India's movement to a Single Market :
Price Convergence among Indian States

인도 시장의 단일화 움직임

: 인 도 내 주 별 가 격 수 렴

2012年 8月

서울大學校 國際大學院

國際學 國際地域學 專攻

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인도 내 주 별 가격 수렴

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: Price Convergence among Indian States

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Abstract

India's movement to a Single Market
:Price Convergence among Indian States

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The aim of this paper is to find out if the law of one price(LOP) is holding in India and if India is moving toward a single market. Furthermore, this study tries to figure out reasons for the violation of Purchasing Power Parity(PPP) in India.

India is a nation with a single currency and the single central government. However, it is also significantly diversified country, as shown in various languages and culture, strong political power of state governments. In addition, there are fiscal impediments to trade such as sales tax imposed on movement of goods between different states.

The concept of single market used in this study is same as the one adopted by European Union. It means four fundamental freedom in

movement of goods, services, capital and people. Based on the concept, India is currently not a single market, due to fiscal charges and non-tariff barriers. It resulted in persistent price differential across regions in India.

One of the explanations for such violation of LOP is Harrod-Balassa-Samuelson hypothesis. It argues that productivity differential between traded and non-trade sectors of different regions lead to price differential. It can be applied to both across countries and across regions within a country. And the other is transportation costs proxied by distance.

The study employed general Consumer Price Index for Industrial Workers(CPIIW) of 38 cities of India, from 1971 to 2010. We define inflation differential of city i at time t as $Q_{it}=\ln(P_{it}/P_{nt})$, where Pit is inflation rate of city i at time t and P_{nt} is national inflation rate at time t. In descriptive data analysis, it is observed that there is persistent inflation differential across cities in India, however, they are converging to PPP, which implies its movement to a single market.

We examined determinants of such price differential and convergence trend by running regression of panel data. The analysis is carried out at city and state level, respectively, and before and after the economic liberalization in 1991. The result proved that distance and productivity differential are statistically significant variable and its impact

on price differential has increased after the liberalization. In other words, India is, currently, spatially segregated and H-S-B hypothesis holds in India since 1991. Yet, by examining time fixed effect, clear price convergence trend is observed at the same time.

In conclusion, though distance and productivity differential between regions have been functioning as impediments to market integration of India, it is getting closer to a single market.

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I.   Introduction

With free trade increasing, various studies have been conducted over the law of one price(LOP) at international level. Those studies have shown the law does not hold across countries due to trade barriers such as tariffs, transportation costs, exchange rate volatility and imperfect factor mobility. However, they have suggested that convergence at international level is happening.

Recently, many studies attempt to see if the law is holding within a country where such trade barriers do not exist. Intuitively, the law of one price is believed to hold domestically, as there is no volatile currency fluctuation with a single currency, no tariffs, no barriers to factor mobility and communication. However, it is revealed that the law is not holding at national level either. The literature studies price convergence rate and reason for price differential.

The aim of this paper is to find out if LOP is holding in India and if India is moving toward a single market. Furthermore, this work tries to find out reasons for the violation of Purchasing Power Parity(PPP) in India. India is a federal state like the United States. It is using a single currency under the single central government and reserve bank. This implies no exchange rate volatility and monetary policy difference across regions. Also, there is no apparent

obstacle to free factor mobility, such as *hokou* system in China. These facts suggest that the law of one price would hold. However, it is as diverse as cross country level. For example, its vast size of territory, different languages and culture, and sales tax imposed on trade of goods and services between states hinder unity as a nation at the same time.

Important features of this study are following. First, the present work uses yealy data to see the long term convergence trend. The time span covered in this study is 30 years, from 1971 to 2010 at center level, and 20 year at state level, from 1980 to 2009. To our knowledge, this is the first study to use India's annual price index to see price convergence and to employ the longest time span. Second, this work tries to figure out determinants of inflation differential across regions in india over the long haul. In this context, H-S-B effect will be tested at state level along with effect of distance on price differential. Third, in this study, we compare before and after economic liberalization in 1991 in regression analysis. Since 1991, India has accelerated their efforts to achieve competitive market. Accordingly, lots of changes have occurred to the national economy. Thus, it would be meaningful to see if liberalization accelerated market integration across regions in India.

