

## Price Convergence and Market Integration: Evidence from Malaysia

\*<sup>a</sup>LEE CHIN AND <sup>b</sup>MUZAFAR SHAH HABIBULLAH

<sup>a,b</sup>*Universiti Putra Malaysia*

### ABSTRACT

The purpose of this study is to assess the markets integration within Malaysia by examine the price convergence across Peninsular Malaysia, Sabah and Sarawak. Disaggregate monthly price data for various types of goods or services in Peninsular Malaysia, Sabah and Sarawak were utilized. The empirical evidence suggests that there is a price convergence for majority of price groups in Malaysia. With regard to the degree of persistence of deviations from purchasing power parity after a shock, our empirical results showed a half-life of 6.75 years for Malaysia. Among the commodity/price groups, half-life for the tradable goods is roughly 1-2 years and for nontradable goods is about 10 years. The implication of price convergence in Malaysia is the evidence of increase market integration among Peninsular Malaysia, Sabah and Sarawak.

**Keywords:** Consumer Price Indices, Price Convergence, Half-life, Panel Unit Root Test, Malaysia

### INTRODUCTION

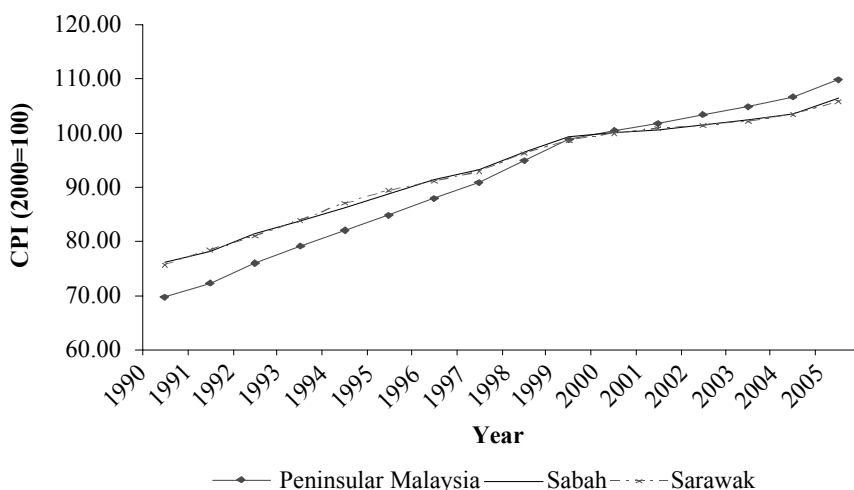
In recent years, the rapid regional cooperation has lead economists to examine market and regional integration. Various definitions and conceptions exist for the analysis of market integration. One of the concepts is the degree of market

---

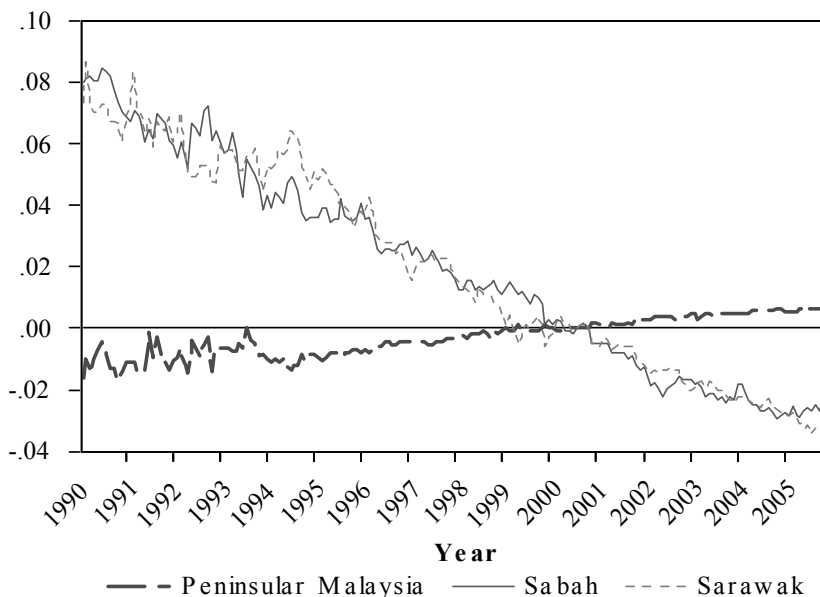
\* Corresponding author. Tel: +603 89467769, Fax: +603 89486188, E-mail: leechin@econ.upm.edu.my  
Any remaining errors or omissions rest solely with the author(s) of this paper.

integration is identified with the level of intermarket price differentials. If these differentials are large (in relative terms), then the market is poorly integrated; if on the contrary they are small, the market would be well integrated.

