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The Diverging Patterns of Profitability, Investment and Growth of China and India, 1980-2003

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Abstract: This paper documents the diverging patterns of capital accumulation, profit rates, investment rates, capital productivity and technological progress of China and India since 1980. It is concluded that the two Asian economies have followed very different growth patterns and, as a consequence, they face different challenges for the future. India's problem is how to accelerate growth, while China's is how to sustain it. India must address impediments to investment so as to increase its investment rate. China must deal with the question of whether investment can continue being the main source of growth given that profit rates and capital productivity are decreasing and that the economy has created substantial excess capacity.

JEL Codes: O10, O30, O40, O53. O57

Key words: Capital accumulation, Capital productivity, Capital share, China, Growth-Distribution schedule, India, Profit rate

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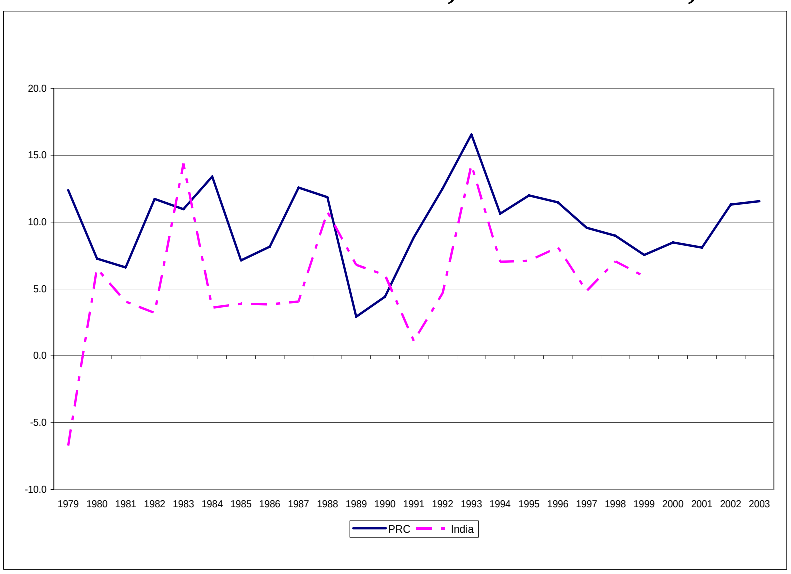
The Diverging Patterns of Profitability, Investment and Growth of China and India, 1980-2003

1. Introduction

The People's Republic of China (China hereafter) has registered impressive economic growth since the initiation of economic reforms in the late 1970s. The result is that hundreds of millions of people have been lifted out of poverty in the most rapid and far reaching economic transformation in history. Average GDP growth increased from an annual average of 5.3% per annum between 1961 and 1979 to 9.5% between 1980 and 2003. In recent years, accelerating economic growth in India has also caught the attention of the world. Between 1951 and 1980, India's annual average GDP growth rate was a lackluster 3.6%, known famously as the 'Hindu' rate of growth. The annual average growth rate between 1981 and 1991 was a significantly higher 5.4%. This rate further strengthened to 6.0% between 1992 and 2003. India's robust growth has given rise to hopes that another major economic transformation may be underway in Asia. Figure 1 shows the differential in growth rates.

Figure 1. GDP Growth rate at factor cost, China and India, 1979-2003 (%)



Source: United Nations National Accounts Statistics; GDP 1952-1995 and GDP 1995-2003-Historical Data on China's Gross Domestic Product 1995-2003.

However, despite India's much improved economic performance during the last decade, it still lags China in many economic indicators. Since 1992, India's GDP per capita has grown by 4.2% a year, compared to 8.7% in China. As a result, while GDP per capita stood at $322.5 in India and $441.8 in China in 1992, by 2003, the latter's income per capita of $1067 was nearly twice as high as that of the former, $510.8 (Based on US$

2000 constant prices). These differences naturally beg the question of why India has lagged behind China in economic growth.[1]

Both Asian giants opted at approximately the same time for a strategy of development based on heavy industrialization, although with important differences: while China followed more the Soviet model until the 1970s, India relied largely on the private sector. In 1978, China started a series of modernizations, including greater openness. India too sought to modernize its industrial sector and started loosening controls on domestic output and investment around 1980. In the early 1990s, China increased its efforts to introduce market reforms, and to acquire modern technology and organization to compete in the world market. India too in 1991 introduced further economic reforms, partly as a result of the recognition that China was growing faster and had begun looking like the Asian Tigers. The result, as noted above, is that the economic outcomes in the two countries have varied significantly.

While the list of papers analyzing the two economies independently is very long (Chow 1993, Chow and Li 2002, Felipe and McCombie 2002, Gilboy 2004, Holz 2005 for China; Balakrishnan and Babu 2003, Lewis 2004, Rodrik and Subramanian 2004 for India, just to mention some recent work), detailed empirical comparative analyses are still rare (see e.g., Goldman Sachs. 2003, Nagaraj 2005).[2] This paper makes a modest attempt at a providing a firmer empirical basis for comparing the performance of the two countries since 1980 by documenting and contrasting the evolution of a number of key economic variables. In particular, we ask what is the main factor underlying the difference in growth between the two economies. There are a number of other related questions with important policy implications that we attempt to shed light on. First, we ask why investment is substantially higher in China than in India. Second, we delve into the question of whether India can match China's performance. Third, we ask whether China can sustain its impressive growth rate. And finally, we explore the nature of technical change. Given the depth of these questions, it is impossible to provide definite answers. However, the straightforward approach we follow brings to light significant aspects of the two economies that are surely part of the answer.

The analysis concentrates exclusively on one macroeconomic aspect of growth, namely, the role of capital accumulation and its determinants as a major factor shaping the difference in performance between the two economies. Certainly there are many other factors and policies which affect growth in both countries, but we do not consider them here. Economic theories (e.g., see Scott 1989) acknowledge that capital accumulation is a most important ingredient of output growth. Capital plays the double role of being an important component of demand via investment and through the multiplier; as well as the source of capacity, i.e., the supply side, as a factor of production. Following the Classical economists, we argue that a major determinant of capital accumulation (though not the

[1] Regarding the reliability of the GDP figures, it is worth reading Studwell (2002), especially part II of the book, entitled *Miracle Deconstructed*. Studwell is very skeptical of many figures that tend to overstate the Chinese miracle.

