HUMAN CAPITAL, TRADE AND DEVELOPMENT IN INDIA, CHINA, JAPAN AND OTHER ASIAN COUNTRIES, 1960-2002: ECONOMETRIC MODELS AND CAUSALITY TESTS

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Abstract

This article emphasizes the important role of human capital, manufacturing and imports to increase real income per inhabitant and non-agrarian employment. Some researchers specialized in economic growth analyse the export-led growth in many countries and insist upon the importance of openness to increase real Gdp. Often this type of beneficial effects seem very clear but it does not always happen that way. The important question in our view is not only to increase the degree of openness due in order to increase foreign demand but also to relate foreign trade with supply side having into account the general positive effects of imports on the domestic growth of industry, building and services. International cooperation is also recommended in order to help Asian developing countries to reach sustained development at high rates for real income per inhabitant.

JEL classification: C5, C51, O11, O53, O57
Keywords: Human Capital, Economic Development, Foreign Trade and Industry, India, China, Japan, Asia.

1. Introduction

After the Japanese miracle in the period 1960-1980, other Asian countries joined a process of increase of trade, industry and human capital in order to improve socio-economic development. China during the period 1980-2000 has been the most outstanding example of success in this regard, although other Asian countries have also shown during that period important increases in human and physical

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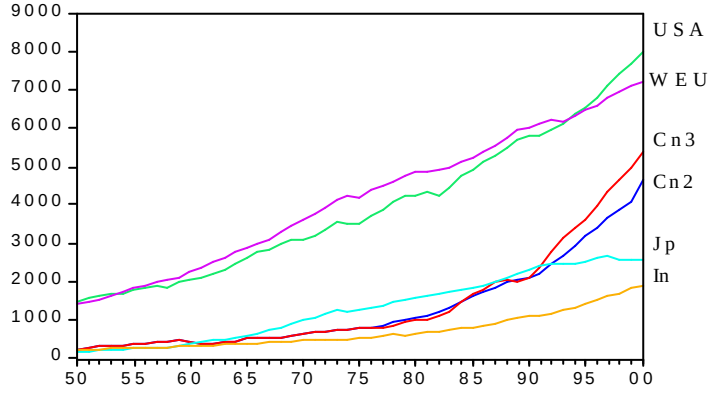
capital as well as a higher degree of trade openness. Here we analyse some effects of those changes on economic development in India and China, in comparison with Japan and other industrialized countries.

In section 2 we present a general view of Growth, Employment, Industry and Foreign Trade for the period 1950-2002, section 3 presents our estimated inter-sector econometric models for India, China, and Japan in order to show the positive effects of industry and foreign trade on the development of services, section 4 presents an analysis of causality between human capital and development and finally section 5 present the main conclusions.

2. Gdp, employment, industry and foreign trade in 1950-2002.

Graph 1 shows the evolution of real Gdp in India, China, Japan, Western Europe, WEU, and the USA. A similar graph at exchange rates would show a higher level for Japan and smaller values for China and India, in comparison with graph . In the case of China we include two estimations of real GDP (Cn2 and Cn3), according with the comparison of sources made by Guisan and Exposito(2004).

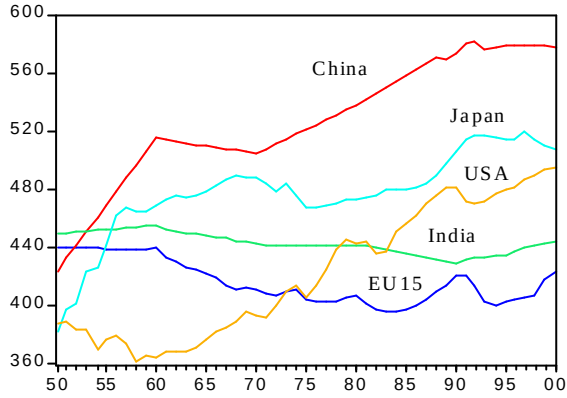
Graph 1. Real Gdp of India, China, Japan and other countries
(Billion US dollars at 1990 PPPs)



Source: Elaboration by Guisan and Exposito(2004) from Maddison(2001) and other international sources.