It should be reasonable to assume that the Sabah and Sarawak economy are well integrated with the Peninsular Malaysia economy. The provinces/states are belong to one country and have a similar legal heritage, speak the same language, and have largely free trade in capital, labour, and product markets. Despite these similarities, a quick look at the Figure 1 reveals that the prices are quite different in Sabah and Sarawak than they are in Peninsular Malaysia. This seems to suggest that the South China Sea that separates the Sabah and Sarawak from Peninsular Malaysia is matter. The impression one gets from the figure is that the price levels in Sabah and Sarawak are quite similar but they appear to be higher than the price level of Peninsular Malaysia from 1990-2000. Begin with five percentage points higher, the differences between the price levels become smaller and convergence in year 2000. The situation is opposite after the year 2000, the price level of Peninsular Malaysia becomes higher, and the divergence seems persistent for few years. Nevertheless, after the year 2004, the price levels of Peninsular Malaysia and Sabah exhibit some tendency of convergence (Figure 2). Figure 2 displays the log price of each of the 3 province/states relative to their cross-sectional average. The Peninsular Malaysia and Sabah relative prices seem to converge, showing reversion to the common mean over long time horizons. Begin with 9 % in year 1990, the deviation reduces to 3 % in 2005. The relative price in Sarawak seems to be downwards trended with no tendency to revert to the common average.



**Figure 1 Consumer Price Index for Peninsular Malaysia, Sabah and Sarawak**



**Figure 2 Relative Prices for CPI – All Items**

The purpose of this study is to assess the markets integration within Malaysia by examine the price convergence across Peninsular Malaysia, Sabah and Sarawak. Specifically, this study will identify whether relative price indices in Malaysia share a common trend, and if so, how quickly do they revert to that trend following a local shock to the price?

The outline of the paper is as follows. Section 2 briefly presents the concepts of price convergence and market integration. Section 3 introduces the method. Section 4 describes the data and presents some descriptive analysis while Section 5 reports the results of econometric analysis and discusses the findings. Finally, Section 6 concludes.

## **PRICE CONVERGENCE IN THE CONCEPT OF MARKET INTEGRATION: THEORY AND EVIDENCE**

In recent years, we have seen an enormous growth in the literature on market integration<sup>1</sup>. Several definitions and conceptions have been put forward giving

<sup>1</sup> For examples, the European Historical Workshop on Market Integration and various issues of the Journal of Common Markets.

rise to two main definitions or concepts. First, the degree of market integration is identified with the level of intermarket price differentials. If these differentials are large (in relative terms), then the market is poorly integrated; if on the contrary they are small, the market would be well integrated. Second, a region (or a market) is said to be integrated if “enough” arbitragers are present in the markets and if they are acting “efficiently” in a sense that supposes a number of conditions such as, for instance, the requirement of perfect information. In this conception, a market either is integrated or it is not; there is no room for a measure to reflect a certain degree of integration. However, it is very difficult to define market efficiency with a clear operational criterion while transportation costs and information on freight rates very often is not made public. Therefore, most of the statistical investigation has to rely on the first definition.

The studies of price convergence are closely related to studies on the law of one price and purchasing power parity (PPP). The law of one price establishes that the price of goods should equalize between economic areas. For the good  $j$  this implies that the ratio of relative prices  $P_{RELj}$  is equal to one:

$$P_{RELj} = P_1^j / P_2^j = 1 \quad (1)$$

where the subscripts 1 and 2 refer to countries or regions<sup>2</sup>. For further convenience it is preferable to specify the PPP in logarithmic terms:

$$PPP: \ln(P_{RELj}) = \ln P_1^j - \ln P_2^j = 0 \quad (2)$$

The law of one price usually fails to hold, as documented by Isard (1977) or Giovannini (1988). The existence of tariffs, nominal exchange rates (between countries) or transportation costs sets a wedge between the prices of the same products in different areas. However, more recent evidence has studied the law of one price within countries (i.e. within a monetary union), thus eliminating the effects of tariffs and nominal exchange rates (Engel & Rogers (1996), Parsley and Wei (1996)), and deviations from the law of one price persist.

In fact, there is wide consensus in that the PPP hypothesis should be most easily satisfied at an intranational level than when it is analyzed at an international level. Among the reasons for that are the higher markets integration, the absence of trade barriers such as tariffs and quotas and the absence of exchange rate volatility. In addition, price indices within a country are expected to be more homogeneous than price indices between countries since there are collected by the same statistical institution and the basket of goods is more homogeneous.

