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Coexistence of Sustained External Imbalance and Real Exchange Rate Misalignment: The Underlying Fundamentals

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Abstract

By focusing on the macroeconomic effects of temporary price shocks, this note clarifies the relationships among the terms of trade, the real exchange rate and the current account. This clarification suggests that a real depreciation might prove incapable of bringing the external imbalance back to a sustainable level.

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1. Introduction

Over the few past decades, the role of exchange rate policy in correcting external imbalance has aroused a great deal of academic interest among international economists. The recent evidence from some industrialized economies indicates that the considerable current account deficit frequently coexists with significant real depreciation, which fundamentally diverges from the conventional predictions. For example, the real value of the dollar was close to its minimum level in 2008; however, at the same time the U.S. current account deficit remained large and would contributed to a further accumulation of external liabilities. By focusing the macroeconomic effects of the terms of trade, this note would like to examine whether the conflicting coexistence of sustained external imbalance and real exchange rate misalignment can be reconciled.

The literature on the US large current account deficit with its attendant implications for currency adjustment is both voluminous and thorough. The mainstream viewpoints in the relevant literature, such as Obstfeld and Rogoff (2005, 2007), Edward (2005) and Mejean et al. (2011), have suggested that a correction of the widening deficit to a sustainable level needs a further real depreciation. However, because of the lack of empirical consensus, skepticism about the plausibility of the depreciation policy has never subsided. For example, Devereux and Engel (2003), Devereux and Genberg (2007), Marquez and Schindler (2007), Thorbecke and Smith (2010), and Kappler et al. (2013) have pointed to limited short-run responsiveness of the current account to exchange rate adjustments.

In contrast to these unresolved controversies, a parallel literature has focused on the alternative inference about what may be in store behind sustained external imbalance. Milesi-Ferretti (2008) discussed several factors, especially for the role of high oil prices and terms-of-trade shocks, that can help shed light on the coexistence of a large trade deficit with a depreciated real exchange rate. Gust et al. (2009) have calibrated that terms-of-trade shocks could play a more crucial role in explaining the current account adjustment than exchange rate shocks. With similarly benign views, the assessments made by Engel and Rogers (2006) and Croke (2006) proposed the possibility that the large current account deficit is consistent with intertemporal optimizing behavior. These sequential notions have important implications for the macroeconomic effects of exchange rate adjustments. To the extent that the terms-of-trade change exogenously, regardless of whether the changes essentially reflect volatile oil price or revaluation policy, the comovement between the current account balance and real exchange rate may actually reflect a reasonable interdependence based on intertemporal optimization.

By placing emphasis on the macroeconomic effects associated with temporary price shocks, herein we take a distinct stand to clarify the relationship between the exchange rates, real exchange rates and the current account. To clarify the conflicting coexistence of sustained external imbalance and real exchange rate misalignment, we extended the traditional analyses on the Harberger-Laursen-Metzler effect to the nontradable sector.

2. Analytical Framework

Consider a small open economy that produces and consumes three goods: exportables (x), importables (m), and nontradables (n). The prices of exportables and importables are given abroad, and the country also has free access to the world capital market at a given rate of interest. In this economy, there is a representative individual who maximizes his (her) lifetime utility:

$$\sum_{t=0}^{\infty} \beta^t U(c_t), \tag{1}$$

and is subject to the following budget constraint:

$$B_0 + \sum_{t=0}^{\infty} \frac{R_t}{(1+r)^t} = \sum_{t=0}^{\infty} \frac{Q_t c_t}{(1+r)^t}, \tag{2}$$

where the subutility (or real spending) c denotes a concave, homogeneous function of degree one defined over the consumption levels of exportables, importables, and nontradables; the utility function $U(\cdot)$ is strictly concave in c; B denotes the net level of foreign bond (loan) holdings which are denominated in imports; the revenue function, $R = R(p,q) = p\bar{x} + \bar{m} + q\bar{n}$, represents the total value of exogenous flows of the three goods in each period and the variables p and q are the prices of exportables and nontradables relative to importables, respectively. Without loss of generality, it is assumed that the subjective time-preference discount factor β equals market discount factor $1/(1+r)$.

