Journal of Macroeconomics 44 (2015) 50–59

Contents lists available at ScienceDirect

Journal of Macroeconomics

journal homepage: www.elsevier.com/locate/jmacro

Currency invoicing and state-dependent pricing

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ARTICLE INFO

Article history:
Received 8 April 2014
Accepted 28 January 2015
Available online 27 February 2015

JEL classification:
F41
F42

Keywords:
Invoicing currency
Exchange rate pass-through
State-dependent pricing
International policy transmission

ABSTRACT

While invoicing currency has been extensively studied in open-economy macroeconomics, Dotsey and Duarte (2011) suggest that the currency denomination of exports does not matter because standard invoicing currency regimes such as producer currency pricing (PCP) and local currency pricing (LCP) generate similar aggregate responses. However, this paper demonstrates the importance of invoicing currency in a two-country state-dependent pricing (SDP) model with variable demand elasticity in response to monetary shocks. To highlight the role of SDP, I contrast the SDP model's responses across invoicing regimes with those from a time-dependent pricing (TDP) model identical to SDP except exogenous price adjustment. While SDP gives rise to different aggregate responses across invoicing currency regimes, TDP, which Dotsey and Duarte (2011) use in their analysis, fails to make a difference in the aggregate responses except in trade balance.

1. Introduction

Invoicing currency has been a crucial element in open-economy macroeconomic models with nominal price rigidities, due to its emphasis on the pass-through of the exchange rate to import prices and optimal monetary policy. In this class of models, there are two standard price-setting regimes for exporters: *producer currency pricing* (PCP) and *local currency pricing* (LCP). Under PCP, exporters set prices in their own currency. As the law of one price holds in this price setting, the foreign price of home exports moves one-to-one with the nominal exchange rate (full exchange rate pass-through). Under LCP, however, price-discriminating firms set prices in the consumer's currency. With realistic nominal price rigidities, this specification generates incomplete pass-through of the exchange rate to consumer prices. Devereux and Engel (2003) show that the degree to which an optimal monetary policy in an open economy requires flexible exchange rate depends on invoicing currency. If prices are set in the producers' currency, optimal monetary policy should incorporate flexible exchange rates to achieve a change in relative prices. If prices are set in the consumers' currency, optimal monetary policy should keep exchange rates fixed.

However, Dotsey and Duarte (2011) show that the invoicing regimes actually do not matter in a quantitative open-economy model. This is because the two polar invoicing regimes generate similar aggregate responses, despite the difference in the innate mechanism. This fact strongly suggests that the role of invoicing regimes is less important for optimal monetary policy in open economies than what traditional analyses may suggest.

In this paper, I reconsider the implications of different invoicing currency assumptions on the international transmission of monetary shocks in a two-country model. The model features state-dependent pricing (SDP) with variable demand

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http://dx.doi.org/10.1016/j.jmacro.2015.01.003
0164-0704/

elasticity: firms will adjust their prices when doing so is more valuable, and it is costly for price-adjusting firms' prices to deviate from the prices set by others. In particular, the framework used in this paper is the two-country dynamic stochastic general equilibrium (DSGE) model of Landry (2009) and Landry (2010), which extend Dotsey et al. (1999, hereafter "DKW") and Dotsey and King (2005, hereafter "DK") into an open economy setting. I also contrast the SDP model's responses with those from its time-dependent pricing (TDP) version, which is identical to the SDP model except for the exogenous timing of price adjustment. In response to a monetary shock, SDP gives rise to different aggregate responses across invoicing currency regimes. PCP generates greater inflation and depreciation of home currency than LCP. In contrast, TDP, on which Dotsey and Duarte (2011)'s research is also based, fails to make a difference in the aggregate responses, except for trade balance. While the full exchange rate pass-through in PCP contributes to higher prices under both SDP and TDP, no change in the fraction of price-adjusting firms in TDP prevents making a difference at both the aggregate and firm level.

The contribution of this paper to the literature is its demonstration of the importance of invoicing currency under SDP, which implies that the standard analysis of optimal monetary policy based on the currency denomination of exports and the resulting exchange rate pass-through is still valid. This paper also shows that the endogenous timing of price adjustment is the key factor behind the differences in the results of this paper from those of Dotsey and Duarte (2011).

The rest of this paper is organized as follows. In the next section, I present the SDP model of Landry (2009, 2010) and consider the different pricing regimes. In Section 3, parameter values will be provided. In Section 4, I compare the results from different price-setting specifications under SDP and TDP. I conclude in Section 5.

2. State-dependent pricing model

The SDP model in this paper is based on Landry (2009) and Landry (2010) which extend DKW and DK into the two-country setting. While Landry (2009) and Landry (2010) consider PCP and LCP separately, this paper also considers the asymmetric case[1] with the two symmetric cases.

In the model, there are two countries: Home and Foreign. Country 1 and Country 2 represent Home and Foreign respectively. Each country is populated by a representative household, a continuum of monopolistically competitive firms selling final goods and a monetary authority. When three subscripts are present in this section, the first denotes the location of production, the second denotes the location of consumption or investment and the third denotes time.

2.1. Underlying monopolistic competition setting

2.1.1. Households

A representative household in each country i makes consumption $c_{i,t}$ and labor $n_{i,t}$ decisions to maximize expected lifetime utility

$$\max_{c_{i,t},n_{i,t}} E_0\sum_{t=0}^{\infty}\beta^t U(c_{i,t},n_{i,t}),\ \text{for } i=1,\ 2 \tag{1}$$

where $U(c,n)=\log c-\chi n$. This utility specification follows Hansen (1985) and Rogerson (1988) by assuming indivisible labor decisions implemented with lotteries. The parameter β represents the discount factor.

Aggregate consumption is defined as a constant elasticity of substitution (CES) composite of domestic and imported consumption

$$c_{i,t}=\left[(1-\theta_i)^{\frac{1}{\gamma}}c_{i,i,t}^{\frac{\gamma-1}{\gamma}}+\theta_i^{\frac{1}{\gamma}}c_{j,i,t}^{\frac{\gamma-1}{\gamma}}\right]^{\frac{\gamma}{\gamma-1}},\ \text{for } i,\ j=1,\ 2 \text{ and } i\neq j \tag{2}$$

The coefficient θ_i measures the degree of home bias in consumption, while γ denotes the elasticity of substitution between domestically produced goods $c_{i,i,t}$ and imported foreign goods $c_{j,i,t}$.

Households also choose an optimal amount of capital through its choices of investment $i_{i,t}$.[2] Investment decisions are made as the following equation

$$k_{i,t+1}=(1-\delta(x_{i,t}))k_{i,t}+\phi\left(\frac{i_{i,t}}{k_{i,t}}\right)k_{i,t},\ \text{for } i=1,\ 2 \tag{3}$$

where $k_{i,t}$ denotes the capital stock, $\delta(\cdot)$ the depreciation function with $\delta'>0$ and $\delta''<0, x_{i,t}$ the utilization rates of capital and $\phi(\cdot)$ the capital adjustment cost with $\phi'>0$ and $\phi''<0$. The household's investment allocations are identical to the consumption allocations (2).

[1] Empirical studies such as Gopinath and Rigobon (2008) and Goldberg and Tille (2008) show that U.S. imports and exports are heavily invoiced in U.S. dollars. This implies that the asymmetric case is appropriate for modelling U.S. trade: while the U.S. follows PCP, its trade counterparts follow LCP.

[2] Following Christiano et al. (2005), the assumption that households make the capital accumulation and utilization decisions is a matter of convenience.