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# Development of Human and Physical Capital and Change in the Structure of Exports in Developing Countries: An Analytical Study

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## **Abstract:**

The objective of this paper is to look at how development of physical and human capital affects the structure of exports from developing countries. As a country becomes increasingly developed, it moves away from production in primary goods to production of manufactures. This structural change will also be reflected in its exports. The more developed a country is in terms of human and physical capital the higher will be its manufacturing exports. This hypothesis is tested empirically. Factors like education, per capita income, infrastructure and capital investment are used to capture human and physical capital development, while the percentage of manufacturing exports in the total captures structural change in trade. This paper analyzes data from four SE Asian countries for the years 1980 to 1995. The results show that human and physical capital are positively related to manufacturing export growth. This result implies that besides policy changes to make the economy export friendly, Governments in developing countries need to pay attention to development of human and physical.

## **Section I: Introduction**

This paper looks at the relationship between the composition of exports and development. The basic argument is that as a country becomes more developed, it moves away from production in the primary sectors towards a more manufacturing oriented economy. This change in the pattern of the economy should also be reflected in the composition of exports. The country should start exporting more and more manufactured produce and less primary produce. Emery<sup>1</sup> advocated this idea by linking economic growth, development and the composition of exports. In his empirical work Emery found that while total exports are positively related to economic growth, agricultural exports do not show a significant relationship. This idea underlines the importance of exports of manufactured products for developing countries, i.e. more developed, more the manufactured exports, but the same is not true for agricultural exports

Development means many things. As an idea it encompasses improvements in various spheres of human activity, social, economical, cultural and political. This paper however will focus on the development of capital. It will try to incorporate both human as well as physical capital developments. Thus factors such as primary school education, energy consumption, capital investment and per capita income will be important and their relationship to the composition of exports will be the primary focus of this study. Jagdish Bhagwati<sup>2</sup> states that countries with outward looking, export-oriented policies have on average been more successful compared to those countries that followed a more inward looking import substitution policies. Empirical evidence suggests that not all countries that had liberalized export oriented policies succeeded in promoting manufactured exports. There is also considerable variation in the level of success in promoting manufactured exports between different relatively 'liberalized' developing economies.

The objective of this paper is to posit the idea that development of human and physical capital played a primary role in the success of those economies that developed a strong manufacturing base. The development of a strong manufacturing base helped these countries to promote manufactured exports and move away from primary exports. The idea that human and physical capital development play a vital role in the development of manufacturing exports base has important policy implications for developing countries, which have often ignored physical and especially human capital development. These countries have usually put more stress on policy issues such as export subsidies and the development of specialized Free Trade Zones rather than development of human and physical capital.

This paper examines the relationship between development of human and capital resources and growth of manufactured exports in four Asian countries; Malaysia, Thailand, Indonesia and Philippines. These four countries have all followed Export Oriented Industrialization (EOI) policies in the last thirty years. However, despite this similarity in policy, their success in evolving into modern industrialized economies has been very different. The paper establishes that the prime factor behind this difference in performance is the variation in development of physical and human capital in these four economies.

A brief outline of the paper is as follows. Section II will discuss in brief the existing literature which deals with the development of physical and human capital and the role it has played in fostering growth in the manufacturing exports sector. Section III shall posit a theoretical model to investigate the relationship between the development of human and physical capital and manufacturing exports. Section IV establishes the empirical framework and data used to test this relationship. Section V presents the results and Section VI puts forward the conclusions and policy implications that arise from the results.

## Section II: Theoretical Review

A lot of work has been done in trying to explain what factors help a country develop a competitive manufacturing sector. Several of these papers dealing with trade and industrialization highlight the important role played by **physical and human capital** in the process. The following paragraphs will summarize some of the more prominent works by various economists in the field of trade theory. These works deal with the topic of structural change in trade and the factors that might promote this change of structure.

Morrison<sup>3</sup> raises the importance of labor skills. Morrison says that

“Since most developing countries have more than enough unskilled labor, this particular resource should not be very helpful in explaining relative performance in the export of manufactures. There are indeed significant differences in the quality of labor existing in these countries. Some of the East Asian countries, notably Korea, Taiwan and Hong Kong owe significant part of their success in exports of manufactures to the relatively high quality of their labor force.”