By assuming homothetic preference, the consumption-based price index $Q = Q(p,q)$ is concave in (p,q), which corresponds to the minimum expenditure incurred to purchase a unit of the subutility. We also assume exportables and nontradables are substitutes, so the intra-temporal cross-demand effect, Q_{pq}, will be positive. In order to simplify the exposition, in this paper we define the inverse of the relative price of nontradables ($1/q_t$) as the real exchange rate.

3. Real Exchange Rates and Terms of Trade

Assume that the economy is initially at a stationary position and that the expected path of the terms of trade remains fixed at $p_t = \bar{p}$ for all t. Once commodity market fluctuations or exchange rate policy discretions bring about an anticipated price shock, the anticipated pattern of the terms of trade is given by: $p_t = \bar{p}^S < \bar{p}$ for $0 \le t < T$, and $p_t = \bar{p}^L = \bar{p}$ for $t \ge T$. Since temporary changes in relative prices will simultaneously lead the related variables to jump twice, we denote the attendant short-run and long-run equilibriums by superscripts "S" and "L", respectively. Based on the assumption that agents have perfect foresight, the maximization of (1) subject to (2) yields the following necessary condition:

$$\frac{U'(c^S)}{U'(c^L)} = \frac{Q(\bar{p}^S, q^S)}{Q(\bar{p}^L, q^L)} \tag{3}$$

The intertemporal relative price $Q(\bar{p}^S, q^S)/Q(\bar{p}^L, q^L)$ corresponds to the real cost of the present consumption relative to the future consumption, i.e. a real interest rate. Since the real cost of borrowing abroad will be lowered if the terms of trade are temporarily poor, there is an incentive to substitute real consumption away from the future into the present. This incentive disappears once the terms of trade recover, and so the real spending falls discontinuously at that moment.

For given values of the fundamental variables, $\bar{p}^S$ and $\bar{p}^L$, the intertemporal allocation of real spending as well as the equilibrium relative prices of nontradables (real exchange rates) are all determined simultaneously:

$$(1-\beta^T)Q(\bar{p}^S, q^S)c^S + \beta^T Q(\bar{p}^L, q^L)c^L = B_0 + (1-\beta^T)R^S + \beta^T R^L \tag{4}$$

$$Q_q(\bar{p}^i, q^i)c^i = \bar{n}; \quad i = S, L. \tag{5}$$

According to equations (3) – (5), we can derive equilibrium responses of q^S and q^L to a transitory terms-of-trade deterioration initially evaluated at $p_t = \bar{p}$:

$$\frac{dq^S}{d\bar{p}^S} = \frac{\alpha_n}{\bar{n}} \cdot \frac{1}{\sigma_n} \cdot (\bar{x} - \bar{Q}_p \bar{c}) \cdot (1-\beta^T) + \frac{\bar{q}}{\bar{p}} \cdot \frac{\alpha_x \sigma_c}{\sigma_n + \alpha_n \sigma_c} \cdot \left[\frac{\sigma_n}{\sigma_{xn}} \cdot (1-\beta^T) - \beta^T \right] + \frac{\bar{q}}{\bar{p}} \cdot \frac{\sigma_{xn}}{\sigma_n + \alpha_n \sigma_c} \tag{6}$$

$$\frac{dq^L}{d\bar{p}^S} = \frac{\alpha_n}{\bar{n}} \cdot \frac{1}{\sigma_n} \cdot (\bar{x} - \bar{Q}_p \bar{c}) \cdot (1-\beta^T) + \frac{\bar{q}}{\bar{p}} \cdot \frac{\alpha_x \sigma_c}{\sigma_n + \alpha_n \sigma_c} \cdot \left(\frac{\sigma_n}{\sigma_{xn}} + 1\right) \cdot (1-\beta^T) \tag{7}$$

where σ_c and σ_{xn} denote the intertemporal and intra-temporal elasticities of substitution, respectively; σ_n is the price elasticity of nontraded demand; α_n and α_x represent the shares of nontradables and exportables in consumption.