Section II discusses theoretical background of this study and review the literature. Section III explains data used in this work and descriptive data is

analyzed in order to see price convergence trend. Section IV examines reasons for violation of PPP in India at both city and state level. Finally, Section V summarizes the findings and gives implication for India's further market integration.

II.   Theoretical Background and Literature Review

European Union adopted the concept of "Single market", which means fundamental freedom in movement of goods, services, capital and people. More specifically, it is a market within which there are no institutional or legal barriers to the free circulation of such products, so that producers or traders can sell with the same freedom across state borders as he can within his own state.(FAO,2005) As international trade is increasing and technology develops, many countries are trying to maximize economic efficiency by achieving a single market with other countries. European Union has been leading the trend.

India is also one of those countries, however, interestingly concern has been raised that it needs to turn the domestic market into a single market prior to integrating them internationally. In India at present there are no internal customs duties but certain fiscal levies and administrative orders are sometimes applied to restrict or prevent movement of goods.(FAO,2005) Thus, India is not

a single market, given the definition used in EU.

Law of one price(LOP), or purchasing power parity(PPP), refers to that an identical product has the same price regardless of its location. In other words, purchasing power parity would hold in a single market. At international level, a lot of studies have conducted to find out violation of the law. Various impediments have been found, such trade barriers as tariffs, exchange rate fluctuation. At national level, most of the studies have conducted on the United States to conclude that convergence rate is faster within a country but the deviation from PPP is persistent. This is against intuitive belief that LOP would hold domestically with no such apparent trade barriers.

One of the explanations for violation of PPP is Harrod-Balassa-Samuelson effect. It argues that productivity differential between two different regions lead to price differential in the long run. More specifically, cross-country productivity differentials between traded and non-traded sectors will lead to changes in real costs and the price of traded goods relative to the non-traded goods, and subsequently affect the real exchange rate, in particular for the medium and long-term.(Morshed, Ahn and Lee(2005). Nenna(2001) applied the hypothesis to Italia, which is monetary union. Since this factor is of a relatively long-term, structural nature, it can be expected to give rise to differentials in inflation within a monetary union,(Nenna (2001))

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There are a few works conducted on domestic market integration, or price convergence of India. Virmani and Mittal(2006) worked on spatial integration of India's domestic market. If the difference in prices between the two regions is only because of transport cost then the markets are said to be spatially integrated. (Virmani and Mittal(2006)) This work employed the consumer price/retail data of 2004 for disaggregated commodities and compared it with that of 1994 for selected commodities. It showed the evidence of the market integration across states and centers as well as among the commodity markets, comparing 1994 and 2004. They concluded that India is getting spatially integrated.

Morshed, Ahn and Lee(2005) and Das and Bhattacharya(2008) also worked on price convergence in India. Both studies focused on calculating price convergence rate of India. Morshed, Ahn and Lee(2005) used monthly consumer price indices for industrial workers(CPIIW) of 25 large cities for 156 months, from October 1988. It employed cointegration technique to calculate the rate of convergence to the PPP. Half-life issue was looked thoroughly and shock transmission was also studied. They proved that the rate of price convergence of India is faster than that of the existing literature. Das and Bhattacharya(2008) used CPIIW of 76 different cities for 114 months, starting from Janurary 1995. They calculated convergence rate using panel unit root test

and examined impact of distance and common or local shocks to inflation differentials. They studied the impact of distance both in short term and long term and of common and local shocks on price differential. The study showed that distance accounts for inflation differential between the regions across India. The significance of distance is higher in the short term of one month than in the long term of a year. Also, it concluded that local shocks are more permanent to the price than common factors.

III.   Data and Descriptive Data Analysis

1. Data

The price index used in the study is general Consumer Price Index for Industrial Workers(CPIIW) for 30 years, from 1970 to 2010, of 38 cities of India. At state level, we calculated the average of CPI of cities of 17 states for 20 years, from 1980 to 2009. We chose aggregate data to see the general convergence trend of price index including non-traded goods. The data is collected from India stat[1]. The content is same as the data collected by Labour Bureau of India but the site provides with data for longer span, starting from 1960. The original data set has

[1] www.indiastat.com

three different base year; 1960, 1982, 2001. To set the same base year of 1960 for all the data, we multiplied linking factor to the data with base year of 1982 and 2001. India stat also provides with the linking factor. A few lacked data was completed with data from EPW Research Foundation(EPWRF)[2]. For 30 years, names of several cities have changed and they were unified into the latest one. Appendix A presents the names of cities and States where they belong to.