---

<sup>2</sup> The law of one price is typically defined for economic areas with different currencies. In this case, the price level for country 2, the ‘foreign’ country is specified in terms of the domestic currency  $P_2 = EP_1$ , where  $E$  is the nominal exchange rate.

The issue of price convergence across regions within a single economy has received increasing attention in recent literature. However, most of the empirical evidence on intranational price convergence has focused on the cities in North America and Europe – see Parsley and Wei (1996), Engel and Rogers (1996), Jenkins (1997), Engel and Rogers (2001), Cecchetti, Mark, and Sonora (2002), Chen and Devereux (2003), Ceglowski (2003), Sonora (2005) and Carrion *et al.* (2004). There are less empirical studies that address the intranational price convergence on other geographical areas. Exception are Esaka (2003), and Chaudhuri and Sheen (2004). Esaka (2003) examined whether thirteen disaggregated consumer price indices convergence between seven major Japanese cities while Chaudhuri and Sheen (2004) examined the intranational price convergence for eight goods/services across seven major Australia cities.

## METHODOLOGY

The analysis of this study is as follows. First we are interested in whether or not relative prices between provinces/states are unit-root processes. That is to say, we ask whether the relative prices between provinces/states contain a unit root, under which they will diverge from one another. The alternative hypothesis in our statistical tests is that the level of relative prices in various provinces/states converges to a steady-state value in the long run. For this purpose, we conduct Levin and Lin (LL) panel unit root test on the relative prices, or real exchange rates,  $q_{i,t}$

$$q_{i,t} = \ln(P_{i,t}/P_{0,t}) \quad (3)$$

where  $P_{i,t}$  is the consumer price index (CPI) for province/state  $i$  and  $P_{0,t}$  is the CPI for numerarie province/state.<sup>3</sup> If the unit root hypothesis cannot be rejected, we will conclude that intranational price convergence is rejected by the data. In this event, the price level of different provinces/states will tend to diverge over time. On the contrary, if the relative price is a mean reverting process, there exists a tendency for the price level to return to its equilibrium parity path. We will conclude that the relative prices converge to a steady-state value in the long run.

Second, having obtained evidence that relative prices converge across provinces/states, we are now interested in the speed of converge based on the persistence parameters: the  $\rho_i$ . The approximate half-life of a shock to  $q_{i,t}$  is computed as  $-\ln(2)/\ln(\rho_i)$ .

---

<sup>3</sup> For this study, the national CPI for Malaysia is used as the numerarie.

## DATA AND DESCRIPTIVE ANALYSIS

Our data source is the Department of Statistics Malaysia. Aggregate data as well as disaggregate data for consumer price index (CPI) for various goods or services in Peninsular Malaysia, Sabah and Sarawak were used. Our monthly data span is from 1990M2 to 2005M12, giving a panel of 189 observations through time for three provinces/states. Table 1 presents the basket of goods and services included in CPI together with their weights in the calculation of CPI Malaysia. Nine groups of goods and services are included in the calculation of CPI. There are Food; Beverages & Tobacco; Clothing & Footwear; Gross Rent, Fuel & Power; Furniture, Furnishings & Household Equipment; Medical Care & Health Expenses; Transport & Communication; Recreation, Entertainment, Education & Cultural Services; and Miscellaneous Goods & Services. The expenditure for each item in the basket of goods and services compared to the total expenditure is termed as the relative importance of the item. This relative importance reflects the weightage for the particular item in the CPI baskets. The effect on the price changes for a particular item depends on the weightage of that item in the consumers' expenditure. As can be seen from Table 1, Food; Gross Rent, Fuel & Power; and Transport & Communication are the three major consumers' expenditures, which comprise 75% of the total expenditure. The main groups of Food carried the highest weightage of 33.8%, followed by Gross Rent, Fuel & Power, 22.4% and Transport & Communication, 18.8%, respectively. Since the Food is the most important item, we are interested to further conduct separate tests according to its sub-groups: Food At Home and Food Away From Home.

**Table 1 Weights in Consumer Price Index for Malaysia**

Groupings of Goods and Services	Weights (%)
Food	33.8
Food At Home	24.1
Food Away From Home	<u>9.7</u>
Beverages & Tobacco	3.1
Clothing & Footwear	3.4
Gross Rent, Fuel & Power	22.4
Furniture, Furnishings & Household Equipment	5.3
Medical Care & Health Expenses	1.8
Transport & Communications	18.8
Recreation, Entertainment, Education & Culture Service	5.9
Miscellaneous Goods & Services	5.5
Total (All Items)	100.0

Note: Base year 2000=100

Source: Department of Statistics Malaysia

Table 2 presents the average inflation rates in Malaysia provinces/states for various commodity/price groups. At the aggregate level, Malaysia recorded an average price rise of 4.13 percent per annum during 1991-2005. Among the commodities, Beverages and Tobacco products recorded a slightly higher price rise (7.36 percent per annum), while price group like Recreation, Entertainment, Education & Culture Service recorded relatively lower price rise (less than 2 percent per annum). Among the provinces/states, Peninsular Malaysia recorded a higher rate of inflation (4.83 percent per annum) while Sarawak's inflation was the lowest (3.37 percent per annum).