By aiming at the case where nontradables and exportables are gross substitutes, a number of important results can be obtained from (6) and (7). Since the economy must be a net exporter of exported goods, $\bar{x} - \bar{Q}_p \bar{c} > 0$, these two equations indicate that a transitory deterioration in the terms of trade leads to a real deterioration in the long run, and generates an ambiguous change in the real exchange rates in the short run. The intertemporal substitution effect (ISE) on the demand for nontraded goods, which is captured by the second term on the RHS of (6) and (7), can either offset or reinforce the other two corresponding effects: the consumption smoothing effect (CSE) in the first term of these two equations and the intra-temporal substitution effect (SE) in the third term of (6). The forceful ISE may increase the nontradable demand and raise its relative prices in the short run for strong intertemporal substitutability (σ_c is large enough) or less persistent shocks (T is rarely small). When the terms of trade deteriorate temporarily, given that the intertemporal elasticity of substitution is relatively small (Figure 1), we observe either a swing path ($1/q^S = 1/q_1$) associated with less-persistent shocks or a progressive depreciation ($1/q^S = 1/q_1$) associated with more-persistent shocks. However, an overshooting ($1/q^S = 1/q_3$) path may also occur with a high intertemporal substitutability.

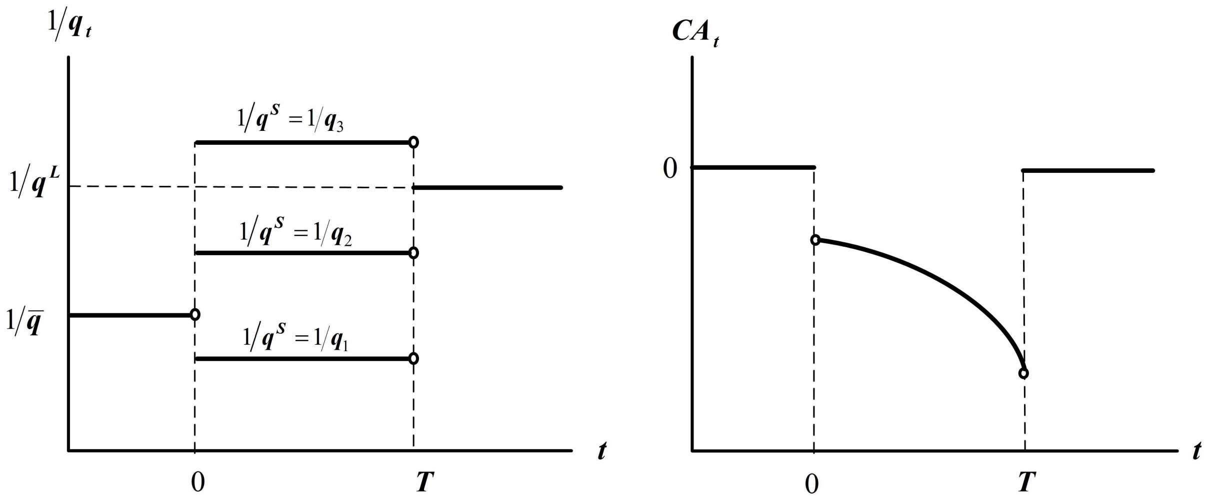

Figure 1: Real exchange rate paths in response to a terms-of-trade deterioration

Most importantly, a transitory terms of trade must tilt real spending toward the period of terms-of-trade weakness as exportables and nontradables are gross substitutes. There is no doubt that a contingent real appreciation during the period of terms-of-trade weakness can never reverse the pattern of intertemporal consumption. The economic intuition can be stated as follows. If the ISE on nontraded goods is strong enough to overcome CSE and SE in the short run, this will altogether increase the nontraded demands and then a real appreciation may occur during the period $0 \le t < T$. However, if such a real appreciation can turn to raise the intertemporal relative price and therefore tilt the real spending towards the future, it will contradictorily diminish the demand for nontradables during the period $0 \le t < T$. These developments will eventually cause a real depreciation rather than a real appreciation in the short run.