[2] Papers discussing both economies certainly abound, but they tend to be comparisons and reviews of the two economies with not much empirical content, e.g., Lal 1995, La Croix et al. 1999, Weede 2001, Huang and Raghbendra 2004.

only one) is the rate of profit. We show that capital accumulation can be expressed as the product of the investment-to-GDP ratio and capital productivity, and the profit rate as the product of the capital share in output and capital productivity. Therefore, the five variables that constitute the core of our analysis are: capital accumulation, investment rate, capital productivity, profit rate and capital share. The study reveals stark contrasts between India and China, which provide some answers to the questions above, but also raise some puzzles.

The study reveals diverging patterns of capital accumulation and growth in India and China, and concludes that the two countries face very different challenges in their respective quests for economic growth and prosperity. India must address impediments to investment so as to increase its investment rate. China must deal with the question of whether investment, the engine of growth, can continue running at full steam. India's problem is essentially how to accelerate growth, while China's is how to sustain it. They are not easy tasks.

The rest of the paper is structured as follows. In section 2 we document the major differences between the two countries from the income and demand sides of the economy. From the latter, the main difference is the contribution of capital formation (i.e., investment) to output growth; and from the income side, the contribution of capital accumulation. Clearly, these two aspects are the two sides of a coin. Section 3 describes the methodological framework. In sections 4 and 5 we look at profitability and its determinants, namely the capital share, capital productivity. We also study the investment potential of the two economies as well as the nature of technical change. Section 6 discusses the challenges that the two economies face within the context of the discussion of this paper. Section 7 offers some conclusions.

2. Where do China and India differ?

In order to understand the major factors contributing to the growth differences between India and China, we examine the structure of the two economies from the income and expenditure sides. From the income side, the growth rate of output equals the sum of the growth rates of the wage and profit rates plus the sum of the growth rates of employment and the capital stock, each weighted by the corresponding factor share.[3] This decomposition is shown in Table 1.

Table 1. Decomposition of the GDP Growth Rate. Income Side (%)

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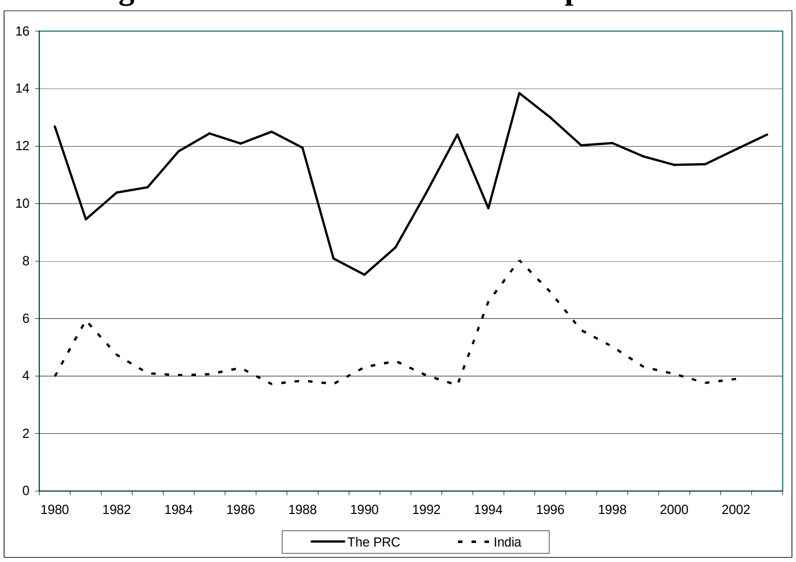
[3] Algebraically: $\hat{Y}_t \equiv \pi_t \hat{r}_t + (1-\pi_t)\hat{w}_t + \pi_t \hat{K}_t + (1-\pi_t)\hat{L}$. This expression states that the growth rate of output equals the sum of the growth rates of the factor prices ($\hat{w}_t$ and $\hat{r}_t$) plus the sum of the growth rates of employment ($\hat{L}$) and the capital stock ($\hat{K}$), each weighted by the corresponding factor share. It is again important to stress that this equation is an accounting identity. Details of the derivation are provided in section 3.

Country	Year	(1)	(2)	(3)	(4)	(5)	(6)	(7)
China	1980-2003	30.2	11.3	-1.9	69.8	1.6	8.4	9.9
	1992-2003	28.8	11.9	-1.2	71.2	1.1	9.7	10.8
India	1980-1999	43.2	4.8	1.8	56.8	2.1	4.0	6.3
	1992-1999	44.1	5.5	1.7	55.9	1.9	5.4	7.3

Source: Authors' estimates based on data from the United Nations National Accounts Statistics; GDP 1952-1995 and GDP 1995-2003-Historical Data on China's Gross Domestic Product.
Notes: (1) Profit share; (2) Growth rate of capital stock; (3) Growth rate of profit rate; (4) Share of compensation to employees; (5) Growth of employment; (6) Growth of wage rate; (7) GDP growth.

The results indicate that the main difference between China and India lies in the higher growth rate of the capital stock in the former, more than double. Figure 2 shows the growth rate of the capital stock in these two economies. The decomposition also indicates that while India has a higher rate of employment growth and a higher growth rate of the profit rate, these are not sufficient to lift its GDP growth rate to that of China. In a later section we address why the growth rate of the profit rate has negative contribution to output growth.

Figure 2. Growth rate of the net capital stock



Source: GDP 1952-1995 and GDP 1995-2003-Historical Data on China's Gross Domestic Product, CEIC.

From the expenditure side, the GDP growth rate is equal to the weighted sum of the growth rates of the aggregate demand components.[4] The decomposition is shown Table 2. India and China differ in both the shares of each component and the growth rates.

