \frac{dx/x}{dF/L} \tag{34}$$

The equilibrium implications of the adjustment are shown in Table 1. A current account adjustment requires Home exports to increase in value relative to Home imports. This can only be achieved if labor effort increases in the Home country relative to the rest of the world. The adjustment occurs at both the extensive and the intensive margins, and the number of varieties produced changes in both the tradables and nontradables sectors. Along the 'traditional' intensive margin, terms of trade depreciation allows exporting firms to produce and sell more, and import-competing firms to increase their market share.

Observe that there is exit in the Home nontradables sector, and entry into the nontradables sector in the Foreign country. Also, exportable varieties are created by the Home

[11] Note that in the tradables sector, the ratio of export profits to domestic profits $\Pi(h_X)/\Pi(h_D)$ is equal to ϕ in the symmetric equilibrium. Similarly, $\Pi(h_N)/\Pi(h_D) = \frac{1-\delta}{\delta}\frac{1+\theta}{n_N/n_D}$, and the ratio n_N/n_D is equal to $\left[\frac{1-\delta}{\delta}\frac{c_D}{c_N}(1+\theta)\right]^{1/(1+\gamma)}$ in the symmetric equilibrium.

[12] By way of example, in the past the country's residents may have borrowed from abroad on expectations of growth differentials. Given the current stock of external debt, the country faces an adjustment problem to the extent that these differentials do not materialize ex post — disappearing differentials have indeed been the subject of vast debate since 2001. Also, liberalization of capital flows may have contributed to the emergence of U.S. deficits as a consequence of asymmetric developments of national financial markets (or differences in the level of risks and preferences), causing high precautionary savings in emerging market economies as in Caballero et al. (2007) and Mendoza et al. (2007).

Table 1: Comparative statics

$$\widehat{\ell} = -\widehat{\ell^*} = \frac{1}{(1+\xi)} \tag{35}$$

$$\widehat{n_N} = -\widehat{n_N^*} = -\frac{\xi}{(1+\xi)(1+\gamma)} < 0 \tag{36}$$

$$\widehat{n_X} = -\widehat{n_X^*} = \frac{(1+\theta)}{\Gamma(1+\gamma)\theta}\left\{[\sigma(1+\gamma)+\gamma\theta][1+\xi(1-\delta)]+\sigma\xi\delta(1+\gamma)\right\} > 0 \tag{37}$$

$$\widehat{n_D} = -\widehat{n_D^*} = \frac{(1+\theta)}{\Gamma(1+\gamma)}\left\{[\sigma+\gamma(\sigma-1)][1+\xi(1-\delta)]-\sigma\xi\delta(1+\gamma)\right\} \tag{38}$$

$$\widehat{n_D} + \widehat{n_X} = \frac{\sigma(1+\theta)}{\theta\Gamma}\left[(1+\theta)(1+\xi)-2\delta\xi\theta\right] \tag{39}$$

$$\widehat{\varepsilon} = \frac{\gamma(1+\theta)}{\theta\Gamma}\left[(1+\theta)(1+\xi)-2\delta\xi\theta\right] = \frac{\gamma}{\sigma}\left(\widehat{n_D}+\widehat{n_X}\right) \tag{40}$$

$$\Gamma \equiv \delta\left[2\sigma+\gamma(2\sigma-1+\theta)\right](1+\xi) > 0 \tag{41}$$

country, while they are destroyed in the Foreign country. The magnitude of entry and exit crucially depends on the convexity of the cost function.

The effect of the transfer on the number of import-competing varieties n_D is ambiguous. Specifically, n_D rises (a) if the size of the nontradables sector is large relative to the tradables sector (δ is close to zero), so that the amount of resources released by the nontradables sector is enough to produce additional varieties in the import-competing sector; (b) if labor supply is sufficiently elastic (ξ is close to zero), so that there is no shortage of labor. When these two conditions fail, exit from the nontradables sector n_N and the equilibrium contraction in leisure are not sufficient to compensate for the expansion of the tradable sectors: the number of import-competing varieties n_D has to shrink as well. Observe that in this case the net effects of the transfer on the size of the Home tradables sector as a whole, i.e. $n_D + n_X$, depends on the magnitude of the rise in n_X relative to the contraction in n_D. A sufficient condition for the tradables sector to expand as a whole is that the mass of firms in the domestic tradable sector is sufficiently high, that is $\theta < 1$.

