

EMPLOYMENT BY SECTOR AND DEVELOPMENT IN INDIA FOR 1950-2020 AND INTERNATIONAL COMPARISONS WITH CHINA AND OECD COUNTRIES

GUISAN, Maria-Carmen *

Abstract . We analyze economic development in India for the period 1950-2020, in three sub-periods: 1950-1980, 1980-2000 and 2001-2020. We have into account production by sector and its effects on employment and productivity. We present a comparison of data with other economies, as China, Japan and some European countries, regarding some indicators of development and welfare. We include references to some interesting econometric models of Employment by sector in India and in other countries and we focus on the trends to diminution of Farm Employment and increase in Non Farm Employment. We highlight the important effects of industrial production on general productivity of workers, real income per capita and poverty diminution, as well as the positive effects, on development, of increase of schooling and social capital. For the next decade: 2021-2030, we conclude that there are good opportunities for advances on economic development in India and that good economic policies addressed to foster international investments and cooperation for the creation of Non Farm Employment in India may have a positive impact both for urban and rural areas.

JEL codes: C51, E24, I3, J13, J21, J43, L6, N15, N35, O40, O53

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1.. Introduction

In this study we present a survey of employment, production and economic development of India in comparison with China, OECD countries and World average.

Section 2 analyzes Production by sector, Population growth, Educational level, Gross Domestic Product per capita, Life Expectancy and Poverty diminution.

Section 3 analyzes the evolution of Employment and Productivity per worker

Section 4 analyzes some econometric models of Employment and productivity, estimated with data of India or with data of other countries which are of interest for economic policies of development.

Section 5 presents the main conclusions. In the Annex we include some supplementary information.

*Maria-Carmen Guisan, Presidente of the Euro-American Association of Economic Development Studies, Honorary Professor of Econometrics, University of Santiago de Compostela, Spain. E-mail: euroamericanassociation@gmail.com: Website: <https://www.usc.gal/economet/guisan2.htm>

2. Production by Sector, Population, Education, GDP per capita and Life Expectancy

India has increased the level of Education and Economic Development, slowly during the period 1900-1980 and at a higher rate for the periods 1980-2000 and 2000-2020. Year 2020 has implied a diminution, as in many countries of the World, due to the pandemic of Covid-19. It is a desirable recovery since year 2021, with policies addressed to sustainable development and increase of quality of life.

Table 1 presents a comparison of production by sector and per capita in India, China, Japan and World average in

2.1. Production by sector, population, schooling and fertility around year 2000

Table 1. Production per capita in India, China, Japan and the World, year 1999

Country	Agriculture	Industry	Services	Total
India	668	597	1122	2387
China	638	1876	1238	3753
Japan	519	9611	15845	25975
World average	591	2285	4154	7031

Note: Data is expressed at 1999 prices and purchasing power parities, PPPs, based on our own calculations from international data published by World Bank, United Nations, and other institutions. PPPs are generally more appropriate for international comparisons than exchange rates. Source: Elaborated by Guisan and Exposito(2003) from World Bank Statistics.

Table 2. Population, Education and Fertility in India, China, Japan and World average

Country	Pop80	Pop90	Pop99	Eduh99	Tyr99	Fer00
India	687	849	997	86	4.8	3.3
China	981	1133	1249	76	5.7	1.8
Japan	117	124	127	935	9.7	1.4
World	4429	5262	5971	258	5.8	2.8