Table 2. Decomposition of the GDP Growth Rate. Expenditure side (%)

Country	Year	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
China	1980-2003	32.5	11.7	12.9	9.1	48.5	9.6	17.9	11.5	16.7	13.4	9.5
	1992-2003	36.5	14.5	12.6	8.7	45.5	8.5	24.1	16.4	21.6	17.8	9.8
India	1980-2003	21.4	6.8	11.5	6.2	67.2	5.4	9.1	9.7	10.5	9.6	5.7
	1992-2003	22.3	7.5	11.8	6.4	66.2	5.1	11.8	13.2	12.8	13.3	6.0

Source: Authors' estimates based on data from the World Bank World Development Indicators
Notes: Shares do not sum to 100% because changes in stocks are not included.
(1) Share of gross fixed capital formation; (2) Growth of gross fixed capital formation; (3) Share of government expenditure; (4) Growth of government expenditure; (5) Share of household expenditure; (6) Growth of household expenditure; (7) Share of exports; (8) Growth of exports; (9) Share of imports; (10) Growth of imports; (11) GDP growth.

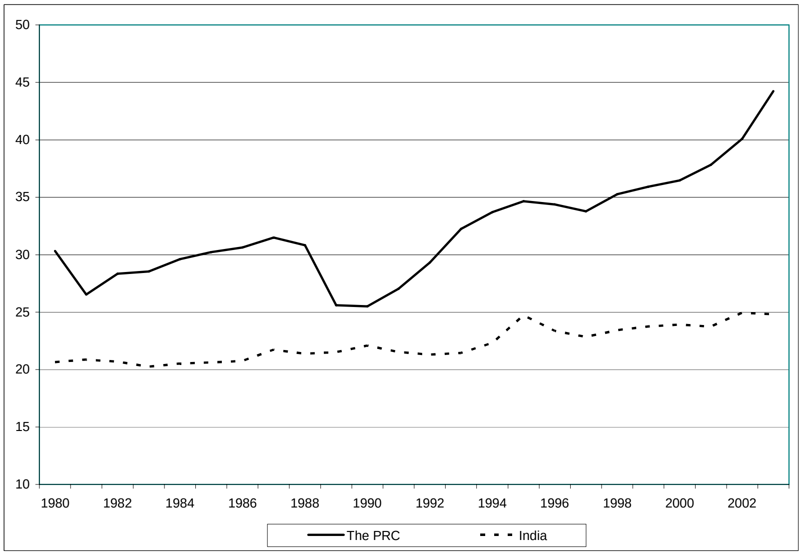
The main difference between China and India lies in the relative importance of investment. Investment has played a much more important role in propelling economic growth China. Gross fixed capital formation in China as a share of GDP stood at a staggering 42.5% in 2003, while the comparable figure for India was a substantially lower 27.7%. Between 1980 and 2003, investment grew at an annual average rate of 11.7% in China, compared to 6.8% in India. Due to the higher growth rate as well as higher proportion of investment in GDP, the contribution of investment to growth in China far exceeds that in India (this is calculated as the product of the share of investment in GDP times the growth rate of investment, divided by the GDP growth rate). Between 1980 and 2003, investment contributed on average about 40% of total growth in China, while its contribution in India was 25.5%. Figure 3 shows the investment shares of the two economies. The rising importance of investment in China seems to mirror the experience of some of the East Asian newly industrialized economies (NIEs). Young (1995), for example, noted that investment shares in these economies rose substantially during the years of rapid growth.

[4] This decomposition is as follows:

$$\widehat{GDP} = \left(\frac{C_p}{GDP}\right)\hat{C}_p + \left(\frac{I}{GDP}\right)\hat{I} + \left(\frac{G}{GDP}\right)\hat{G} + \left(\frac{X}{GDP}\right)\hat{X} - \left(\frac{M}{GDP}\right)\hat{M},$$

where C_p is private consumption, I is investment (or gross fixed capital formation), G is government consumption expenditure, X is exports, and M is imports. Variables with a hat denote growth rate, for example, $\hat{C}$ denotes the growth rate of consumption.

Figure 3. Investment as a share of GDP



Source: World Bank: World Development Indicators

The importance of investment in China seems to mirror the experience of some of the East Asian newly industrialized economies (NIEs). Young (1995, pp. 644-645), for example, noted that investment shares in these economies rose substantially during the years of rapid growth. Singapore's investment to GDP ratio (measured at constant local currency prices), stood at 10% in 1960, before going on to reach 39% in 1980 and 47% in 1984, after which it declined to below 30% by 1988, only to begin another rise in the late 1980s and reaching almost 40% in 1997. In Korea, investment shares were around 5% in the early 1950s, but climbed to 20% in the late 1960s and to 30% by the late 1970s. They were approaching 40% by 1991. In Taipei,China, the share was around 10% in the early 1950s, from which it grew steadily to 27% in 1975, after which it has fluctuated at around 22%.[5]

We conclude that the major factor explaining the difference in growth rates between the two economies lies in the differentials in the share of investment and in the rate of capital accumulation. In fact, both variables are related as the growth rate of capital accumulation is definitionally equal to the product of the investment share multiplied by the productivity of capital (see next section). Below we examine the factors associated with investment and capital productivity in China and India.

3. Methodological Framework

The approach we follow in the paper, which we label *exploratory* due to its simplicity, is very much descriptive. The main objective is to document a number of stylized facts. However, we believe this approach can be very helpful for purposes of identifying

[5] Hong Kong, China is a contrast with respect to these cases in that the investment-GDP ratio has fluctuated at around 20% since 1960.

important differences between the two economies. It consists of two related pieces. First, following the Classical tradition, we argue that profit rates play a central role in determining investment and capital accumulation. Through its role on capital accumulation, classical economists like Smith, Ricardo and Marx argued that the profit rate shapes the growth rate of the economy.[6] Thus, we posit that causality runs from the profit rate to the rate of capital accumulation and from the latter to output growth.[7]

The profit rate is, by definition, the ratio of the operating surplus (in short, profits) to the stock of capital, that is,

$$r_t = \frac{\Pi_t}{K_t} \tag{1}$$

where Π denotes profits and K is the constant-price value of the capital stock. For purposes of this paper, profits are computed as the difference between real GDP at factor cost and the wage bill (total labor compensation) also in real terms.[8] Defined this way the profit rate is a real rate return net of indirect taxes and depreciation. Data on profits are taken from the National Income and Product Accounts (NIPA).[9] We computed China's capital stock, while that of India was taken from the Central Statistics Office. Detailed information on data and how the different series were computed is provided in the Appendix.