**Table 2 Average Annual Inflation Rates across Malaysia Provinces/States: 1991-2005 (Percent)**

Goods	Malaysia	Peninsular		
		Malaysia	Sabah	Sarawak
All Items	<b>4.13</b>	<b>4.83</b>	4.20	<b>3.37</b>
Food	5.01	6.56	5.40	3.07
Food At Home	5.40	7.08	5.99	3.12
Food Away From Home	2.92	4.55	1.31	2.90
Beverages & Tobacco	<b>7.36</b>	9.79	6.26	6.02
Clothing & Footwear	2.69	3.19	2.45	2.42
Gross Rent, Fuel & Power	2.85	3.74	2.94	1.88
Furniture, Furnishings & Household Equipment	2.53	2.73	2.62	2.24
Medical Care & Health Expenses	3.31	3.79	2.21	3.94
Transport & Communications	5.31	4.17	5.72	6.03
Recreation, Entertainment, Education & Culture Service	<b>1.45</b>	3.14	0.21	1.00
Miscellaneous Goods & Services	2.83	1.97	3.14	3.39

## ECONOMETRIC ANALYSIS AND DISCUSSION

Table 3 reports the results from Levin-Lin (LL) test for aggregate price as well as commodity group price for Malaysia. The result showed that we are able to reject the null hypothesis of unit root for relative price for all items at 10 percent significance level. This suggested that the aggregate relative prices for Malaysia converge over time. For the disaggregate price level, we are able to reject the null hypothesis of unit root in more than half of the cases. Of the 9 main groups considered, LL test rejected the null hypothesis in 5 cases at the 10 percent significance level. The unit root null is rejected by the LL test for Food; Beverages & Tobacco; Clothing & Footwear; Gross Rent, Fuel & Power; and Transport &

**Table 3 Results from Levin-Lin Panel Unit Root Test**

Goods	test statistic	<i>p</i> -value	adj $\rho$	adj half-life
All Items	-1.333*	0.091	0.991	81.008
Food	-1.516*	0.065	0.974	26.560
Food At Home	-2.415***	0.008	0.969	22.149
Food Away From Home	-1.260	0.104	-	-
Beverages & Tobacco	-3.157***	0.001	0.946	12.453
Clothing & Footwear	-1.408*	0.080	0.944	12.137
Gross Rent, Fuel & Power	-2.583***	0.005	0.995	130.189
Furniture, Furnishings & Household Equipment	0.518	0.698	-	-
Medical Care & Health Expenses	-0.532	0.298	-	-
Transport & Communications	-1.621*	0.053	0.965	19.731
Recreation, Entertainment, Education & Culture Service	-0.990	0.161	-	-
Miscellaneous Goods & Services	0.293	0.615	-	-

Notes: \*\*\*, \*\* and \* denote significance at 1%, 5% and 10% level, respectively.

Communications. Evidence of stationary among these price groups (relative to a common numeraire) implied that shocks to state/province relative prices do not drive them away from the average Malaysia national prices. Hence, strongly support price convergence and market integration among these goods markets. As expected intranational PPP is hold for tradable goods such as Food; Beverages & Tobacco; Clothing & Footwear. It is interesting that PPP holds for Gross Rent, Fuel & Power; and Transport & Communications. It is conjectured that they may be nationally regulated prices. The LL test is unable to reject the null hypothesis for Furniture, Furnishings & Household Equipment; Medical Care & Health Expenses; Recreation, Entertainment, Education & Culture Service; and Miscellaneous Goods & Services. Hence, there exists divergence between price of these goods in different provinces/states and intranational PPP does not hold. These probably are the most non-tradable of goods. Further test on sub-groups of Food demonstrated that the relative price differentials for Food At Home tends to converge to the national average price level in the long-run while the gap of relative prices for Food Away From Home seems persistent over time.