Regarding determinants of inflation differential, effects of distance, H-S-B hypothesis, state and language are examined later part in the study. For distance, the actual travel/road distance has been used in this paper. The source is distance calculator on globefeed site[3]. As the minimum and maximum distances are given together, the average distance between two cities was chosen in this paper. In case of data for some region is lacked, we completed the data from whereincity website.[4] For the productivity of traded and non-traded goods of each state, which is required for H-S-B hypothesis examination, share of service sector in gross state domestic products(GSDP) was employed. GSDP and GSDP in service were collected from EPWRF for 20 years, starting from 1980. As GSDP data was available only from 1980 to 2009, state level analysis is conducted for less time period than that of city level. At state level, we also

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[2] www.epwrfits.in

[3] http://distancecalculator.globefeed.com/India_Distance_Calculator.asp

[4] http://www.whereincity.com/india

examined effect of language, especially Hindi, the most spoken language in India. The list of state belonging to Hindi belt, where Hindi languages are widely spoken, either as primary or secondary languages[5], are presented on Hindi Belt site[6].

2. Descriptive analysis

In this section, we present price differential among Indian cities and its converging trend over 30 years. We define inflation differential of city i at time t as $Q_{it} = \ln(P_{it}/P_{nt})$, where P_{it} is inflation rate of city i at time t and P_{nt} is national inflation rate at time t. The method was used in other studies to see the inflation deviation across the regions in US and India in previous works. (Cecchetti, Mark and Sonora(2002) and Fan and Wei(2003), Das and Bhattacharyya(2008)) In this study, we added 100 to inflation rate (P_{it} and P_{nt}, respectively) to get rid of negative value in the bracket. When the inflation rate is the same as the national level, the inflation differential is equal to zero.

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[5] www.hindibelt.com

[6] www.hindibelt.com
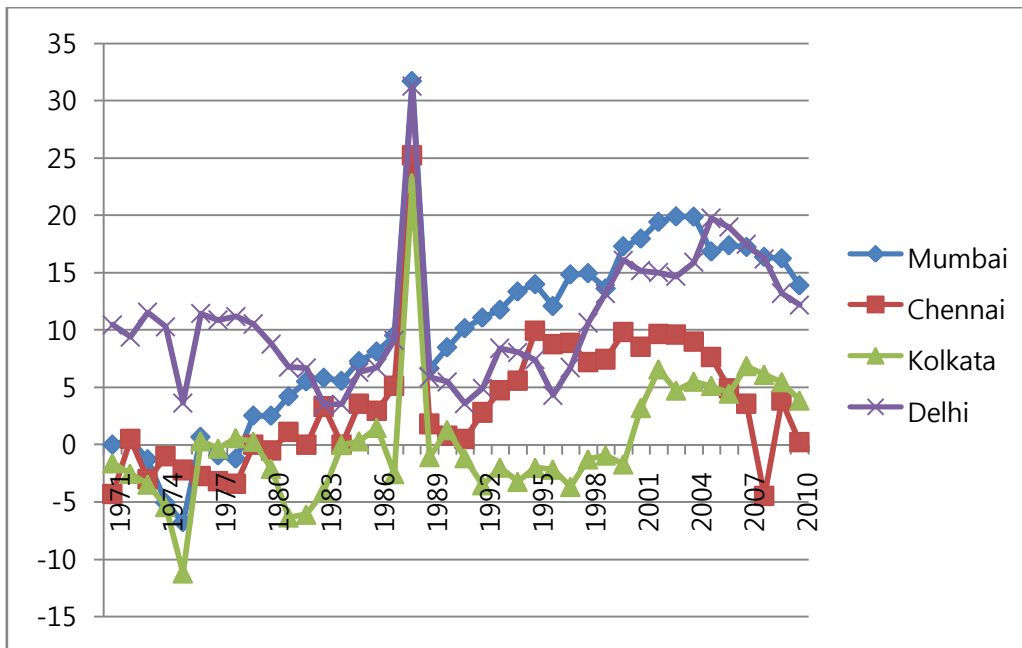
<Figure 1> Price variation of four metro cities of India, 1972-2010

