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Empirical Investigation of Impact of Capital Formation by Agriculture and Industry on Industrial Productivity in India

Pathania Rajni
Department of Business Economics, Faculty of Commerce, The M.S. University of Baroda,Vadodara, Gujarat, INDIA

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Abstract

This paper investigated the impact of the capital formation by agriculture and Industry on Industrial productivity in India during the period 2004-2011. In this study, time series data over the period 2004-2011 was used. The study employed two and multi -variable regression analysis model specified on the basic of hypothesized functional relationship between capital formations as the explanatory variables, while Index of Industrial production constituted the explained variable. The model for the study was estimated using the ordinary least square (OLS) technique. The result shows that capital formation by agriculture and industry has positive statistically significant impact on the industrial productivity of the economy in the reviewed period.

Keywords: Capital formation, industrial productivity, multi-variable regression, explanatory variables, ordinary least square.

Introduction

Capital formation plays a predominant role in all types of economies whether they are of the American or the British type. Development is not possible without capital formation. Capital formation refers to all the produced means of further production, such as roads, railways, bridges, canals etc. Saving and investment are essential for capital formation. Saving is the result of waiting or abstinence. When a person postpones his consumption to the future, he saves his wealth which he utilizes for further production, if all people save like this, the aggregate savings will increase which can be utilized for investment purpose in real capital assets like machines, tool, canals, etc but saving are different from hoardings. For savings to be utilized for investment purpose, they must be mobilized in banks and financial institutions. The businessmen, the entrepreneurs and the farmers invest these community savings on capital goods by taking loans from these banks and financial institutions, this is capital formation. Capital is the core of economic development and development is not possible without adequate capital resources. Capital formation plays an important role in increasing the production potential of the economy and bringing about balanced growth of the different sectors of the economy and additional capital bring about technical progress in the economy. Capital formation also plays a significant role both in deepening and widening the industrial base of a developing economy like India.

To achieve the optimum rate of economic growth, the rate of capital formation should be above 40%. In India the gross capital formation for the year 2009-10 was 36.5% of the GDP. It was composed of 9.2% in public sector and 24.9% in private sector. The investment from household sector was 11.7% and investment from the corporate sector was 13.2%.

Table-1
Rate of Capital Formation in India

Year	Rate of Capital Formation (%)
2004-05	32.8
2005-06	34.9
2006-07	35.7
2007-08	38.1
2008-09	34.5
2009-10	36.5
2010-11	35

Source: Economic Survey 2010-11

Review of literature: A lot of studies have been done on the different aspects of capital formation at national and international level. A few studies have been taken for review:

Bhatt[1] examined the trends in savings and capital formation in India since 1950-51. This study examined the volume and pattern of investment and savings. The result shows that the sector-wise investment and savings both the government and corporate sector draw on the resources of the house-hold sector for financing their investment. For the household sector, its savings exceed its investment, while the case is the reverse with respect to the other two sectors. The most important conclusion of this study is that the marginal propensity to save at least in the initial stages of development may not rise appreciably above the average propensity to save. The rising trend of investment therefore can be supported only if adequate foods as well as foreign exchange resources become available. Bina Roy[2] estimated capital formation in India for the period 1901 to 1951 and calculates the long-term movement of the pro-portion of capital formation to national income. This study covered the whole of India excluding Burma and area covered by Pakistan after 1947. This study found that the rate of growth of national

income was much slower than the rate of growth of investment and capital formation from 1901 to 1911-12. Capital formation increased by 56 per cent but national income only by 21 per cent; that is by less than 2 per cent per year. The average proportion of capital formation to national in-come was 7.9 and average capital-output ratio was 0.40 during this period. Rao[3] examined that how far savings and capital formation in India have increased during the three decades of planning and also examined the effect these increases had on economic growth and increase in national income during the period 1950 to 1976. The results shows that the lowest capital-output ratios are found in agriculture, banking and insurance, and trade, including hotels and restaurants, while the highest capital output ratios are found in real estate, electricity, railways and other transport; all except real estate fall under infra-structural facilities and confirm the existence of a secular trend for the savings ratio to grow over the period under review. Gulati and Bathla[4] conducted a study on capital formation in Indian agriculture for the year 1974 to 1998. The study, after re-defining and re-estimating trends in capital formation in agriculture, concludes that the situation is definitely not good, but not as alarming as is sometimes made out to be. This is because of the increasing share and role of private sector investments in agriculture over time. And the trend in that has remained robust despite decline in public sector capital formation in agriculture, and despite the fact that public sector investment has an inducement effect on private sector capital formation. Tan and Wei Ge[5] investigated the cross-country comparison of sectoral investment patterns in China and India during the period 1993-2003. The result found that both economies had a large share of capital formation in the transformation sector, a feature common to developing economies. But China's share was significantly higher than that of India, about 10 percentage point during the period considered. The results of this study indicated that China consistently allocated larger proportion of investment in transformation sector than India did, which produced much faster output growth of major transformation industries, and consequently, higher GDP growth in the Chinese case. Thus, the difference in the sectoral investment pattern between the two economies stands as an important source for their GDP growth differentials.

