RECENT GROWTH EXPERIENCES OF ASIAN TIGERS: WHERE DOES INDIA STAND?*

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Abstract

The four Asian tigers, Hong Kong, Singapore, South Korea, and Taiwan (also called Four Dragons) experienced miraculous high growth rates in the pre-nineties period and rapidly transformed their economic status from less developed 'basket cases' to developed high-income countries gaining entry to the rich OECD club of countries. These countries even in the post-nineties, barring few years, have continued to grow further and are an inspiring role model for the newly emerging economies. In this study we adduce certain trends in these countries since the nineties and specifically examine role of human capital and knowledge building, productivity convergence and intra-regional trade in the Asian tigers'. We examine these in the context of India.

Keywords: Asian Tigers; India; economic growth; development
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1. Introduction

In the fifties, soon after gaining independence, expectations were high from India and South Asia in terms of expected growth, increasing incomes and reduction in poverty (Hicks 1989). In contrast, the Asian tigers (Hong Kong, Singapore, South Korea, and Taiwan, also called Four Dragons) were considered as 'outcasts' and 'basket cases'[1] and excluded from the list of potential performers (Paldam 2003). Yet defying all expectations and development theories advanced by development economists of the time, the Asian tigers experienced rapid growth from 1960s onwards and emerged as the Asia's 'poster child' for a long time. The fascination with the four Asian tiger economies which began more than fifty years ago continues even still (OECD 2006; Gill, Kharas *et al.* 2007; Fogel 2009; Fontana and Srivastava 2009; Khan 2010; Schuman 2009).[2] Gill, Kharas *et al.* (2007) described rise of the region as the unfolding of an 'economic renaissance' led by rapid changes in trade, finance, ideas, innovation, and technology.

In the voluminous literature on their rapid rise, the sources of economic growth of Asian tigers in the pre-nineties ranged from 'getting the basics right' (World Bank 1993) to several policies involving economic, social, cultural, and political changes (Hughes 1995). Some studies attributed favourable external environment accompanied with good domestic policies for the success of Asian tigers. World Bank (1993) listed seven major factors for the rise of Asian Tigers and other high performing economies.[3] These were **'**rapid output and productivity growth in agriculture; higher rates of growth of manufactured exports; earlier and steeper declines in fertility; higher growth rates of physical capital, supported by higher rates of domestic savings; higher initial levels and growth rates of human capital; generally higher rates of productivity growth' (World Bank 1993).[4] Recent studies on Asian tigers and East Asian economic development have viewed development and growth in the region as a dynamic process unconstrained by rigid policies and evolving institutions (OECD 2006; Gill & Kharas 2007; Khan 2010).[5] The major new sources of growth since the nineties identified by this literature are knowledge and innovation, increased regional integration through trade and policy coherence and coordination (OECD, 2006).

In this study we specifically examine certain focal areas such as knowledge economy and increased intra-regional trade of the Asian tigers. We also examine whether the Asian tigers and India have converged with total productivity in Japan in the post-nineties period. Theoretically, both trade openness and human capital have a secure place in the endogenous growth literature. Human capital influences economic growth through the channels of innovation, technologically catching-up with other countries through adaptation and as an accumulated factor of production. Furthermore, trade through increased competition in domestic markets enhances efficiency and productivity and enables technology spillover leading to innovation and high economic growth. Technology spillover through trade is, however, grounded on the prevailing human capital levels and R&D in the country (Badinger & Tondl 2002; Rivera-Batiz & Romer 1991). Empirically, both single and cross-country

1The term basket case was first used by American media and refers to injured soldiers in the wars whose arms or limbs had to be amputated and were on support.

[2] Perhaps, the first publication analysing the economic growth of East Asian nations was that of Szczepanik (1958).

[3] The countries considered were Japan; Four Tigers (Hong Kong, Republic of Korea; Singapore and Taiwan); and Indonesia, Malaysia and Thailand (latter three countries were termed as newly industrialising economies of South East Asia). Together, all these countries were called High Performing Asian Economies (HPAE).

[4] Some of the well-known studies are World Bank (1993), Lall (2003), Wade (1990, 2005), Rodrik (1995).

[5] Recent studies have included other East Asian economies as well such as China, Vietnam, Malaysia and Philippines. In our study we however, focus only on the four Asian tigers.

studies have noted positive association between trade openness and human capital (Tsen 2006; Basu & Bhattarai 2008). Our study therefore, examines trends and pattern in the above factors in the Asian tigers' countries in a comparative perspective with India.[6]

India is a good study ground for several reasons. **Firstly**, it has been achieving high growth rates in recent years and to compare her performance with that of the Asian tigers, which developed and transformed their economies in a relatively short span of time, is logical. The post-nineties period is particularly important in the Indian context as the policymakers carried out substantial macroeconomic reforms in industrial sector, financial sector and those relating to trade in 1991 leading to high growth rates. The average annual growth rate during the period 1992-93 to 2012-13 was 6.9 per cent and during 2003-04 to 2010-11 it averaged 8.5% (RBI 2012). The country's shift to a higher growth path took place after decades of low growth rates, high poverty, and low per capita incomes. **Secondly**, although in terms of size, India is a large country with a population of 1.2 billion and the different states are at varied levels of development (Arora 2009). The Asian tigers such as Hong Kong and Singapore however, are city states, and Korea and Taiwan though relatively larger than the city states, are still smaller in size compared to India and their combined population is only 7.25% of India's population. Yet all the Asian tiger economies hold certain common characteristics, such as, rapid growth, outward orientation, and high human capital. **Thirdly**, Asian tigers have often been cited as a role model for their social and economic achievements (Bosworth & Collins 2008)Barring Japan, only Asian tigers' among developing Asia in 1970s and 1980s took off to rapid growth and their performance is particularly inspiring for the newly emerging economies such as India. Despite their size differences, some studies have compared Asian tigers' and India's economic development (Maksymenko & Rabbani 2008; Panagariya 2008).

