Journal of Macroeconomics 42 (2014) 241–262

Contents lists available at ScienceDirect

Journal of Macroeconomics

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

Weak-form and strong-form purchasing power parity between the US and Mexico: A panel cointegration investigation ☆

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ARTICLE INFO

Article history:
Received 14 June 2014
Accepted 13 August 2014
Available online 16 September 2014

JEL classification:
F31

Keywords:
Purchasing Power Parity (PPP)
Weak-form PPP
Strong-form PPP
Cointegration
Mexico

ABSTRACT

This study examines the long-run relationship between US and Mexican prices. We use panel cointegration techniques that allow for heterogeneous relationships across goods to examine the existence of weak-form and strong-form Purchasing Power Parity (PPP) between the US and Mexico. We construct and work with a panel of highly disaggregated data, matched prices of individual products sold in each country. Our findings provide overwhelming support for weak-form PPP, but less support for strong-form PPP. Strong-form PPP, though, emerges among actively-traded goods. In contrast, non-traded goods exhibit amplified reaction to price changes in Mexico relative to those from the US.

1. Introduction

How integrated are international markets? Recent advances in the purchasing power parity literature reveal that price-based answers to this question depend on factors that vary across time, space, and products. While recent research has generated important insights into long-run deviations in the Law of One Price across countries (Froot and Rogoff, 1995; Rogoff, 1996; Goldberg and Knetter, 1997; Taylor and Taylor, 2004; Crucini and Yilmazkuday, 2013), long-run Purchasing Power Parity (PPP) – especially weak-form and strong-form PPP – remains less than fully understood. This gap remains especially salient between developed and developing countries. Rogoff (1996), in particular, expresses concern about whether PPP holds between developed and developing nations.[1]

This paper investigates the existence of PPP between the US and Mexico using econometric estimation and testing methods involving panel cointegration. The framework allows for straightforward testing for weak-form and strong-form PPP. Our

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[1] The empirical research that focuses on developing countries finds mixed evidence of PPP. The results of Basher and Mohsin (2004), Ahmed (2005), Dal Bianco (2008), and Drine and Rault (2008) indicate little to no evidence of PPP. Other studies (Mahdavi and Zhou, 1994; Holmes, 2001; Zhang and Lowinger, 2006; Ozdemir, 2008) find support for PPP either in the long run or once other factors are included. Alba and Papell (2007) find mixed results across developing regions.

http://dx.doi.org/10.1016/j.jmacro.2014.08.005
0164-0704/

sample consists of a panel of monthly data over a long time span on matched goods-level prices of Mexican and US products. This goes along with the general argument in the PPP literature to use the most highly disaggregated data possible. It also enables us to focus on the PPP issue exclusively between the US and Mexico. In so doing, our study contributes to the body of research that investigates the trading relationship between the US and Mexico. It also adds to the empirical literature on PPP with regard to developing nations.

The panel cointegration framework offers advantages to investigating PPP relative to other commonly used approaches. For example, a sizable body of literature has examined the existence of PPP based upon estimated half-lives of the real exchange rate within an underlying autoregressive specification (see e.g. Robertson et al. (2009) and the references therein). As Pedroni (2001a, 2001b) describes, this method comes with limitations, especially in testing weak-form PPP versus strong-form PPP. In particular, its emphasis on panel unit root testing of the real exchange rate imposes a homogeneous unit value for the implied cointegrating vector between nominal exchange rates and price ratios, or equivalently prices between two countries expressed in the same currency. This property is commonly known as strong-form PPP.[2]

An argument advanced by Froot and Rogoff (1995), Pedroni (2001a, 2001b, 2004), and others states that this long-run relationship may in fact be stationary but not unitary and may also vary across different goods, a characteristic commonly known as weak-form PPP. Especially when heterogeneity is considered, weak-form PPP may stem from factors such as differences in price indices, measurement errors, transportation costs, and productivity shocks.[3] In contrast, the more restrictive strong-form PPP implies that this long-run homogeneous one-to-one price relationship holds across the panel. Consequently as Pedroni (2001a, 2001b) discusses, rejection of strong-form PPP based upon panel unit root tests gives little clarity about the existence of weak-form PPP. In contrast, the panel cointegration framework allows for straightforward testing of both weak-form and strong-form PPP. We employ econometric methods based upon panel cointegration with cross-sectional heterogeneity developed by Pedroni (1999, 2001a, 2001b) and related studies to focus on PPP between the US and Mexico. In this way, our study contributes to the body of literature that has utilized panel cointegration methods to investigate weak-form and strong-form PPP, primarily among developed nations.[4]