A large numbers of studies have been established on different aspects of capital formation, but no desirable literature is found on the capital formation by Industry and agriculture and its impact on industrial productivity at national level during 2004-2011. There is enough scope of research in this area.

Objectives of the paper: To examine the impact of Gross Capital Formation in Four Broad Sectors of Industry on Industrial Productivity Gross capital formation by industry in India. To examine the impact of Gross capital formation by industry on Industrial productivity in India. To examine the impact of Capital formation in Agriculture and allied sector on Industrial productivity in India.

Hypothesis: We have proposed the following hypothesis for this study:

H0: There is no significant impact of capital formation on Industrial productivity in India during the study period 2004 to 2011.

Research Methodology

Data Sources: The current analysis is conducted for the period 2004 to 2011. In this paper, we seek to trace the impact of capital formation on industrial productivity in the context of India over the period 2004 to 2011. For this purpose, data has been collected from Economic survey 2010-11 and Handbook of India Statistics Published by RBI.

Model Specification: MING = Capital Formation by Mining Sector, MANU = Capital Formation by Manufacturing, ELCT = Capital Formation by Electricity, CONST = Capital Formation by Construction, TCFB= Gross Capital Formation in Four Broad Sectors of Industry, TCFI= Total Gross Capital Formation by Industry of Use, CFA= Capital Formation by Agriculture and Allied Activities, IIP= Index of Industrial Production

Estimate Technique: The modern econometric approach for analyzing the relationship is employed. I adopted ordinary least square regression (OLS) for analyzing above models.

Table- 2
Multi-Variable Regression Model

	Multi-Variable Regression Model
Model 1	TCFB = $\beta_0 + \beta_1$ (MING) + β_2 (CONST) + β_3 (ELCT) + β_4 (MANU) + μ
	Two Variable Regression Model
Model 2	IIP = $\alpha_0 + \alpha_1$ (TCFB) + μ_1
Model 3	IIP = $\alpha_0 + \alpha_1$ (TCFI) + μ_1
Model 4	IIP = $\alpha_0 + \alpha_1$ (CFA) + μ_1

β, β_1, α and α_1 are the parameters of the intercept and slopes of the coefficients, while μ represents other variables that could have lent further explanation to explained variables but not included in the model.

Results and Discussion

Regression Results: Model I: TCFB = $\beta_0 + \beta_1$ (MING) + β_2 (CONST) + β_3 (ELCT) + β_4 (MANU) + μ

Dependent Variable: Gross Capital Formation in Four Broad Sectors of Industry

Independent Variable: Capital Formation by Mining, Manufacturing, Electricity and Construction

According to the result of Co-efficient, it is clear that capital formation in manufacturing, electricity and construction are positively related with total capital formation by broad sector of industry. The coefficient of Manufacturing sector capital formation is highest than other sector capital formation. This shows that manufacturing sector capital formation has more positive and significant relation with total capital formation by broad sector of industry. A closer look at the result shows that manufacturing, electricity and construction sector capital formation are statistically significant at 5 percent only one variable i.e. mining is not statistically significant at 5 percent. The R-square which is the coefficient of determination shows the percentage of variation in the dependent variable that was accounted for by variation in the explanatory variables. It measures the explanatory power of the model. It is usually between zero to one. The R-square reports that the variables can explain about 99 percent of total variation in total capital formation by broad sector of industry, the remaining 1% left unaccounted for by the model is attributed to the error term. The F- test for the model also indicates it is highly significant, F = 23565.41 at sig F= .0048.

Model II: IIP = $\alpha_0 + \alpha_1$ (TCFB) + μ_1
Dependent Variable: Index of Industrial Productivity
Independent Variable: Gross Capital Formation in Four Broad Sectors of Industry

From regression coefficient it is clear that there is positive relationship between TCFB and IIP. The positive effect is low and but significant. According to the result, a unit change in TCFB led to 0.00012 increases in IIP. The F- test for the model also indicates it is significant, F = 8.23 at sig F= .0405. This result also indicates that the t- test for the significance of individual independent variable indicates that at the significance level of 0.95 (confidence level of 95%), independent variables are statistically significant in the model. From the above regression result, it is found that coefficient of determination is about 0.67. This implies that about 67% of the total variation in IIP is explained by TCFB. The remaining 33% left unaccounted for by the model is attributed to the error term.