To better understand movements in r_t we decompose it as follows:

$$r_t = \frac{\Pi_t}{K_t} = \frac{\Pi_t}{Y_t} \times \frac{Y_t}{K_t} \tag{2}$$

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[6] This is substantially different from the neoclassical model, where profitability is not considered, at least directly. In this theory, aggregate savings are independent of the distribution of income between wages and profits. Savings are transformed into investment through the interest rate. Even if profitability affected the investment share, this would have no effect on the long term growth rate. Higher investment leads temporarily to a higher growth rate of the capital stock, and thus a higher capital-labor ratio and, consequently, higher productivity. But the initial impact of investment on output growth is small and in the long-run diminishing returns to capital accumulation mean that additional savings are used up in maintaining the higher level of capital per worker. The result is that the growth rate of the capital stock and output go back to their original rates. From this point of view, the profit rate simply reflects the scarcity of capital in relation to labor, without any significant impact on the growth rate of output. In the endogenous growth models such as the "AK", government policies that increase the investment rate of the economy permanently will increase also permanently the growth rate of the economy, and the model generates growth that depends on the savings rate. But the profit rate continues being a variable not considered by these models. In the neoclassical theory the profit rate does not affect investment. In this theory, investment is a function of the cost of capital and output.

[7] It is important to stress that the profit rate we consider is an ex-post accounting concept, not the marginal productivity of capital derived by differentiating the production function with respect to capital, or measured in terms of the user cost of capital.

[8] GDP at factor cost equals GDP at market prices minus indirect taxes plus subsidies minus depreciation.

[9] It must be noted that since we use GDP at factor cost, our computed profit (as the difference between GDP and total labor compensation) is not identical to the operating surplus provided by the NIPA.

where $\pi_t = \frac{\Pi_t}{Y_t}$ is the share of profits in GDP (Y) and $\theta_t = \frac{Y_t}{K_t}$ denotes the productivity of capital. From this point of view, the rate of profit is determined by two factors, namely, the evolution of the profit share in the economy and the pattern of technical change, which affects θ. We will examine both factors in the next sections of the paper.

It must be noted that the decomposition in (2) is an identity, not a behavioral model. Nevertheless, we use it in a somewhat causal way. We argue that causality runs from the right-hand side to the left-hand side, that is, from the capital share and the productivity of capital to the profit rate. Single equation econometric models also proceed in a somewhat similar way (the difference is, obviously, that they are not identities. Indeed, it would be meaningless to attempt to estimate econometrically equation (2)), and acknowledge that, in general, causality also runs from the left to the right-hand side variables. Indeed, in the present context probably there is two-way causality and the profit rate influences the right-hand side variables.

We also decompose capital accumulation, that is, the growth rate of the capital stock, into the product of the investment share times capital productivity, that is,

$$\hat{K}_t = \frac{\Delta K_t}{K_t} = \frac{I_t - \delta K_t}{K_t} = \frac{I_t}{K_t} - \delta = [\frac{I_t}{Y_t} \times \frac{Y_t}{K_t}] - \delta = [\tau_t \times \theta_t] - \delta \qquad (3)$$

where $\hat{K}_t$ is the growth rate of the net stock of capital, $\tau_t = \frac{I_t}{Y_t}$ is the investment share and δ_t is the depreciation rate.

The second piece of the methodological framework is the National Income and Product Accounts (NIPA) accounting identity from the income side. This relates all the variables above and allows us to construct a consistent data set. The NIPA accounting identity is as follows:

$$Y_t^N \equiv P_t Y_t \equiv W_t^N + \Pi_t^N \equiv w_t^N L_t + r_t^N K_t \qquad (4)$$

where Y^N and Y are nominal and real GDP at factor cost, respectively; P is the output deflator; W^N is the wage bill in nominal terms; Π^N denotes total profits. The right-hand side of the accounting identity decomposes the wage bill and total profits into the products $W^N = w^N L$ and $\Pi^N = r^N K$, where w^N is the nominal wage rate; L is the number of workers; r^N is the nominal profit rate; and K is the constant-price value of the stock of capital.

In real terms this expression becomes:

$$Y_t \equiv W_t + \Pi_t \equiv w_t L_t + r_t K_t \tag{5}$$

where $Y \equiv (Y^N / P)$, $W \equiv (W^N / P)$, $\Pi \equiv (\Pi^N / P)$, $w \equiv (w^N / P)$ and $r \equiv (r^N / P)$. Also note that $\pi \equiv \frac{\Pi}{Y} \equiv \frac{rK}{Y}$ is the share of profits in GDP and $1 - \pi \equiv \frac{W}{Y} \equiv \frac{wL}{Y}$ is the share of wages in GDP.

In per-worker terms, equation (5) can be written as:

$$y_t \equiv w_t + r_t k_t \tag{6}$$

where $y = \frac{Y}{L}$ is the productivity of labor and $k = \frac{K}{L}$ is the capital-labor ratio, which can be rewritten as

$$w_t \equiv y_t \left[1 - \frac{r_t}{\theta_t} \right] \tag{7}$$

which is known as the *real wage-profit rate* or *growth-distribution schedule* (Foley and Michl 1999). It will allow us to analyze technical change.

In growth rates the accounting identity (5) becomes:

$$\hat{Y}_t \equiv \pi_t \hat{r}_t + (1 - \pi_t)\hat{w}_t + \pi_t \hat{K}_t + (1 - \pi_t)\hat{L} \tag{8}$$

This expression states that the growth rate of output equals the sum of the growth rates of the factor prices ($\hat{w}_t$ and $\hat{r}_t$) plus the sum of the growth rates of employment ($\hat{L}$) and the capital stock ($\hat{K}$), each weighted by the corresponding factor share. It is again important to stress that this equation is an accounting identity. It will prove useful for purposes of understanding differences in growth rates.

Our methodology possesses the merit of being simple, yet analytically sound. Still, a number of caveats must be born in mind:

(i) The analysis is restricted to long-run trends. Thus, it leaves aside the short-term impact of profitability changes on many macroeconomic variables.