If the tradables sector as a whole expands, then the terms of trade (and the relative price of labor) must weaken. The terms of trade depreciation is large when trade costs are high (ϕ and therefore θ goes to zero), adjustment at the extensive margin is difficult (γ is

high), or the Frisch elasticity is low, making employment less responsive to the transfer. Conversely, the terms of trade depreciation converges to zero — an extreme version of the case made by Ohlin — when γ approaches zero, implying that the fixed cost of entry becomes approximately constant. This is so despite the presence of trade costs and non traded goods, which induce home bias in consumption.

It should be emphasized that the transfer of income abroad raises the relative size of the market for Home exports, and therefore the operating profits of domestic exporters (see equations (26) and (32)). This in turn creates a clear incentive for firms to enter the exports market with new varieties. In the case of constant fixed costs of entry, the terms of trade need not adjust to switch demand in favor of Home exports, even though overall expenditure is biased towards domestic goods.[13]

The impact of the current account adjustment on aggregate consumption C is symmetric in the two countries: consumption falls in the Home country, and rises abroad, by

$$\widehat{C} = -\widehat{C^*} = (1-\delta)\frac{\widehat{n_N}}{(\sigma-1)} + \delta\frac{\widehat{n_D} - \theta\widehat{n_X} - (\sigma-1)\theta\widehat{\varepsilon}}{(\sigma-1)(1+\theta)} - \xi\widehat{\ell} < 0 \tag{42}$$

The change in aggregate consumption is driven by a contraction in demand for both nontradables and tradables, corresponding to the contraction in the number of varieties produced by these sectors (recall that $\widehat{n_X^*} = -\widehat{n_X} < 0$). The demand for imports of course responds to any rise in their price ($\widehat{\varepsilon} > 0$). The negative wealth effect from the transfer, however, also increases labor supply, hence the magnitude of consumption adjustment crucially depends on the labor elasticity. It is more pronounced when a low Frisch elasticity (a high ξ) dampens the response of Home employment (ℓ) and GDP to the transfer:[14]

$$\widehat{\ell} = \widehat{GDP} = \frac{1}{1+\xi} \tag{43}$$

If the fixed costs faced by firms are seen as *investment* required to bring new good varieties on the market, one can note here that the increase in investment exactly offsets the change in GDP as given in the above equation. In fact the transfer affects the relative price of investing in new varieties and setting up new production lines in the tradables and nontradables sector. Specifically, this relative price falls in the nontradables sector relative to the export sector by $\gamma(\widehat{n_N} - \widehat{n_X})$. Instead, the relative price of production remains

[13] It is worth mentioning that the case of a constant or even decreasing fixed cost is standard in endogenous growth models with expanding product variety, as analyzed for example in Grossman and Helpman (1991) and Barro and Sala-i-Martin (1995).

[14] Ju and Wei (2007) focus on the effects of labor market institutions on the dynamics of adjustment: the more rigid the labor market, the slower the speed of adjustment of the current account towards its long-run equilibrium.

unchanged in our setting, as markups and marginal costs are symmetric across sectors.[15]

Finally, it is easy to show that:

$$\frac{dU}{dF/L} = \widehat{C} - \xi\widehat{\ell} < 0 \tag{44}$$

A transfer unambiguously worsens welfare.