On the other hand graph 2 shows the evolution of the rates of employment in those countries and areas.

Graph 2. Rate of employment in India, China and OECD, 1950-2000



Source: Elaborated by Guisan(2004) international statistics

As employment depends mainly on non-agrarian real value-added, the analysis of the impact of Industry on Services is of uppermost importance, accordingly to our previous studies, cited in the bibliography, where we have estimated several inter-sector models for OECD countries, China, Mexico, Central Europe, Northern Africa and other areas , and here we present in section 3 some inter-sector models for India, China and Japan.

Tables 1 and 2 show the evolution of real Valued-Added by sector and per inhabitant in the major areas of Asia-Pacific in comparison with other areas. The countries in the 6 areas of Asia-Pacific are the following ones: 1) Western Asia: Bahrain, Iraq, Israel, Jordan, Kuwait, Lebanon, Oman, Palestinian Territories, Saudi Arabia, Syria, UAE and Yemen. 2) South Central Asia: Afghanistan, Iran, and Pakistan. 3) South: Bangladesh, Bhutan, India, Nepal and Sri Lanka. 4) North East: China, Japan, North Korea, Mongolia, Taiwan and South Korea. 5) Indochina: Cambodia, Lao, Myanmar, Thailand and Vietnam. 6) South Pacific: Australia, Indonesia, Malaysia, New Zealand, Papua-New Guinea, Philippines and Singapore.

Table 1. Real value-added per head and by sector in Asia-Pacific, 1980-99: Agriculture and Total (dollars at 1999 prices and PPPs)

Area	qh80a	qh90a	Ph99a	qh80t	qh90t	qh99t
1. Western Asia	610	641	541	9463	7350	7020
2. Central Asia	372	566	628	2375	2323	2988
3. India and South	489	534	628	1169	1581	2285
4.China and N. East	348	499	630	2539	4075	6209
5.Indochina	461	516	645	1399	1969	3022
6.South Pacific	592	637	645	3295	3928	5061
Total Asia-Pacific	430	532	629	2324	3076	4389
of which: China	314	481	638	763	1716	3753
India	511	561	668	1185	1628	2387
Japan	557	599	519	16359	22757	25975
USA and Canada	443	582	653	22062	27016	31319
Western Europe	389	432	447	16010	20041	22667
World	462	529	591	5434	6191	7031

Source: Own elaboration based on World Bank, and international statistics.

Table 2. Real value-added per head and by sector in Asia-Pacific, 1980-99: Industry and Services (dollars at 1999 prices and PPPs)

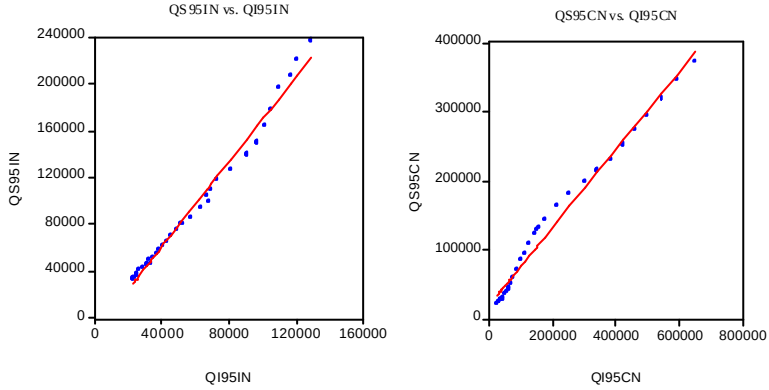
Area	qh80i	qh90i	qh99i	qh80s	qh90s	qh99s
1. Western Asia	4600	3101	2940	4252	3607	3538
2. Central Asia	1006	632	880	998	1126	1480
3. India and South	248	384	575	431	662	1082
4.China and N. East	917	1544	2736	1273	2032	2843
5.Indochina	310	558	999	628	895	1378
6.South Pacific	1091	1291	1819	2605	2000	2597
Asia-Pacific	761	1056	1695	1133	1487	2065
of which: China	249	616	1876	201	618	1238
India	246	391	597	429	676	1122
Japan	6256	8925	9611	9546	13232	15845
USA and Canada	5180	6073	8300	16439	20360	22366
Western Europe	5312	6281	6735	10310	13329	15485
World	1732	1940	2285	3240	3721	4154

Source: Own elaboration based on World Bank and international statistics.