Our study contributes to the literature in several respects. Firstly, it contributes to the literature examining contemporaneous economic performance of Asian tigers and India as not many studies exist in this area. Secondly, our study also builds a unique first ever Knowledge Economy Index at the sub-national level for India and is, therefore, a contribution in this respect. Finally, our study also contributes to the literature on Indian economic development. Rest of the paper is organised as follows. Section 2 explores trends in human capital and knowledge economy in the Asian Tigers vis-à-vis Indian performance. In this context we also look at the performance of sub-national units in India in the building of knowledge economy. This is so as the Indian states are at different stages of development and high variability across the states may reflect country's imminent difficulties overall in catching up with the Asian tigers. Section 3 examines increased regionalism among the Asian tigers. In the next section we also examine how far India is in terms of productivity compared to the Asian tigers. Finally the paper concludes in the last section of the study.

2. Role of Human Capital in Knowledge Building

A significant source of growth of the Asian tiger economies has been attributed to their investment in human capital. Contrasting and comparing the performance and sources of economic growth of Asian tigers and India, Fontana and Srivastava (2009) argue that the difference between the two lies in the superior human capital outcomes achieved by Asian tigers compared to India. Madsen and Ang (2008) argue that in case of Asian tigers' physical capital alone cannot explain the rapid advances in economic growth witnessed in these countries. The explanatory factors, according to them, were technological knowledge, education and R&D which complemented physical capital.

[6] In the literature the differences of Asian tigers with respect to their political setup and Confucian culture and their possible contribution to the rapid economic rise of these countries has been raised and has been found to be indeterminate (see Hughes, 1995). In this study we do not ponder on these issues and draw the attention towards selected new factors which are underway in the recent years since nineties.

Their findings predicted that even in future, growth in the Asian tiger economies will be driven by knowledge and the positive effects from research intensity and level of human capital will ensure that growth will remain positive (Madsen & Ang 2008).

In 1960, population aged 15 years and above had an average year of schooling of 4.9 years in Hong Kong, 4.3 in South Korea, 3.7 in Singapore and 4.9 in Taiwan in contrast to a mere 1.1 years in India.[7] Thus, educational capital was in place even prior to strong export oriented thrust on development began in these countries in the sixties. In contrast, in India, despite economic reforms and increased emphasis on education in recent years, the average years of total schooling in 2010 is still only half of that compared to 10.4 in Hong Kong; 11.8 in Korea; 9.1 in Singapore and 11.3 in Taiwan.

Using Barro-Lee (2010) educational attainment dataset for selected low income and low middle income countries based on the availability of data, we plotted the proportion of population living below $1.25 a day (PPP) and percentage of population 15 years and above with no schooling at all (Figure 1).

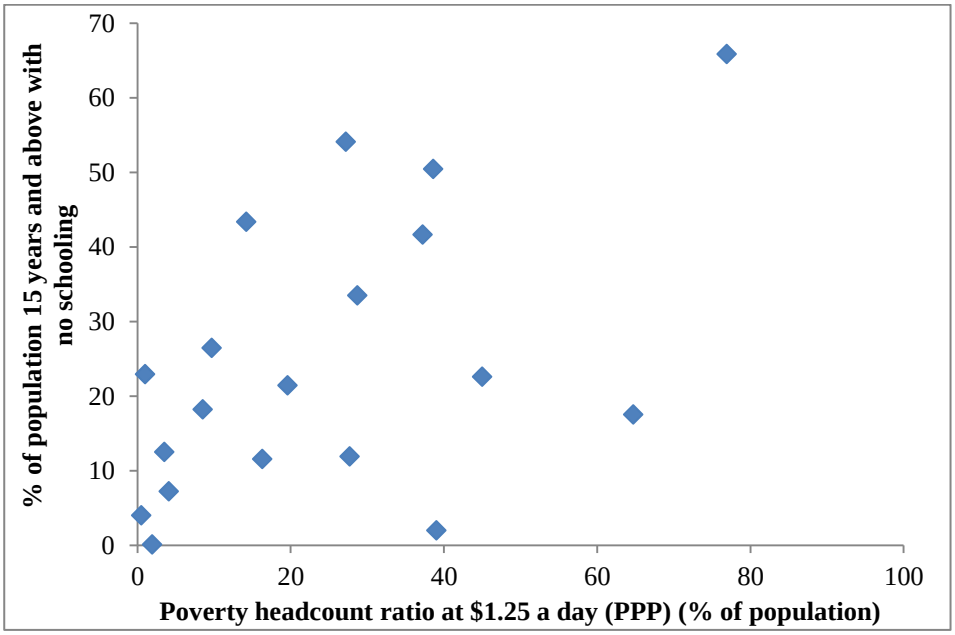

Figure 1: Relationship between headcount poverty and no schooling

Figure 1 generally indicates a positive relationship between no schooling and proportion of population living below $1.25 a day. The correlation between the two works out to 0.52 indicating that in countries with higher poverty levels, the proportion of population with no schooling increases.

Explaining the factors responsible for the Asian miracle, Nelson *et al.* (1997) argue that although education is a pre-requisite in achieving high growth, many countries with high educational levels have still failed to realize high growth rates. What sets the Asian tigers apart is the presence of aggressive entrepreneurship besides education. The authors further argue that investment in education and learning from others, risk taking, and innovation are complementary to each other

[7] The average number of years of schooling is often taken as an indicator of how high is the educational attainment. The concept however, ignores quality of education and also treats 12 years of schooling and 2 years as equivalent (Permani 2009; Stroombergen, Rose *et al.* 2002).

and high education in the absence of aggressive entrepreneurship would not have achieved similar results. In contrast, in India it was neither the absence of entrepreneurship, nor higher education (as higher education was more stressed upon than primary education, see Panagariya 2008), it was heavy regulations and license raj which curbed and inhibited entrepreneurship (Das 2007).

In recent years focus has moved from achieving high literacy rates to building knowledge economy.[8] This, besides generic education, requires focus on higher education, innovation and entrepreneurship and has gained centre place among the policymakers. Gill & Kharas (2007) noted:

> In advanced economies and, increasingly, in leading emerging economies such as the Republic of Korea, Singapore, and Taiwan (China), business firms are among the principal engines for creating new ideas and learning through systematic, long-term, and large-scale investments in research and development (R&D), resulting in discoveries that add to global knowledge, that may be patented, and that are the principal sources of competitiveness and profitability (Gill & Kharas 2007, p 123).