3.2 The interaction between extensive and intensive margins

Let RER denote the welfare-based real exchange rate, i.e., $RER \equiv \varepsilon P^*/P$. Following the current account adjustment, this measure of the real exchange rate can in principle move either way:

$$\widehat{RER} = \frac{1+\theta-2\delta\theta}{1+\theta}\widehat{\varepsilon} + \frac{2\delta}{\sigma-1}\frac{\widehat{n_D} - \theta\widehat{n_X}}{1+\theta} + \frac{2(1-\delta)}{\sigma-1}\widehat{n_N} \tag{45}$$

For reasonable parameters values, the welfare-based real exchange rate does depreciate because of the transfer, i.e. the above expression is positive. But an appreciation scenario is also possible when entry by Home exporters (and exit by Foreign exporters) is large enough. This is because the change in the number of varieties raises the Home price index relative to the Foreign one.

It is worth stressing that the definition of the consumer price index employed in evaluating the real exchange rate (45) does not correspond to the definition underlying official statistics, as these typically do not account for changes in the number of varieties available to consumers (see Broda and Weinstein 2007 for an empirical analysis). To obtain a 'statistical' measure of the real exchange rate depreciation from the above, it is sufficient to make it conditional on a constant number of varieties, that is, the two last terms in (45) should be set equal to zero. Given that these two terms are negative, the statistical measure of the real exchange rate would unambiguously record a larger depreciation (associated with the transfer), than our welfare-based measure. The reason is apparent; the fall in the total number of varieties available to domestic consumers translates into an increase in the welfare-based consumer price index. For any given change in product prices, this variety-effect on the CPI would tend to reduce the equilibrium depreciation rate according to (45), but would be ignored by its statistical counterpart. In fact, abstracting from changes in the number of varieties, the real exchange rate would become proportional to the terms of trade, depending on the degree of home bias (according to the evidence, the statistical measure of real exchange rates and terms of trade tend to move closely together). The rate of depreciation

[15] The estimates by Obstfeld and Rogoff (2005, 2007) point to the need for a strong adjustment in the price of nontradables — up to 3 to 5 times larger than the terms of trade. However, in episodes of dollar depreciation associated with current account adjustment in the 1980s there is little or no evidence of significant changes in internal relative prices.

according to the statistical measure of the real exchange rate is therefore comprised between the rate of depreciation in the terms of trade, and the rate of change in the welfare-based real exchange rate.

The interaction between adjustment at the extensive and the intensive margin is crucial to our understanding of the movement of the real exchange rate (45) and other macroeconomic variables. To analyze this interaction, it is useful to rewrite Home exports X and imports M as

$$X = n_X \cdot \left(\frac{\delta \phi L^* \ell^{*-\xi} \varepsilon^{\sigma}}{n_D^* + n_X \phi \varepsilon^{\sigma-1}} \right) \qquad M = n_X^* \cdot \left(\frac{\delta \phi L \ell^{-\xi} \varepsilon^{1-\sigma}}{n_D + n_X^* \phi \varepsilon^{1-\sigma}} \right) \tag{46}$$

Strictly speaking, the extensive margin of exports is given by the change in the number of exportable varieties n_X (the first term on the right hand side). However, changes in quantities (i.e. the intensive margin, corresponding to the terms in parenthesis on the right hand side) also depend on the number of Foreign import-competing varieties, and the number of Home exporters itself. These affect the size of the sales by each individual exporter, via their general equilibrium effect on total demand for Home products in the Foreign market.

The general equilibrium interaction between the two margins makes the distinction between the two (especially from an empirical point of view) quite a difficult task. To see why, write the response of Home exports and imports to a transfer distinguishing between the two margins, labelled 'extensive' and 'intensive' according to usual conventions:

$$\widehat{X} = \underbrace{\widehat{n_X}}_{extensive} + \underbrace{\frac{1}{1+\theta}\left[\widehat{n_D} - \theta \widehat{n_X} + (\sigma + \theta)\widehat{\varepsilon} + \xi(1+\theta)\widehat{\ell}\right]}_{intensive} \tag{47}$$

$$\widehat{M} = \underbrace{-\widehat{n_X}}_{extensive} - \underbrace{\frac{1}{1+\theta}\left[\widehat{n_D} - \theta \widehat{n_X} + (\sigma - 1)\widehat{\varepsilon} + \xi(1+\theta)\widehat{\ell}\right]}_{intensive} \tag{48}$$

Our model has sharp predictions about the first term on the right hand side: the intensive margin is positive as long as the cost function of entry is convex ($\gamma > 0$). With a transfer, both the number of exported varieties and the sales abroad per product variety rise. Also, there are important implications about the conventionally measured intensive margin. As apparent from the expression above, the term in square brackets on the right hand side of (47) can be further decomposed into different multipliers. These consist of the change in the level of competition on the export market (captured by $\widehat{n_D} - \theta \widehat{n_X}$), the change in the terms of trade, and the wealth effect of the transfer on labor supply.

