



Aggregate real exchange rate persistence through the lens of sectoral data

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ABSTRACT

A novel approach to analyzing real exchange rate (RER) persistence and its sources is presented. Using highly disaggregated data for a group of EU-15 countries, it is shown that the distribution of sectoral persistence is highly heterogeneous and skewed to the right, so that a limited number of sectors are responsible for the high levels of persistence observed at the aggregate level. Quantile regression has been employed to investigate whether traditional theories, such as the lack of arbitrage due to nontradability or imperfect competition combined with price stickiness, are able to account for the slow reversion to parity of RERs.

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1. Introduction

Most of the empirical literature on purchasing power parity (PPP) and real exchange rate (RER) persistence focuses on the analysis of aggregate data, where RERs are constructed with aggregate price indices. The general consensus is that aggregate RERs may converge to parity in the long run, although the rate at which this happens is very slow, with half-lives (HL) in the range of 3–5 years (Rogoff, 1996). Thus, while the high volatility of real exchange rates could potentially be explained by monetary or financial shocks, the rate of reversion to parity seems to be too slow to be compatible with plausible nominal rigidities, giving rise to the so-called *PPP puzzle*.

Several avenues have been pursued to shed more light on this issue. Recent literature has focused on the analysis of disaggregate real exchange rates, cf. Carvalho and Nechio (forthcoming), Crucini et al. (2010a,b), Crucini and Shintani (2008), Kehoe and Midrigan (2007), Imbs et al. (2005a) and Crucini et al. (2005), etc. One common finding is that there is a considerable degree of heterogeneity across sectors. Nevertheless, the relation between aggregate and sectoral RER persistence is more controversial. Some authors have found large divergences between sectoral and aggregate reversion rates. Using Eurostat data, Imbs et al. (2005a) report standard HL estimates in the range of 3–5 years when aggregate data are used, but considerably smaller, around 1 year, when sectoral data are employed. On the other hand, several authors have found very similar estimates using both types of data, suggesting that the *aggregation bias* is not a robust feature in the data (Gadea and Mayoral, 2009; Crucini and Shintani, 2008; Chen and Engel, 2005).

The results recently presented in Mayoral (2009) help to clarify the contrasting empirical findings outlined above. She has studied the relations between measures of persistence computed at different aggregation levels and has shown that there is a close connection between them. She proves that the impulse response (IR) function computed with aggregate

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data equals the average of the sectoral impulse responses and that a similar relation also holds for other scalar measures associated with the IR. These results are the starting point of this paper. They imply that since aggregate persistence—as measured by the IR or the associated scalar tools—is completely determined by the behavior of the sectors, the aggregate HL or the cumulative impulse response (CIR) can also be estimated using sectoral data. By using disaggregate information, it is possible to break down aggregate persistence into the persistence of its different subcomponents, thereby obtaining a lot of valuable information about the sources of aggregate persistence. Another interesting implication of her results is that they unveil the nature of the relation between sectoral and aggregate persistence: the aggregate response to a shock is the average of the individual responses and since averages are very nonrobust measures, a situation where most sectors present relatively quick reversion to parity, but where a few of them are highly persistent, is compatible with a highly persistent aggregate RER.

The goal of this paper is to investigate the causes of the slow reversion to parity of aggregate real exchange rates through the analysis of sectoral ones. Using highly disaggregate price data on a group of EU-15 real exchange rates (defined against the U.K. pound), a twofold strategy is implemented. First, aggregate RER persistence is broken down into the persistence of its different components. This allows us to identify interesting features of the sources that drive aggregate persistence and to show that it is determined, to a large extent, by the behavior of a limited number of sectors in the upper quantiles of the distribution of persistence. Second, the factors that have traditionally been put forward to account for the slow reversion to parity of RERs, in particular, the lack of arbitrage in nontradable goods and the existence of nominal rigidities combined with pricing-to-market are more thoroughly investigated. Special emphasis is placed on explaining the behavior of the upper (conditional) quantiles of the distribution of sectoral persistence because, as mentioned before, they determine, to a large degree, the persistence observed at the aggregate level. To do so, recent quantile panel regression techniques are employed.

Our main results can be summarized as follows. Firstly, a high degree of heterogeneity as well as high and positive skewness in the speed of reversion of EU sectoral RERs are documented. Sectors belonging to the durable category are those that show the lowest speed of reversion to parity: on average, they account for around 40% of the long-run cumulative effect of shocks to aggregate RERs. By contrast, services present the fastest speed of reversion.

Secondly, our quantile panel regression analysis shows that variables related to the market structure of the intermediate inputs and to the price stickiness of the final goods have a significant effect on sectoral persistence. Furthermore, the impact of these variables tends to be larger, the higher the quantile considered. Interestingly, once the market structure of the intermediate inputs has been taken into account, that of the final goods does not appear to be important in explaining sectoral persistence. Finally, variables related to the tradability of goods are not significant either, implying that traditional theories that attribute the slow speed of reversion of RERs to the existence of nontraded goods in the consumption basket do not explain EU current trade patterns very well. These conclusions are in agreement with modern trade theories (cf. [Carvalho and Nechio, forthcoming](#); [Chari et al., 2002](#)).

The rest of the paper is structured as follows. Section 2 presents a brief overview of the literature that has dealt with RER persistence at different levels of aggregation. Section 3 introduces the variables that are used in the paper as well as the different databases employed in their construction. Section 4 provides estimates of aggregate RER persistence computed with both aggregate and sectoral data, tests whether these estimates are equal and explores the distribution of sectoral persistence. Section 5 analyzes whether the traditional theories (lack of arbitrage due to nontradability and/or imperfect competition and price stickiness) are able to explain the distribution of sectoral persistence. Section 6 concludes. An Appendix presents additional explanations not included in the main text.¹

2. Related literature

There is a considerable evidence of a large degree of sectoral heterogeneity in the speed of reversion of RERs ([Crucini and Shintani, 2008](#); [Imbs et al., 2005a](#)). Starting with the contribution of [Imbs et al. \(2005a\)](#) (IMRR henceforth), several papers have looked at the causal relation between heterogeneity in sectoral exchange rates and the slow speed of reversion observed at the aggregate level. IMRR show that persistence estimates based on sectoral RERs are, on average, considerably smaller than those obtained for the aggregate rate itself. They argue that estimates of aggregate persistence rely upon the implicit assumption that relative prices converge to parity at the same speed, and that it is precisely the failure to allow for heterogeneity in adjustment dynamics at the sectoral level which induces a positive bias in persistence estimates when aggregate data are employed.

To illustrate their main arguments, consider a very simple model for the sectoral exchange rate in sector i , $q_{i,t}$, which allows for heterogeneous speed of price adjustment

$$q_{i,t} = \gamma_i + \alpha_i q_{i,t-1} + v_{i,t}, \quad (1)$$

$$v_{i,t} = \rho_i u_t + \varepsilon_{i,t}, \quad (2)$$

¹ This appendix can be found in the online version of the paper.

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