In the Knowledge Economy Index (KEI) constructed by World Bank (2009), the Asian Tigers' among 146 developed and developing countries are much ahead of the emerging economies such as, India (**Table 1**).

Table 1: Ranking of Countries and Scores in Knowledge Economy Index (KEI), 2009[9]

Countries	Rank in Overall Knowledge Economy Index	Knowledge Economy Index Score	Knowledge Index Score	Four Pillars of Knowledge Economy Index (Average score)			
				Economic Incentive & Institutional Regime	Innovation	Education	ICT
Taiwan	18	8.45	8.79	7.42	9.27	7.97	9.13
Singapore	19	8.44	8.03	9.68	9.58	5.29	9.22
Hong Kong	23	8.32	7.92	9.54	9.04	5.37	9.33
S. Korea	29	7.82	8.43	6.00	8.60	8.09	8.60
India	109	3.09	2.95	3.50	4.15	2.21	2.49

Source: World Bank (2009).

The total number of patents registered in East Asia during 1990-94 was 2,239 which rose to 12,108 in 2004-08. South Korea and Taiwan had the highest number of patents within East Asia. Korea with a share of 4.65% in total was among the top five countries in ICT and nanotechnology related patents (OECD 2008). Even after the liberalisation, Indian industries are far behind the technological frontier and innovation enhancing policies in their catch-up to Korea (Chandra *et al.* 2009).

2.1 Knowledge Economy in India

[8] The idea of the knowledge economy was first put forward in the 1960s. It argued that all countries will eventually evolve from 'muscle-based work' to 'mind based work' (Robertson 2009).

[9] Knowledge Index is a simple average of the normalised scores of key variables in three knowledge economy pillars – education, innovation and ICT and excludes the fourth pillar of Knowledge Economy Index that is, economic incentive and institutional regime. Economic Incentive & institutional regime is the simple average of normalised score of tariff and non-tariff barriers, regulatory quality and rule of law. Innovation is the simple average of the normalised scores of three variables: total royalty payments and receipts, patent applications, scientific and technical journal articles. Education is the simple average of the normalised scores of adult literacy rates, secondary enrolment and tertiary enrolment. Information & Information Technology or ICT is the normalised score of telephone, computer and internet penetrations per 1000 people.

As noted earlier, Indian states are at varied levels of development with some states reflecting traits of developed economies, while others trail farther behind with implications for catch-up with the Asian tigers. This is particularly critical for large, but less developed states with the potential to pull down the national average. We therefore, investigate further where individual Indian states stand in respect of the knowledge economy and build KEI at the sub-national level.

Watkins (2008) developed KEI for fifty states of US. Noting the three components of knowledge economy as knowledge, innovation and entrepreneurship, Watkins considered workforce education, industry R&D and fast growth firms as the indicators of knowledge economy and median age and temperatures as the control variables. Instead of using uniform weights, the author employing only three variables developed regression models for assigning weights.

Among other studies at the sub-national level, the index developed by Atkinson & Correa (2007) States New Economy Index examines transformation of states from old economic structure to new knowledge economy. The four pillars of the knowledge economy considered in Dahlman & Utz (2005) were improving governance and institutional regime; education; innovation and building and information infrastructure.

Although the index developed by Watkins (2008) is more comprehensive and technically superior, yet data on a number of indicators used by that study are not available in a developing country context, particularly at the sub-national level. The major variables considered by World Bank in the development of its KEI at the cross-country level are: overall performance of the economy; economic incentive and institutional regime; innovation system; education and human resources and information & communication technology.

Following the World Bank, we consider five broad variables to construct KEI and shortlist sub-indicators under each variable mainly based on the criteria of ease of data availability at the sub-national level. The broad variables are: overall structure of states which comprises per capita income and composition of state domestic product; economic incentive and institutional regime: bank credit/SDP, average number of days required to start a business, and cost to register a new business as ratio of per capita income. Under education, we consider literacy rate; and enrolment in higher education (undergraduate and above). We further took information technology as a broad indicator with sub-indicators as E-readiness of states and telephones per 100 population. The e-readiness index is a composite index constructed by Department of Information Technology, Government of India for each state in India and takes into account environment, readiness and usage of information technology. The index is useful in capturing the state's ability to participate in increasingly networked world and also reflects the ability of the citizens, business, and government to use information technology. Finally, we considered innovation system in each state with sub-indicators as flow of foreign direct investment to each state; proportion of financial services in respective state output and also proportion of business services in state output.

We take the latest year data available (2009-10) on each indicator and the data sources are Ministry of Statistics and Programme Implementation, Government of India, Reserve Bank of India, World Bank (Doing Business in India); Statistics of Technical & Higher Education, Ministry of Higher Education. We focus on 17 major states of India as they account for more than 90 per cent of the country's total population. The methodology followed in the construction of an index is similar to that adopted by the UNDP in developing the Human Development Index. However, instead of allocating uniform weights to the composite indicators we use factor loadings extracted from Principal Component Analysis as the weights.

In this exercise, we construct KEI based on five dimensions. We denote each dimension by D_j where j=1…J, and therefore J=5. Each dimension consists of n number of determinants which we denote by X_i, and i=1..n.[10] First, we compute the value X_i for each dimension j as follows.

$$X_{ij} = \frac{X_{ija} - X_{ijm}}{X_{iju} - X_{ijm}} \quad (1)$$

Here, the notations X_{ija} , X_{ijm} and X_{iju} respectively represent the observed value, minimum value and maximum value for i^{th} determinant in j^{th} dimension. The minimum and maximum values, termed as 'goalposts' (UNDP, 2009), are the minimum and maximum value of each variable in different states. Now we use the simple arithmetic average as follows to determine the value for each Dimension D_j.

$$Dj = \frac{\sum_{i=1}^{n} X_{ij}}{n} \quad (2)$$

Next, we carried out factor analysis to determine the factor loadings for each dimension. Our factor analysis involves five dimensions: state structure; economic incentive and institutional regime; education; innovation; information & communication technology. **Table 2** reports the factor loadings for each dimension which are used to assign weights (denoted by α_j for dimension j). We compute KEI at the sub-national level as follows.

$$KEI = \sum_{j=1}^{J} \alpha_j D_j \quad (3)$$

Table 2: Factor Loadings

Factors	Factor Loadings
Education	.937
Economic Incentives & Institutional Regime	.933
Innovation	.924
Information & Communication Technology	.896
State Services	.836

Source: Authors' Calculations.