The fact that a more skilled labor force leads to greater exports in manufactures has been supported empirically by D. Keesing<sup>4</sup>. He found a positive relationship between manufacturing exports and the literacy rate in 36 developing countries between the period 1963-1968. The lack of a skilled labor force might be a major constraint for countries desirous of an efficient manufacturing sector that is competitive in a global market. Harbison<sup>5</sup> says that the shortage of technicians, nurses, factory workers and other sub-professional personnel is more critical for the economy than the shortage of fully qualified professionals. This is because a rapidly growing manufacturing sector needs a large pool of semi-skilled and efficient workers to man its factories and provide basic services like transportation. A country that wishes to compete globally in the world market for manufacturing exports cannot do so without a steady and cheap source of semi-skilled labor. Importing technological and marketing expertise is an option for developing countries, importing its labor force is not. The

rate of modernization of a country is associated with both its stock of human capital and rate of human capital accumulation. In the words of Schütz<sup>6</sup> “ the process of change from a static or traditional society requires very large doses of human capital”. The accumulation of manpower to overcome skill bottlenecks is a never ending process and one of critical importance to a country that is trying to make a shift from a more traditional economy to a more modern, industrial one. In the race to expand manufactured exports, the developing country that lacks a skilled and educated work force will tend to fall behind in the industrialization process as it will have shortages of a crucial input, an appropriately skilled labor force.

It is almost natural intuition that the formation of physical capital is very important to the process of developing a competitive manufacturing sector. According to the UNCTAD (United Nations Council for Trade and Development) report for trade in manufactures of developing countries<sup>7</sup>, “capital investment can augment scarce skills and know-how that exist in most developing countries, which is essential for production geared for export markets”.

Capital occupies a position so dominant in the economic theory of production and distribution that it is natural to assume that it should play an equally important role in the theory of growth and industrialization. According to Cairncross<sup>8</sup>, the contribution of capital investment is threefold. First, a greater abundance of capital permits the introduction of what Cairncross calls a more roundabout method of production. This involves the use of more durable instruments in production. Second, the investment in capital is a normal feature of industrialization. This is the process normally known as capital deepening as opposed to widening and leads to more and more sectors of the production process becoming industrialized. Third, this leads to a change in patterns of trade and consumption in favor of manufactured goods and services. These processes of changing trade and consumption patterns are historically associated with higher standards of living and terms of trade for a given

economy. In his paper Cairncross cites several empirical<sup>9</sup> works which provide evidence of a positive relationship between capital, investment in capital goods and industrialization.

The per capita income level in an economy is a major factor behind the success or failure of a nation to promote a strong manufacturing exports sector. A higher level of per capita income naturally suggests that a country will have a better chance at creating and sustaining a manufacturing sector that is efficient. According to the World Bank<sup>10</sup>,

“Knowing a country’s GNP per capita is a good first step toward understanding the country’s economic strengths and needs, as well as the general standard of living enjoyed by the average citizen. A country’s GNP per capita tends to be closely linked with other indicators that measure the social, economic, and environmental well-being of the country and its people”.

Thus, GNP per capita or the standard of living can be a very strong if not perfect indicator of several issues that might affect the process of industrialization and development in an economy. For example it has been observed in the World Bank surveys<sup>11</sup> that countries with higher GNP/capita have far less health problems and longer life expectancy. This would suggest that the standard of living might be a good indicator of the efficiency of a work force, since healthier workers in theory make more efficient workers. Standard of living is also a good indicator of how good a market a country is for manufactured products. It has been observed by Pentrose<sup>12</sup> that there is a threshold level of per capita income only beyond which does demand for consumer goods really start to take off. Thus, a higher per capita income would be an indicator of a stronger domestic market for manufactured goods. A strong domestic market will augment the manufacturing sector producing for exports, and help the economy develop faster from a traditional to a more modern industrial economy.

