# METROPOLITAN HOUSE PRICES IN INDIA: DO THEY CONVERGE?

AYE. Goodness C. [1]
GOSWAMI, Samrat[2]
GUPTA, Rangan[3]

**Abstract**
The paper examines the long-run behavior of house prices by addressing the issue of price convergence or divergence across fifteen metropolitan cities in India. Using available city-level quarterly data covering the period 2007-2011 and applying the Im, Pesaran and Shin (2003) panel unit root test, it is found that relative price levels among various metropolitan cities in India do not converge. This implies that the Law of One Price does not hold in the Indian housing market, hence the different metropolitan house markets operate independent to one another.
*JEL Classification: D40, L85*
*Keywords: House Prices, Law of One Price, Price Convergence, India*

## 1. Introduction

Since the inception of the theory and idea of development, the common feature that emerged in different point of time is the developmental gap that emerged in different parts of the world and also among various parts of a country in a particular time period. This disparity in development, like many other indicators, has also been reflected in India. Traditional development theories believed that agriculture, industrialisation, urbanisation, are significant ingredients of growth, and, ultimately important prerequisites for achieving development. Within the economy itself, the status of growth of a state can be judged through its performance in agricultural and industrial production, performance of service sector and urbanisation, and their impact through their contribution in income and employment generation at the national level. Thus, house price behaviour may also reflect some short of developmental status of the households of a country. Keeping in view the above fact of rapid urbanisation and regional disparities, it is not unexpected that it may lead to some sort of differences in regional house prices, where housing and real estate are considered as major sources of physical and financial asset. This also leads to the differences in the dynamics of house price determination. It simply means that there might be shift of house prices in cities from average, in the country, depending upon its economic status. For instance, average house prices in the poorer provinces might be lower than the national average. Similarly, for richer states, the urban house prices, on average might be higher than the national average.

[1]Postdoctoral Research Fellow, Department of Economics, University of Pretoria,South Africa. Email: goodness.aye@up.ac.za.
[2]Assistant Professor, Department of Rural Management & Development, Tripura University, India. Email: sam449@gmail.com.
[3]Corresponding author. Professor, Department of Economics, University of Pretoria, South Africa. Email: rangan.gupta@up.ac.za.

The Times of India (2012) report indicates that housing prices in India witnessed the steepest rise in the world in the last 10 years since 2001. "House prices in India have increased by 284% in real terms, after allowing for inflation — equivalent to an average annual rise of 14%. The upward movement could be due, significantly, to, rapid urbanisation, increase in population, migration from rural areas as a result of unsatisfactory performance in agriculture and expectation for better livelihood, in terms of greater earning possibilities in urban areas. Only couple of cities registered price decline in the last quarter of 2011. Hence, this paper focuses upon residential property prices in metropolitan cities in India, more specifically, on the study of fifteen metropolitan cities located at different parts of the country consisting Delhi, Mumbai, Bengaluru, Kolkata, Chennai, Jaipur, Lucknow, Hyderabad, Pune, Surat, Ahmedabad, Patna, Faridabad, Kochi and Bhopal. Due to their locations, the cities are having regional characteristics. Against this background, the basic question that arises is whether these fifteen metropolitan cities act as a single market or they work separately as segmented independent metropolitan housing markets within the country. In other words, does the Law of One Price (LOOP) hold true in the housing market of the fifteen metropolitan cities of India? Although a number of studies have been conducted for some countries to determine the convergence of house prices in the respective regions[4], to the best of our knowledge, no such study has been conducted for India.