Table 3 shows ranking of the Indian states in the KEI.

Table 3: Knowledge Economy Index of States in India

States	Dimensions of Knowledge Economy Index					Knowledge Economy Index Score	Normalised Index Score
	State Structure	Economic Incentive	Education	Innovation	Information & Communication Technology		
Maharashtra	0.823	0.950	0.878	0.867	0.769	4.29	1.00
Tamilnadu	0.761	0.610	0.683	0.542	0.550	3.15	0.67
Karnataka	0.567	0.417	0.431	0.534	0.591	2.54	0.50
Haryana	0.639	0.441	0.369	0.599	0.384	2.43	0.47
Kerala	0.695	0.385	0.438	0.365	0.541	2.42	0.47
Gujarat	0.688	0.494	0.440	0.209	0.479	2.31	0.43
Andhra Pradesh	0.408	0.464	0.426	0.379	0.461	2.14	0.39
Punjab	0.369	0.498	0.226	0.179	0.579	1.85	0.30
West Bengal	0.429	0.366	0.114	0.335	0.431	1.67	0.25

[10] Note that *n* can vary for different dimensions. For example, in Appendix 1, n=2 in dimension labelled as 'Overall state structure' while n=3 in dimension labelled as 'Economic incentive and Institutional Regime'.

Rajasthan	0.403	0.408	0.194	0.222	0.225	1.45	0.19
MP	0.234	0.344	0.235	0.198	0.325	1.34	0.16
Uttar Pradesh	0.245	0.281	0.385	0.249	0.170	1.33	0.15
Orissa	0.410	0.347	0.183	0.112	0.167	1.22	0.12
Assam	0.284	0.204	0.113	0.045	0.177	0.82	0.01
Bihar	0.273	0.147	0.109	0.142	0.115	0.79	0.00
Jharkhand	0.458	0.208	0.082	0.044	0.000	0.79	0.00
Chattisgarh	0.454	0.062	0.163	0.104	0.006	0.79	0.00
Average	**0.479**	**0.390**	**0.322**	**0.302**	**0.351**	**1.659**	**0.303**
Standard Deviation	**0.185**	**0.201**	**0.218**	**0.225**	**0.225**	**0.868**	**0.271**
Coefficient of Variation%	**38.7**	**51.5**	**67.9**	**74.5**	**64.0**	**52.3**	**89.6**

Source: Authors' Calculations.

The results show that Maharashtra tops among the major states of India in the KEI followed by the southern states, Tamilnadu and Karnataka. OECD (2008) also noted that most of the patents registered in India under Patent Cooperation Treaty originate from Maharashtra (720 applications mainly from Mumbai); Karnataka (497 applications) and Andhra Pradesh, which ranks seventh in our sub-national level index, had filed 414 patent applications. The large interstate disparity across the states is evident from the values as shown in columns 2-8 reflecting unevenness in the country as a whole in respect of catching-up with the Asian tigers. Analysing the range of progress of the states towards reaching the status of knowledge economy, the three classifications based on the results as shown in **Table 4** can be summarised as below:

Table 4: Summary of States performance in Knowledge Economy Index

KEI Score	Level	Number of States
< 1	Low	4
1-3	Medium	11
>3	High	2

Source: Authors' Calculations.

3. Intra-regional trade

Besides high level of human capital, the governments of the Asian tigers' countries also adopted export promotion strategies leading to increased trade regionally as well as with the rest of the world. Did high human capital (as discussed earlier) facilitate increased trade including regional trade in these countries? Gould and Ruffin (1995) found that human capital has a strong effect on economic growth in more open economies. Similarly, Barthelemy, Dessus and Varoudakis (1997) also noted positive relationship between human capital and trade openness as enhanced human capital assists in the assimilation of new technologies associated with trade.

We carried out Pearson product-moment correlation coefficient two tailed test to assess the relationship between exports/GDP and average year total schooling attained in South Korea. Our results showed strong positive statistically significant relationship between the two variables $r (11) = .84$, $p < .01$. However, the direction of causality is not clear as the effect can be both ways. For instance, the capacity of trade to contribute to economic growth is certainly enhanced by the availability of high human capital. Export oriented policies, in turn, lead to increase in economic growth and family incomes enabling further strengthening of the educational capital of the

country.[11] Acknowledging the mutual reinforcement of human capital and increasing regional trade patterns among Asian tigers and East Asia in general, Gill and Kharas (2007, p 46) observed that, "Just as the region was drawn earlier to the developed world by prospects of a mutually beneficial exchange of goods, capital, and ideas, different parts of the region are now being pulled towards each other by the same motives and modes."

High trade integration is reflected in the growing trade of the Asian tigers directed towards the East Asian countries. The total exports of the Asian tigers to the East Asian region were 33.8% in 1990 which increased to 47.3% in 2008. Total intra-regional imports also increased from 45.8 to 50.9% in 2008 (Figure 2). In 1990, 35.8% of Hong Kong's exports went to the East Asian economies. This rose to 59.2% in 2008. About 64% of the country's imports were from other East Asian economies and in 2008 the share of the rest of world in Hong Kong's imports was just 29%. China alone in 1990 accounted for 24.7% of Hong Kong's exports; by 2008 this had increased to more than 50%. In other countries too, trade with China has increased significantly. South Korea's exports to China were only 1.5 % of its total exports in 1990. By 2008 about 25 % of its total exports were to China. Imports too increased during this period from 5 to 19 %. Figure 2 shows intra-regional trade pattern among the Asian Tigers' economies.