In light of these theoretical considerations, the extensive margin of exports adjustment should actually be re-defined as to encompass all the effects (direct and indirect) from entry

and exit of new varieties. As a result, the label 'extensive' should include the first two terms in the square brackets on the right hand side of the export equation; the label 'intensive' should residually include only the last two terms. It is worth stressing that the adjustment at the intensive margin also comes in two parts: exports of each variety increase because of the terms of trade depreciation, and expenditure in the Foreign country rises due to the effect of the transfer. This new classification better captures the general equilibrium implications of changes in the number of varieties predicted by theory, but its implementability in empirical studies is bound to be highly demanding.

3.3 An economy with a fixed number of varieties

How would our results above compare with the effects of a transfer in an economy in which the number of goods (both local and exported) is exogenously given? To address this issue, we note that under the assumption of a fixed set of goods, the ratio of exported to local varieties $\phi n_X/n_D = \theta$ in our economy is constant.[16] Then the terms of trade response to the transfer is:

$$\widehat{\varepsilon} = \frac{(1+\theta)\left[(1+\theta)(1+\xi) - 2\xi\delta\theta\right]}{\delta\theta(2\sigma - 1 + \theta)(1+\xi)} \tag{49}$$

The terms of trade change is unambiguously larger in an economy in which no adjustment occurs at the extensive margin.[17]

Interestingly, the effect of a transfer on GDP and employment is identical in the two economies: labor rises exactly by the same amount across model specifications. Similarly, for reasonable parameters values, the fall in consumption is also comparable. In the latter case, however, similar quantitative effects on consumption may correspond to quite different transmission mechanisms. In the economy with a fixed number of varieties, consumption falls by:

$$\widehat{C} = -\widehat{C^*} = -\frac{\delta\theta}{1+\theta}\widehat{\varepsilon} - \xi\widehat{\ell} \tag{50}$$

The fall in consumption is due to relative price and wealth effects. When the number of goods varieties is endogenous, instead, consumption also responds to changes in production patterns. As discussed above, part of the fall in real consumption can be attributed to the equilibrium contraction in the number of goods available to the consumers through imports or local production (nontradables and possibly importables). As households value variety, adverse effects from changes in the availability of differentiated products and from terms of trade deterioration can compensate each other in consumption (and welfare) terms.

[16] This case corresponds to our economy when γ goes to infinity. Very high values of γ correspond to the case of insurmountable barriers to entry.

[17] The implied elasticity of the real exchange rate to the transfer is, using parameters explained in section 4.1, around 3, an order of magnitude larger than the one estimated by Lane and Milesi-Ferretti (2004).

4 Quantitative simulations

In this section we calibrate our model and provide some basic quantitative elements for an analysis of the U.S. current account, complementing our comparative statics analysis above. In Section 3 we started from a symmetric balanced equilibrium and engineered a current account surplus to match the transfer to foreign creditors. In this section we account for country-size asymmetries. The initial conditions are such that the Home country runs a trade deficit, and we consider the effects of a transfer that restores the balanced equilibrium. The approach is therefore similar to the one adopted by Obstfeld and Rogoff (2007). As in the latter paper, we also assume that prices are flexible. However we do not assume a fixed output, allowing for an endogenous response of employment, both total and across sectors. We also analyze the macro response for different degrees of economic 'flexibility', in terms of creation and destruction of goods varieties. In this respect, we should make it clear that the simulations below are not meant to provide a framework for a critical 'sudden stop' scenario — which is arguably more plausible for small emerging markets than for a large economy. On the contrary, we want to provide a rough assessment of the relative price and macroeconomic adjustment associated with a correction of trade imbalances over a time horizon in which new firms and product varieties can be created.