(ii) Comparability of profit rates across countries may be an issue, though no more serious and potentially problematic than that of comparing the GDP per capita of these two countries. Differences in measurement on capital stocks in particular raise questions about the comparability of profit rates and growth rates of capital stocks. We have been as careful as possible in constructing the series. Nevertheless, data availability and reliability for India and China are nowhere near of those for more advanced economies. For the time being, we have to be content with the basic information available from which we construct our series and we hope to improve our measurements in future research.

(iii) The analysis is carried out at the level of the total economy. This masks important differences between agriculture, industry and services as well as between private and public sectors.

(iv) As noted in the Introduction, the paper focuses on the nexus among a small number of macroeconomic variables. It does not address, at least directly, many other issues and policies that are related to economic growth in China and India, such as employment and labor market reforms (and economic reforms in general), demography, macroeconomic stability (e.g., fiscal situation), education, institutions, or the political situation in both countries.[10]

4. Profitability, Capital Share and Investment Potential in China and India

In order to trace the factors behind the differences in capital accumulation and investment between China and India, we start the analysis by looking at profitability. First, we calculate the profit rate according to equation (1), and then we analyze its determinants according to decomposition (2). Of the two determinants, profit share and capital productivity, in this section we analyze the first one, and leave the analysis of capital productivity for a subsequent section. In this section we also compute an additional measure of profitability, namely, the incremental profit rate. Finally, we analyze the investment potential of the two economies.

Why are profit rates important? The profit rate, defined as the ratio of total profits to the capital stock, is a measure of the return to capital, and it is the key variable that shapes investment and capital accumulation. It influences investment via its impact on both expectations and the availability of finance. Kalecki's investment theory, for example, explicitly states the importance of profit rates and retained profits in determining the level of investment (Arestis 1996). A high return on capital not only provides firms with incentives, but also with financial capacity to carry out investment. While a firm has several sources of financing, it often views retained earnings as the preferred source of financing, ahead of debt and equity (e.g., Brealey and Myers 1991). In China and India, in particular, microeconomic evidence indicates that firms fund investment mainly out of retained earnings, a part of profits, due to under-developed financial markets (Dollar et al. 2004).[11] Furthermore, even though a firm can raise funds through debt and equity, eventually it must rely on its profits to repay debt, and must provide returns to its share

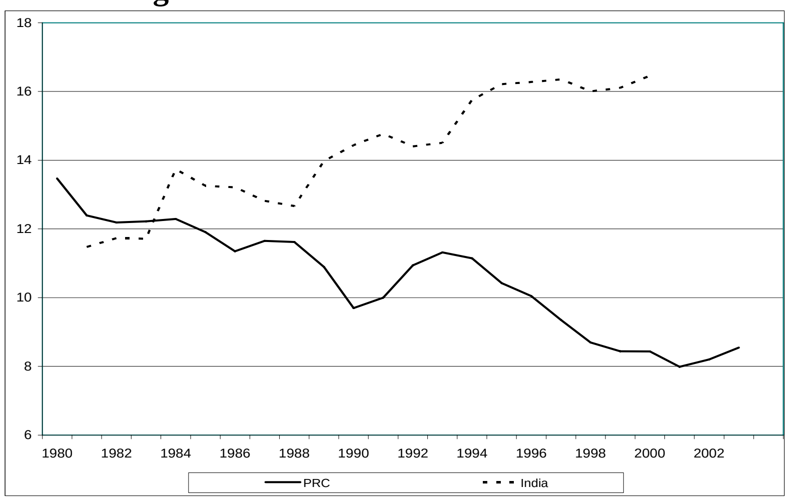
[10] For broader views about growth see, for example, the recent analysis of the OECD (2005) for China.

[11] China's Statistical Yearbook shows that the share of extra-budgetary funds plus internal finance has increased from 55.4% in 1981 to 70.5% in 2003. We are thankful to Carsten Holz for providing us with this information.

holders. Thus, it is natural to expect that profits play a major role in determining investment and capital accumulation. For these reasons, we concur with Balakrishnan and Babu (2003, p. 3997), who indicate that "…the rate of profit appears to us central to what drives entrepreneurs or their late capitalist avatar, the corporation." They go on to observe that "While we remain convinced of the importance of 'animal spirits', acting to make investment an autonomous factor in macroeconomics, we believe that sustained investment cannot really be divorced from profits in any meaningful way" (Balakrishnan and Babu 2003, p.4001).

Figure 4 shows the average profit rates for the two economies. The obvious difference between the two series is that they have moved in opposite directions. In China, the profit rate has declined from 14.8% in 1978 to 8.5% in 2003, while in India it has increased from 11.5% in 1980 to 16.5% in 1999. China's profit rate averaged 10.9% for 1978-2003, and India's 14.3% for 1980-1999.

Figure 4. Profit rate in China and India



Source: United Nations National Accounts Statistics; GDP 1952-1995 and GDP 1995-2003-Historical Data on China's Gross Domestic Product.

Lin (2001, Table 7.2, p.185) has documented the sharp decrease in average profit rates in China across a number of products between 1985 and 1995, such as bicycles (from 44.9% to 0.2%), motor cycles (from 18.4% to 8.6%), sedan cars (from 41.6% to 18.3%), buses (from 40.1% to -0.3%), refrigerators (from 32.2% to 8.1%), washing machines (from 30.0% to 2.9%), air-conditioning units (from 30.0% to 6.4%) and beer (from 24.2% to 2.5%).[12] Likewise, Balakrishnan and Babu (2003, Table 8) document the evolution of

[12] In a 2004 speech, Shan Weijan, Newbridge Capital's co-managing partner, gave a grim picture of the Chinese growth model in recent years, emphasizing the lack of profitability (downloaded from http://blog.9team.net/bigbear/archive/2004/05/08/285.aspx). Studwell (2002, chapter 7) details the cases of a number of foreign companies' investments in China gone sour. For example, referring to the beer industry he notes: "By the second half of the 1990s, there were many industries where it was a challenge to find more than one or two profitable foreign companies, despite billions of dollars of investment. Not one of the ninety foreign breweries was believed by peers to have turned a profit. In 1998, a survey of 229 foreign-invested businesses by management consultants A.T. Kearney showed that only 38 per cent of all manufacturers were covering their operating costs" (Studwell, 2002, p.157). On the hand, recent estimates

profit rates across 15 Indian manufacturing industries. They compared the average annual rates for 1973-74 to 1990-91 to the average annual rate for 1991-92 to 1999-00. The average of the 15 industries is almost identical, 13.06% in the first period and 13.93% in the second, and in eight industries the profit rate increased.[13]

It is not easy to explain why China's profit rate has declined while that of India has increased. Different theories would provide different insights.[14] At the most simple level, the profit rate can be written as the product of the capital share in output times the productivity of capital, equation (2) above. [15]

Figure 5 shows the capital shares of the two countries. The difference in the evolution of the two series explains (at least partially) why the profit rate has declined in China while it has increased in India. Between 1980 and 2003, capital lost about 7 percentage points in China, from about 36% to about 29%. Naturally, this implies that labor's share increased by that much. On the other hand, India's capital share has increased from about 41% to about 44%.