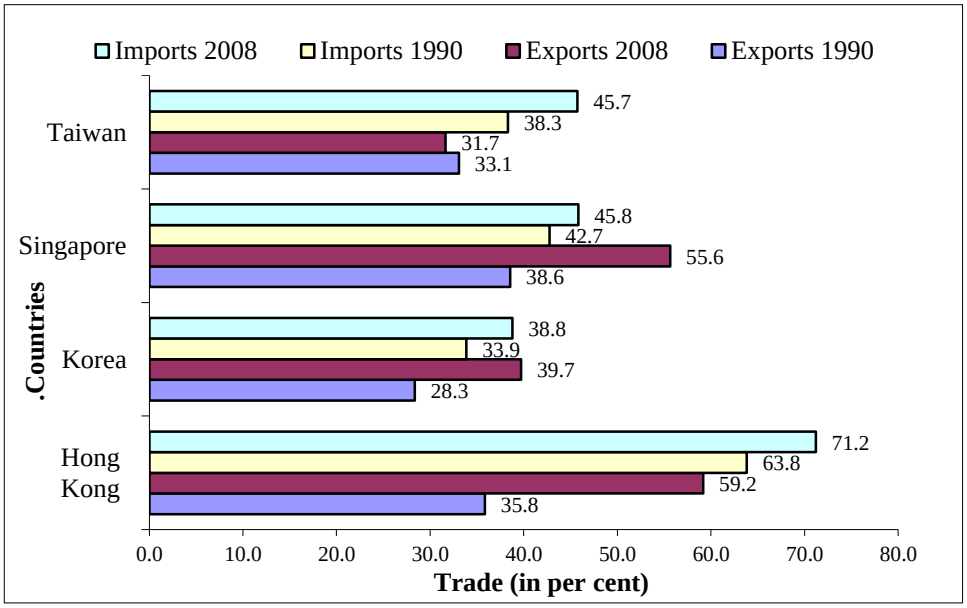

Figure 2: Intra-regional trade among Asian Tigers'

The export oriented relations among the nations developed through outsourcing and subcontracting resulting in increased regionalism in the region, and a sort of heirarchical relations formed among the countries led by Japan (Numazaki 1998). The hierarchy developed in all aspects of the trade-market; inputs; output and location. Among labour intensive and low skilled industries, clothing, textiles and miscellaneous items were major exports in 1970s. This declined significantly in 1980s and exports of electrical and capital intensive products increased in 1981. As the product cycle chain moved from less skilled to labour intensive to capital intensive, production sites too moved from Japan to South Korea to Taiwan to ASEAN countries and then China. Japan had set up manufacturing units in Korea, Hong Kong, Taiwan and China and the assembly lines in each of

[11] However, high initial human capital would not by itself lead to economic growth unless accompanied with the policies promoting growth. For instance, human development in the state of Kerala is very high compared to other Indian states, yet it is not well known for its superior economic performance.

these countries led to linkage of these countries. The industrialisation pattern in Asian tigers is called 'partial industrialsation' and not full industrialisation by some studies as the countries were more in assembly lines rather manufacturing the entire product (Numazaki 1998).

Kuchiki (2008) showed that the industrial structure in East Asia is clustered and multinational enterprises (MNEs) play a major role in the formation and linkage of industrial clusters. These have a strong network of production, distribution and procurement in the region. Spread over many countries (plants) in Asia these form an intra-firm global production network and work in value chain management[12] (also called fragmentation). Value chain management is defined as a "high level model of how businesses receive raw materials as input, add value to the raw materials through various processes, and sell finished products to customers".[13] Regional integration in Asia occurs through these value chain networks created by MNEs with different clusters being linked into one another through the value chains.[14] With different activities of industrial manufacturing being located in geographically dispersed locations (countries) facilitated by reduction in national barriers, they lead to specialisation by firms, innovation and increased efficiency. Some of the examples of global value chain networks are garments, agro-industry, furniture, automobiles, consumer electronics, telecommunications and ICT.

The nature of regional networking though differed among the countries. While Korea was more developed in terms of industrialisation and had its independent brands and large companies (chaebols); other Asian tigers (Singapore, Hong Kong and Taiwan) were "subcontractors, assembling or producing final consumer goods using the intellectual property (brand names, patents, organizational capital) of European, Japanese and US firms" (Gill & Kharas, p.81). More specifically, Taiwan was international subcontractor and Singapore, the center for international procurement for foreign transnational corporations. While countries such as Korea and Taiwan have followed the model of labour intensive industries, followed by high technology and capital intensive industries; Singpaore followed a distinct model straight into the capital intensive products bypassing different stages experienced by Korea and Taiwan. The mass factory assembly labour intensive units also provided employment and led to the movement of rural labour to the urban areas particularly in South Korea. The proportion of rural population in total in South Korea fell from 72.3% in 1960 to 18.5% in 2008 (Figure 3). The figure also displays manufacturing exports in Korea as proportion of total merchandise exports which rose from 18.2 to 90% in 1981 and peaked at 93.5% in 1990.

[12] The concept is from business management first described and popularised by Michael Porter in 1985.
[13] See http://www.1000ventures.com/business_guide/im_value_chain_main.html
[14] China, India and ASEAN also termed as Asian Triangle are expected to be a high value network by 2030.