4.1 The choice of parameters

We normalize the size of the world economy to 200 and choose $L = 54$ and $L^* = 146$ to roughly approximate the weight of the U.S. economy in world GDP, about 27 percent in 2006. Consistently, we set $F = -3.5$ in the initial equilibrium, which yields a Home country deficit of roughly 6.5 of U.S. GDP (corresponding to the U.S. deficit in 2006), and consider the effects of a transfer $\Delta F = 3.5$.

In the baseline calibration the elasticity of substitution between product varieties σ is set equal to 2, a value consistent with macro studies of current account adjustment. We also experiment with $\sigma = 5$, a value suggested by trade studies. Trade costs τ are set at 20 percent following Anderson and van Wincoop (2004). Following Obstfeld and Rogoff (2007) we take the share of tradables to be 25% of consumption (e.g. $\delta = 0.25$), although in sensitivity analysis we consider the implications of values as high as $\delta = 2/3$.

We normalize c_N and $c_N^* = 1$. We set c_X such that the ratio of Home exports to Home GDP is 11 percent (corresponding to U.S. values in 2006). Similarly, in the rest of the world c_X^* is such that Foreign exports as a ratio of Foreign GDP are equal to 6.6 percent.[18] In

[18] The latter value is equal to U.S. imports from the rest of the world in 2006 (about $2280 billion) divided

our model the choice of c_D and c_D^* is not consequential for our analysis, in the sense that changes in these parameters only affect the ratios n_X/n_D and n_X^*/n_D^* without modifying relative profits across sectors, thus leaving unchanged the equilibrium allocation of resources and agents' response to macroeconomic shocks.

The parameter γ, the measure of convexity in the cost function for the creation of new varieties, is directly related to the relative importance of extensive margin adjustment. Hummels and Klenow (2005) show that the extensive margin accounts for two-thirds of the greater exports of larger economies. In our model, the latter effect is equal to $\partial \ln X/\partial \ln L = 1/(1+\gamma) = 2/3$, suggesting $\gamma = 0.5$. Other empirical estimates suggest a smaller role for the extensive margin. In sensitivity analysis we experiment with more conservative parameters such as $\gamma = 1$ (i.e. a quadratic cost function corresponding to a 50 percent extensive margin) and $\gamma = 12$ (corresponding to the case in which adjustment at the extensive margin accounts for a small fraction of exports). We also consider an (admittedly unrealistic) calibration with γ very close to zero, to emphasize the differences between a model in which all adjustment occurs at the extensive margin relative to the conventional models in which all adjustment occurs at the intensive margin.

Finally, most micro studies using microdata on wages, hours worked and various household characteristics, suggest a low estimate of the Frisch elasticity $(1/\xi)$. For men, most estimates are in the range 0 to 0.5 (see for example Heckman and MaCurdy 1980, MaCurdy 1981, Altonji 1986, Blundell and MaCurdy 1999). Browning et al. (1999) note however that these microeconomic estimates are often incompatible with real business cycle models that use values in the range of 3 or higher. In our baseline parameterization we choose $\xi = 1$, following Gali, Gertler and López-Salido (2007). In sensitivity analysis we consider the cases $\xi = 0$ (infinite elasticity that corresponds to the Hansen (1985) and Rogerson (1988) model of indivisible labor) and $\xi = 5$.

4.2 Numerical results

Table 2 reports our numerical results. The table compares our models with entry (columns 1 through 8), with a specification in which product varieties are given and the current account adjustment only occurs at the intensive margin (the last four columns). For each variable in the Table 2, we report the percentage change resulting from current account adjustment.

Our baseline parameterization is displayed in the first row of the Table (*Benchmark*). A transfer from the Home country to the rest of the world is associated with an 11.5 percent

by world GDP excluding the U.S. in 2006 ($47800 billion minus $13000 billion).