## 2. House Price Determination: Theoretical Aspects

The standard price behaviour of a good or its close substitute reveals the same price movements and they generally vary within a price range, when they are sold at markets located at different places (Shepherd, 1997; Lipczynski et al., 2005). Two houses in two different locations are believed to be sold within the same market, if house prices in one location impose a competitive constraint on house prices in the other location (Motta, 2004; Carlton and Perloff, 2005). For example, whether a home owner is free to set the price of his house in, say, Kolkata without any difficulty that may occur from the house going to be sold in Delhi or in Mumbai or in any other city in the country. Here, two different situations may arise. In the first situation, the home owner in Kolkata may face problem in setting a competitive price of his house. In the second situation, he may not face the same and can freely set the price of his house. If situation one arises, then it will imply that residential house market in Kolkata is an integrated part of the single house market prevailing in the country and there exists less scope of price fluctuation in the long run. Therefore, LOOP holds when the housing market is single and not segmented, and their absolute prices should converge. It means that relative prices of the houses should be mean reverting or stationary. If the second situation arises and the home owner can freely set the price of his house, then it will imply that Kolkata and other cities are having the residential housing market of their own and the house price in one part of the country is not going to pose any threat to the house prices to be set in other parts of the country and there exists a possibility of price divergence in the longer run.

[4] See Drake, 1995; Holmes and Grimes, 2007; Burger and Van Rensburg, 2008; Das et al., 2010; Hiebert and Roma, 2010; Abbott and De Vita, 2011; Cook, 2011; Holmes et al., 2011; Lee and Chien, 2011; Canarella et al., 2012.

Studies on LOOP with respect to house prices usually consider two important questions. First, the homogeneity is questioned in the case of residential houses. This is because the housing is attached to various factors like environment, locality, connectivity, extent of urban facilities available surrounding the house. Moreover, some socio-cultural factors also play significant role in determining house prices. Hence, this leads to some extent heterogeneity among the houses to be sold and ultimately decreases the scope of arbitrage among the house prices in different geographical locations of the country. Thus, the absence of arbitrage can readily point to the absence of the existence of a single market. Although houses are heterogeneous, they all provide an unobservable homogenous, but non-tradable commodity called housing service, and thus, one can ignore the physical heterogeneity (Smith et al., 1988). Another important question that automatically arises is why would one expect prices of such non-tradable services to converge across geographical areas? As Burger and Van Rensburg (2008) indicate, the answer lies with the investors. The investment behaviour of large individual investors is importantly responsible for this price movement. These investors and speculators use to invest on more than one real estate placed in various locations with the primary objective of capital appreciation and to earn rental income. Understandably, this is an attempt to reduce risk or to create a balance between risk and return. Given this, if property prices in one area diverge too far from another area, an arbitrage opportunity always exists (Goetzmann, 1993; Montezuma, 2004).

## 3. Data and Empirical Procedure

The clear definition of the product is required to compare the products sold at different locations (Burger and Van Rensburg, 2008; Gupta and Das, 2008; Das et al., 2010). Hence, the paper concentrates on the price of residential properties which has been taken from the National Housing Bank (NHB) in the form of index. Unlike the South African house prices that have been captured for various categories of houses (Burger and Van Rensburg, 2008; Das et al., 2010), this study rely on simple house price index created only for the residential houses. The NHB pilot study was conducted primarily in five large cities (Delhi, Mumbai, Kolkata, Bengaluru and Bhopal) covering various regions of India. Later, it has been extended to ten more cities (Ahmedabad, Faridabad, Chennai, Kochi, Hyderabad, Jaipur, Patna, Lucknow, Pune and Surat) for larger representation of the residential housing market. Currently the NHB RESIDEX is constructed with 2007 as the base year. In the NHB, the index had earlier been calculated biannually, i.e. from January to June and July to December till 2009. From 2010 onwards, the index has been calculated on quarterly basis. In this study, the data from January – June 2007 to July – December 2009 has been interpolated to quarterly data for all 15 cities. Therefore, our study employs data from 2007Q1-2011Q4 giving a total of 20 quarters.