According to equation (6), the reallocation of real spending for temporary price shocks can be captured by the changes in the intertemporal relative price, $Q(\bar{p}^S, q^S)/Q(\bar{p}^L, q^L)$,

$$\frac{d}{d\,\bar{p}^S}\frac{Q(\bar{p}^S, q^S)}{Q(\bar{p}^L, q^L)} = \frac{1}{\bar{p}}\cdot\frac{\alpha_x\sigma_{qq}+\alpha_n\sigma_{pq}}{\alpha_n\sigma_c+\sigma_{qq}}\,. \tag{8}$$

By assuming intra-temporal substitutability in consumption, $\sigma_{pq} > 0$, equation (8) implies that the real interest rate will fall in response to a transitory terms-of-trade deterioration. Therefore, the real cost of current consumption relative to future consumption will decline and this induces the individuals to shift expenditure toward times $0 \le t < T$. That is, together with equation (3), the intertemporal ratio of the consumption c^S/c^L must increase.

4. The Current Account

Given that the intertemporal consumption ratio c^S/c^L will be increased because of the worsening of terms of trade, the optimal level of traded bond holdings can be obtained from the intertemporal budget constraints. Because the intertemporal consumption programs computed at time 0 must coincide with the program recomputed at time t, the optimal current account during the period $0 \le t < T$ is then

$$B_{t+1} - B_t = \beta^{T-t-1}\left[\, Q(\bar{p}^L, q^L)c^L - R(\bar{p}^L, q^L) - Q(\bar{p}^S, q^S)c^S + R(\bar{p}^S, q^S)\,\right] < 0\,. \tag{9}$$

A transitory terms-of-trade deterioration lowers the real income during that period, and this change enables individuals to spread their temporary low income over intertemporal consumption. By means of the consumption-smoothing effect, the real saving has to shrink, and hence the current account deficit must emerge to finance the intertemporal excess expenditure. Alternatively, a transitory deterioration in the terms of trade also generates the expectation of a future fall in the real value of external debt in terms of the domestic consumption basket. This expected fall will decrease the real interest rate of foreign borrowing and will lead households to tilt their real spending towards the period $0 \le t < T$.

In contrast with previous studies that allow a deterministic parameterization to decide the current account balance, this analysis provides an explicit interpretation based on general assumptions. The results of this model hold irrespective of size of the elasticity of intertemporal substitution and of indeterminable paths of real exchange rates.

5. Simulations

The proceeding numeration simulated the adjustment trajectories of real exchange rates and the current account with several episodes, focusing on the roles of shock persistence and intertemporal substitutability. For the numerical implementation, the instantaneous utility function is taken to be the following form:

$$U(c) = \frac{c^{1-1/\sigma_c}}{1-1/\sigma_c}, \tag{10}$$

where

$$c = \left[\alpha^{\frac{1}{\theta}} (c_x)^{\frac{\theta-1}{\theta}} + \beta^{\frac{1}{\theta}} (c_m)^{\frac{\theta-1}{\theta}} + (1-\alpha-\beta)^{\frac{1}{\theta}} (c_n)^{\frac{\theta-1}{\theta}} \right]^{\frac{\theta}{\theta-1}}.$$

The world interest rate is set at 0.1 and initial terms of trade are assumed to equal 1. In turn, the parameter θ measuring the (constant) intra-temporal elasticity of substitution between traded and nontraded goods is 0.75. The endowed output flows of exportables, importables and nontradables are assumed to be 40, 20 and 60, respectively. To reveal the realistic home bias in traded goods, the expenditure share α is equal to 0.6 and β is 0.2. In accordance with this parameterization, the simulation below considers four values of intertemporal elasticity of substitution ($\sigma = 10$, 2, 1 and 0.5) and three durations of the price shock ($T = 5$, 10 and 20). Allowing for diversified parameters, the numerical simulations provide institutional insight in explaining the preceding theoretical conjectures.