Table 2: Numerical simulations

	Extensive Margin Model								Fixed Varieties Model			
	n_D	n_N	n_X	n_X^*	ε	RER	ℓ	C	ε	RER	ℓ	C
Benchmark	11.5	−2.1	24.4	−13.1	6.4	1.1	3.3	−6.8	21.9	17.0	3.3	−6.2
$\sigma = 5$	12.9	−2.1	23.3	−11.7	2.5	1.1	3.3	−4.1	7.8	6.2	3.3	−4.3
$\xi = 0$	16.1	0	26.9	−12.6	7.4	4.8	6.9	−1.8	25.2	19.5	6.9	−3.6
$\xi = 5$	8.7	−3.5	22.8	−13.4	5.9	−1.2	1.1	−9.8	19.8	15.4	1.1	−2.8
$\xi = 5, \delta = 2/3$	−0.4	−3.5	18.5	−15.6	4.2	−2.1	1.1	−9.4	15.7	12.4	1.1	−7.3
$\gamma = 0$	21.6	−3.2	35.5	−15.8	0.0	−4.4	3.3	−6.3	21.9	17.0	3.3	−6.2
$\gamma = .35$	13.4	−2.4	26.9	−13.9	4.9	−0.2	3.3	−6.7	21.9	17.0	3.3	−6.2
$\gamma = 1$	7.6	−1.6	18.4	−10.9	9.9	4.4	3.3	−6.9	21.9	17.0	3.3	−6.2
$\gamma = 12$	0.8	−0.2	2.9	−2.2	19.9	14.8	3.3	−6.4	21.9	17.0	3.3	−6.2

increase[19] in the (varieties produced by the) import-competing sector n_D, a 2.1 percent contraction in the nontradables sector n_N and a 24.4 percent expansion in the export sector n_X (abroad, the export sector n_X^* contracts by 13.1 percent). The terms of trade (and the relative price of labor ε) depreciate by 6.4 percent, while the CPI-based real exchange rate RER depreciates by only 1.1 percent, reflecting the interaction between intensive and extensive margins. In the absence of firms' entry (see the last four columns of the Table) the adjustment relies exclusively on movements of relative prices: the terms of trade depreciate almost 3.5 times more in the fixed varieties model than in the extensive margin model, and the extent of RER depreciation is more than 15 times!

The transfer is associated with an expansion of employment and GDP in the Home country (labor effort ℓ increases by 3.3 percent), but external demand crowds out internal demand and Home consumption C falls by 6.8 percent. As a result, welfare unambiguously falls in the Home country. Welfare also falls in the 'fixed-variety' model, as this also predicts a

[19] It is possible to consider scenarios in which n_D actually *falls* due to the effect of the transfer. For instance, in our case this happens when the Frisch elasticity is sufficiently low *and* the share of tradables is particularly (and implausibly) high: see the results reported in row $\xi = 5, \delta = 2/3$.

fall in consumption and a rise in labor effort. In the baseline calibration, it is straightforward to compare welfare losses across models, since labor movements are identical whether or not the extensive margin is operational. Thus, what matters is the fall in consumption, which is larger in the extensive margin model (6.8 percent) than in the fixed varieties model (6.2 percent).

These findings suggest that fluctuations in currency values and growth slowdowns, much emphasized in the traditional literature on current account rebalancing, are only imperfect gauges of the social costs associated with the adjustment process. It is certainly possible to envision *soft-landing* scenarios of current account rebalancing involving small exchange rate depreciations and above-average GDP growth, but they are nevertheless associated with larger welfare losses than alternative scenarios in which relative prices play a much more conspicuous role.[20]

This point is subject to a number of caveats, stressed by our sensitivity analysis. When varieties are relatively more substitutable in global consumption ($\sigma = 5$), the welfare loss is stronger in the 'fixed-variety' model than in our setup. The parameterization of σ does not influence the response of the labor effort, but mostly the change in consumption: namely, the higher is σ, the smaller is the loss of consumption. This is especially relevant in the extensive margin model (the fall in C goes from 6.8 to 4.1 percent in the extensive margin model and from 6.2 to 4.3 percent in the 'fixed-variety' model). With a large σ, small equilibrium movements in relative prices can have a large impact on trade values. While this is true both in the extensive margin and the fixed varieties models, the reduction in the predicted exchange rate depreciations of ε and RER is much more evident in the latter model (in fact, in the extensive margin model the depreciation of RER is the same regardless of the choice of elasticity).