The movement of the residential house price index reflects the behaviour and type of the market prevailing in the country. The average real house price index is plotted in Figure 1. The average real house price index shows the trend of the house prices for the 2007Q1 to 2011Q4 time period for all 15 metropolitan cities. In summary, the average

house price trend is increasing throughout the considered time period with exception in 2010Q1, 2011Q1 and 2011Q3 where there are noticeable declines. The relative price movement for each of the metropolitan cities for the time period has been depicted in Figure 2.

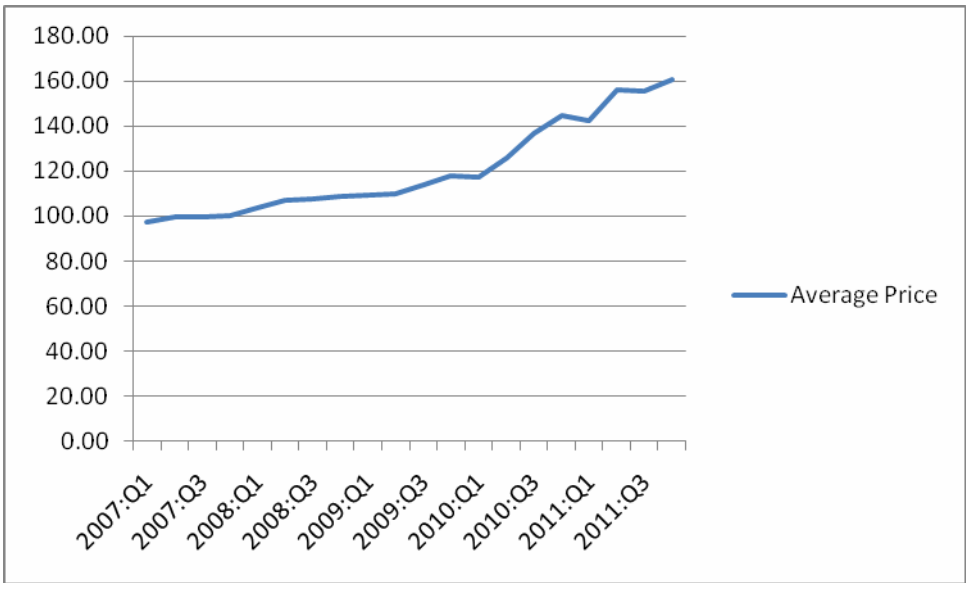


***Figure 1: Average Real House Price Movement for the 15 Metropolitan Cities (2007:Q1-2011:Q4)***

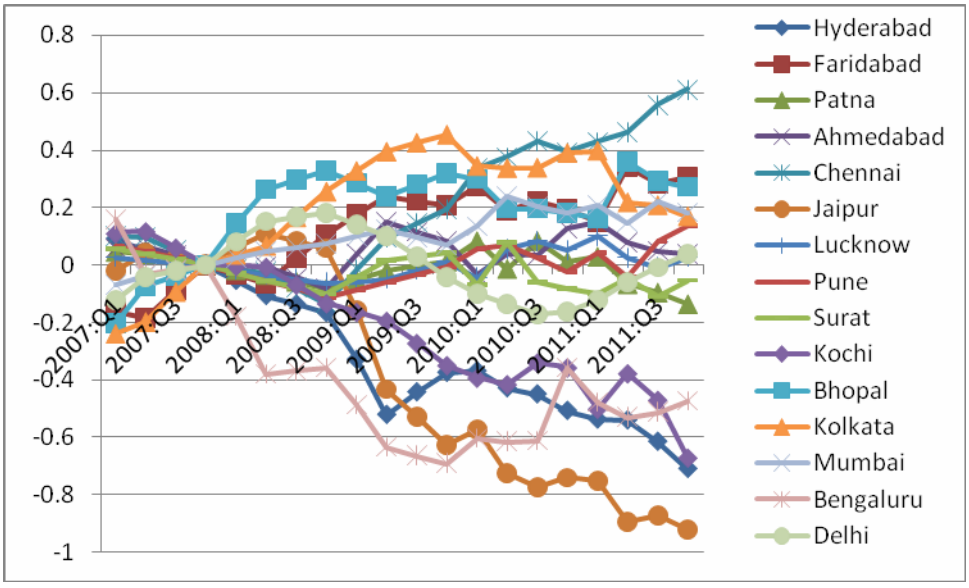


***Figure 2: Log relative price of the residential house prices***

The movement of the average price index shows an overall increasing trend with the passage of time. But whether the house price movement are having any variation across the metropolitan cities can be seen through the comparison of house prices in each metropolitan city with its cross sectional mean value. The relative price differential is defined by Equation 1.

$$y = \ln\left(\frac{p_{it}}{\overline{p}_t}\right) \tag{1}$$

where $p_{it}$ is the nominal price level of metropolitan area $i$, at time period $t$, and $\overline{p}_t$ is the cross-sectional average at time $t$. Note, convergence to the LOOP for the metropolitan house price would imply that $y$ is mean reverting or stationary (Dreher and Krieger, 2005). The common approach is to apply unit root tests, to examine the stationarity property of the variable under consideration. The rejection of the null hypothesis of a unit root would imply that the time series of relative prices, $y$, are stationary, implying that the relative prices will converge in the long-run. If we fail to reject the null hypothesis of unit roots, then the relative prices would be believed to follow a random walk. In other words, any deviation from the "one price" would be permanent (Fan and Wei, 2005) and hence, houses in different geographical locations would indicate the existence of separate housing markets.