Table I: Real Exchange Rates and External Debt under Different Assumptions

		$1/q^S - 1/\bar{q}$	$1/q^L - 1/\bar{q}$	$B_T - B_0$
$\sigma_c = 10$	$T = 5$	-1.2871	2.2913	-325.85
	$T = 10$	-0.5836	4.2992	-474.12
	$T = 20$	0.2986	6.9284	-645.90
$\sigma_c = 2$	$T = 5$	-0.3017	0.7510	-138.17
	$T = 10$	0.1203	1.3106	-217.65
	$T = 20$	0.6111	1.9622	-293.13
$\sigma_c = 1$	$T = 5$	0.1520	0.4044	-79.66
	$T = 10$	0.4266	0.6971	-129.50
	$T = 20$	0.7401	1.0314	-207.01
$\sigma_c = 0.5$	$T = 5$	0.4910	0.2096	-43.04
	$T = 10$	0.6516	0.3596	-71.50
	$T = 20$	0.8333	0.5291	-118.35

The patterns of real exchange rates:

[light grey] = overshooting [dark grey] = swing [white] = progressive adjustments

Table 1 presents the short-run and long-run adjustments of real exchange rates, $1/q^S - 1/\bar{q}$ and $1/q^L - 1/\bar{q}$, and the accumulation of the external debts, $B_T - B_0$, following an anticipated transitory 10% deterioration in the terms of trade. Starting from the initial steady state equilibrium $\bar{q} = 0.38352$ (Figure 2), we observe the current account deficit emerging and hence the external debt accumulating, regardless of whether the pattern of real exchange rates exhibits a swing ($\sigma_c = 10, T = 5$), an overshooting ($\sigma_c = 0.5, T = 20$), or a progressive depreciation ($\sigma_c = 1, T = 10$). As noted above, a real depreciation and an accumulation of net liabilities will significantly coexist with a low intertemporal elasticity of substitution.

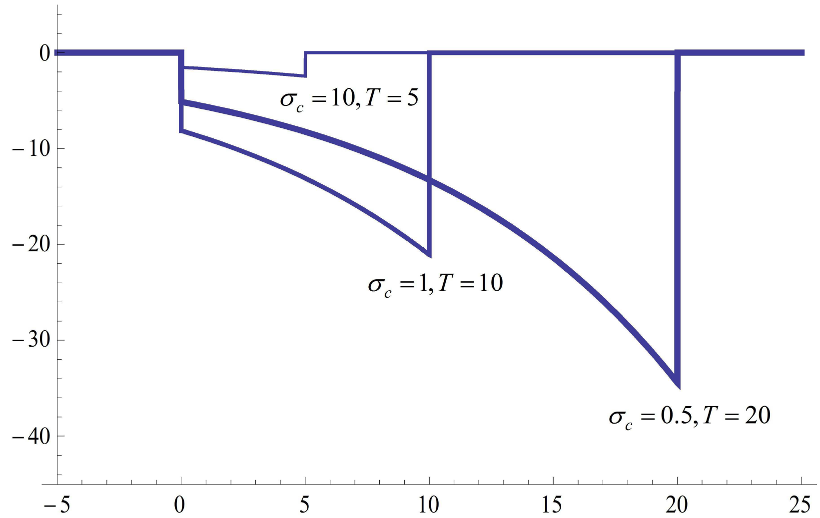

Figure 2: Simulated current account trajectories for different shock persistence

6. Conclusion

This paper provided a theoretical explanation for the coexistence of a widening deficit and sustained real depreciation. The paradoxical coexistence was shown to actually reflect reasonable interdependence based on intertemporal optimization. By formulating the endogenous mechanism through which temporary terms-of-trade disturbances are transmitted to real exchange rates and the current account, the analysis demonstrated that the temporary current account responses are not sensitive to real exchange rate adjustments. The theoretical results obtained from our model have an important direction: a further real depreciation would prove incapable of bringing the external imbalance back to a sustainable level.

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