Title: Price Level Convergence Among Danish Cities and Retailers

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Purpose of the project

The purpose of this project is to analyze price convergence between regions/cities/retailers in the Danish economy. Earlier literature on the Law of One Price (LOOP) compares price movements across international borders and finds that there are deviations from LOOP that are fairly persistent. To get a better understanding of the sources of these deviations from LOOP, we focus on inter-city price differentials within the Danish economy where trade barriers are expected to be lower than in monetary unions and where the influence from the nominal exchange rate is eliminated. Our innovation is that we are not only analyzing price convergence between cities but also price convergence between individual items sold at different retailers in the same city. In this respect, our study extends earlier literature on inter-city price level differentials. To our best knowledge, there are no earlier papers analyzing these issues. A central theme is to examine how goods prices on individual goods converge to a common price level. There are a number of issues that are of interest in our study, in particular if there are structural differences between types of goods, the degree of price stickiness, the degree of competition and price setting behavior, i.e., whether firms use state-dependent or time-dependent pricing.

We employ a unique data set of micro data collected by Statistics Denmark used to compute the Danish CPI. The available sample is January 1997 to December 2005. The data is very detailed, for each price record we have the following information: The price of the item, the year and month, the brand name of the item, the name of the product category, a numeric code for a given retail chain, a numeric retail code and the zip code. This information allows us to identify and track each individual item. The product category code corresponds to the Classification of Individual Consumption (COICOP) 5-digit code. The database is made up of 2731841 monthly price records and the data is collected between the 7th and the 15th of every month.

Background

The Law of One Price (LOOP) states that the price on identical goods or baskets of goods should be the same in different regions within the same country or between different countries when measuring prices in the same currency. In other words, if we abstract from transport costs and other transaction costs, there should not exist any persistent price difference. If prices in two regions deviate, consumers will choose to transport the good from one region to another such that the price difference will be eliminated.

Empirical studies very often find large and persistent deviations from LOOP. One explanation as to why we observe these deviations is that markets are segmented (Debreu (1959)).[1] Using this argument, Engel (1993) examines price differences and price

[1]Debreu, G. (1959), *Theory of Value*, Yale University Press, New Haven.

convergence in US and Canadian cities and finds that the border effect is more important than distance when explaining price differences between cities.[2] Engel and Rogers (1996) support this result. The distance between regions and countries explains to a large degree why we observe price differences and deviations from LOOP.[3] Parsley and Wei (1996) study a panel with 51 goods prices from 48 US cities and find that the price levels in these cities converge at a higher degree than prices on the same goods in different countries.[4] They also find that the distance between cities only explains a small portion of this convergence. Cecchetti, Mark and Sonora (2002) study CPI's for 19 US cities over the period 1918 to 1995 and find a slow rate of convergence, the estimated half-life is nine years.[5]

Engel and Rogers (1995) analyze disaggregated price data for 23 countries including data for eight north American cities. They reach the conclusion that price differences are explained by exchange rate fluctuations.[6] One possible interpretation is that prices adjust very slowly. They also find support for the hypothesis that economic integration leads to smaller price differences. This conclusion is interesting as it suggests that price differences within a country or a monetary union will be eliminated in the long-run. We would therefore expect price differences to be much smaller and the degree of convergence more rapid in, for example, Denmark than in the euro area. This hypothesis is supported by Rogers and Jenkins (1995) who found empirical evidence suggesting very large price differences between countries and small within countries.[7] They find empirical evidence supporting LOOP for traded goods such as eggs but not for non-traded goods such as haircuts.

Common for the empirical studies discussed above is that they very often rely on data for Canada or the US or they study a cross-section of few specific goods in different countries. There are only very few empirical studies for other countries. Esaka (2003) analyses price convergence for 13 groups of goods in seven Japanese cities over the period 1960-98.[8] He finds that the LOOP cannot be rejected but he does not report an estimate of the half-life of

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[2]Engel, C. (1993), "Real Exchange Rates and Relative Prices: An Empirical Investigation," *Journal of Monetary Economics*, 32:35-50.