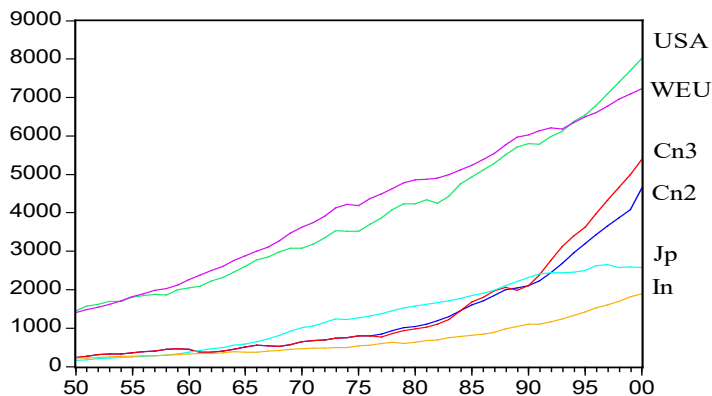
Source: Elaborated from WB Indicators and Barro and Lee(2003). Eduh=average expenditure in public education in 1995-99. Tyr99=Total years of schooling of population over 15 years, in year 1999. Fer00=Fertility rate in year 2000 (average number of children per woman in her life).

For the period 1980-1999, population in India increased in a 45.1%, in China 27.3%, in Japan 8.5% and in the World 34.8%. Generally, the lower percentages of natural population growth (without taking into account immigrations) correspond to countries with the higher levels of schooling, like is the case of Japan in this group of countries. China is a special case due to particular demographic policies

In table 2, the highest fertility rate of year 2000 corresponds to India with 3.3 average children per woman in her life, over World average of 2.8. China with 1.8 and Japan with 1.4 where below World average. As seen in Guisan, Aguayo and Exposito (2001), an international econometric model relating fertility and education shows that there is a moderation effect of the variable *Tyr* on excessively high fertility rates, Moderation in fertility rates contributes to increase Savings and Investment per capita and to increase Production per capita, and Productivity per worker.

Graph 1 show the evolution of total real Gross Domestic Product (GDP) of India, China, Japan, West Europe and the United States for the period 1950-2000. In the case of China we include two estimations of real GDP (Cn2, and Cn3).

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. Notes: In=India, Jp=Japan, Cn1 and Cn2=two estimations of China, WEU= West Europe, USA=United States of America.

For the period 1950-2000, India experienced an important increase of real GDP although lower than the increases of Japan, China, West European Union and the United States. While around 1960 the real values of GDP in China and India were very alike, in year 1980 China showed a higher value. For the period 1980-2000 there was an important increase in India, but lower than the increases of Japan and China.

For the period 2000-2015 production per capita in India increased in 30.6%, with a higher percentage than in the periods 1980-1985 (18.6%), 1985-90 (14.5%), 1990-1995 (27.0%) and 1995-99 (16.46%), accordingly to data from World Bank.

As we will see in table 4, the increase in industrial production per capita is of uppermost importance to increase total real production per head, due to the positive effects of industry on services and other sectors. The degree of industrialization is generally very important. In 1999 India and China were below World average of industrial production per capita, with higher value in China in comparison with India. Schooling in year 1999 was lower in India.

Education has an important effect to moderate excessively high fertility rates as seen in Guisan, Aguayo and Exposito(2021). Accordingly to Indian Planning Commission (2001), The composition of workers, of age 15 years and above, by level of education around year 2000, was very low with high percentages of not literates, particularly in the case of rural areas and female population. The percentage of not literate was 51.3% in rural areas and 21.5% in urban ones. The total of not literate in female population was 69.3% (74.0% in rural areas and 43.9% in urban ones), and in the case of male population 32.9% (39.6% in rural areas and 16.0% in urban ones). Figures from WB(2021) show an important increase of education with 74% of literate population in India in year 2018.

2.2. Advances in Life expectancy and diminution of Poverty in India

For the period 1950-2020 there was an important increase of Life Expectancy in India.

Table 3 shows the evolution of Life Expectancy in India in comparison with China and with two OECD countries with the highest levels of Life Expectancy (Japan and Spain).

Table 3. Life Expectancy in India, China, and 2 OECD countries

Year	India	China	Japan	Spain
1960	42.27	43.73	67.97	66.68
1970	47.74	59.09	71.95	72.03
1980	53.81	66.84	76.09	75.40
1990	57.87	69.15	78.84	78.99
2000	62.51	71.40	81.08	79.34
2019	69.66	76.91	84.36	82.40
Increase 1960-2019	27.39	33.18	16.39	15.72

Source: Elaborated from WB(2021)

Some of the main impacts of the increase in economic development, have contributed to avoid undernourishment and to increase sanitation, vaccines distribution, the prevention of illness and sanitary assistance. These measures have contributed to a high increase in Life Expectancy.