It is extremely important to have proper infrastructure in order to develop a strong manufacturing sector. According to Pearson<sup>13</sup>, industrial expansion is fostered more readily in

countries that already possess substantial levels of physical infrastructure. Adequate transport facilities, communication systems and energy resources are necessary in order to facilitate industrial production and the trade in manufacturing goods. The lack of proper infrastructure is an 'important bottleneck'. Without proper roads and energy supplies, it will be impossible to obtain inputs in the production process or run machines in factories. According to The India Today magazine<sup>14</sup> 'India's total industrial output was 19% lower than potential because of intermittent supply of power and frequent power cuts'. It is clear from the discussion in this section that physical and human capital plays a substantial role in the development of a modern manufacturing sector and gradual transformation of a country's economic structure.

### **Section III- Theoretical Model**

To reiterate the main argument of this paper, as a country becomes more developed it moves away from primary to manufacturing sector and this shift should also be reflected in its composition of exports.

In this presents a theoretical model employed to capture the linkages between human and physical capital and exports of manufactures. At this stage it is imperative to focus this paper on specific aspects of human and physical capital that might be relevant to the development of a strong manufacturing sector that is competitive globally. The discussion in section II looks at several different factors related to human and physical capital development and its effect on trade. In my opinion the factors that will have the most impact on developing a strong manufacturing base for exports are: the level of education, per capita income, depth of infrastructure and the level of investment in durable production goods. What follows is a detailed discussion on the relevance of these factors to manufacturing exports.



### **Level of education**

For a developing economy trying to industrialize efficiently, it is essential to have a large pool of semi-skilled and skilled labor from which to draw. As production processes become more and more complex with the changing industrial structure of the economy, a shortage of such skilled and semi-skilled labor may become a critical bottleneck. A manufacturing sector needs workers who have sufficient knowledge and skills to operate machines and mechanized processes. It also needs service personnel like truck drivers, telephone maintenance and inventory keepers etc. A better-educated work force is also easier to train; i.e. they will absorb new knowledge faster than their lesser-educated counterpart. This makes the initial training process faster and cheaper. The shortage of an educated work force will also drive up the cost of skilled and semi-skilled labor making the industrialization process that much harder. More expensive labor will also make the finished product more expensive and less competitive, reducing exports. A better-educated labor force is also in theory, more productive. Labor skills play a vital role in giving a country a comparative advantage in developing a manufacturing sector for exports successfully. Thus it makes sense that a country that is successful in its industrialization process and making the transition to being an exporter of manufactures will tend to have better human capital resources. This paper hypothesizes that a better education, representing better human capital, will be positively related to the level of manufacturing exports.

### **Per capita income**

Higher levels of per capita income are usually associated with a healthier work force and better socio-economic conditions. It usually reflects greater ease in obtaining the basic needs of life for a population. A country that has a better socio-economic environment will be more conducive to

rapid development of human and physical capital. It will find structural change to a more complex economy easier to accomplish. Higher levels of per capita income are also indicative of consumption patterns. Better off populations have a greater demand for manufactured goods, especially consumer goods like textiles, radios, watches, shoes etc that comprise a major bulk of the exports from developing countries. A better off population will mean a better market for manufactured products domestically, which will be a major catalyst for development of such industries. Thus this paper hypothesizes that higher per capita levels of income will be positively related to the level of manufactured exports.

### **Infrastructure**

Industrialization and the export of manufactured goods are critically dependent on infrastructure. Without efficient and proper systems that support movement of inputs and output, energy to run factories as well as shipping and communication networks that support trade and create markets, no country can industrialize or effectively participate in trade. This paper hypothesizes that infrastructure is positively related to the level of manufacturing exports.

### **Capital Investment**

An increase in investment in durable capital goods is a sure sign of industrialization. However it is just not the existence of a more developed capital market and financial intermediaries that will aid in industrialization. One has to take into account what the investible funds, once collected, are used for. A country that manages to focus more of its savings and financial inflows from abroad into creation of durable capital goods is likely to have faster rates of industrialization. This is due to the fact that historically capital investment flows have been

proportionally higher to the industrial sector in comparison to other sectors in most developing economies. This paper hypothesizes that capital investment and manufacturing exports are positively correlated.

In conclusion, the theoretical model states that any development of human and physical capital as represented by the four factors, level of education, capital investment, infrastructure and per capita income, will have positive effects on the development of a large and efficient manufacturing sector. This in turn will result in a change in the structure of the economy and trade patterns of the country, leading to higher manufacturing exports.