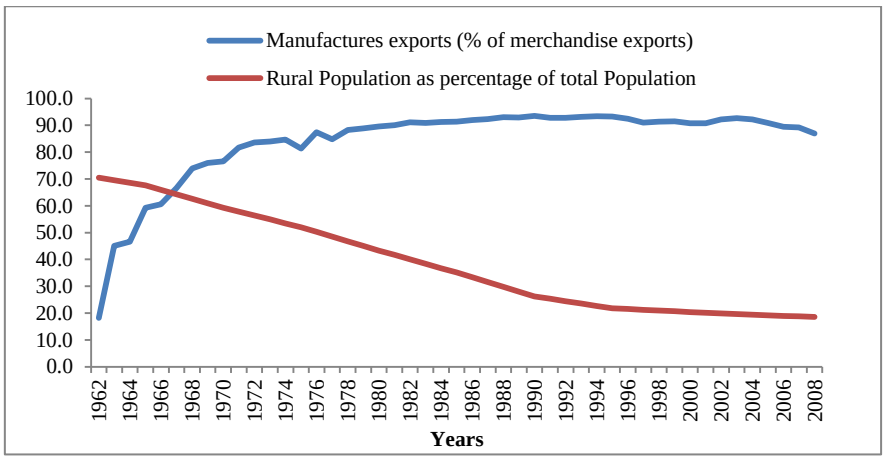

Figure 3: Percentage of Rural Population and Manufacturing Exports in South Korea

In contrast to the Asian tigers, intra-regional trade in South Asia is very low for instance, India exports just 4.5% of its total exports to South Asia region. Its intra-regional imports are less than 1% of its total imports. Several studies have noted potential positive economic effects of increased South Asian integration on economic growth, infrastructure development and reduction in poverty (Kumar & Singh 2009). Yet, reasons such as high levels of tariffs; inter-state barriers to trade; restrictive mobility of people; exclusion of services and investment from intra-regional trade agreement, SAFTA and political barriers continue to limit intra-regional trade (ADB 2009). Also, in contrast to the vertical integration (trade in parts) of East Asia wherein the countries form a part of global value chain management, the Indian companies, including both trade and FDI, are more horizontal (market seeking) in nature and focus on trading finished products (Choorikkadan 2010; Athukorala 2013). This approach, although holistic and carries advantages of less interdependence, particularly in case of external demand shocks[15], has economies of scale and is more applicable to heavy industries (thus more capital than labour intensive) has slowed considerably the structural transformation of the Indian economy from an agrarian to industrialized economy as about 62 % of the population is still employed in the agricultural sector and lives in the rural areas (Choorikkadan 2010).[16]

4. Productivity of the Asian Tigers and India in the Nineties

Human capital and build-up of knowledge with increased trade will be reflected in improved productivity levels and higher living standards. Madsen and Ang (2010) argued that domestic R& D, human capital and absorptive capacity including import of knowledge were the principal factors contributing to high productivity growth of the Asian tigers'. Below we examine how far productivity per worker has converged in Asian tigers and India since the nineties. In this exercise we basically explore the rate of 'catch up' with a 'benchmark' country. Choice of the benchmark is very contextual, for example, in a study that focused on the European Region, Esteben (2000) use regional average as the benchmark. A within-country study conducted by Papalia and Bertarelli (2009) use the national average. Caselli and Tenreyro (2005) selected a benchmark country (France)

[15] This is unlike the vertical specialisation of Asian tigers led by MNEs in which increased trade takes place as inputs in various processing stages cross national borders multiple times and are vulnerable to external shocks.

[16] Budhwar (2007) argued that although the Indian industry is not as vertically integrated as the Asian tigers, yet it does participate in the value chain management model as in IT and has strong potential in pharmaceuticals. The author further argued that in IT, Indian companies currently are at the lower end of the value chain model where they contribute only to application maintenance and application management. To maintain their competitive edge over rising competition from China, Philippines and Russia, they need to move to higher value chains such as understanding business problems and designing IT strategy (Budhwar 2007).

whose growth experiences are virtually identical to that of an average country in the study region. According to Baumol's (1986) hypothesis, countries tend to converge to a leader.We, therefore, adopt an Asian country in the frontier of economic growth. We chose Japan as our benchmark country as we believe that growth experiences of Japan resemble a representative country in the Asian region due to its status as an industrialized country and being the first country to achieve takeoff to rapid growth in Asia.[17] Japan also figures highly in the regional trade in East Asia, hence was our obvious choice as a benchmark.

A number of studies have examined whether increases in productivity can account for the superior performance of Asian tigers. Similar to Caselli and Tenreyro (2005), we looked at the convergence process in the four Asian tigers and India during the period of 1960-2010 further broken into five-yearly intervals. We follow conventional growth accounting approach as outlined in Bosworth and Collins (1996). However, in this exercise, we are focusing on the convergence accounting rather than growth. In particular, we follow Caselli and Tenreyro (2005) and adopt the following familiar looking neoclassical production relationship (denoted in per capita terms) to examine the components of productivity convergence of Asian tigers and India.[18]

$$\log y_{it}^{*} = \log A_{it} + \alpha \log k_{it}^{*} + (1-\alpha)\log h_{it}^{*} \qquad (4)$$

Where y_{it} is production, k_{it} is physical capital stock, and h_{it} is the stock of human capital of i^{th} country at time *t*. Note that we use lower case letters to denote those variables on per worker basis. Furthermore, the superscript* in these variables denotes the modification that we introduce to measure these two input variables in our production function. That is, they are measured relative to the benchmark country in order to capture the degree of convergence between i^{th} country and benchmark country. This feature is slightly different from conventional approach, although a similar technique was used by Caselli and Tenreyro (2005) in a different context.

Data for y_{it} is obtained from Penn World Table 8, real GDP per worker (rgdpwok). Of course, based on neoclassical explanation, A_{it} denotes exogenous technological progress and the notation α represents share of capital in production. We constructed data on physical capital stock using investment share of real GDP per capita (ki) from the same version of the Penn World Tables. For this calculation, real GDP per capita (rgdpl) data was also obtained from the same source. To construct the human capital stock, we use Barro and Lee (2001) data set. Similar to Caselli and Tenreyro (2005) and Hall and Jones (1999) we also calculated human capital stock $h_{it} = \exp(\beta sit)$ where *sit* is the average years of schooling and β is the Mincerian marginal rate of return of schooling. In this exercise we set β=0.1 which reflects average returns to schooling across rich and poor nations (Psacharopulos,1994). For simplicity, we follow the conventional growth accounting literature and set the share of capital α=0.33 (Hall & Jones, 1999). We finally use first difference operator of the equation 1 to estimate the convergence during a period. More specifically, we tailored equation 4 as follows to accommodate the difference between time period *t* and *(t-1)*.