<Figure 1> shows inflation deviation of 4 metro cities of India; Chennai, Delhi, Kolkata, and Mumbai. If the inflation rate of a city is same as the national level, the value of deviation should be 0 percent point. Kolkata shows converging trend for the most of the time, but the degree of deviation has increase since 2000. Chennai was also converged into national level, but it started to deviate since 1991. Mumbai and Delhi show quite severe deviation from PPP for given period and have shown upward trend until 2005. After 2006, Mumbai and Delhi both have recorded downward trend for 6 consecutive years. It is observed that deviation from PPP among metro cities of India is persistent and substantially high compared to US level. Cecchetti, Mark and Sonora(2002)

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showed that log price indices of US cities is within the range between -10 and 10 percent points from 1910 to 2000

<Figure 2> shows dispersion of the annual inflation rate difference among Indian cities for 29 years, from 1972 to 2010. The figure shows difference between the maximum and minimum inflation rates of each year. The bigger the difference is, the larger the divergence of prices. Even though the difference is recorded as high as around 10 in 2010, the trend line clearly shows that dispersion has become less after 1991.
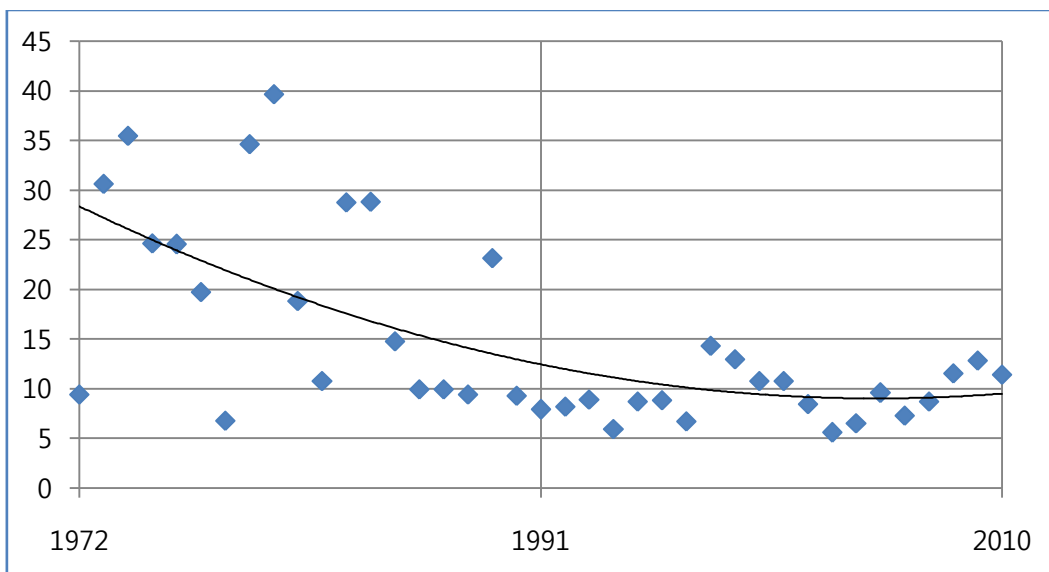
<Figure 2> inflation rate dispersion among Indian Cities,1972-2010

<Table 1> presents the difference for longer time span, 10 years and 20

years. We calculated the average inflation rate of each city for 10 years and 20 years, respectively.(Only from 1972 to 1980, it was calculated for 9 years.) <Table 1> shows the maximum and minimum value, and the name of city and state, which recorded that value. For example, from 2000-2010, Asanol of West Bengal state recorded the highest average inflation rate over 10 years, or 7.60 percent, while average annual inflation of 4.31 of Marinani-Jorhat in Assam state recorded the lowest in the sample. And the difference is 3.29 in this period. The difference has become smaller in longer time span than that of one year based sample.