The conventional Augmented Dickey-Fuller unit root test for a single time series has been critiqued of having low power, thus causing it to overly reject the stationarity of a time series.[5] To circumvent this problem, Levin, Lin and Chu (2002) (LLC) have shown that the use of a panel unit root test can significantly increase the power of a unit root test. However, the LLC test has two limitations: it assumes independence across individual time series and homogeneity regarding the presence or absence of a unit root among the series. To address these restrictions, Im, Pesaran and Shin (2003) (IPS) put forward a panel unit root test that allows for residual serial correlation and heterogeneity of the dynamics and error variances across groups. Therefore, in this study, we employ the IPS unit root test to examine the convergence of the relative house prices in 15 metropolitan cities in India for a period of 20 quarters.[6] Given the large data requirement of the conventional Akaike Information Criterion (AIC) which is violated by our small data set, we use both the Modified Akaike Information Criterion (MAIC) and Modified Schwarz Information Criterion (MSIC) to select the number of lags. We conduct the test for the constant only and constant and trend cases.

[5] Note alternative ways of analyzing convergence are also based on cointegration techniques (see for example, Ahmed (2005), Hsing (2009) and Rashid (2009), Khokhar (2010)) and measures of half-life (see for example Sedgley and Elmslie (2004) and Mokoena et al. (2009)). See also Escobari (2011) and Iyer (2010).

[6] We also used the ADF-Fischer Chi-square test. The results are similar to the IPS test, hence are not reported.

## 4. Empirical Results

The result of the Im, Pesaran and Shin panel unit root test is presented in Table 1. The consistently high probabilities of the relative house prices indicate that the series is consistently non-stationary and therefore diverges indefinitely in the long-run. The lack of convergence of the relative house prices simply implies that separate metropolitan cities in India function as separate housing markets in their respective localities. In other words, the Law of One Price (LOOP) does not hold in Indian housing market case.

Table 1: Im, Pesaran and Shin (2003) Test Statistic and Probabilities of Relative House Prices

| | MAIC | | MSIC | |
|---|---|---|---|---|
| | Statistic | Prob. | Statistic | Prob. |
| Constant | 0.22738 | 0.5899 | 0.33900 | 0.6327 |
| Constant & Trend | 1.61812 | 0.9472 | 1.61812 | 0.9472 |

*, **, *** indicates statistical significance at the 10%, 5% and 1% levels, respectively.