Poverty in India, and in other countries, although has diminish needs more advances to be eradicated.

Guisan and Exposito (2020) analyze the evolution of food and poverty, and other indicators of welfare in the World. They cite Settimo(2015) who includes data of the evolution on extreme poverty in the World, given by the number of people below 1.25 US Dollars (USD) at 2005 prices and Purchasing Power Parities (PPP). The number evolved from around 2000 million (1920 million) in year 1990 to around 1000 million in year 2015 (1011 million). They also cite Guisan and Exposito(2010), who show the evolution of poor population for 2000-2005.... Besides, estimations for the period 2005- 2015 indicate a diminution of extreme poverty, because people with less than 3.20 Dollars a day in 2015 (equivalent to 2 Dollars in 2005) amounted to 1900 million people. It is an impressive amount, although lower than in year 2005.

FAO(2020) estimate a diminution of undernourishment in South Asia, from 26% of population in year 1990 (289 million people) to 12% in year 2015 (195 million people). It is important to following this trend of diminution in undernourishment.

Alison J. Barret, Head Urban Poverty Group, DFID, New Delhi, and Richard M. Beardmore Senior Urban Specialist, World Bank, Washington, presented an interesting discussion paper (Barret and Beardmore(2000)), analyzing the important impacts of economic development on the increase of urban population in order to prevent poverty and lack of resources in urban areas. They found that 73% of urban population under poverty line where women and children, and recommend an increase of female participation in urban employment in order to diminish the high rates of poverty among urban women. Of course it is also important to increase social services for children care, in order to allow mothers to have an employment or economic activity.

2.2. Production per head in 2010-2017

Table 4 presents a comparison of real Value-Added by sector, per capita in year 2017, in India in comparison with China. Data are expressed at constant prices and Purchasing Power Parities of year 2011.

Table 4. Real Value-Added by sector and Population in year 2017
(Value-Added in Dollars per capita at 2011 prices and PPPs, Population in millions)

Country	Agriculture	Industry	Services	Total	Population
India	1018	1727	3772	6516	1340
China	1154	6184	7916	15254	1390
Japan	463	11339	27105	38907	127
Spain	956	6878	26291	34126	46.6
UK	263	7065	32900	40229	59.7
Mexico	608	5530	11817	17956	125

Source: Elaborated by Guisan and Exposito (2020) (Annex 2) from WB statistics.

The Nobel Prize, L.R. Klein(2004) analyzed data from the Reserve Bank of India(2003) comparing the shares of sectoral Value-added, on the total, for the period 1970-2001. In table 5 we include data of the shares of each sector for that period as also in year 2017.

Table 5. Shares of real Value-Added by sector in Total, 1970-2017

		1970	1980	1990	2001	2017
India	Agriculture	44.5	38.1	31.0	13.9	15.6
	Industry	23.9	25.9	29.3	26.7	26.5
	Services	31.6	36.0	39.7	49.8	57.9
China	Agriculture	42.2	30.1	27.0	11.3	7.6
	Industry	44.6	48.5	44.6	64.5	40.5
	Services	13.2	21.4	31.3	24.1	51.9

Source: For 1970-2001, from Klein(2004) and Indian FRB(2002). For 2017 data elaborated by Guisan and Exposito(2020) from WB(2020). Industry includes Industry and Building.

The comparison with 4 OECD countries indicates that higher levels of economic development implies higher values of production per capita in Industry and Services, and higher percentages of real Value-Added in Services. Higher values of industrial production per capita usually lead to high increases in employment and production in Services. Accordingly to the World Bank data, the percentages for 5 OECD countries in year 2017 where as follows:

Agriculture: Japan (1.2%), Spain (2.8%), UK (0.7%), Mexico (3.4%)

Industry: Japan (29.21%), Spain (20.2%), UK(17.6%), Mexico (30.8%)

Services: Japan (69.7%), Spain (77.0%), UK (81.7%), Mexico (65.8%).