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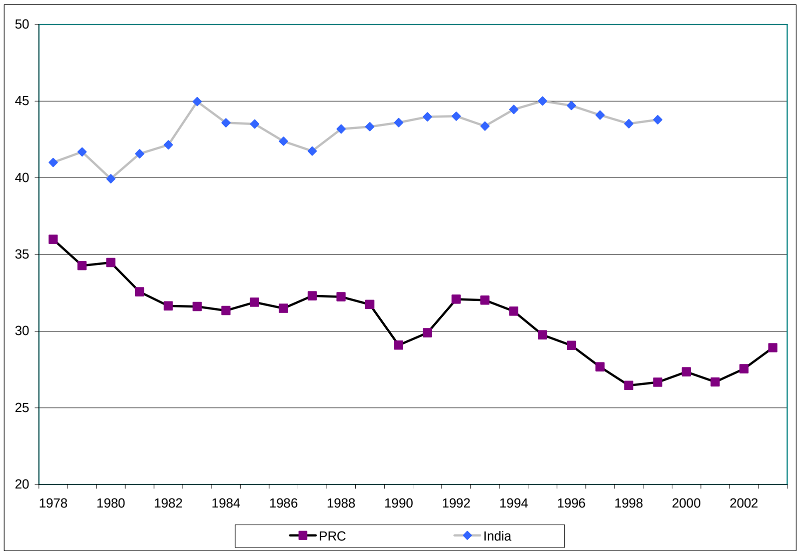
by the OECD (2005) using data for 160,00 firms show that China's rate of return on capital (calculated as the ratio of the operating surplus to fixed assets plus inventories) increased between 1998 and 2003 across all types of companies. The average (i.e., all enterprises) increased from 6.1% to 12.2%; the rate of return of state-controlled companies increased from 4.8% to 10.2%. Nevertheless, when one considers the distribution of the rates of return of these companies, two-thirds of them make less than 5% and 35% make a loss; for collectively controlled companies from 11.2% to 16.5%; and for private companies it went from 7.8% to 15.0% (OECD 2005, Table 2.7 and Figure 2.7).

[13] Beverages and tobacco from 62.44% to 63.97%; textile products from 46.00% to 61.74%; paper and paper products from 5.37% to 8.70%; leather and leather products from 14.10% to 35.23%; chemicals and chemical products from 12.39% to 18.22%; basic metals and alloys from 4.57% to 5.25%; transport equipment and parts from 11.41% to 17.62%; other manufacturing industries from 35.06% to 36.10%.

[14] In the neoclassical model, for example, the marginal productivity of capital is constant in the steady state. Hence, the profit rate is constant too. On the other hand, the profit rate is decreasing in transitional dynamics. For Adam Smith, David Ricardo and Karl Marx, the profit rate had an inherent tendency to decline. Smith argued that as competition for markets among capitalists increases, at some point capital accumulation reaches a maximum, and then the opportunities for profitable investment decrease. For Ricardo, the decrease in the profit rate was a consequence of the decreasing returns to land. For Marx, it was the result of the permanent increase in capitalization.

[15] As indicated in section 3, equation (2) above is not a behavioral relationship. It is, by construction, an identity. However, like in many relationships in macroeconomics there is a gray area between causality (behavioral relationships) and tautology (identities). Think, for example, of the relationships among the variables in the demand-side national income accounting identity. In the case at hand, although the decomposition is an identity, there is no doubt that relationships of causality among the three variables run in all directions. It is worth noting that it could be argued that from a neoclassical point of view, the profit rate equals the marginal productivity of capital (i.e., $r = \partial Y / \partial K$) which, in the case of the Cobb-Douglas production function, equals the product of the output elasticity of capital (which equals the capital share) times capital productivity (i.e., $r = \pi \times \theta$). Hence, it might be inferred that the decomposition we use is simply a way of re-stating what every textbook shows. This argument is, however, incorrect. First, the equality between the profit rate and the marginal productivity of capital in the neoclassical model is an equilibrium relationship derived from an optimization problem. Our decomposition, for being an accounting identity, is not theory-dependent. Second, the Cobb-Douglas production function implies constant factor shares. As we show in Figure 4, this is not the case here. And finally, the notion of marginal productivity of capital (at the aggregate level) requires the existence of an aggregate production function. As has been known for decades, aggregate production functions do not exist (Felipe and Fisher 2003).

Figure 5. Capital Share in India and China (%)



Source: United Nations National Accounts Statistics; GDP 1952-1995 and GDP 1995-2003-Historical Data on China's Gross Domestic Product.