The estimated half-life for overall relative price for Malaysia is 81 months or 6.75 years. Among the different commodity groups, Clothing & Footwear have the lowest half-life (12.1 months or 1.01 years), followed by Beverages & Tobacco (12.4 months or 1.04 years), Transport & Communications (19.7 months or 1.64 years), Food (26.6 months or 2.21 years), and Gross Rent, Fuel & Power (130.2 months or 10.85 years). For the sub-group of Food, the estimated half-life for Food At Home is about 22.15 months or 1.84 years. It is found that the convergence



rates for tradable category are much faster than nontradable category. Half-life of the price gap for tradable goods such as Clothing & Footwear; Beverages & Tobacco and food is roughly 1-2 years but 10 years for nontradable good like Gross Rent, Fuel & Power.

## CONCLUSION

In this paper, we have examined the issue of convergence of prices (CPI) in Malaysia at the aggregate and disaggregate level as well as for various commodity/price groups over the period 1990-2005. Based on the panel unit root tests, we found statistical evidence of price convergence between Peninsular Malaysia, Sabah and Sarawak for majority of price groups in Malaysia. For instance Food; Beverages & Tobacco; Clothing & Footwear; Gross Rent, Fuel & Power; and Transport & Communications. Most importantly, price convergence exists for the three major consumers' expenditures items. Evidence of mean reversion among these price groups suggested that the prices of these goods and services tend to converge over time. The results also revealed that there are significance differences in price levels across Peninsular Malaysia, Sabah and Sarawak for a few goods and services. Price groups for most of the non-tradable goods like Medical Care & Health Expenses; Recreation, Entertainment, Education & Culture Service; and Miscellaneous Goods & Services show little evidence of convergence. These markets were characterized by substantial price disparity. To sum up, evidence of stationary among the price groups of Food; Gross Rent, Fuel & Power; and Transport & Communication strongly support price convergence and market integration within Malaysia since the expenditures of three items comprises of 75% of the total consumers expenditure. With regard to the degree of persistence of deviations from PPP after a shock, our empirical estimates showed a half-life of 6.75 years for Malaysia. Among the commodity/price groups, half-life for the tradable goods is roughly 1-2 years and for nontradable good is about 10 years. Tradable goods prices adjust more rapidly than both nontradable goods and the overall index. In conclusion, the greater the good towards the nontraded end, the less likely as PPP to hold or price converges, and the longer the expected half-life of the adjustment process.

The implication of price convergence in Malaysia is the evidence of increase market integration among Peninsular Malaysia, Sabah and Sarawak. One explanation for price convergence in Malaysia is the improvements in transportation and communications. The evidence of price convergence more for tradables than nontradables further supports this view.

## REFERENCES

- Carrion-i-Silvestre, J. L., Barrio, T. D. and López-Bazo, E. (2004) Evidence on the Purchasing Power Parity in Panel of Cities, *Applied Economics*, **36**, 961-966.
- Cecchetti, S. G., Mark, N. C. and Sonora, R. J. (2002) Price Level Convergence Among United States Cities, *International Economic Review*, **43**, 1081-99.
- Ceglowski, J. (2003) The Law of One Price: Intranational Evidence for Canada, *Canadian Journal of Economics*, **36**, 373-400.
- Chaudhuri, K. and Sheen, J. (2004) Purchasing Power Parity across States and Goods within Australia, *Economic Record*, **80**, 314-329.
- Chen, L. L. and Devereux, J. (2003) What Can US City Price Data Tell Us about Purchasing Power Parity? *Journal of International Money and Finance*, **22**, 213-222.
- Engel, C. and Rogers, J. (1996) How Wide is the Border, *American Economic Review*, **86**, 1112-1125.
- Engel, C. and Rogers, J. (2001) Violating the Law of One Price: Should We Make a Federal Case Out of It, *Journal of Money Credit and Banking*, **33**, 1-15.
- Esaka, T. (2003) Panel Unit Root Tests of Purchasing Power Parity between Japanese Cities, 1960-1998: Disaggregated Price Data, *Japan and the World Economy*, **15**, 233-244.
- Giovannini, A. (1988) Exchange Rates and Traded Goods Prices, *Journal of International Economics*, **24**, 45-68.
- Isard, P. (1977) How Far can We Push the 'Law of One Price', *American Economic Review*, **67**, 942-948.
- Jenkins, M. A. (1997) Cities, Borders, Distances, Non-Traded Goods and Purchasing Power Parity, *Oxford Bulletin of Economics and Statistics*, **59**, 203-213.
- Parsley, D. C. and Wei, S. J. (1996) Convergence to the Law of One Price without Trade Barriers of Currency Fluctuations, *The Quarterly Journal of Economics*, **111**, 1211-36.
- Sonora, R. J. (2005) City CPI Convergence in Mexico, *Review of Development Economics*, **9**, 359-367.