The increase of real value-added in manufacturing is very important to increase real value-added and employment in services sectors.

Table 5 shows the evolution of real value added per capita in years 2010 and 2015 in Manufacturing and Non Manufacturing and also Gross Domestic Product per capita.

Tabla 5 .Production per head in Manufacturing (QMH) and Non-Manufacturing (QNMH)(US \$ at 2011 prices and PPPs)

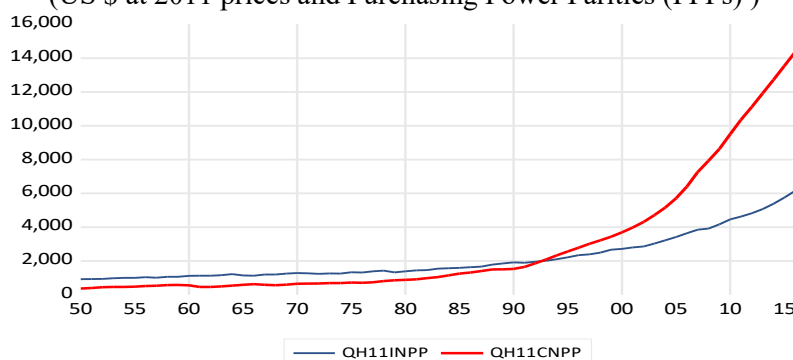
	QMH 2010	QMH 2015	QNMH 1110	QNMH 1115	PH11 2010	PH11 2015
China	3005	3929	6521	9641	9526	13570
India	769	954	3635	4800	4405	5754
Indonesia	1859	2174	6575	8193	8433	10368
France	4148	4242	32724	33524	36872	37766
Germany	8971	9987	31458	33797	40429	43784
Italy	5726	5450	30475	28794	36201	34245
Japan	7466	7771	28284	30047	35750	37818
Spain	4316	4586	28190	27630	32506	32216
UK	3615	3759	32580	34750	36196	38509
United States	6145	6477	43228	46313	49373	52790

Source: Elaborated by Guisan, from WB statistics. Note: PH=QMH+QNMH

The percentage of Production per head (PH) between China in comparison with the UK has changed from 26% in year 2010 to 35% in 2015, and the percentage between India and the UK has changed from 12% in year 2010 to 15% in 2015.

Graph 2 presents de evolution of real production per capita in India and China. China evolved slightly below India until 1990 but has overpassed real Gross Domestic Product of India, since year 1991.

Graphs 2. Real Production per capita in India and China, 1950-2016
(US \$ at 2011 prices and Purchasing Power Parities (PPPs))