Manufactured Exports = f (Education, Capital Investment, Per capita income, Infrastructure)

The next section contains a description of the data set and the empirical model used to test the theory set forth in this section. The basic model can be expressed as follows:

#### **Section IV-The Empirical Model and Data**

As mentioned earlier, this paper looks at the four countries Malaysia, Indonesia, Philippines and Thailand, popularly called the ASEAN-4 (Association of South East Asian Nations). The data, which is annual, extends for the years 1980-1995, a total of 16 years. The reason this paper limits the data to 1995 is to avoid the Asian Financial crisis. All the data is from the World Bank Development Indicators CD 2000 (copyright World Bank Group<sup>R</sup>). On the next page a table with descriptive statistics of all the variables and a general discussion of each of them follows.

**Table 1: Descriptive Statistics for the Independent Variables.**

Variable	Maximum	Minimum	Mean	Std Deviation
Manufacturing Exports as % of Total	75.0	3.0	14.220	39.09
% of primary school age children actually attending school	118.0	86.5	104.9	8.585
Per Capita GNP in PPP terms	8146	794.6	3091.33	1657.67
Total capital investment as % of GDP	69.3	10.2	38.71	14.228
Energy Consumption per capita in KW/h	1904.2	43.6	596.5	429.142

The reason for looking at manufacturing exports as a percentage of total exports as the dependent variable as opposed to total manufacturing exports is to capture the change in composition in the export structure, i.e. the move away from primary exports rather than just sheer volumes changes. The highest figure attained is by Malaysia, while the lowest is by Indonesia (see Table 1). The standard deviation from the mean for manufactured exports as percentage of total exports is rather high, showing the wide variance between countries and over time in this regard. This paper uses the variable name MANX to represent manufacturing exports as percentage of total exports (see Table 2 for the discussion of all the variables).

The independent variable used to capture changes in the level of human capital is the percentage of school age children actually attending school at the primary level. There is an important theoretical reason for not using tertiary education data. Myint<sup>15</sup> mentions that too

much investment in tertiary education, the demand for whose graduates are not yet fully developed in these economies, might result in large scale unemployment, and as such does not help the growth process. As mentioned in the literature review, what a rapidly industrializing economy needs is a large mass of educated and semi-professional workers as opposed to a lot of highly qualified doctors or engineers. One assumes in such a case looking at secondary education would have been more appropriate, but due to insufficient data this paper settled on primary education as the best proxy of skill level of the work force. The mean for percentage of school going kids attending school is quite high, which means that all of these four countries have attained high levels of primary school attendance over time. The maximum number is for Indonesia, while the lowest is for Thailand (see Table 1). The standard deviation from the mean is relatively small. The variable name EDU is used to represent percentage of school going kids attending school (see Table 2).

The independent variable used to capture the effect of standard of living is per capita GNP calculated on Purchasing Power Parity terms. As the World Bank report suggests, per capita income is a very good indicator of various socio-economic factors, higher incomes reflecting more developed socio-economic structures. The GNP/capita in PPP terms is used in order to adjust for the real purchasing potential in the economy as opposed to just a Dollar figure. Using simply the official foreign exchange rate tends to decrease the real relative domestic purchasing power of different currencies. Since Purchasing Power parity reflects the amount required in the domestic currency to buy the same number of goods and services that can be bought by US\$1 in the domestic market, it is a more realistic measure of standard of living issues. The mean of GNP per capita in these countries is much higher than most developing nations (see Table 1). The country with maximum value of GNP per capita is

Malaysia, while Indonesia registers the lowest figure. The standard deviation from the mean for GNP per capita data for these countries is quite high suggesting large variance among countries and over time. The variable name used to represent GNP per capita in PPP terms is PCI (See Table 2).

