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Journal of International Money and Finance

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



Exchange rate pass-through and inflation: A nonlinear time series analysis

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A B S T R A C T

JEL Classification:

C22

E31

F31

Keywords:

Import prices

Inflation indexation

Pricing-to-market

Smooth transition autoregressive models

Sticky prices

This paper investigates the relationship between the exchange rate pass-through (ERPT) and inflation by estimating a nonlinear time series model. Based on a simple theoretical model of ERPT determination, we show that the dynamics of ERPT can be well approximated by a class of smooth transition autoregressive (STAR) models using the past inflation rate as a transition variable. We employ several U-shaped transition functions in the estimation of the time-varying ERPT to US domestic prices. The estimation result suggests that declines in the ERPT during the 1980s and 1990s are associated with lowered inflation.

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1. Introduction

Within the framework of new open economy macroeconomic models, the degree of exchange rate pass-through (ERPT) into domestic prices is one of the key elements in evaluating international spill-over effects of monetary policy. Over the past decade, a number of empirical studies have investigated whether ERPT, defined as the response of domestic inflation rates to the changes in exchange rates (or

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in marginal costs), decreased during the 1980s and 1990s.¹ If there was a reduction in ERPT, it is natural to conjecture some interaction between the ERPT and the inflation rate because the timing corresponds, in many countries, to a period of low and stable inflation. This view is emphasized by Taylor (2000), who states that “the lower pass-through should not be taken as exogenous to the inflationary environment (p.1390).”

The purpose of this paper is to investigate Taylor’s hypothesis on the positive relationship between the ERPT and inflation by estimating a nonlinear time series model. In particular, we employ the class of smooth transition autoregressive (STAR) models so that the degree of ERPT to domestic prices can be determined by the lagged domestic inflation rate. Most previous empirical studies on the positive association between ERPT and inflation focus on the cross-country evidence, including the analyses by Calvo and Reinhart (2002), Choudhri and Hakura (2006), and Devereux and Yetman (2010). This paper differs from the existing studies in that we examine the role of inflation in the time-varying ERPT under the time series modeling framework.

In the empirical literature on the nonlinear adjustment of real exchange rates, STAR models have been popularly employed in many studies, including Michael et al. (1997), Taylor and Peel (2000), Taylor et al. (2001), and Kilian and Taylor (2003), among others. However, STAR models have rarely been used in analyses of the ERPT.² While nonlinear mean reversion of real exchange rates implies the full ERPT in the long-run, it does not imply the time-varying ERPT. We employ several U-shaped transition functions in STAR models to consider alternative forms of time-varying ERPT. Our method is applied to monthly US import and domestic price data and evaluates fluctuations of ERPT during the period from 1975 to 2007.

To motivate our nonlinear regression approach, we first present a simple theoretical model of importing firms where the ERPT becomes a nonlinear function of the past inflation rate. Our model is closely related to a model of ERPT developed by Devereux and Yetman (2010) so that the optimal price level depends directly on the nominal exchange rate, which corresponds to the marginal cost, and that importing firms endogenously select the probability of adjusting their price to an optimal level. However, our model differs from their model in several aspects. First, for every period, a fraction of firms make a finite-period Taylor (1980) type staggered contract of an inflation indexation rule. Second, each firm faces the problem of opting out of a contract. When firms opt out, they can set an optimal price by paying a fixed cost. Because the ERPT increases if more firms set an optimal price, and the probability of opting out depends on the past inflation rate, our model predicts that ERPT depends on the lagged inflation. This prediction is in contrast to the case of Devereux and Yetman (2010) where the ERPT depends on the steady-state inflation level of the economy. We show that the dynamics of ERPT predicted by the theoretical model can be well approximated by the STAR structure, and that the past decline during the 1980s and 1990s and the recent increase in the ERPT to US prices are well explained by the STAR model.

The remainder of the paper is organized as follows. Section “Theoretical motivation” briefly describes the prediction from the theoretical model. Section “Econometric procedures” introduces the empirical model. Estimation results are provided in the section “Empirical results”, followed by “Conclusions” in the next section.

2. Theoretical motivation

In this section, we briefly describe our theoretical model of importing firms, which predicts that the ERPT depends on the lagged inflation.³ The basic setup is similar to Devereux and Yetman (2010) in that importing firms are monopolistic competitors who import differentiated intermediate goods from abroad. A representative domestic final good producer purchases all the imported intermediate goods

¹ See, for example, Goldberg and Knetter (1997), Otani et al. (2003), Campa and Goldberg (2005), Sekine (2006) and McCarthy (2007).

² One of the few exceptions is a study of UK import prices by Herzberg et al. (2003). However, their study did not find supporting evidence on nonlinearity.

³ The details of the model are provided in the Appendix.

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