

Regional inflation dynamics using space-time models

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PRELIMINARY – PLEASE DO NOT QUOTE

Abstract

This paper explains the heterogeneity of inflation dynamics at the regional and product level. It introduces two novel features with respect to previous literature: the use of space-time models that allow for a simultaneous estimate of the transmission of different types of shocks through space and time; and evidence for emerging markets (98 monthly commodity prices for 23 regions of Chile in 2002-2008). Preliminary estimation results show that space-dependency is found in 80% of the commodities, whilst the common factor determines inflation for only 10% of them. Existing literature had obtained the opposite result for Europe and the reasons for that difference warrant further investigation.

Keywords: regional inflation dynamics, space-time models, Chile

JEL codes: E31, E52, E58, R11, C23, C21

1. Introduction

It is generally argued that, according to the law of one price, individual prices in the different regions of a given country should be similar. Under conditions of perfect arbitrage, if prices differed in space, traders would try to profit from those differences by buying where prices were low and selling where prices were high. Over time, their actions would bring prices to line in the various locations.

There are, however, several factors that prevent such trading and lead to persistent price differences for the same products, both in space and over time. One obvious factor is transport costs that immediately drive a wedge between prices at the producer's and at the consumer's location. However, there is currently a consensus in the empirical literature about the persistence of deviations from the law of one price in excess of what could reasonably be attributed to transport costs. For example, Parsley and Wei (1996) study the convergence of 51 retail prices for 48 U.S. cities during the 1975-1994 period. They find that the hypothesis of unit root for the relative prices could not be rejected at the conventional levels in a significant number of cases. Cecchetti et al. (2002) consider a century-long panel of US commodity prices for major cities and estimate a very slow rate of convergence of 9 years on average. Beck *et al.* (2006) study the heterogeneity of regional prices in the Euro Area and the US, finding evidence of heterogeneity at the regional level that is explained by the size of the region's agricultural sector, the size of the region, output growth and output volatility.

Thus, the evidence so far has focused exclusively on the US and Europe. In this paper we attempt to explain the heterogeneity of inflation dynamics at the regional and sectoral level for an emerging market in South America (Chile). Chile is an excellent natural experiment due to its geography and climate that prevent perfect, or near-perfect, arbitrage in time and space. We aim

to identify the role of those factors that prevent price arbitrage in time and space at a disaggregated sectoral level. The results generated for the case of Chile can be transferable to other emerging markets to a varying extent and allow both regional and national policy-makers to better understand inflation dynamics in the particular context of emerging markets.

We use a panel of 98 monthly commodity prices for 23 regions of Chile that covers the period 2002-2008. As far as we are aware, this is the first attempt to investigate the heterogeneity of inflation dynamics for an emerging market with such level of detail. In order to study the sectoral and spatial interactions of the different commodity prices we will follow Beck *et al.* (2006) and estimate the effect of different factor models related to the Chilean and international economies on the evolution of the price series. Additionally, we compare this approach to the methodology suggested by Giacomini and Granger (2002) that consists on imposing a priori constraints on the amount of spatial correlation in the econometric system. By doing this we can estimate the transmission of economic shocks across time and space.

Section 2 briefly describes the econometric specification and section 3 summarizes some preliminary results.

2. Econometric specification

We estimate the following equation for each of the 98 commodities in the sample:

$$\pi_{i,t} = \alpha_i + \beta_1 \pi_{i,t-1} + \beta_2 \sum_{i \neq j} w_j \pi_{j,t} + \beta_3 \sum_{i \neq j} w_j \pi_{j,t-1} + \beta_4 f_t + \beta_5 f_{t-1} + \beta_6 \pi_t + \beta_7 \pi_{t-1} + \varepsilon_{it}$$

where $\pi_{i,t}$ is the annual inflation rate for the i -th city at time t ; w_j is the spatial weights given to the j -th region; f_t is the principal common factor for that commodity; π_t is the aggregate annual rate of inflation for Chile; and ε_{it} is the error term.

The neighbour's inflation rate provides a source of spatial heterogeneity in the model. For simplicity, it is assumed that only adjacent regions are neighbours. On the other hand, time heterogeneity is introduced by adding a one-period lag for all variables, including the dependent variable.

3. Preliminary results

Space-dependency is found in 79% of the commodities, whilst the common factor determines inflation for only 13% of them (Table 1). This result is the opposite of what Beck et al (2006) had found for Europe, where the common factor was the most important determinant of inflation dynamics. The reasons for this difference warrant further investigation. Moreover, the finding that neighbours matter more than common factors justifies the introduction of spatially lagged variables in models of determination of regional inflation.

Lagged dependent variable	100
Neighbour	79
Lagged neighbour	41
Common factor	13
Lagged Common factor	12
Aggregate Chilean inflation rate	13
Lagged aggregate inflation rate	15

Two possible explanations for the differences between our results and those of Beck et al (2006) are country-specific factors and a composition effect, as we analyse a particular set of commodities. In our sample, the common factor is important in a very small number of products that are homogeneous, relatively expensive and easily transportable. In addition to these, the neighbours' inflation rate explains a great deal of variability in the dynamics of some perishable

products (dairy, fruits and vegetables). Hence it seems that the composition of the product basket could play a role, however we should bear in mind that the conditions are very different in advanced economies and in emerging markets.

Further research will look into this issue.

References

Beck, G., Hubrich, K. And Marcellino, M., (2006). Regional inflation dynamics within and across Euro Area countries and a comparison with the US, European Central Bank, working paper 681.

Cecchetti, S., Mark, N. and Sonora, R. (2002). Price index convergence among united states cities, *International Economic Review* 43, 1081–1099.

Giacomini, R. and Granger, C.W.J., (2004), “Aggregation of space-time processes”, *Journal of Econometrics*, 118, 7-26.

Parsley, D. and Wei, S-J., (1996), “Convergence to the Law of One Price without Trade Barriers of Currency Fluctuations”, *Quarterly Journal of Economics*, 111, 1211-1236.