Figures for real value-added of Services in China are probably undervalued in comparison with that of Industry, while in the case of India the opposite seems to happen. Japan seems to have some degree of underdevelopment of Services in comparison with its industrial capacity.

Industrial development is generally needed to guarantee high levels of development of Services, at least in middle size and large size countries. Graphs 3 shows the important positive correlation that exists between real Value-Added of Industry, QI, and Services, QS, in India and China.

Graph 3. Relationship between QS and QI in India and China

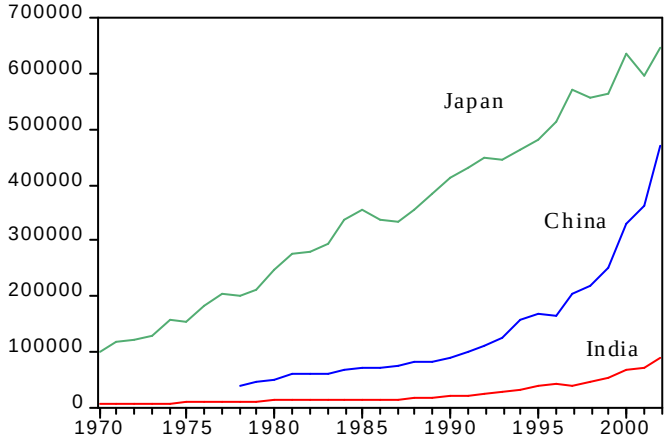


The positive evolution of Industrial real value added during the last decade of the 20th century indicates the starting point of a dynamic process of development which is expected to continue during the first decades of the 21st century in order to reach convergence with developed countries. In the case of these to economic giants to multiply by two, three or more times their industrial production means an important impact on world trade of goods and services. Industrial development generally increases both internal and external trade.

Guisan and Exposito(2003) present a comparison of exports of goods, services and total, per inhabitant for the large areas of Asia-Pacific, in comparison with world average, base on World Bank statistics, with a total value of exports per inhabitant higher than world average, estimated slightly around 1141 current dollars, only in two areas: Western Asia, and South-Pacific. while the other areas remain clearly below, with a value of 718 for North East, 410 for Indochina, and only 122 for South Central and 48 for South. These figures will likely be highly increased for the first decades of 21st century.

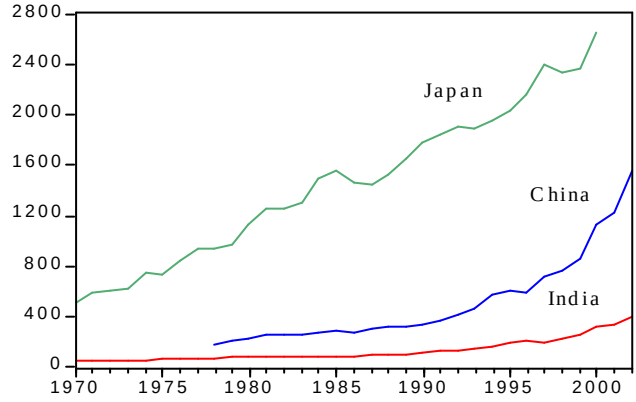
Graph 7 shows the evolution of Exports of goods and services in million dollars at 1995 prices and exchange rates, accordingly to the World Bank statistics. The corresponding graph in terms of PPPs would be even more impressive with India and China figures more than 4 times their value at exchange rates, while Japan in PPPs is approximately half its value at exchange rates.

Graph 7. Exports of goods and services
(million dollars at 1995 prices and exchange rates)



Even at purchasing power parities, exports of goods and services per inhabitant are already lower in China and India than in Japan, as it is shown in graph 8. Guisan and Cancelo(2002) show that exports per inhabitant, for a same degree of development, are usually higher in small countries than in big ones, and they growth with economic development. According to that it is expected a future increase of this variable in India and China although they could be stabilized at a lower level than in Japan.