Model III: IIP = $\alpha_0 + \alpha_1$ (TCFI) + μ_1
Dependent Variable: Index Of Industrial Productivity
Independent Variable: Total Gross Capital Formation by Industry of Use

Above regression results shows that the coefficient of TGCF is positively related with IIP. This result indicates that, a unit change in TGCF led to 8.14 increases in IIP. The F- test for the model also indicates that it is significant, F = 272.29 at sig F= .0000. This result shows that the t- test for the significance of individual independent variable indicates that at the significance level of 0.95 (confidence level of 95%), independent variables are statistically significant in the model. R-Square gives the adequacy of the model. Here the value of R-Square is 0.98 that means the independent variable in the model can predict 98% of the variance in dependent variable. The remaining only 2% left unaccounted for by the model is attributed to the error term.

Model IV: IIP = $\alpha_0 + \alpha_1$ (CFA) + μ_1
Dependent Variable: Index of Industrial Productivity
Independent Variable: Capital Formation by Agriculture and Allied Activities

The coefficient results show that there is positive relation between CFA and IIP, it is also clear from the above results that Individual Independent variable is Significant in this model. From the table, it shows that F-statistics is 43.53 and Prob (F-statistic) =0.0003, it implies that the overall model is statistically significant. From the R-square result it is clear that about 91% of the total variation in IIP is explained by CFA. The remaining 9% left unaccounted for by the model is attributed to the error term.

Table-3

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.322106	0.267656	4.939572	0.1272
MING	-0.007835	0.077008	-0.101745	0.9354
CONST	0.132773	0.010094	13.15383	0.0483
ELCT	0.128300	0.005480	23.41089	0.0272
MANU	0.709141	0.033516	21.15819	0.0301
R-squared	0.999989	F-statistic		23565.41
Adjusted R-squared	0.999947	Prob(F-statistic)		0.004886
Durbin-Watson stat		2.9918		

Source: Researcher's own calculation based on Capital formation and IIP data 2004-2011, TCFB = 1.32 - 0.0078MING + 0.13CONST + 0.12ELCT + 0.70MANU

Table-4

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	43.14520	33.98297	1.269612	0.2731
TCFB	0.000126	4.38E-05	2.869269	0.0455
R-squared	0.673008	F-statistic		8.232707
Adjusted R-squared	0.591260	Prob(F-statistic)		0.040502
Durbin-Watson stat	1.765			

Source: Researcher's own calculation based on Capital formation and IIP data 2004-2011. IIP = 43.14 + 0.000125TCFB

Table-5

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	12.75738	7.759092	1.644184	0.1755
TCFI	8.149672	4.94E-06	16.50129	0.0001
R-squared	0.985523	F-statistic		272.2927
Adjusted R-squared	0.981903	Prob(F-statistic)		0.000079
Durbin-Watson stat	2.316188			

Source: Researcher's own calculation based on Capital formation and IIP data 2004-2011, IIP = 12.75 + 8.14TCFI

Table- 5

Dependent Variable: IIP				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	39.77835	15.34713	2.591908	0.0606
CFA	0.000873	0.000132	6.597922	0.0027
R-squared	0.915847	F-statistic		43.53258
Adjusted R-squared	0.894809	Prob(F-statistic)		0.002734
Durbin-Watson stat	2.187186			

Source: Researcher's own calculation based on Capital formation and IIP data 2004-2011, IIP = 39.77+ 0.00087CFA

Conclusion

This study highlighted the impact of capital formation by agriculture and industrial sector on Industrial productivity in India from 2004-05 to 2011-12. For this study, IIP (index of industrial production) was used as a proxy for industrial productivity. From the above analysis the following inferences can be drawn:

In India, IIP has increased with increase in capital formation by both agriculture and Industrial sector. The result shows that capital formation by manufacturing sector has more positive and significant relation with total capital formation by broad sector of industry. From regression coefficient it is clear that there is very high and significant positive relationship between total gross capital formation by Industry of use and Industrial productivity in India. The study revealed that there is positive but low and significant impact of Agriculture and Allied Activities Sector Capital Formation on Industrial Productivity in India during 2004-2011.

Limitation of the study: The limited database, short time period and selected variables are some of the major limitations of this study.

Suggestions: It is observed from above regression analysis that Industrial Productivity is much affected by total gross capital formation by Industry of use. On the basis of above findings, it is suggested that more thrust should be given for manufacturing sector capital formation and capital formation by Industry of use in the economy.

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