$$\Delta \log y_{it}^{*} = \Delta \log A_{it} + \Delta\alpha \log k_{it}^{*} + \Delta(1-\alpha)\log h_{it}^{*} \qquad (5)$$

[17] The choice of Japan in our study is due to several reasons. It is well accepted that Japan is the leader nation in Asia as it was the first one to reach a steady-state level of growth in the region (World Bank, 2011). In addition, the World Bank recognized Japan as an industrialized nation (World Bank, 1993). Furthermore, in a recent investigation of national productivity, Cette, Kocoglu and Mairesse (2010) found that during 1980-1990 per worker productivity growth was highest in Japan with an average rate of 2.7% per year, compared with the leaders in the other regions such as the United Kingdom and the United States. Analytically as well, it is practical to estimate the gap between a leader and a follower. For those reasons, we choose Japan as our benchmark country for this study.

[18] The assumed Cobb-Douglas function is the most common one used in growth accounting literature since the seminal work of Solow (1956) and Swan (1956).

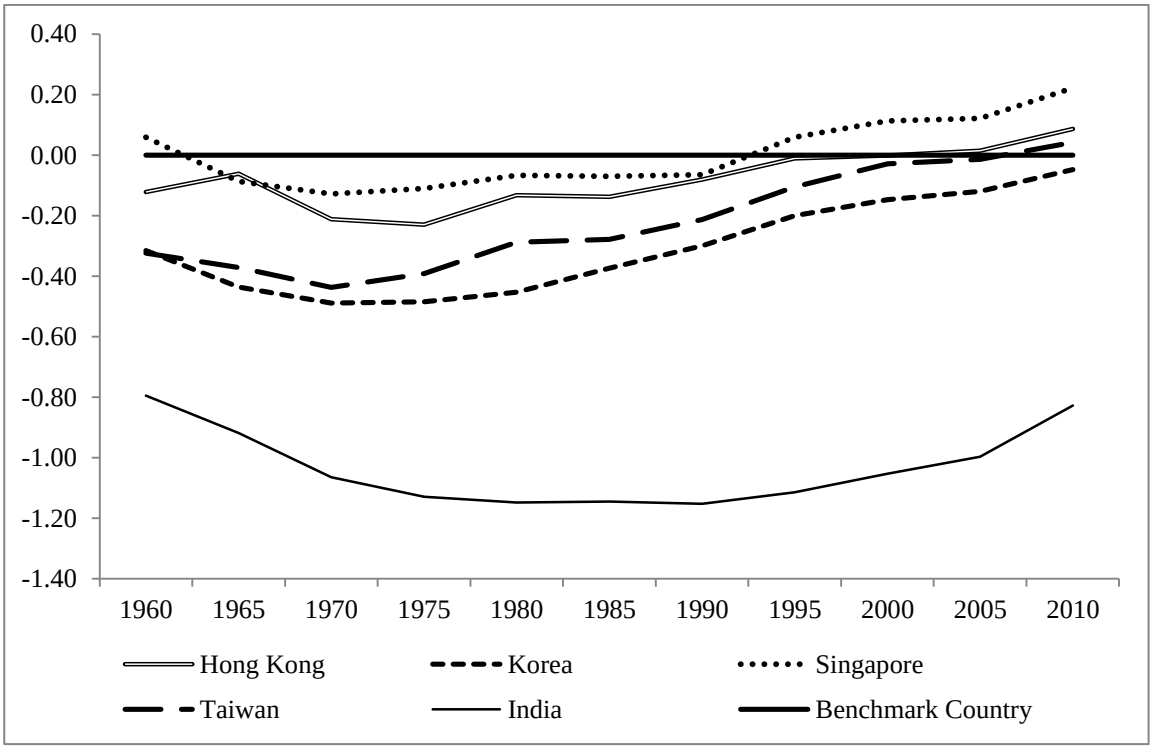

Figure 4. Estimated difference (in log) in per worker productivity over period 1965-2010[19]
Source: Authors' Calculations

Figure 4 shows the patterns of the gap between per worker productivity of each country with Japan. As displayed in the figure, the Asian tigers' started to converge to Japan since the late 1960s. Countries like Singapore have now even surpassed per worker productivity in the leading country, Japan. In the case of India, the gap was wide until 1990, in the subsequent years it has started to catch up with the benchmark country, Japan. Apparently the contemporary Indian trend resembles the path followed by the tiger nations when they took off from stagnation to rapid growth. Column 6 of Table 5 also shows magnitude of convergence in per worker productivity (which we label as total convergence) in each country with base as the beginning of each period.[20] It can be seen that almost all the countries including Asian tigers were lagging in total per worker productivity relative to Japan during the period 1960-1970. In other words, per worker productivity of all these countries were lower than that of Japan during this period and is indicated by the negative sign. India's largest gain in productivity (17%) was during the period 2005-10. This was a significant gain compared to the gains achieved by Asian tigers during their heydays 1970-80. Bosworth & Collins (2008) also noted stark similarity in the patterns of productivity gains in Asian tigers in their prime period and India since the reforms.

Table 5: Sources of convergence by sub-period

Country	Period	Physical capital	Human Capital	TFP	Total
Hong Kong	1960-1965	0.055	0.043	0.014	0.061

[19] The zero line indicates the bench mark country and the values computes as $\ln(y_{it}) - \ln(y_{nt})$ where y is per worker productivity of country *i* and subscript *n* denotes the reference country. Note that zero line then indicates the benchmark country.

[20] For example, in table 5 column 6 we report $\Delta \ln(y_{it}) - \ln(y_{it-1})$.

