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On price convergence in Eurozone ☆

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ABSTRACT

We investigate price level convergence with Germany in eleven countries belonging to the Eurozone between January 1970 and July 2011. Relying on smooth transition regression models, we show that the price convergence process is nonlinear, depending on the size of the price differential: for most countries, price convergence occurs only when price differentials with Germany exceed a certain threshold. Moreover, our findings put forward some heterogeneity across the Eurozone members in terms of price convergence speed, that can be explained by the evolution of price-competitiveness, rigidities in labor markets, but also by specialization patterns.

1. Introduction

One controversial criterion to enter the EMU is the convergence of inflation rates, which is based on the similarity of inflation rates rather than on a convergence in price levels. After the efforts made in 1996–1997 to reach EMU criteria, inflation rates have diverged within the Euro area.

Though part of it may be explained by the Balassa–Samuelson effect, this divergence has involved significant real interest rate differentials within the zone; some countries experiencing negative real interest rates that have encouraged debt bubbles. Fleming (1971) was the first to highlight the importance of price level convergence between members of a monetary union under the Optimum Currency Areas' theory. According to him, the main optimality criterion rests in the similarity of inflation rates between members: spreads of relative costs that are not offset by productivity gains lead immediately to a loss in competitiveness via a deterioration in terms of trade. In turn, this leads to a demand reallocation from "high inflation" countries to "low inflation" ones, generating external disequilibria between economies (deficits for high inflation countries and surpluses for low inflation countries). This risk did materialized in the Euro area between 1999 and 2009, with a number of higher inflation countries undergoing internal imbalances (excess leverage, asset price bubbles) and external deficits. After the sovereign debt crisis of 2009–2011, the question is whether these countries will manage in adjusting their price levels without the help of a nominal exchange rate devaluation, and how long this is going to take.

This question of price convergence is obviously crucial in a monetary union, and especially in the case of the recent experience of the EMU. Indeed, even if multiple factors may explain the current sovereign debt crisis, one possible important reason lies in the heterogeneity of price dynamics among members Guerreiro et al. (2012). Among the rules stated in the Maastricht Treaty and completed by the Pact of Stability and Growth, the main important one is surely price stability. In other words, price convergence appears as a key factor to ensure economic convergence and, consequently, stability and viability of a monetary union. The study of price convergence among EMU members is thus worthy of investigation.

The literature dealing with price convergence primarily relies on the empirical verification of the Law of one price (LOOP) or the purchasing power parity (PPP). Four main approaches can be distinguished. The first one tries to circumvent the problems inherent to incomplete microeconomic panels by focusing on a specific market. Goldberg and Verboven (2005) pay a special interest to the price dispersion on the car market in five European countries (Germany, Belgium, Italy, France and United Kingdom). The results show that there is price convergence that tends to validate the relative – and to a lesser extent the absolute – LOOP hypothesis. As the authors point out, however, it is difficult to extend this conclusion to other goods. Lutz (2003) achieves a comparable study based on the Big Mac indicator of *The Economist*, and on the price

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of five varieties of cars within the Eurozone. The results are at odds with those of Goldberg and Verboven (2005), since the introduction of the euro seems to have only little effect.[1]

The second approach consists in transforming microeconomic panels to obtain comparable individuals (see Engel and Rogers (2004), Crucini et al. (2005) and Rogers (2007)). Using the *Economic Intelligence Unit* database, Engel and Rogers (2004) and Rogers (2007) analyze the price of "standard" goods measured in 18 cities belonging to the Eurozone. The results are broadly similar in the sense that a reduction in price dispersion is found before the launch of the euro, during the implementation of the European Single Act signed in 1986. Crucini et al. (2005) test the existence of LOOP by relying on the Eurostat database for four different years (1975, 1980, 1985, 1990), and also provide evidence of price convergence.

The third approach uses inflation rate differentials (see Honohan and Lane (2003) and Arnold and Verhoef (2004) among others). Beck and Weber (2005) show that the convergence process is nonlinear: adjustment speeds seem to decrease after the introduction of the euro. Moreover, they find that the dispersion of inflation rates decreases only before the introduction of the European currency.

Finally, the last approach is based on the consumer price index (CPI). Camarero et al. (2000) tackle the price convergence between peripheral countries of the EU (Spain, Italy, United Kingdom) and Germany through time series unit root tests, and find evidence of a catching-up effect. Cecchetti et al. (2002) assess the price convergence between 19 US cities using panel unit root tests. According to Faber and Stockman (2009), as well as Crucini et al. (2005), CPI may be useful only for testing the relative PPP (convergence in inflation rates) and not the absolute PPP (convergence in price levels). Recalculating CPI that take into account price differentials between countries, Faber and Stockman (2009) find that price dispersion has decreased through time for countries belonging to Eurozone. Allington et al. (2005) rely on the comparative price levels (CPL) supplied by Eurostat, and put forward a significant effect of the euro which leads to a reduction of price dispersion in EMU.