<Table 1> Differentials of annual average inflation rate for longer span, 1972-2010

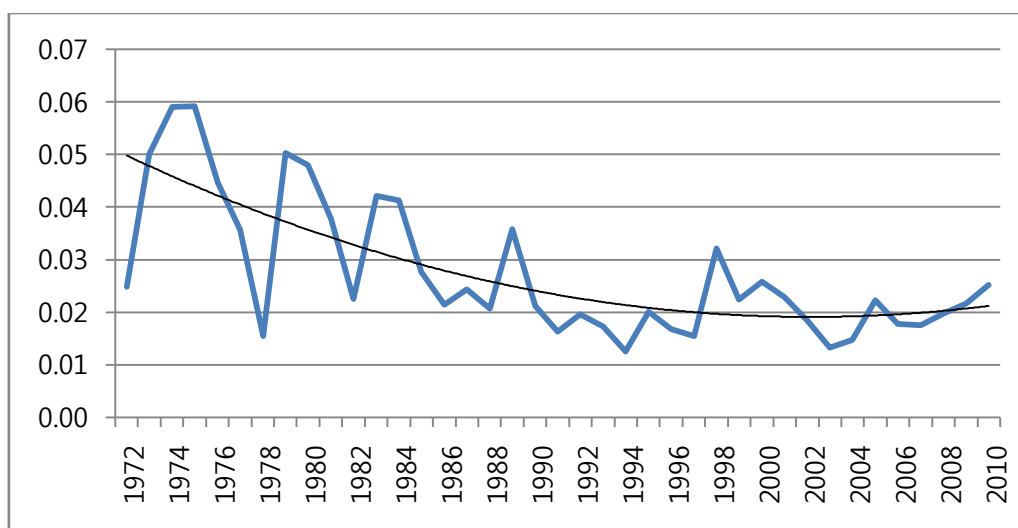|	**max**	State	city	**min**	state	city	**Difference**
1972-1980	10.71	Tamil Nadu	Coimbatore	7.57	West Bengal	Jalpaiguri	3.14
1981-1990	10.18	Madhya Pradesh	Bhopal	6.86	West Bengal	Raniganj	3.31
1991-2000	10.40	Jammu and Kashmir	Srinagar	7.61	Jharkhand	Jharia	2.79
2000-2010	7.60	West Bengal	Asansol	4.31	Assam	Mariani-Jorhat	3.29
						average	3.13
1972-1990	9.55	Madhya Pradesh	Bhopal	7.43	Assam	Labac-Silchar	2.12
1991-2010	8.41	Jammu and Kashmir	Srinagar	6.56	Assam	Mariani-Jorhat	1.85
						average	1.99

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It is observed that the city and state of maximum and minimum value keeps changing. For instance, West Bengal recorded the lowest inflation rate during 1972-1980, while the highest during 2000-2010. In other words, inflation rate of various regions of India reverse themselves. Cecchetti, Mark and Sonora(2002) looked into the dynamics of price adjustment based on the same table for the US. The same method applied in the study. It is observed that there is little variation in the values of difference between 10-year average maximum and minimum values for the given period. This implies little change in the dynamics of adjustment. Another way to look at the dynamics is to compare the average of 10-year differences and 20-year difference, which is 3.13 and 1.99, respectively. The value for the 20-year span is almost two third of the previous value and this is another evidence of slow adjustment. We now move on to look at the convergence trend in depth.

Price variation can be estimated by price differential variability and mean absolute price differential. (Cecchetti, Mark and Sonora(2002)) Price differential variability is defined as the standard deviation over time of the percentage price difference $Q_{tt}=\ln(P_{it}/P_{nt})$, (Fan and Wei(2003). Thus, we need to look at standard deviation of inflation differential, which used in the above analysis. Figure 3 shows trend of price differential variability from 1972 to

2010. The trend line clearly shows decreasing price differential variability. And the trend has become quite stable at the level of 0.2 since 1995. Such convergence can be partially explained by increasing commercialization, development of communication and transport facilities, and expansion of market network. (Virmani, Ahn and Lee(2005))

This descriptive data analysis suggests that there is persistent inflation differential across cities in India, however, they are converging to PPP, which implies its movement to a single market. Now, we are moving on to the regression analysis of determinants of such deviation.

<Figure 3 >price differential variability

IV. Determinants of Price differences and Convergence trend

In this section, determinants of price difference will be examined through regression of panel data at city and state level. At both level, we run regression for the full period, before and after liberalization in 1991, seperately. As India's economy has experienced significant change after economic liberalization in 1991, we look into explanatory power of the variables seperately.