[3]Engel, C. and J.H. Rogers (1996), "How Wide is the Border?" *American Economic Review*, 86:1112-1125.

[4]Parsley, D.C. and S-J Wei (1996), "Convergence to the Law of One Price without Trade Barriers or Currency Fluctuations," *Quarterly Journal of Economics*, 111:1211-1236.

[5]Cecchetti, S. G., N.C. Mark and R. J. Sonora, (2002), "Price Level Convergence Among United States Cities: Lessons for the European Central Bank," *International Economic Review*, 43, 1081-1099.

[6]Engel, C. and J.H. Rogers (1995), "Regional Patterns in the Law of One Price: The Roles of Geography Vs. Currencies," NBER Working Paper No. 5395.

[7]Rogers, J.H. and M. Jenkins (1995), "Haircuts or Hysteresis? Sources of Movements in Real Exchange Rates," *Journal of International Economics*, 38:339--360.

[8]Esaka, T. (2003), "Panel Unit Root Tests of Purchasing Power Parity Between Japanses Cities, 1960-1998: Disaggregated Price Data," *Japan and the World Economy*, 15, 233-244.

deviations from LOOP. Roos (2006) uses data for only one year (1993) and examines data on four groups of goods (goods, services, non-durables and durables) in 50 German cities.[9] He finds that prices converge very slowly, the estimated half-life is 15 years which is considerably slower than the conventional estimate of three to five years. Nenna (2001) suggests that the slow price convergence is explained by productivity differentials. She studies monthly regional CPI data from Italy over the period 1947-2000 and finds that both distance and productivity differentials (using data for the period 1980-95) explain why prices do not converge in Italy.

EU Commission publishes studies of price convergence on a regular basis. Those studies show that the price level has a tendency to be high in Northern Europe and low in Southern Europe. The common market in Europe has, however, had an effect on both the general price level as well as on the degree of price convergence but price differences are common, in particular, on regulated markets. Some of these differences can be explained by differences in living standard, taxes, transportation costs and exchange rate volatility.[10]

Policy relevance

The project has important policy implications. First, we employ a unique database that can give us new knowledge about price convergence between cities, between retailers and chains of retailers within a country. The results from our study can be used to evaluate the potential for price convergence within the euro area and therefore how economic integration (and absence of exchange rate fluctuations) affects price level differentials. Second, our analysis also has consequences for the design of monetary policy. If price convergence explains why there are inflation differentials between different locations, then this local price inflation is temporary and should not be used as arguments for a restrictive monetary policy. This may be of relevance both for countries and monetary unions. Third, we relate the degree of price level convergence to the actual price setting behavior (state-dependent versus time-dependent pricing) in the Danish economy documented by Hansen and Hansen (2007).[11] This might be useful when designing competition policy.

Project period: January 1, 2009 to December 31, 2009.

Expected result: Our plan is to produce at least one working paper that will be submitted for review to a leading journal.

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[9]Roos, M. W. M. (2006), "Regional Price Levels in Germany," *Applied Economics*, 38, 1553-1566.

[10]See, for example, Bergman, M., (2004), "Anpassas svenska priser till europeisk nivå?" (Do Swedish Prices Converge to the European Level?), *Ekonomisk Debatt*, 7, 21-36.

[11]Price formation in the Danish economy is documented in Hansen, B.W. and N.L. Hansen (2007), "Price Setting Behaviour in Denmark – A Study of CPI Micro Data 1997-2005," *Nationaløkonomisk Tidskrift*, 29-58.

Budget

1. Forbrug af forskningstid: Michael Bergman (3 måneder), Niels Lynggård Hansen og Morten Spange (0 måneder)

2. Vi har behov for forskningsassistance men kostnaden beregnes ikke overstige 8% af lønudgift.

3. Uden behov, Nationalbanken bidrar med data.

4. En konference rejse for Michael Bergman.