The independent variable used to capture the effect of capital investment is total capital investment as a percentage of the GDP. As mentioned previously, the reasoning is that this variable will in effect capture most of the investment that flows into industry. As Nevin<sup>16</sup> points out it is “the act of investment itself, by which resources are used for increasing capital stock” which is vital as opposed to just measures of savings or investment as a whole. Nevin also says that capital investment in developing countries have been historically geared towards the manufacturing and infrastructural sectors, rather than the agricultural sector. Indonesia attained the maximum capital expenditure as percentage of the GDP, while the lowest figure is for Malaysia. The standard deviation from the mean for capital investment as percentage of the GDP is relatively high (see Table 1). The variable name CAP is used to represent Capital Expenditure as a percentage of GDP in this paper (see Table 2).

The independent variable used to measure the effect of infrastructure is kilowatt-hours of electricity consumed per capita. The reason behind choosing this variable is that as a country becomes more industrialized, it will naturally tend to consume more electricity. Thus it is a very good indicator of structural change. Cheap and efficient energy supply is also one of the key infrastructural issues confronting many developing countries trying to industrialize. The highest per capita consumer of electricity is Malaysia, while the lowest figure is in Indonesia. The standard deviation from the mean for this data set is very high which shows the wide variation

between countries and across time in electricity consumption (see Table 1). The variable name ELEC is used to represent Electricity consumption per capita (see Table 2).

Any cross-country study will have to acknowledge the differences that exist between countries in all aspects of social and economic life. In order to look at some country specific effects dummy variables are used. The dummy variables name for Malaysia is MAL, for Indonesia is IND, for Philippines is PHIL. The regression is terms of Thailand. In summary, the equation used in the OLS regression to test the model can be expressed as follows:

$$MANX = \gamma_1 + \gamma_2 EDU + \gamma_3 ELEC + \gamma_4 CAP + \gamma_5 PCI + \gamma_6 MAL + \gamma_7 IND + \gamma_8 PHIL$$

**Table 2: Variable Names and Expected signs**

Variable	Variable name	Expected sign
Manufactured exports as % of total exports	<b>MANX</b>	<b>Dependent variable</b>
Percentage of school age children attending primary school	<b>EDU</b>	<b>+VE</b>
Electricity consumption in kilo-watt hours per capita	<b>ELEC</b>	<b>+VE</b>
Capital investment as a percentage of GDP	<b>CAP</b>	<b>+VE</b>
GNP per capita in Purchasing Power Parity terms	<b>PCI</b>	<b>+VE</b>
Dummy variable for Malaysia	<b>MAL</b>	
Dummy variable for Indonesia	<b>IND</b>	
Dummy variable for Philippines	<b>PHIL</b>	

#### **Section IV: Results**

The results look very promising. The adjusted  $R^2$  for the regression stands at .933, which is reasonably high. The percentage of school age kids attending school in the primary level is significantly and positively related to manufacturing exports as a percentage of total exports as predicted (the actual coefficients and significance of all variables are reported in Table 3). Thus development of human capital predicts higher exports of manufacturing products. This result upholds the idea that a better educated work force is a major asset for a country trying to develop exports in manufacturing as discussed in the theory section (see pg. 7).

Per Capita Income (GNP per capita in PPP) is also significantly and positively related to manufacturing exports as predicted in the model (see Table 3). This implies that better socio-economic structure and standard of living is an important factor for developing manufacturing exports. This result supports the idea in the theory section (see pg. 8) that countries with better living standards have an advantage over countries with lower living standards in developing exports in manufacturing. Thus both the human capital aspects of the model predict higher exports in manufacturing with improvement and investment in human capital aspects of the economy.

Capital Expenditure as percentage of total expenditure is also significantly and positively related to manufacturing exports as percentage of total exports (Table 3). This attests to the theory that the development of physical capital will lead to a change in the economic and trade structure in the country. This result supports the idea discussed in the theory section (see pg. 9) that countries with an investment focus on industries are going to be more successful in developing exports in manufacturing.



The only variable without the expected sign is electricity consumption per capita (Table 3). This result is in a way surprising, as electricity consumption per capita is increasing in all countries during this period. However there is strong correlation between the variables PCI, EDU and ELEC. This correlation is significant at the .01 level, which might have led to these unexplained results. A simple regression with manufacturing exports as the dependent variable and electricity power consumption per capita as the independent variable shows better results. Electricity consumption per capita is positively and significantly related to manufacturing exports as percentage of total exports, with a coefficient of  $2.923 \cdot 10^{-2}$ .