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1. City Level

Dependent variable is absolute value of inflation rate gap between two cities of India. Independent variable is distance measured in 100km. One of the explanations for violation of PPP within a country is transportation costs. As it is impossible to estimate exact the costs due to insufficient data, distance has been used as substitute for the variable in the literature (Engel and Rogers (1996), Parsley and Wei (1996), Cecchetti et al (1998) and Nenna (2001), Das and Bhattacharya(2008).We examine influence of state government and time as dummy variables. State dummy variable takes 1, when a pair of cities belong to the same state. As India's state government has been increasing its political

power, impact of single policy under the state government needs to be examined. Time is another dummy for the fixed effect.
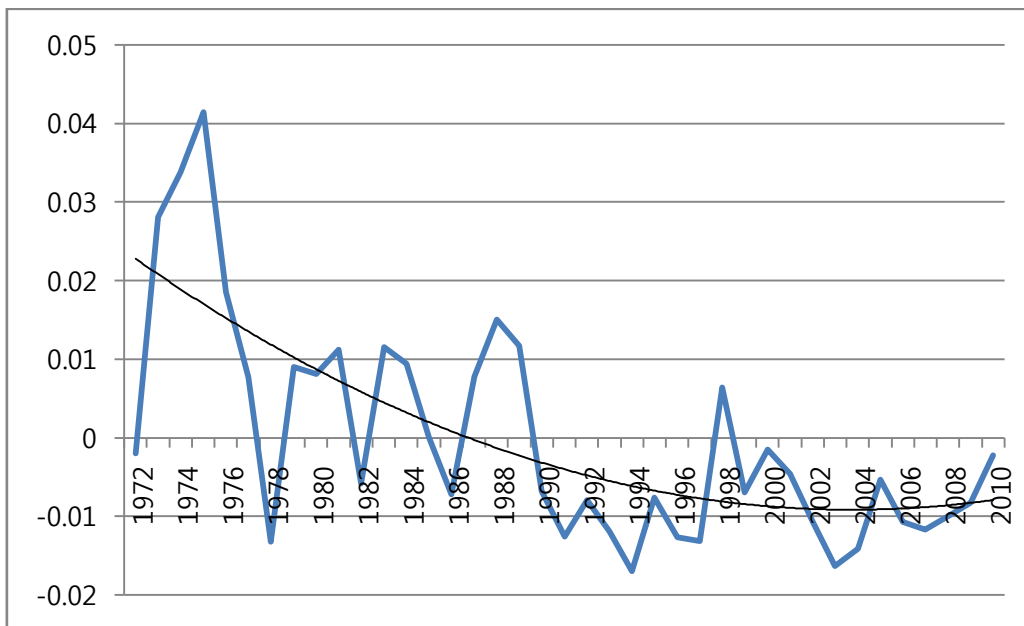
<Table 2> presents the results of regression. The second column is the result of the full period, while third is before 1991 and fourth is after 1991. To summarize the result at city level, the farther cities are, the larger the price difference. Interestingly, the significace of distance is bigger after 1991. State dummy is also turned out to be statistically significant over the full period. Beloning to the same state reduces price differential between cities. However, state dummy has become less insignificat after liberalization. Furthermore, the value has change into positive one from negative one.

Eventhough there is price differentials in India at city level, converging trend is observed, again. <Figure 4> shows fixed time effect and decreasing trend is obvious. Since 1990, the value becomes negative and it is evidence of price convergence among Indian cities.

<Table 2> regression results at city level

	1972-2010	1972-1990 (Before liberalization)	1991-2010 (After liberalization)
Distance(100km)	0.003 (10.29)	0.003 (5.97)	0.003 (12.97)
State	-0.006 (-6.29)	-0.011 (-5.74)	-0.002 (2.60)
Time	yes	yes	yes
R^2	0.15	0.09	0.10
no of observation	27416	13356	14060

Note : T values in parenthesis

<Figure 4> time fixed effect at city level

2. State level

Dependent variable is absolute value of difference of inflation rate between two states. As price data at state level does not exist, average of inflation rate of cities in a state is employed. Distance between states is proxied for distance between state capitals. To examine H-S-B hypothesis, data for productivity differential between states is required. In this study, absolute value of difference between service share in GSDP of two states is employed. Two dummy variables are examined at state level, one is language and the other is time fixed effect. In case of language, we tested impact of hindibelt, where 46 percent of India's total population live[7]. This dummy variable takes 1, when a pair of cities belong to hindibelt.