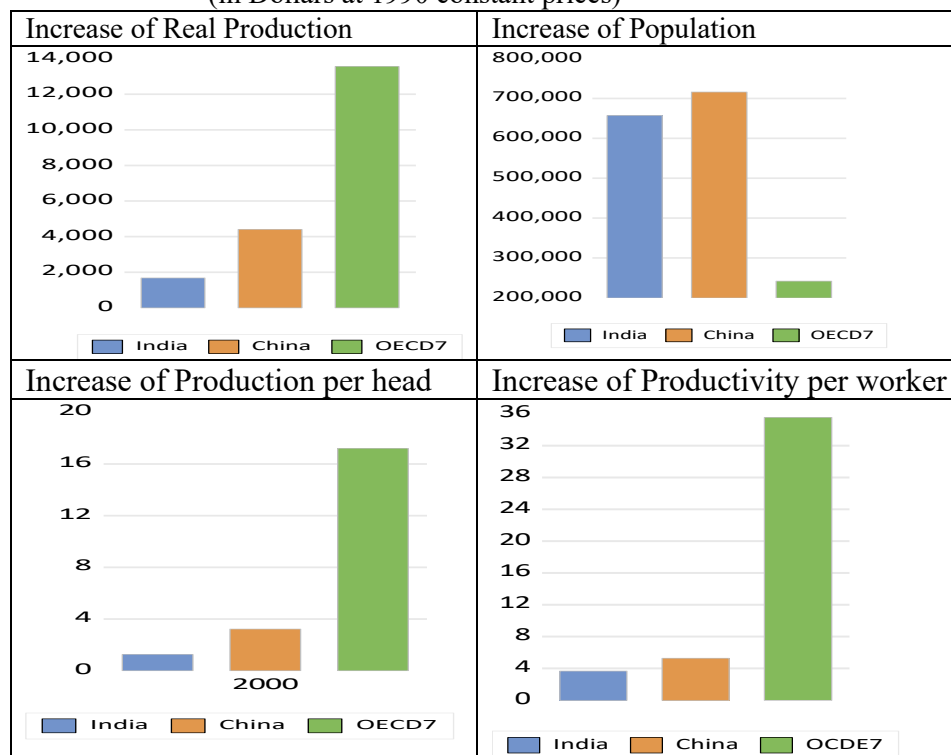


Note: Elaboration from World Bank Statistics

As it was pointed out by Kaldor and other authors, industrial production per capita has positive effect on the production of services, and other sectors, and also in workers productivity, rates of non Farm Employment, real wages and real income per capita.

Graph 3 present a general overview of Production, Population, Production per capita and Productivity per worker in India, China and 7 OECD countries (United States, Japan, France, Germany, Italy, Spain and the United Kingdom).

Graph 3. Increase of production in the second half of the 20th century
(in Dollars at 1990 constant prices)



Source: Elaborated by M.C. Guisan from Maddison, World Bank, OECD and other statistics

In the two first decades of the 21st century, India and China have experienced increase of Production per head due to increase in production and moderation in population growth.

3. Employment and Productivity per worker

3.1. Rates of Employment for 1950-2020 in India, China and OECD countries

Farm employment is usually very high in countries with low levels of industrialization, and there are important movements of population from rural areas to urban areas when there are increases of industry and services production and employment in many cities.

In order to avoid undesired high levels of emigration of population from rural to urban areas it is important to increase production and employment ; of some Non Farm activities, sustainable and compatible with rural life, in those areas in order to allow families to increase their real income per capita.

Table 6 shows the evolution of the rates of Farm and Non-Farm rates of Employment in India, China and 17 OECD countries, for the period 1950-2020.

Table 6. Rates of Employment by 1000 thousand people, 1950-2019

	Farm			Non-Farm			Total		
	India	China	OECD	India	China	OECD	India	China	OECD
1950	324	326	95	126	97	322	450	424	416
1960	317	383	76	138	132	346	455	516	421
1970	298	362	46	145	143	372	443	505	418
1980	287	371	32	154	167	398	441	538	430
1990	273	310	23	156	264	433	430	574	456
2000	235	272	17	163	307	445	398	579	463
2010	182	213	24	172	366	411	354	579	435
2019	146	142	22	197	419	440	343	561	462

Source: Elaborated from World Bank statistics, by Guisan(2001), (2005) and (2021). Note: Year 2000 in India: average of old and new estimations from WB (260 and 211 for Farm), (444 and 354 for total), (184 and 143 for rates of Non-Farm Employment).

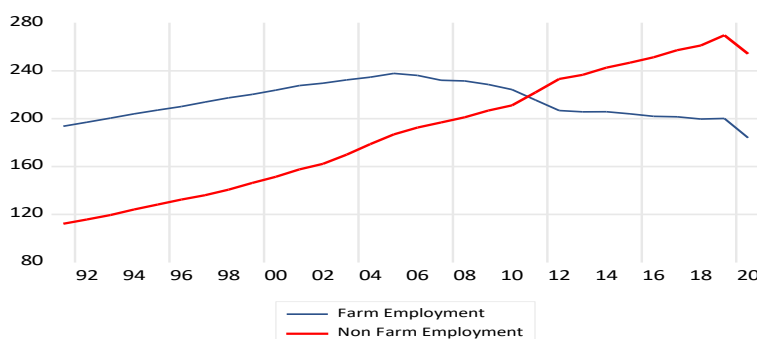
Farm rates: have decreased in India from 324 to 146 employed people in Agriculture per 1000 people, and very alike in China, from 326 to 142. The rates of OECD countries was 95 in year 1950 and has decreased to 22 in year 2019. Lower rates of Farm employment usually are accompanied by increases in productivity and real income per worker.

