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# Devaluation, pass-through and foreign reserves dynamics in a tourism economy ☆

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ABSTRACT

This paper examines the effects of currency devaluations on goods prices and foreign reserves for a small-open economy with inbound tourism. Tourism transforms non-traded goods into exportable goods. Devaluations yield an over pass-through to the prices of the non-traded tourism goods. This may hurt the trade balance and hence lead to a decline in foreign reserves for the economy.



## 1. Introduction

International tourism, one of the most vibrant industries in many countries, is a major export industry and a main source for earning foreign exchange for these economies. According to a 2010 WTTC report, for about 10% of 171 countries, revenue from tourism contributed to more than 50% of export revenues, including 80% in Anguilla, 75.2% in Macau, 63.6% in the Maldives, 63.1% in Antigua and Barbuda, and 61.7% in the Bahamas. Tourism is one of the top five export categories for as many as 83% of countries.

Foreign tourists visit the destination country by consuming mainly the non-traded goods produced in the local economy. That is, inward tourism transforms the formally non-traded goods into exportables and hence the non-traded prices serve as a terms-of-trade effect, which in turn affects trade balances and foreign reserves.[1] In the seminal paper by Dornbusch (1987), for a small-open economy, one of the prominent factors that influences the prices of non-traded goods is the exchange rate and the confluent phenomenon of incomplete or complete pass-through of the exchange rate to domestic prices is identified (Dornbusch, 1973; Menon, 1995).[2] Nonetheless, in this paper, we will show that for an economy with inbound tourism, the exchange rate pass-through phenomenon can be amplified to a case of over pass-through. This is because changes in the exchange rate not only affect the relative price between importable and exportable goods, but also influence the number of foreign tourists.

Traditionally, for a small open economy, a currency devaluation makes the exportable goods relatively cheaper and hence improves the trade account when the sum of the price elasticities of export and import demands exceeds one (known as the Marshall–Lerner condition).[3] However, this trade-improving result and the price elasticity condition may not hold for the tourism economy. Due to the over pass-through of the exchange rate, a currency devaluation makes the non-traded goods even more expensive, which can worsen

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[1] Copeland (1991, p. 515) claims that, "in contrast to commodity exports, tourists must visit the exporting country to purchase and consume tourist goods and services. That is, rather than sending the goods across national boundaries, the final consumer must cross national boundaries to consume the good. As a result, goods that are normally non-tradable, such as restaurant meals, become partially tradable in the presence of tourism."

[2] Takhtamanova (2010, p. 1118) puts forth a concern on the definition of exchange rate pass-through: "It is also important to note that there is no uniform definition of the term "pass-through". Much of the existing research focuses on the relationship between movements in nominal exchange rates and import prices. A smaller, but equally important, strand of the literature concentrates on the macroeconomic exchange rate pass-through to aggregate price indices." In this paper, in line with Dornbusch, we pay attention to the relationship between domestic prices and exchange rates. Also see Arize (1995, 1996), Barhoumi (2006); Devereux and Yetman (2010) and Junttila and Korhonen (2012).

[3] See Krugman, Obstfeld and Melitz (2012, p. 491).

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the trade balance and it gets even worse when demands for export and import goods are more price-elastic. Hence, a currency devaluation can actually lead to lower foreign reserves when foreign tourists are present in the economy.

The remainder of this paper is organized as follows. Section 2 sets up a dynamic model of a small open economy with inbound tourism, in which foreign tourists demand for non-traded goods only, while Section 3 examines the transitional and steady-state effects of currency devaluations on the non-traded prices and foreign reserves. Section 4 provides the concluding remarks.

## 2. The model

Consider a small open economy that produces two goods: a traded good $T$ and a non-traded good $N$. Let $P^T$ denote the price of the traded good in terms of the domestic currency, $P^{T*}$ be the price of the traded good in terms of the foreign currency, and $E$ denote the exchange rate (defined as the price of foreign currency in terms of domestic currency). Assume that the domestic and foreign traded goods are perfect substitutes, implying that the law of one price holds, i.e., $P^T = EP^{T*}$. While the price of the traded good is given by the world market, the price of the non-traded good $P^N$ is endogenously determined in the economy. Domestic residents consume both goods by $D^T$ and $D^N$. In line with Calvo and Rodriguez (1977) and Frenkel and Rodriguez (1982), the demands for goods are homogeneous of degree zero in goods prices, $P^T$ and $P^N$, and money supply $\Omega$. This suggests that the demands for goods depend on the relative price $P^N/P^T$ and real money balance $\Omega/P^T$, i.e., $D^T = D^T(P^N/P^T, \Omega/P^T)$ and $D^N = D^N(P^N/P^T, \Omega/P^T)$. Assuming $D^T$ and $D^N$ are "normal" goods and letting the subscript denote the partial derivative, we have: $D^T_P(=\partial D^T/\partial P) > 0$, $D^T_y(=\partial D^T/\partial y) > 0$, $D^N_P(=\partial D^N/\partial P) < 0$ and $D^N_y(=\partial D^N/\partial y) > 0$, where $P = P^N/P^T$ and $y = \Omega/P^T$. In the following analysis, the impacts of $P^N/P^T$ on $D^T$ and $D^N$ are referred to as the price effect while the effects of $\Omega/P^T$ on $D^T$ and $D^N$ are called as the wealth effect.