## 5. Conclusions

This paper analyzes whether the Law of One Price (LOOP) holds in the housing market of fifteen metropolitan areas in India, namely Delhi, Mumbai, Bengaluru, Kolkata, Chennai, Jaipur, Lucknow, Hyderabad, Pune, Surat, Ahmedabad, Patna, Faridabad, Kochi and Bhopal. We test the existence of LOOP using the Im, Pesaran and Shin (2003) panel unit root test based on quarterly data on residential property prices covering the period of 2007Q1 to 2011Q4 of the Indian housing market. Based on the criterion of price convergence, house prices in the 15 metropolitan cities do not converge to the LOOP. This implies that the housing markets in the different areas operate as segmented independent local markets. Therefore, house prices in one location in India cannot impose a competitive constraint on house prices in other location, and as such a home owner can freely set the price of his house.

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House Prices Index (Raw Data)

| Date | Hyderabad | Faridabad | Patna | Ahmedabad | Chennai | Jaipur | Lucknow | Pune | Surat | Kochi | Bhopal | Kolkata | Mumbai | Bengaluru | Delhi | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2007:Q1 | 106,52 | 82,64 | 101,50 | 103,00 | 107,37 | 95,22 | 99,51 | 103,61 | 102,55 | 108,42 | 79,14 | 76,43 | 90,60 | 113,82 | 86,15 | 97,10 |
| 2007:Q2 | 104,35 | 82,64 | 103,00 | 106,00 | 109,47 | 103,48 | 100,98 | 104,12 | 103,06 | 111,58 | 92,05 | 81,43 | 95,73 | 96,05 | 95,38 | 99,29 |
| 2007:Q3 | 102,17 | 91,32 | 101,50 | 103,00 | 104,74 | 101,74 | 100,49 | 102,06 | 101,53 | 105,79 | 96,03 | 90,71 | 97,86 | 98,03 | 97,69 | 99,64 |
| 2007:Q4 | 100,00 | 100,00 | 100,00 | 100,00 | 100,00 | 100,00 | 100,00 | 100,00 | 100,00 | 100,00 | 100,00 | 100,00 | 100,00 | 100,00 | 100,00 | 100,00 |
| 2008:Q1 | 98,00 | 100,00 | 101,50 | 103,00 | 102,00 | 109,50 | 101,50 | 100,50 | 100,50 | 103,00 | 119,50 | 107,00 | 106,00 | 86,50 | 112,00 | 103,37 |
| 2008:Q2 | 96,00 | 100,00 | 103,00 | 106,00 | 104,00 | 119,00 | 103,00 | 101,00 | 101,00 | 106,00 | 139,00 | 114,00 | 112,00 | 73,00 | 124,00 | 106,73 |