<Table 3> presents the regression results of three period at state level. For the full period(1980-2009), distance and service gap is statistically significant. When comparing before and after liberalization, significance of distance has increased after liberalization, as in the results at city level. On the other hand, significance of service gap is significant only after liberalization. It might be caused by increased trade between states in liberalized economy. It is because that mobility of factors changes price structure through wages and
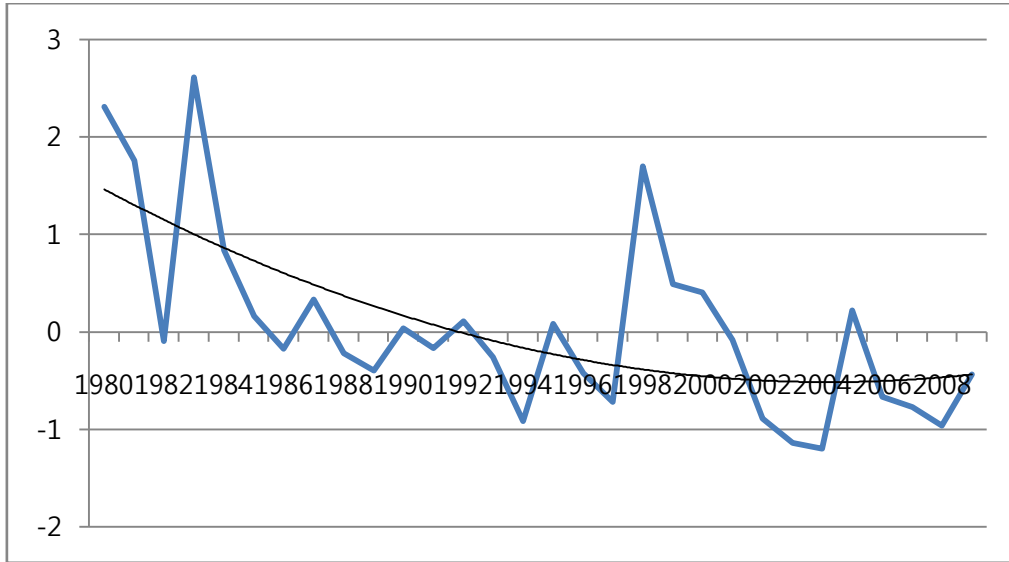
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[7] www.hindibelt.com

demand within a nation. Hindibelt was significant variable before liberalization, but it unexpectedly has positive effect to price differentials.

However, as in the city level results, converging trend is observed at state level, again. <Figure 5> shows time fixed effect at state level and its decreasing trend is clear. At state level, during 2000s, the effect mostly recorded negative value.

<Table 3> regression results at state level

	1980-2009	1980-90 (Before Liberalization)	1991-2009 (After liberalization)
Distance(100KM)	0.347	0.427	0.313
	(6.83)	**(3.46)**	**(6.49)**
SERVICE GAP	0.007	-0.004	0.013
	(2.22)	**(-0.48)**	**(3.96)**
HINDIBELT	0.156	0.551	-0.014
	(1.51)	**(2.17)**	**(-0.14)**
Time	yes	yes	yes
R^2	**0.18**	**0.14**	**0.18**
no of observation	3677	2552	1260

<Figure 5> time fixed effect at state level

To summarize, distance and productivity differential between regions are impediments to market integration of India, however, it is getting closer to a single market.

V.　　Conclusion and Implication

This paper examined the price differences among Indian regions since 1972 and price convergence trend. It also tried to understand the determinants of such deviation from PPP, such as distance, H-S-B effect, state, language. For almost three decades, LOP has been violated in India,

however, it shows evident price convergence trend at the same time. Such trend has become more obvious after economic liberalization in 1991. We also analyzed panel data at city and state level, running regression. At city level, distance and state dummy variable both are statistically significant. At state level, distance and productivity differential both are statistically significant. In case of service gap, however, it was not significant at all before liberalization. Distance is more significant after liberalization at both city and state level. Through time fixed effect, price convergence trend is also observed.

The results give lessons for India to accelerate their efforts to integrate domestic market. First, the India's government needs to improve transportation infrastructure to lessen spatial segregation. Significant impact of distance shows that India is currently spatially segregated. And the segregation has been more progressed after liberalization. It implies increasing domestic trade and poor transportation infrastructure in India.