Graph 8. Exports of goods and services per inhabitant
(dollars at 1995 prices and PPPs)



The effects of foreign trade on Gross Domestic Product, Gdp, are twofold: 1) From the demand side Exports of goods and services have generally a positive impact on real Gdp. 2) From the supply side the increase of real Imports of goods and services, usually due to a higher financial capacity to import, favoured by an increase in Exports, generally has a very positive impact on economic growth, allowing the availability in international markets of raw materials and intermediate inputs which are scarce in the domestic market. Industrialization usually implies a higher degree both of internal and foreign trade. In the next section we estimate some econometric models which have into account these effects.

3. Econometric models of growth of services depending on industry and foreign trade.

Before to present the estimation of our econometric model which relates Services with Industry and Foreign Trade I would like to mention some interesting econometric models which have had indeed a positive impact on the development of growth policies in these countries. In the first place its is worthy to mention the outstanding contribution of Lawrence Klein and the teams of Project Link of the United Nations. Klein(2004) has just written a very interesting article on the future of the two giants: India and China.

Klein and Ichimura(2000) present an interesting analysis of econometric models of growth in China, particularly from the point of view of demand and supply of primary inputs, through production functions. Regarding the availability of intermediate inputs and other factors I would like to mention particularly the interesting chapter by Liang(2000), who comments on the important role of intermediate inputs for economic growth in China: "*The shortages of natural resources, infrastructures and funds has imposed restrictions on Chinese economic development*". He points that although the restrictions from supply have been generally stronger there have been also some limitations from demand: "*After 1988, some new problems in the economy supply capacities of most sectors grew faster than demands. Since 1989, the sluggish market and weak demand for some manufactured products led to the result that output of some manufacturing sectors are not determined by their productive capacities any longer but by the demand for their products. Broadly speaking, however, it may be said that China´s Gdp is determined by productive capacity*".

Some authors focus on the role of human capital accumulation on China´s economic growth. Although human capital quality has generally a positive impact on economic growth it is important to mention that, according to the international experience, the main positive impact of education on development is not due to its effect on the increase of real GDP but to its beneficial effect to avoid

excessively high fertility rates, as shown in the international cross-country model presented by Guisan, Aguayo and Exposito(2001).

Pandit(2002) analyses sustainable economic growth in India, according to his wide experience with macro-econometric models of this country, and emphasizes the convenience to have into account, in the case of low income countries, more the important restrictions from supply side and focus more on long term relationships than in short-term fluctuations. Other authors like Dees(1999) analyse the role of external variables in China and Karras(2003) present an international analysis of causality between growth and foreign trade.

Equation 1 to 4 estimate the positive effects of industry and foreign trade on real value-added of Services in India, China, Japan and in a panel of these three countries, while equation 5 estimate the average effects of foreign trade and the lagged value of services on industry with the same panel.

These equations into account direct and indirect effects of foreign trade on economic growth. The dynamic relationships should be completed having into account that industrial development usually increases the level of Exports and the capacity to import, with an overall positive impact on economic growth.

The expected sign of coefficients in equations 1 to 4 is positive for all the explanatory variables but Exports, while in the case of equation 5 Exports is expected to have a positive impact on real value-added of industry, due to demand effects, while Imports could have an overall positive or negative effect on industry, depending on the final result of substitutive and complementary relationships of imports of goods and domestic industry.

The variables: QA95, QI95, QS95, correspond to real value-added, and EXP95 and IMP95 are, respectively, exports and imports of goods and services. All variables are measured in million dollars at 1995 prices and exchange rates from World Bank statistics.