The foreign tourists mainly demand for the tourism good, captured by the non-traded good,[4] as: $D^F = D^F(P^N/P^T, \alpha)$, which is negatively dependent on $P^N/P^T$ and positively on the number of tourists $\alpha$, i.e., $D^F_P(=\partial D^F/\partial P) < 0$ and $D^F_\alpha(=\partial D^F/\partial \alpha) > 0$. Furthermore, according to Crouch (1994) and Lim (2006), current arrivals of foreign tourists are also influenced by exchange rates and price expectations on the tourism good:

$$\alpha = \alpha\left(\frac{\dot{P}^N}{P^N}, E\right), \tag{1}$$

with $\alpha_q > 0$ and $\alpha_E > 0$,[5] where $q\left(=\dot{P}^N/P^N\right)$ is the change in the future price of the tourism good. When foreign tourists expect the price of the tourism good to rise in the future, they are motivated to bring forward the date of their visits. It is noted that following Calvo and Rodriguez (1977) and Frenkel and Rodriguez (1982), tourists form their expectations by perfect foresight and the expected rise in prices is equal to its realized rise.

Letting $H$ and $R$ be the domestic credit and foreign reserves, domestic money supply is then the sum of them, $\Omega = H + R$. Based on the demands for the non-traded good by domestic residents and foreign tourists, the equilibrium condition for the market of the non-traded good $N$ in the home economy is given by[6]:

$$D^F\left(\frac{P^N}{P^T}, \alpha\right) + D^N\left(\frac{P^N}{P^T}, \frac{H+R}{P^T}\right) = S^N\left(\frac{P^N}{P^T}\right), \tag{2}$$

where $S^N(\cdot)$, the supply of the non-traded good in the economy, is an increasing function of the relative price between nontraded and traded goods, with $S^N_P(=\mathrm{d}S^N/\mathrm{d}P) > 0$.

Given that the law of one price holds for the traded good, imports of the traded good $M^T$ are defined as

$$M^T = D^T\left(\frac{P^N}{P^T}, \frac{H+R}{P^T}\right) - S^T\left(\frac{P^N}{P^T}\right), \tag{3}$$

where $S^T_P(=\mathrm{d}S^N/\mathrm{d}P) < 0$. It is noted that $D^T_P(=\partial D^T/\partial P) > 0$, $D^T_y(=\partial D^T/\partial y) > 0$ and $S^T_P(=\mathrm{d}S^N/\mathrm{d}P) < 0$. This gives $M^T_P = D^T_P - S^T_P > 0$ and $M^T_y = D^T_y > 0$.

Since foreign tourists convert the non-traded good into an exportable good, foreign reserves accumulate over time as

$$\dot{R} = P^N D^F\left(\frac{P^N}{P^T}, \alpha\right) - P^T M^T\left(\frac{P^N}{P^T}, \frac{H+R}{P^T}\right). \tag{4}$$

The model stated in Eqs. (1)–(4) will be used to examine the transitional and steady-state effects of currency devaluations on commodity prices and foreign reserves for the economy.

## 3. Dynamic adjustments

To highlight the role of inbound tourism played in the dynamic adjustments of the non-traded price $P^N$ and foreign reserves $R$, we start the analysis by considering the case when inbound tourism is absent and then compare it to the case with the presence of inbound tourism.

### 3.1. Absence of inbound tourism

When inbound tourism is absent, $D^F(P^N/P^T, \alpha) = 0$, Eqs. (2) and (4) become[7]:

$$D^N\left(\frac{P^N}{P^T}, \frac{H+R}{P^T}\right) = S^N\left(\frac{P^N}{P^T}\right), \tag{5}$$

$$\dot{R} = -P^T M^T\left(\frac{P^N}{P^T}, \frac{H+R}{P^T}\right), \tag{6}$$

and they can be linearly approximated around the steady-state equilibrium by

$$\begin{bmatrix} 0 \\ \dot{R} \end{bmatrix} = \begin{bmatrix} \left(S^N_P - D^N_P\right) - D^N_y & \\ M^T_P & M^T_y \end{bmatrix} \begin{bmatrix} P^N - \hat{P}^N \\ R - \hat{R} \end{bmatrix} + \begin{bmatrix} -\left(S^N_P - D^N_P - D^N_y(H+R)\right)dE \\ \left(M^T - M^T_P - M^T_y(H+R)\right)dE \end{bmatrix}, \tag{7}$$

where $\hat{P}^N$ and $\hat{R}$ are the steady-state values of $P^N$ and $R$. Furthermore, without loss of generality, it is assumed that $P^N = P^T = P^{T^*} = 1$ initially.

In the long-run equilibrium, $\dot{R} = 0$, from Eq. (7) we have:

$$\frac{\partial \hat{P}^N}{\partial E}\frac{E}{\hat{P}^N} = 1, \tag{8}$$

$$\frac{\partial \hat{R}}{\partial E} = (H+R) > 0. \tag{9}$$

Hence, under the fixed exchange rate system without inbound tourism, a rise in the exchange rate increases the price of the non-traded

[4] See Copeland (1991) for a discussion.
[5] Also see Sinclair (1998).
[6] See Beladi and Batra (2004) for studies on non-traded goods in general equilibrium models.
[7] In Eq. (3), imports are defined as $M^T = D^T(P^N/P^T, \Omega/P^T) - S^T(P^N/P^T)$. As a result, Eq. (6) can be alternatively expressed as $\dot{R} = P^T[S^T(P^N/P^T) - D^T(P^N/P^T, \Omega/P^T)]$. This implies that, in the absence of inbound tourism, the economy accumulates foreign reserves only through the traded good.