The sample here consists of a panel of seasonally-adjusted monthly data on matched-goods prices between the US and Mexico from 1982:1 to 2010:2. Most prices are measured at the individual goods level of aggregation. These data enable us to identify the cross-section as goods within an individual country, as opposed to cross-country studies found in the empirical PPP literature. Based upon results with a similar data set, Robertson et al. (2009) provide evidence that the level of disaggregation makes a notable difference in reliably testing for PPP, following earlier arguments of Imbs et al. (2005) and Broda and Weinstein (2008).

This paper differs from Robertson et al. (2009) in three important ways. First, Robertson et al. (2009) evaluate PPP by estimating half-lives of adjustment back to long-run PPP rather than the cointegration approach used in this paper. Second, Robertson et al. (2009) focus on the importance of aggregation bias rather than cross-section differences across goods. The importance of using cross-section differences across goods to investigate PPP has been well-established in the trade literature, as conclusions can be affected by trade costs, local taxes, varying shares of traded inputs (Crucini et al., 2005), and the frequency of price setting (Crucini and Telmer, 2012).[5] Hernandez Vega (2012) uses a highly disaggregated sample of matched prices of individual goods between the US and Mexico in examining competing theories of real exchange rate determination, based upon the variable's volatility.

Third, as in Hernandez Vega (2012) and Crucini and Yilmazkuday (2013), we examine effects of separating traded versus non-traded goods during the course of our investigation. Differences between traded and non-traded goods are frequently debated in the literature. Robertson et al. (2009) find small (and not statistically significant) differences in estimated half-lives across traded and non-traded goods. Based upon variance decomposition, however, Hernandez Vega (2012) finds that the non-traded component accounts for between 69 and 84 percent of the real exchange rate volatility and that the non-traded component is negatively correlated with the trading component, despite the floating exchange rate regime characterized by his sample. Consistent with Hernandez Vega (2012) and other studies, we also find that separation between traded and non-traded goods matters. In particular, while our results indicate overwhelming evidence of weak-form PPP between the US and Mexico for the entire set of products, support for strong-form PPP emerges only for traded goods. These differences are important because they highlight the value of identifying the nature of economic integration between countries.

In all, our study contributes to the body of empirical research involving the US and Mexico. The trading relationship between these two nations arguably remains an important issue. Fig. 1 portrays US trade with Mexico over the period 1985–2012. Aside from a drop due to the Great Recession, the figure reveals that the volume of both exports and imports between the two countries has steadily increased over time. This rise in trade has been substantial. In real terms, US imports

[2] Pedroni (2001a, 2001b), in fact, refers to this characteristic as "strong" PPP. Similarly, we use the term "weak-form" PPP to describe what Pedroni (2001a, 2001b) calls "weak" PPP.

[3] Carvalho and Nechio (2011) argue that ignoring underlying heterogeneous sector-level dynamics leads to underestimation of both volatility and persistence of exchange rates.

[4] Examples of such work, which has generated mixed results with regard to the existence of PPP, include Chang et al. (2011), Chang and Tzeng (2011), Liu and Su (2011), Sulku (2010), and Liew et al. (2010). Haug and Basher (2011) examine cointegration between US and European countries using time series data along with linear and nonlinear cointegration methods.

[5] The importance of product-level data has been established beyond the PPP literature. Recent papers examining price-setting behavior in the context of exchange rate pass-through rely heavily on product-level data (Crucini and Telmer, 2012; Crucini et al., 2005; Klenow and Malin, 2011; Fitzgerald, 2008; Crucini and Landry, 2012; Burstein and Jaimovich, 2008, and Alessandria and Kabolski, 2011).