Equation 1. Real value-added of Services in India

Dependent Variable: QS95IN. Method: Least Squares				
Sample(adjusted): 1971 2002. 32 observations				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(QA95IN)	-0.107713	0.090901	-1.184954	0.2464
D(QI95IN)	0.188820	0.197345	0.956800	0.3472
D(IMP95IN)	0.285978	0.141986	2.014129	0.0541
D(EXP95IN)	-0.172363	0.145467	-1.184894	0.2464
QS95IN(-1)	1.065555	0.007764	137.2519	0.0000
R-squared	0.999225	Mean dependent var		97878.59
Adjusted R-squared	0.999111	S.D. dependent var		59990.09
S.E. of regression	1789.056	Akaike info criterion		17.95936
Sum squared resid	86419447	Schwarz criterion		18.18839
Log likelihood	-282.3498	Durbin-Watson stat		1.783300

Equation 2. Real Value-Added of Services in China

Dependent Variable: QS95CN. Method: Least Squares				
Sample(adjusted): 1980 2000. 21 observations.				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(QA95CN)	0.159712	0.166093	0.961582	0.3515
D(QI95CN)	0.373618	0.083974	4.449200	0.0005
D(IMP95CN)	0.062577	0.045027	1.389781	0.1849
D(EXP95CN)	-0.000950	0.036226	-0.026216	0.9794
QS95CN(-1)	1.009712	0.019785	51.03384	0.0000
AR(1)	0.839819	0.153313	5.477793	0.0001
R-squared	0.999505	Mean dependent var		153720.9
Adjusted R-squared	0.999340	S.D. dependent var		85375.29
S.E. of regression	2192.864	Akaike info criterion		18.45876
Sum squared resid	72129802	Schwarz criterion		18.75720
Log likelihood	-187.8170	Durbin-Watson stat		1.422864

Equation 3. Real value-added of Services in Japan

Dependent Variable: QS95J. Method: Least Squares				
Sample(adjusted): 1963 2000. 38 observations.				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(QA95J)	0.218916	0.714658	0.306323	0.7613
D(QI95J)	0.419707	0.115306	3.639942	0.0010
D(IMP95J)	0.105075	0.267254	0.393164	0.6968
D(EXP95J)	-0.298193	0.225908	-1.319973	0.1962
QS95J(-1)	1.017917	0.013969	72.87134	0.0000
AR(2)	0.798243	0.207002	3.856219	0.0005
R-squared	0.999252	Mean dependent var		2144571.
Adjusted R-squared	0.999135	S.D. dependent var		972004.7
S.E. of regression	28590.19	Akaike info criterion		23.50345
Sum squared resid	2.62E+10	Schwarz criterion		23.76202
Log likelihood	-440.5656	Durbin-Watson stat		1.625182

Equation 4. Pool of China, India and Japan for Services

Dependent Variable: QS95?. Method: Pooled Least Squares.				
Sample(adjusted): 1961 1999. 3 cross-sections. Total panel 89 obs.				
White Heteroskedasticity-Consistent Standard Errors & Covariance				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(QA95?)	-0.086285	0.431971	-0.199748	0.8422
D(QI95?)	0.406592	0.092266	4.406753	0.0000
D(IMP95?)	0.264888	0.149633	1.770258	0.0804
D(EXP95?)	-0.319578	0.260244	-1.227996	0.2230
QS95?(-1)	1.000608	0.008595	116.4172	0.0000
IN--TI	56.76817	14.84583	3.823846	0.0003
CN--TI	53.84026	37.24609	1.445528	0.1522
J--TI	798.9667	201.9398	3.956459	0.0002
R-squared	0.999788	Mean dependent var		947433.1
Adjusted R-squared	0.999769	S.D. dependent var		1156859.
S.E. of regression	17577.30	Sum squared resid		2.50E+10
Log likelihood	-992.0125	F-statistic		54443.90
Durbin-Watson stat	1.518501	Prob(F-statistic)		0.000000

Equation 5. Pool of India, China and Japan for Industry

Dependent Variable: QI95?. Method: Pooled Least Squares				
Sample(adjusted): 1962 2000. 3 cross-sections. Total panel 89 obs.				
White Heteroskedasticity-Consistent Standard Errors & Covariance				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(IMP95?)	1.360019	0.291060	4.672643	0.0000
D(EXP95?(-1))	0.310810	0.345079	0.900693	0.3703
D(QS95?(-1))	0.581473	0.180961	3.213246	0.0019
QI95?(-1)	0.976115	0.013831	70.57341	0.0000
R-squared	0.998424	Mean dependent var		614357.2
Adjusted R-squared	0.998368	S.D. dependent var		658341.8
S.E. of regression	26592.48	Sum squared resid		6.01E+10
Log likelihood	-1031.005	F-statistic		17949.88
Durbin-Watson stat	1.460544	Prob(F-statistic)		0.000000