Non-Farm rates: In India increased from 126 to 197, in China from 97 to 410 and in OECD from 322 to 440.

Total Employment rates: In India total employment rate, accordingly to the statistics of table 1 has decreased from 450 to 343 because the increase of Non-Farm Rates was not enough to balance the diminution of Farm rates. In China there was an increase from 424 to 561 because the increase of Non-Farm Rates was higher than the decrease in Farm Rates. In OECD there was an increase from 416 to 462.

Graph 4 shows the evolution of Farm and Non Farm Employment of India

Graph 4: Farm and Non-Farm Employment in India, 1991-2020 (million workers)



Source: Elaborated by M.C. Guisan from table 7.

Table 7. Employment, Population and Rates of Employment in India, 1991-2020

	Employment (million)			Population	Rates of Employment		
	Farm	Non Farm	Total		Farm	Non Farm	Total
1991	194	112	306	891	217	126	343
1992	197	116	313	909	217	127	344
1993	200	119	320	927	216	129	345
1994	204	124	328	946	216	131	347
1995	207	128	335	964	215	133	348
1996	210	132	342	982	214	135	349
1997	214	136	350	1000	214	136	350
1998	217	141	358	1020	213	138	351
1999	220	146	366	1040	212	141	352
2000	224	151	375	1060	211	143	354
2001	228	158	385	1080	211	146	357
2002	230	162	392	1090	211	149	359
2003	232	170	402	1110	209	153	362
2004	235	179	413	1130	208	158	366
2005	238	187	425	1150	207	162	369
2006	236	193	429	1170	202	165	366
2007	232	197	429	1180	197	167	363
2008	232	201	433	1200	193	168	361
2009	228	207	435	1220	187	169	357
2010	224	211	435	1230	182	172	354
2011	215	222	437	1250	172	178	350
2012	207	233	440	1270	163	184	346
2013	206	237	442	1280	161	185	346
2014	206	243	448	1300	158	187	345
2015	204	247	451	1310	156	188	344
2016	202	251	453	1320	153	190	343
2017	202	257	459	1340	150	192	342
2018	200	261	461	1350	148	193	341
2019	200	270	470	1370	146	197	343
2020	184	254	438	1380	133	184	318

Source: Elaborated by Guisan(2021), in this report, from WB(2021) statistics. Note: World Bank provide the ratio of Employment to Population+15. We have discounted from Total Population, the number of people below 15 years old, and applied the rate provided by World Bank in order to calculate Total Employment. Applying the % of employment in Agriculture to Total we have calculated Farm Employment, and Non.Farm Employment is the difference between Total and Farm Employment.

The diminution of Farm Employment in India has evolved from its maximum of 236 million people in year 2006 to 200 in year 2019 and 184 in 2020.

This diminution agrees with the expectations provided by the econometric models estimated by Guisan(2005). In the next section we analyze the results of those models.

Table 8. Workers (millions) and Productivity per worker 2010-2019
(US \$ at 2017 prices and PPPs)

Country	Workers 2010	Workers 2019	Productivity 2010	Productivity 2019
India	435	451	11966	15882
China	775	784	15339	22632
Japan	63	67	76365	75400
Spain	18.7	19.8	92998	87590
UK	29.1	32.7	90831	89271

Source. Elaborated by Guisan(2021), in this report, from WB and OECD statistics.

Productivity per worker, in India, has increased for the period 2010-2019 and has reached in 2019 a level very alike to China in 2010. Productivity per worker in OECD countries is generally much higher mainly due to their higher levels of several variables: Industrial Production per capita, Research and Development expenditure per capita, highest levels of stock of capital per capita, higher levels of schooling and expenditure per capita on Education, etc.