The results above show that for the most part there is indeed a very strong relation between manufacturing export performance and the development of physical and human capital. Without proper investment of capital, both human and physical, a country will not be able to establish a strong and globally competitive manufacturing sector. The dummy variables all turn out to be significant (see Table 3), suggesting there are cross-country differences to account for. Thailand (the regression was in the terms of Thailand) seems to be doing the best, while Philippines the worst with regards to manufacturing exports. Malaysia is the second best and Indonesia the third among the four countries in this regard. The next section concludes this paper and discusses important policy implications of the findings.

SEE NEXT PAGE FOR TABLE

**Table 3: Summary results of regression**

<b>Variable Name</b>	<b>Coefficient</b>	<b>Significance</b>	<b>Expected sign</b>
<b>EDU</b>	<b>.553</b>	<b>.013</b>	<b>YES</b>
<b>ELEC</b>	<b>-3.087*10<sup>-2</sup></b>	<b>.000</b>	<b>NO</b>
<b>CAP</b>	<b>1.019</b>	<b>.000</b>	<b>YES</b>
<b>PCI</b>	<b>1.418*10<sup>-2</sup></b>	<b>.000</b>	<b>YES</b>
<b>MAL</b>	<b>-9.768</b>	<b>.000</b>	
<b>IND</b>	<b>-35.437</b>	<b>.000</b>	
<b>PHIL</b>	<b>-55.717</b>	<b>.000</b>	

**Conclusion**

As hypothesized in the model, the human and physical capital development of a country is positively linked to the structural change in the composition of its exports. This is an important finding as it shows that development in human and capital terms is very important if a developing country has to evolve into a successful industrialized economy. The structural change in exports is an important factor as there is significant correlation between a country's composition of exports and its economic growth rate. Countries with higher percentage of manufactured exports tend to have far higher growth rates than countries with lower proportions in manufactured exports (See Emery). Development of human capital emerges as a particularly strong factor behind the growth of manufacturing exports. Capital investment, also as expected turns out to be a very strong factor for the growth of exports in manufacturing. This makes sense, as industrialization is strongly related to the development of

physical capital, especially in developing countries. The standard of living is also a strong factor behind structural change as predicted in the model. Higher per capita income is usually an indicator of better socio-economic structures that increase the efficiency in the economy, and augment the process of industrialization. As expected standard of living turns out to be highly significant for development of a manufacturing sector for exports.

There are some potentially important policy implications arising out of these results. The basic ideas of Morrison, that just an (Export Oriented Industrialization) EOI policy will not result in the development of industries bear fruit. Chen<sup>17</sup>, a Malaysian economist and Lee Kuan Yew<sup>18</sup>, the former Prime Minister of Singapore, had attributed the success of ASEAN industrialization to their investment in infrastructure, subsidized capital for manufacturing sector and the rapid growth in human capital. Chen particularly mentions the strides made by these countries in primary and secondary education as opposed to a heavily subsidized tertiary education sector. Thus a basic requirement for developing countries is to remove the bottlenecks in infrastructural development and start paying more attention to certain areas of human and physical capital development that have been ignored. This is essential if they are to succeed in their ambition to industrialize their countries and compete in the world market for manufactured goods. If not they will be forever relegated to the position of a primary product exporter. Given the falling terms of trade<sup>19</sup> for many developing countries because of their dependence on commodity exports, no developing country would want to get be stuck in the position of primary product exporter.

Recall that the results for the infrastructure proxy was unexpected and should be investigated further, one idea is to find a better proxy for infrastructure. A better proxy for education is also desirable. The percentage of labor force with secondary education is probably the best way to capture human capital aspects in the economy while trying to capture industrialization. In the future a bigger

sample size incorporating many more developing countries, thus expanding the research across countries is another idea. This will validate the significance of our findings in this paper, as it will take into account the effect of human and physical capital on structure of exports across a wide range of situations and geographic setting. Expanding across time is another possibility, and hopefully will also give us stronger results. This is so mainly because the effects of human and physical capital development take time to show; thus true effects of human and physical capital investment will come through better.

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