In order to further explore the relationship between profitability and investment, we look at another measurement of profitability, the incremental profit rate (ICPR). This is calculated as the ratio of the change in profits between two periods to investment of the initial period, that is:

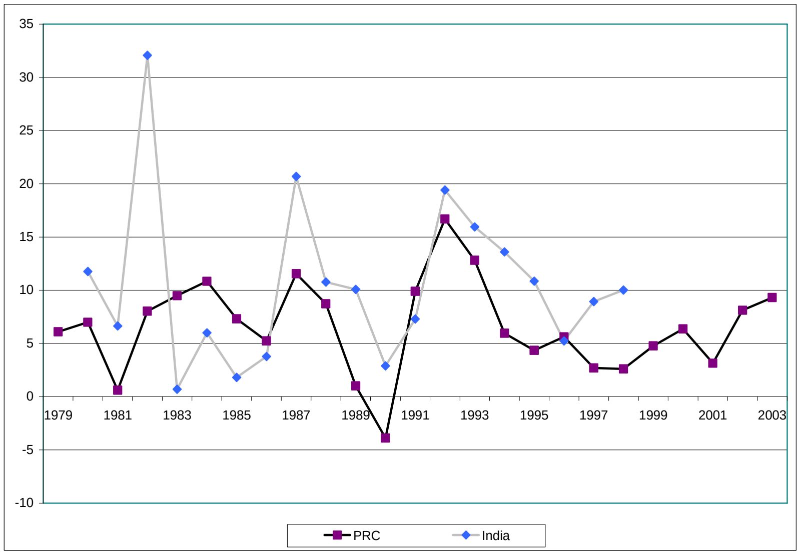
$$ICPR = \frac{\Pi_t - \Pi_{t-1}}{I_{t-1}} \quad (9)$$

where I denotes real investment, and Π denotes real profits. The ICPR measures changes in profits between two periods relative to recent investment. Expectations of future returns are sensitive to the evolution of profits in relation to past recent investments. The dynamics of the incremental profit-rate provides an indication of the movement of the average profit rate and leads future expectations driving investment growth. While the average profit rate is important in the long term, the ICPR is more a measure of short-term profitability. The change in profits produced by recent investments is a thermometer shaping businesses' immediate expectations and investment plans. Indeed, rising profits signals healthy economic conditions, which are likely to make firms adopt a more optimistic stance and thus proceed with their investment plans. The opposite holds if profits are falling. Therefore, planned investment growth is likely to be influenced by the dynamics of recent profit changes. That is, the growth of profits produced by recent investments is the indicator that shapes businesses' future profit expectations as plans for the future are, to some extent, shaped by the current outcome of near past expenditures.

Econometric analysis for China shows that the ICPR is an important factor influencing investment growth and capital accumulation. In particular: (i) Granger-causality tests indicate that the ICPR Granger-causes investment growth and capital accumulation; (ii) changes in average profitability are important in explaining capital accumulation and the growth rate of the investment share, but only in the short run; (iii) the same occurs when the two components of the profit rate, i.e., profit share and capital productivity, are introduced as separate regressors: both help explain capital accumulation and the growth rate of the investment share, but only in the short run.

Given China's much higher investment growth, documented in Table 2, we expect China's ICPR to be higher than that of India. However, data once again reveal some unexpected results (Figure 6). India's ICPR averages 10.4% for 1981-1999, compared to an average of 6.6% for 1978-2003 for China.

Figure 6. Incremental profit rates in India and China (%)



Source: Authors' estimates

The fact that India's average profit rate and incremental profit rate are higher than those of China is intriguing. Given the expected positive correlation between accumulation and investment and the profit rate, one would expect the differences to be in the other direction. Though certainly there are other factors influencing investment decisions, the fact that average profitability and ICPR are lower in China poses the interesting question of why investment is so high in China compared to India.[16]

4.1 Investment Potential

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16 It must be added that China receives much more FDI than India, $60 bn. dollars versus $5 bn. One important reason for the difference is that India imposes caps on FDI on sectors such as insurance, aviation, coal mining, or retailing, among others. The government has succeeded in raising the cap on FDI for telecoms, which recently increased from 49% to 74%.

To shed some light on the question in the previous paragraph, we investigate the investment potential of the two economies. Theoretically, the maximum sustainable growth rate of an economy occurs when all profits are reinvested as productive inputs (Von Newman 1942-43, Leontief 1953). This occurs when the growth rate of capital equals the rate of profit. This result can be derived from the "Cambridge equation" (Pasinetti 1962) or simply from a Harrodian warranted growth path (i.e., the rate of growth necessary to absorb society's saving in investment projects) with a Kaldorian classical savings function, which implies that $I = s_c \Pi$, where s_c s the propensity to save out of profits. Dividing both sides by K, it follows that $(I/K) = \hat{K} = s_c(\Pi/K) = s_c r$.[17] An implication of this relationship is that, *in the long run*, the highest possible investment (I_{max}) will be achieved when all available enterprise profits are plowed back as productive inputs, and this occurs when all profits are saved, i.e., $s_c = 1$. This implies that, in the long run, the maximum rate of capital accumulation $(\hat{K}_{max})$ cannot exceed the profit rate (r), without affecting the rate of inflation (Shaikh 1999). Algebraically:

$$I_{max} = \Pi \text{ so that } \left(\frac{I}{K}\right)_{max} = \left(\frac{\Delta K}{K}\right)_{max} = \left(\hat{K}\right)_{max} = \frac{\Pi}{K} = r \qquad (10)$$

Thus, one can interpret the ratio of the actual growth rate of capital accumulation to the profit rate $(\hat{K}/r)$ as an indicator of the degree to which the growth potential of the economy is being utilized (Shaikh 1999). A ratio below 1 indicates that the country's capacity for investment is not fully utilized. The more this ratio approaches 1, the higher the probability that excess demand will end up accelerating inflation rather than boosting growth. In some sense it is an indicator of the tightness of the economy.[18]

Figure 7 plots the ratio between the growth rate of the capital stock and the profit rate in China and India. The chart reveals a remarkable contrast between the two economies. In China, the rate of capital accumulation has been close to, or exceeded, the profit rate. The average ratio from 1979 to 2003 was 1.1. The rate has been especially high since 1995 with the ratio averaging 1.4 between 1995 and 2003.[19] India exhibits a different picture. The ratio between the growth rate of capital stock and profit rate averaged 0.3 from 1980 to 1999, with very small fluctuations.