	1965-1970	-0.467	0.009	-0.003	-0.151
	1970-1975	0.125	0.003	-0.061	-0.018
	1975-1980	0.226	0.024	0.007	0.097
	1980-1985	-0.080	0.009	0.015	-0.005
	1985-1990	-0.016	0.020	0.049	0.057
	1990-1995	0.197	-0.026	0.022	0.070
	1995-2000	-0.026	-0.020	0.031	0.009
	2000-2005	-0.009	0.012	0.010	0.015
	2005-2010	0.188	0.009	0.004	0.072
Korea	1960-1965	-0.005	0.057	-0.157	-0.121
	1965-1970	0.049	0.021	-0.083	-0.052
	1970-1975	0.155	0.017	-0.059	0.003
	1975-1980	0.215	0.022	-0.053	0.032
	1980-1985	0.115	0.015	0.032	0.079
	1985-1990	0.147	0.000	0.026	0.074
	1990-1995	0.172	0.027	0.024	0.099
	1995-2000	0.035	0.006	0.038	0.053
	2000-2005	0.068	0.003	0.004	0.028
	2005-2010	0.111	0.007	0.031	0.072
Singapore	1960-1965	-0.205	0.043	-0.107	-0.146
	1965-1970	-0.116	0.009	-0.009	-0.041
	1970-1975	0.133	0.003	-0.027	0.018
	1975-1980	0.128	0.024	-0.015	0.043
	1980-1985	0.011	0.009	-0.012	-0.003
	1985-1990	-0.105	0.020	0.027	0.005
	1990-1995	0.142	-0.026	0.094	0.123
	1995-2000	0.107	-0.020	0.032	0.054
	2000-2005	-0.136	0.012	0.046	0.009
	2005-2010	0.257	0.010	0.009	0.100
Taiwan	1960-1965	-0.062	0.030	-0.046	-0.047
	1965-1970	-0.074	0.011	-0.049	-0.066
	1970-1975	0.226	0.007	-0.033	0.046
	1975-1980	0.154	0.013	0.044	0.103
	1980-1985	-0.076	0.002	0.033	0.010
	1985-1990	0.089	0.016	0.026	0.065
	1990-1995	0.198	0.000	0.043	0.109
	1995-2000	0.118	0.017	0.026	0.076
	2000-2005	-0.023	0.023	0.008	0.015
	2005-2010	0.082	0.004	0.026	0.055
India	1960-1965	-0.157	0.016	-0.082	-0.124
	1965-1970	-0.337	-0.004	-0.032	-0.146
	1970-1975	0.038	-0.006	-0.073	-0.064
	1975-1980	-0.040	-0.006	-0.002	-0.019
	1980-1985	0.051	0.002	-0.015	0.003
	1985-1990	-0.060	0.015	0.002	-0.008
	1990-1995	0.125	-0.011	0.004	0.038
	1995-2000	0.049	0.002	0.045	0.062
	2000-2005	0.249	0.006	-0.030	0.056
	2005-2010	0.264	0.009	0.076	0.168

Source: Authors' Calculations.

Table 5 also shows disaggregated picture of productivity by its sources. The contribution of three sources of convergence, namely physical capital, human capital and TFP to total convergence is presented in columns 3, 4 and 5 respectively. Decomposing the factors accounting for convergence, gains in total factor productivity (TFP) were major for India during the sub-period 2005-2010. Gains in TFP for India have been noted by other studies too (Bosworth & Collins 2008). Taking an average picture of the contribution of three components physical capital, human capital and TFP in

total convergence, one finds that gains in TFP were most significant for the Asian tiger economies. This phase, however, begins only from late seventies onwards. Other studies such as Madsen & Ang (2009) also found that TFP contributed most to high per capita growth in these countries. In contrast, in India convergence to Japanese productivity was reported mainly in physical capital accumulation particularly after 1990. Investment in India particularly in the pre-reform period (before 1991) was driven by public sector investment. In the post-reform period the trend has reversed with increase in private investment and fall in public investment (Mallick 2009). Human capital formation has also contributed to overall productivity gain over time in most of the tiger nations. In the Indian context this shows a mixed influence on total productivity convergence.

In summary, outcome of our simple analysis suggests that all these countries started off with negative TFP contribution to total convergence (measured relative to Japan) and, over time they tended to catch up with the Japanese TFP. In regards to other sources of convergence the contribution of human capital has been positive in most countries. The contribution of physical capital has been mixed depending upon the country and time period. In terms of total convergence, contemporary Indian experience is similar to the tiger nations when they have taken-off to converge. Furthermore, at disaggregated level also the recent Indian experience, particularly after 1995, reasonably resembles the Asian tigers' take-off, however it is too early to reach such a conclusion as further studies are warranted.

4. Conclusion

Since the economic reforms in 1991, India has been witnessing high growth rates. This shift in the country's growth path has taken place after decades of low growth, high poverty and low per capita incomes. The four Asian tigers since the sixties have experienced high growth rates and have rapidly transformed their economies. Even in the post-nineties period the tiger economies continue to experience high growth rates. In this paper we adduced certain focal areas, as have been suggested in the recent literature too, and examined their relevance in the Indian context. These factors were human capital development and creation of knowledge economy; and role of intra-regional trade. We also examined whether the Asian tigers and India have converged with total productivity in Japan in the post-nineties period.

Our study observed that India ranks far below the Asian tigers in the knowledge economy index. As India is a large country and a big macro picture may not entirely reveal why the country lags behind other countries in the knowledge economy we also constructed a first such knowledge economy index at a disaggregate level for 17 major states of India. We have not come across any study which has constructed knowledge economy index for the Indian states. The results showed large disparities across the states in knowledge economy reflecting country's difficulties in catching up with other countries overall. Regarding labour productivity, as our results show that India was moving away from the benchmark country until 1990 (pre-reform period) and started catching up particularly due to physical capital (not necessarily human capital) since 1995 onwards.

Some policy implications in the Indian context are strong focus required on human development, particularly education that enables building up the knowledge economy. This is crucial for large, but less developed states. Such a strong focus on human capital in combination with sustained physical capital investment will potentially support India to catch-up with the leaders in the region. Another policy implication emerging from our study is increased focus on intraregional trade considering its potential to improve economic growth, infrastructure development and reduction in poverty. Increased trade within the region will lead to mutual growth of all partcipating countries within the region and will also facilitate movement of rural and agricultural labour to non-farm sectors.

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