Second, India's state governments need to coordinate their policies to facilitate domestic trade. As shown in the result, productivity differential between states' service sector has significant effects on price differential. It is well known that some cities of India have achieved stunning economic growth based on service industry. Generally, economic development of a

region spreads to other regions through trade and factor mobility. However, India still has impediments to such trade to hinder catch-up effect of other regions. Furthermore, as the results show, state variable is negatively correlated with inflation differential in India. To fasten market integration, state governments' policies should be harmonized not to hamper free movement of goods and services within a nation.

We close the paper by noting limitation to the work and suggestions for future work. Another important variable in accessing a single market, besides price convergence, is wage rate convergence. Due to insufficient data, this aspect was not examined. If the research is conducted on movement of goods and labors together, it would enrich the literature.

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2. Website

EPW Research Foundation   (www.epwrfits.in)

http://distancecalculator.globefeed.com/India_Distance_Calculator.asp

http://www.whereincity.com/india/jk/

India Statistics(www.indiastat.com)

www. Hindibelt.com

Appendix A : States and Cities covered in this study

State/Union Territory	Cities
Andhra Pradesh(2)	Guntur, Hyderabad
Assam(4)	Doom-Dooma, Labac-Silchar, Mariani-Jorhat, Rangapara-Tezpur
Jharkhand(3)	Jamshedpur, Jharia, Kodarma
Bihar	Munger-Jamalpur
Delhi	Delhi
Gujarat(2)	Ahmedabad, Bhavnagar
Haryana	Yamunanagar
Jammu and Kashmir	Srinagar
Karnataka	Bangalore
Kerala(2)	Ernakulam, Mundakayam
Madhya Pradesh(2)	Bhopal, Indore
Maharashtra(3)	Mumbai, Nagpur, Solapur
Punjab	Amritsar

Rajasthan(2)	Ajmer, Jaipur
Tamil Nadu(4)	Coimbatore, Coonoor, Chennai, Madurai
Uttar Pradesh(2)	Kanpur, Varanasi
West Bengal(6)	Asansol, Kolkata, Darjeeling, Howrah, Jalpaiguri, Raniganj

국문 초록

인도 시장의 단일화 움직임
: 인 도 내 주 별 가격 수렴

　본 연구는 인도 국내에서 일물일가 법칙의 성립여부를 살펴보고, 인도 시장이 유럽연합이 정의하는 단일 시장에 가까워지고 있는지 보고자 한다. 또한 일물일가 법칙이 성립하지 않는 원인에 대한 분석도 하고자 한다.

　유럽연합이 도입한 '단일시장'이란 개념은 재화,서비스,자본, 인구의 이동이 완전히 자유로운 시장을 말한다. 이 때, 무역 장벽 뿐만 아니라 행정적, 비무역 장벽도 존재하지 않아야 한다. 현재 인도의 경우는 행적정적, 비무역 장벽의 존재로 인해 유럽연합이 정의하는 단일시장이라고 볼 수 없다.

　1971년부터 2010년까지의 소비자 물가지수를 통해 인도 도시 별, 주 별 가격 격차를 살펴본 결과, 인도 내에서 일물일가법칙은 성립하지 않고 있다. 그러나 주목할 것은 인도 내에서 느리지만 가격 수렴의 현상이 발견되며, 1991년 경제 개방 이후 그 추세가 더욱 뚜렷해졌다는 점이다.

한 국가 내에서도 가격 격차가 발생하는 이유 중 하나는 Harrod-Balassa-Samuelson 효과이다. 이 이론은 두 지역의 무역재와 비무역재 분야에서의 생산성 격차가 장기적으로 가격 격차로 이어진다고 주장한다. 또 다른 이유는 거리로 대체되는 교통비이다.

본 연구에서는 패널데이터에 대한 회귀분석을 통해 거리와 생산성 격차가 가격격차에 갖는 영향력을 살펴보았다. 전 기간에 걸쳐 두 가지 변수는 유효한 것으로 밝혀졌으며, 거리의 경우는 1991년 인도 경제 개방 이후에 그 영향력이 더욱 커지고 있다. 생산성 격차의 경우에는 개방 이후에 유효한 것으로 나타난다. 이러한 요인들이 인도의 시장 통합을 방해하고 있지만, 패널데이터 시간 고정 효과(time fixed effect)의 추세 분석을 통해서 현재 인도는 단일 시장에 가까워지고 있음을 알 수 있다