Falling in this latter approach, our aim in this paper is to investigate price convergence among twelve countries belonging to EMU. To this end, we consider monthly data over the January 1970 to July 2011 period. Relying on cointegration techniques, we show that the underlying linear hypothesis regarding the price convergence process may be viewed as too restrictive. To overcome this limit, we account for potential nonlinearities in the price adjustment process through the estimation of smooth transition regression models. These models allow us to put forward a different behavior of prices depending on whether price differentials are above or below a certain threshold. In other words, while price convergence may not be observed in a standard linear framework, it can be at play only when price differentials are important in terms of size. Furthermore, from the estimation of these models, it is possible to deduce mean-reversion speeds in the case of convergence.

The paper is organized as follows. Section 2 presents the data and some stylized facts. Section 3 reports the estimation results, and Section 4 discusses our findings. Finally, Section 5 concludes the paper.

2. Data and stylized facts

Testing price level convergence amounts to testing absolute PPP. Accordingly, we use the definition of "external" real exchange rate:

$$RER = NER.\frac{P^*}{P} \tag{1}$$

where RER is the real exchange rate, NER the nominal exchange rate (expressed as the number of domestic currency units per foreign currency unit), P the domestic price level, and P^* the foreign price level. Obviously, within a currency union, NER is equal to one since the currency is the same for all the members.

2.1. Data

Testing price convergence requires to select price series P and P^*. From a macroeconomic viewpoint, CPI is the key indicator. Although as an index it is useful to depict the evolution of prices (inflation), it gives no indication regarding the level of prices. CPI can thus not be used for testing the convergence of price levels.

To overcome this issue, we rely on the International Comparison Program (ICP) carried by the World Bank that aims at providing comparable international prices. Based on this framework, Eurostat and OECD have computed comparative price level (CPL) series for each European country. These CPLs are defined by the OECD as the ratio between purchasing power parity conversion factor for private consumption[2] and the nominal exchange rate. This ratio measures price level differences between two countries (in our case between a European country and the United States) and can be expressed as follows:

$$CPL_{i,t} = \frac{PPP_{i,t}}{NER_{i,t}} \times 100 \tag{2}$$

where $PPP_{i,t}$ stands for the PPP conversion factor for private final consumption of country i relative to the United States at time t, expressed in euros per US dollar, and $NER_{i,t}$ is the euro/dollar exchange rate at time t. Turning to data availability, CPLs are computed by Eurostat and OECD for each European country annually only since 1995. It is however possible to recover observations previous to 1995 using the price evolution relative to the US in each European country — i.e. using the relative CPIs corrected by the exchange rate variations. More specifically, we construct the monthly domestic price level series of country i on the period from January 1970 to July 2011 as follows:

$$P_{i,t} = \frac{PPP_{i,2005}}{NER_{i,2005}} \times \frac{\frac{CPI_{i,t}}{CPI_{i,2005}}}{\frac{NER_{i,t}}{NER_{i,2005}} \times \frac{CPI_{US,t}}{CPI_{US,2005}}} \times 100 \tag{3}$$

where $i = 1, \ldots, 12$ denotes the European country. $PPP_{i,2005}$ is the PPP for private consumption for country i relative to the US in 2005 (euros per US dollar). $CPI_{i,t}$, $CPI_{i,2005}$, $CPI_{US,t}$ and $CPI_{US,2005}$ are respectively the country i's CPI at time t and at year 2005, and the US CPI at time t and at year 2005. $NER_{i,2005}$ is the euro/dollar exchange rate in year 2005.

2005 has been chosen as the basis year because it corresponds to the year of the last ICP survey realized by the World Bank.[3] From Eq. (3), we thus obtain 12 series of price levels that can be used to test for price convergence. Given the importance of Germany in the Eurozone, we retain this country as the benchmark, and investigate convergence between each domestic price level series and the German one.

2.2. Stylized facts

Fig. 1 depicts German and domestic price levels (in logarithms) for each country over the period from January 1970 to July 2011. Price differentials and their evolution are quite different across countries during the period under study. Three groups can be distinguished. The first group is characterized by some price differentials at the beginning

[1] These results are very questionable as there is only one observation after the introduction of the euro.

[2] Following the World Bank definition, the PPP conversion factor for private consumption is the number of units of a country's currency required to buy the same amount of goods and services in the domestic market as a US dollar would buy in the United States, the conversion factor being applicable to private consumption.

[3] *PPP* series are extracted from the OECD database. NER and CPI series are from IFS, except the German and the Irish CPIs that come from Datastream.