Another economy in which welfare worsens more in the fixed varieties model than in the extensive margin model is one in which the Frisch elasticity is high (ξ is low). Consider the row $\xi = 0$ in Table 2. As labor supply is infinitely elastic, the transfer does not require any contraction in the nontradables sector ($\widehat{n_N} = 0$). Exchange rates adjust more than in the *Benchmark* cases across models, and this is especially relevant for the extensive margin model. In both models, labor effort increases more than twice relative to *Benchmark*. Consumption falls 3.6 percent in the fixed-variety model, but only 1.8 percent in the extensive margin model.

The parameter γ is key to our numerical simulations and welfare comparisons. Consider

[20] These welfare considerations are particularly relevant when ξ is high: see for instance the consumption losses associated with $\xi = 5$ in Table 2.

the last four rows of Table 2. When $\gamma = 0$ the exchange rate does not move at all in the extensive margin model ($\widehat{\varepsilon} = 0$) and all adjustment occurs through the reallocation of product varieties, in strong contrast with the traditional view captured by the fixed-variety model. Raising the value of γ brings our model with the extensive margin progressively closer to the fixed-variety model. Interestingly, in terms of welfare analysis the polar cases $\gamma = 0$ and $\gamma \to \infty$ yield virtually similar outcomes (compare the consumption losses under the two parameterizations, noting that changes in labor effort are unaffected by γ). Interestingly, the welfare difference across the two models is non monotonic in γ: when $\gamma = 0$ the loss of Home consumption and welfare in the extensive margin model is close to the fixed varieties model. When γ goes to one, the loss of welfare in the extensive margin model is significantly larger than in the alternative model. When γ increases above one, the gap between the two welfare losses shrinks, and disappears completely when γ is sufficiently high.

5 Conclusion

In a world of increasing integration of markets for manufacturing goods and services, a larger share of trade in differentiated products should be expected to affect substantially the relation between trade and equilibrium relative price movements. In this paper we have investigated this issue by revisiting the classical model of international transfer, in light of the current debate on the sustainability of the current account deficits run by the U.S. since the mid 1990s.

A transfer-model approach to the analysis of current account rebalancing has many important advantages. It clarifies the macroeconomic implications of intersectoral allocation of resources, as well as of the interplay between domestic and international relative prices. Traditional models that emphasize the role of the elasticities of substitution across goods predict large swings in the domestic relative price of nontradables. In our model, domestic relative prices are pinned down by symmetry in equilibrium marginal costs and markups across sectors. Adjustment thus requires changes in relative sectoral output. While our analysis abstracts from dynamic considerations, it has the advantage to single out the basic components of the transmission mechanism that are bound to shape the macroeconomics of transfers even in full-fledged dynamic models.

Namely, to the extent that market integration is far from perfect, a large transfer does affect the domestic macroeconomic process in fundamental ways. Multisector models encompassing extensive margins, such as ours, call attention to market structure and the costs of product differentiation as key determinants not only of the type of adjustment (prices vs. quantities) but also of their welfare implications. The real exchange rate movements

predicted by our model, either with or without adjustment at the extensive margin, are nonetheless small compared to historical records. Over time, exchange rates have vastly erred on either side of purchasing power parity across the main currency areas of the world. Large and persistent swings have systematically eluded theoretical explanations stressing fundamentals. Since the multiple roles of the exchange rate as equilibrium relative price in both the product and financial markets are not sufficiently understood, mapping the results of a theoretical analysis of transfers into predictions about international price movements cannot escape being subject to important caveats.

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