| 2008:Q3 | 94,00 | 110,50 | 101,50 | 103,00 | 99,50 | 117,00 | 102,50 | 99,00 | 99,50 | 100,50 | 145,00 | 127,00 | 114,50 | 74,50 | 127,00 | 107,67 |
| 2008:Q4 | 92,00 | 121,00 | 100,00 | 100,00 | 95,00 | 115,00 | 102,00 | 97,00 | 98,00 | 95,00 | 151,00 | 140,00 | 117,00 | 76,00 | 130,00 | 108,60 |
| 2009:Q1 | 78,50 | 130,00 | 103,50 | 113,50 | 107,50 | 93,00 | 103,00 | 100,00 | 104,50 | 92,50 | 145,00 | 151,00 | 120,00 | 67,00 | 125,50 | 109,00 |
| 2009:Q2 | 65,00 | 139,00 | 107,00 | 127,00 | 120,00 | 71,00 | 104,00 | 103,00 | 111,00 | 90,00 | 139,00 | 162,00 | 124,00 | 58,00 | 121,00 | 109,40 |
| 2009:Q3 | 73,00 | 142,00 | 113,00 | 127,50 | 131,50 | 67,00 | 111,50 | 110,00 | 117,00 | 86,50 | 150,00 | 173,50 | 125,00 | 58,50 | 117,00 | 113,57 |
| 2009:Q4 | 81,00 | 145,00 | 119,00 | 128,00 | 143,00 | 63,00 | 119,00 | 117,00 | 123,00 | 83,00 | 162,00 | 185,00 | 126,00 | 59,00 | 113,00 | 117,73 |
| 2010:Q1 | 81,00 | 154,00 | 127,00 | 113,00 | 164,00 | 66,00 | 112,00 | 124,00 | 109,00 | 79,00 | 158,00 | 165,00 | 134,00 | 64,00 | 106,00 | 117,07 |
| 2010:Q2 | 82,00 | 152,00 | 124,00 | 131,00 | 183,00 | 61,00 | 133,00 | 135,00 | 136,00 | 83,00 | 153,00 | 176,00 | 160,00 | 68,00 | 110,00 | 125,80 |
| 2010:Q3 | 87,00 | 170,00 | 148,00 | 141,00 | 210,00 | 63,00 | 148,00 | 140,00 | 128,00 | 97,00 | 166,00 | 191,00 | 167,00 | 74,00 | 115,00 | 136,33 |
| 2010:Q4 | 87,00 | 176,00 | 146,00 | 164,00 | 214,00 | 69,00 | 152,00 | 141,00 | 133,00 | 101,00 | 173,00 | 213,00 | 173,00 | 101,00 | 123,00 | 144,40 |
| 2011:Q1 | 83,00 | 165,00 | 146,00 | 165,00 | 218,00 | 67,00 | 157,00 | 148,00 | 128,00 | 86,00 | 167,00 | 211,00 | 175,00 | 88,00 | 126,00 | 142,00 |
| 2011:Q2 | 91,00 | 220,00 | 146,00 | 169,00 | 248,00 | 64,00 | 160,00 | 150,00 | 149,00 | 107,00 | 224,00 | 194,00 | 181,00 | 92,00 | 147,00 | 156,13 |
| 2011:Q3 | 84,00 | 206,00 | 141,00 | 163,00 | 271,00 | 65,00 | 154,00 | 169,00 | 139,00 | 97,00 | 208,00 | 191,00 | 194,00 | 93,00 | 154,00 | 155,27 |
| 2011:Q4 | 79,00 | 218,00 | 140,00 | 167,00 | 296,00 | 64,00 | 165,00 | 184,00 | 152,00 | 82,00 | 211,00 | 190,00 | 193,00 | 100,00 | 167,00 | 160,53 |