All the coefficients have the expected signs but real value-added of Agriculture in India and in the panel, what could be due to the use of exchange rates instead of PPPs or to multicollinearity or other causes that lead to an underestimation of this coefficient. It is important to notice that the complementary effects of Imports on industry is more important than the substitutive ones in equation 5, and the coefficient of imports is positive and significant.

4. Human capital and development: analysis of causality in Asia

Although researchers have found some contradictory results when trying to show the beneficial effects of education in growth and development, we can conclude, as Guisan, Aguayo and Exposito(2001) point out, that the main positive impact of education on development is to avoid excessively high average fertility rates, what implies a positive, and often high, difference between the rates of growth of production and population, and lead to an increase in investment and production per inhabitant. In the next tables we present a Granger´s test of causality between real value-added per inhabitant, QH, and human capital, measured by Total Years of Education of adult population, TYR, accordingly to the data by Barro and Lee and other international estimations

Table 3. Analysis of causality between QHI and TYR in India.

Pairwise Granger Causality Tests. Sample 1960 2002. Lags 2			
Null Hypothesis:	Obs	F-Statistic	Probability
QHIN does not Granger Cause TYRIN	39	2.5071	0.0964
TYRIN does not Granger Cause QHIN		0.5333	0.5914

Table 4. Analysis of causality between QH and TYR in China

Pairwise Granger Causality Tests. Sample 1960 2002. Lags 2			
Null Hypothesis:	Obs	F-Statistic	Probability
QHCN does not Granger Cause YRCN	39	0.0113	0.9887
TYRCN does not Granger Cause QHCN		5.6845	0.0074

Table 5. Analysis of causality between QH and TYR in Japan

Pairwise Granger Causality Tests. Sample 1960 2002. Lags 2			
Null Hypothesis:	Obs	F-Statistic	Probability
QHJP does not Granger Cause TYRJP	39	3.45447	0.04308
TYRJP does not Granger Cause QHJP		0.45928	0.63560

Due to the problems of multicollinearity present in this test, and analysed in Guisan(2003), the bilateral relationship between both variables is not clearly show, although there are other empirical evidences in favour of the existence of this relationship. Equation 6 presents the effects of education to diminish fertility rates, FER, measured by the number of children per woman, in these three countries, which agree with the international results presented in Guisan, Aguayo and Exposito(2001), and thus implies that the increase of human capital has a positive effect in the increase of real value-added per inhabitant, mainly due to the moderation effect on natural population growth.

(6) $FER_{it} = 0.9882\ FER_{it-1} - 0.3369\ D(TYR_{it})$; $R^2 = 0.9963$; dw=1.59
(t=282.4) (t=-2.31)
SE = 0.10; Mean of dependent variable=3.33, %SE = 3.0%

Dreze and Murti(2000) and other studies also show the moderation effect of education on population growth in India. This moderation has generally a positive effect on economic development and it

should be a priority for many less developed countries if they aim to reach real convergence with developed ones. Another positive effects of education on economic development have been analysed in other studies as in Cancelo, Guisan and Frias where it is shown the positive effect of human capital on exports per inhabitant.

5. Conclusions

Industrial development of China, India and other Asian countries, following the example of Japan and other developed countries, has been one of the most important economic events of the last decades of the 20th century. The challenges for India and China during the first decades of the 21st century are formidable, and both countries will achieve a high rate of sustainable economic development if their policies are focused on improving the educational level of population, industrial development, and trade, among other factors. The econometric models here presented show some of the main positive direct and indirect effects of industry and foreign trade on economic growth, as well as the high positive impact of education on economic development due to its effect on the moderation of fertility rates.

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