4. Econometric Models of Employment and Productivity

4.1. Model of Farm Employment in India and China estimated by Guisan(2004).

Guisan(2005) estimated some interesting models that relates the evolution of real Value-Added by sector on employment by sector. Regarding Farm employment the findings of those models show that increases of real of real Value-added and Employment of Non-Agricultural sectors has usually a negative effect on Farm Employment, because many workers move from Farm to Non-Farm activities.

Real value-added by sector: It may be measured accordingly to *production approach* or to *income approach*. The first approach results from dividing monetary value of sectoral Value-Added by a sectoral deflator of prices and provides an indicator of produced quantities of goods and services in the sector. The second approach results from the division of monetary Value-Added by general deflator of Consumption, and it is an indicator of the acquisitive power of income from the sector. This distinction is of great importance for the Agriculture sector. A good level of Real income per worker is of great importance to attract workers to work in the Farm sector.

Table 9 shows the results of the estimation of a model in individual estimations and a pooled sample of India and China for the period 1965-2000.

The model was formulated as a *mixed dynamic model*, where the dependent variable (y) is a function of its lagged value ($y(t-1)$) and the increases of one or more exogenous variables ($D(x)$). Mixed dynamic form is usually very useful with better results than models in levels or in first differences. The relationships are cointegrated and have high levels of goodness of fit.

The dependent variable is Farm Employment measured by LA=Labour in Agriculture, and the exogenous variables are LNA=Labour in Non-Agricultural sectors, RINA=Real Income of Non-Agricultural sectors, and POP=Population.

Table 5. Estimated models for Farm Employment, in India and China, 1965-2000
Dependen variable: y =Labour in Agriculture=LA)

Explanatory vairables	India	China	Pooled sample: India and China
$y(t-1)$	1.0153 (211*)	1.0206 (172*)	1.0257 (277*)
D(LNA)	-0.2372 (-3.91*)	0.9293 (-17.07*)	0.9190 (-22.13*)
D(RINA)	-4.4182 (-2.13*)	-11.0092 (4.14*)	-11.0037 (-3.65*)
D(POP)	0.0744 (1.30)	0.2622 (2.61*)	0.1320(2.57*)
R^2	0.999938	0.995040	0.999473
%S.E.	0.14%	0.68%	0.65%
Durbin-Watson	1.17	1.67	1.45

The goodness of fit was high in the three estimations, with the coefficient of determination R^2 close to 1, and the % of Standard Error on the average of the dependent variable (%S.E.) below 1%. Durbin Watson statistic indicates autocorrelation in the model of India, likely due to the effect of a missing variable, while the autocorrelation is lower in the case of China and in the pooled sample.

We estimated an extended pooled model, by including more explanatory variables, in order to diminish the small degree of autocorrelation: RIA (Real Income of Agriculture) and one time trend for each country.

Autocorrelation diminished in the extended model but there is a problem because multicollinearity has increased. The coefficient of D(RINA) was negative and the coefficient of D(RIA) was positive, but the model could not show the significance of both coefficients due to a high degree of multicollinearity. The coefficients of the time trends were significant, with an estimated diminution of 0.102 million of Farm Employments in India and 0.145 in China due to some missing variables.

The pooled model of table 5 presents very good results and satisfied the test of homogeneity of coefficients as seen in Guisan(2005).

In the Annex we will include references to the modelo of Behera(2016), and other models of Farm and non Farm Employment in other countries, as those of Guisan and Exposito(2004) and other ones.

5. Conclussions

It is important for India to increase both the rates of employment per one thousand people and the productivity per worker. It is also important to increase the educational level of some sector of not literate population or with low number of years of schooling, as well as to provide facilities to increase the rates of female employment and help mothers to make compatible children care and employment. International investment for sustainable development may be of interest in order to favor investment per capita and the increase of sustainable industrial production, because it is of uppermost importance for increasing production and employment in Services sectors.

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Annex is scheduled to be included by the end of October of 2021.