Relative House Price Index

| Date | Hyder abad | Farid abad | Patna | Ahmed abad | Chen nai | Jaipur | Luck now | Pune | Surat | Kochi | Bhopal | Kol kata | Mum bai | Benga luru | Delhi |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2007:Q1 | 1,097 | 0,851 | 1,045 | 1,060 | 1,105 | 0,980 | 1,024 | 1,067 | 1,056 | 1,116 | 0,815 | 0,787 | 0,933 | 1,172 | 0,887 |
| 2007:Q2 | 1,050 | 0,832 | 1,037 | 1,067 | 1,102 | 1,042 | 1,017 | 1,048 | 1,037 | 1,123 | 0,927 | 0,820 | 0,964 | 0,967 | 0,960 |
| 2007:Q3 | 1,025 | 0,916 | 1,018 | 1,033 | 1,051 | 1,021 | 1,008 | 1,024 | 1,018 | 1,061 | 0,963 | 0,910 | 0,982 | 0,983 | 0,980 |
| 2007:Q4 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 2008:Q1 | 0,948 | 0,967 | 0,981 | 0,996 | 0,986 | 1,059 | 0,981 | 0,972 | 0,972 | 0,996 | 1,156 | 1,035 | 1,025 | 0,836 | 1,083 |
| 2008:Q2 | 0,899 | 0,936 | 0,965 | 0,993 | 0,974 | 1,114 | 0,965 | 0,946 | 0,946 | 0,993 | 1,302 | 1,068 | 1,049 | 0,683 | 1,161 |
| 2008:Q3 | 0,873 | 1,026 | 0,942 | 0,956 | 0,924 | 1,086 | 0,952 | 0,919 | 0,924 | 0,933 | 1,346 | 1,179 | 1,063 | 0,691 | 1,179 |
| 2008:Q4 | 0,847 | 1,114 | 0,920 | 0,920 | 0,874 | 1,058 | 0,939 | 0,893 | 0,902 | 0,874 | 1,390 | 1,289 | 1,077 | 0,699 | 1,197 |
| 2009:Q1 | 0,720 | 1,192 | 0,949 | 1,041 | 0,986 | 0,853 | 0,944 | 0,917 | 0,958 | 0,848 | 1,330 | 1,385 | 1,105 | 0,614 | 1,151 |
| 2009:Q2 | 0,594 | 1,270 | 0,978 | 1,160 | 1,096 | 0,648 | 0,950 | 0,941 | 1,014 | 0,822 | 1,2705 | 1,480 | 1,133 | 0,530 | 1,106 |
| 2009:Q3 | 0,642 | 1,250 | 0,995 | 1,122 | 1,157 | 0,589 | 0,981 | 0,968 | 1,030 | 0,761 | 1,325 | 1,527 | 1,100 | 0,515 | 1,030 |
| 2009:Q4 | 0,687 | 1,231 | 1,010 | 1,087 | 1,214 | 0,535 | 1,010 | 0,993 | 1,044 | 0,704 | 1,375 | 1,571 | 1,070 | 0,501 | 0,959 |
| 2010:Q1 | 0,691 | 1,315 | 1,084 | 0,965 | 1,400 | 0,563 | 0,956 | 1,059 | 0,931 | 0,674 | 1,349 | 1,409 | 1,144 | 0,546 | 0,905 |
| 2010:Q2 | 0,651 | 1,208 | 0,985 | 1,041 | 1,454 | 0,484 | 1,057 | 1,073 | 1,081 | 0,659 | 1,216 | 1,399 | 1,271 | 0,540 | 0,874 |
| 2010:Q3 | 0,638 | 1,246 | 1,085 | 1,034 | 1,540 | 0,462 | 1,085 | 1,026 | 0,938 | 0,711 | 1,217 | 1,400 | 1,224 | 0,542 | 0,843 |
| 2010:Q4 | 0,602 | 1,218 | 1,011 | 1,135 | 1,481 | 0,477 | 1,052 | 0,976 | 0,921 | 0,699 | 1,198 | 1,475 | 1,198 | 0,699 | 0,851 |
| 2011:Q1 | 0,584 | 1,161 | 1,028 | 1,161 | 1,535 | 0,471 | 1,105 | 1,042 | 0,901 | 0,605 | 1,176 | 1,485 | 1,232 | 0,619 | 0,887 |
| 2011:Q2 | 0,582 | 1,409 | 0,935 | 1,082 | 1,588 | 0,409 | 1,024 | 0,960 | 0,954 | 0,685 | 1,434 | 1,242 | 1,159 | 0,589 | 0,941 |
| 2011:Q3 | 0,541 | 1,326 | 0,908 | 1,049 | 1,745 | 0,418 | 0,991 | 1,088 | 0,895 | 0,624 | 1,339 | 1,230 | 1,249 | 0,598 | 0,991 |
| 2011:Q4 | 0,492 | 1,357 | 0,872 | 1,040 | 1,843 | 0,398 | 1,027 | 1,146 | 0,946 | 0,510 | 1,314 | 1,183 | 1,202 | 0,622 | 1,040 |