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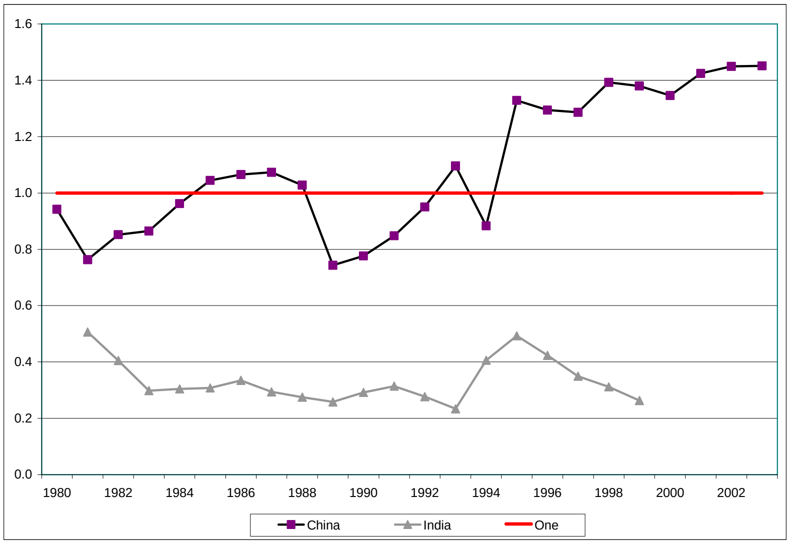
[17] This equation is fundamental for the post-Keynesian school of thought for it is the essence of their model of growth and distribution (Pasinetti 1962). The equation says that the rate of profit does not depend on microeconomic technical conditions, or on relative physical endowments, like in the neoclassical model, but solely on macroeconomic variables, namely the rate of accumulation and the propensity to save on profits. We are expressing the Cambridge equation with the profit rate determining the rate of growth of accumulation. Some authors argue that causality runs the other way around, i.e., from accumulation to the profit rate. This is a standing controversy. See Lavoie (1992, pp.285-286).

[18] This result derives from a closed-economy model. To our knowledge, the condition for an open economy has not been worked out and thus the implications of equation (10) should not be overstated. Nevertheless, we believe equation (10) provides a rough guidance.

[19] In practice, firms also borrow to finance their operations and investment plans, not only retained earnings. Hence, the ratio can go above unity.

This indicates that India differs from China in terms of how much profit has been plowed back into investment. In China virtually all profits are reinvested, with the consequence that actual investment has outstripped the capacity provided by profit and has led to the creation of overcapacity.[20] In India, however, investment accounts for about two thirds of profits. While profit provides a means and capacity for investment, whether this capacity is utilized depends on other factors.

Figure 7. Profit rate and growth rate of the capital stock



Source: United Nations National Accounts Statistics; GDP 1952-1995 and GDP 1995-2003-Historical Data on China's Gross Domestic Product.

The contrast between China and India points to two very different challenges confronting the two economies. China's chief issue is how long such a high growth of investment can be sustained. China's success story to date is very much related to high investment growth. How can this continue without any major destabilizing effect is a question policy makers must face. For India, the data indicates that there is much leeway to increase investment to fulfill the potential provided by profit. The importance of understanding why investment falls short of profit and addressing the impediments to investment cannot be over-emphasized.[21]

[20] Lin (2001, Table 7.2, p.185) documents the increase in the number of manufacturers across a number of products before the industrial reform, in 1985 and in 1995. For example, in 1978 there were 38 makers of bicycles. The number had increased to 672 in 1985 and to 1,081 in 1995. And the number of manufacturers of motorcycles increased from 194 in 1985 to 1,535 in 1995. The result is that capacity utilization in many sectors in 1995 was relatively low.

[21] Latest data indicate that China's gross domestic savings rate is close to 45%, while that of India is about 25%. Certainly this provides an explanation for China's higher investment rate. However, what our analysis indicates is that India could do better with its lower savings rate.

5. Capital productivity and Technical change

As mentioned before, the other important variable determining the profit rate and capital accumulation is the productivity of capital (see equations (2) and (3)). Capital productivity measures the amount of output produced per (monetary) unit of capital and can be interpreted as an indicator of the efficiency with which capital is used.[22] A comparison of capital productivity between India and China once again reveals a major difference between the two countries (Figure 8). While capital productivity has increased in India, it has declined in China. Between 1981 and 2003, capital productivity fell from 0.39 to 0.30 in China. In India, however, it increased from 0.29 in 1980 to 0.38 in 1999.

Figure 8. Capital productivity in India and China

Source: United Nations National Accounts Statistics; GDP 1952-1995 and GDP 1995-2003-Historical Data on China's Gross Domestic Product.

This is a very important and revealing finding, which attests to the inefficiency, or poor utilization, of China's capital resources vis-à-vis India's. Though this aggregate measure of capital inefficiency may hide many factors such as the sectoral composition of investment, and the high rate of urbanization in China, which requires capital-intensive physical infrastructure, at least the findings raise legitimate doubts as to the productivity of the capital being used.[23]

The above findings indicate the following:
(i) the decreasing capital productivity in China is lessening the contribution of a high and increasing investment share to the rate of capital accumulation, equation (3). In the case

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22 The concept of capital productivity is not a straightforward one. While labor productivity is the ratio of output to a measure of labor (usually employment or number of hours), capital productivity is a much more complicated notion due to the problems of measurement and interpretation of the concept of capital, in particular at the aggregate level (Cohen and Harcourt 2003 and Felipe and Fisher 2003).

23 A probable cause of why this is happening in China but not in India lies in the recent Chinese industrialization effort, which is leading to an oversupply of infrastructure services, housing and consumer goods in the urban areas.

of India, on the other hand, the increasing capital productivity is playing a positive role. However, the differential in the investment share between the two countries is so large that India's increasing capital productivity cannot compensate its much lower investment share, resulting in a much smaller growth rate of the capital stock;

(ii) the declining capital productivity adds to the declining capital share as an explanation for the declining profit rate in China. The opposite happens in India; and

(iii) with declining capital productivity (i.e., $\hat{K}_t > \hat{Y}_t$), a falling profit rate (i.e., $\hat{r}_t < 0$) is needed to open room for the wage rate to equal or exceed the labor productivity growth rate (i.e., $\hat{w}_t \geq \hat{q}_t$), and vice-versa. This is what is happening in China. As shown in Table 1, the growth rate of the profit rate was negative. This has to be the case in an economy where capital productivity is declining, given that the growth rate of the real wage rate was above that of labor productivity. The opposite happened in India, namely, capital productivity and the profit rate have increases, but real wages have not grown faster than labor productivity. Algebraically, this can be shown by rearranging equation (8):

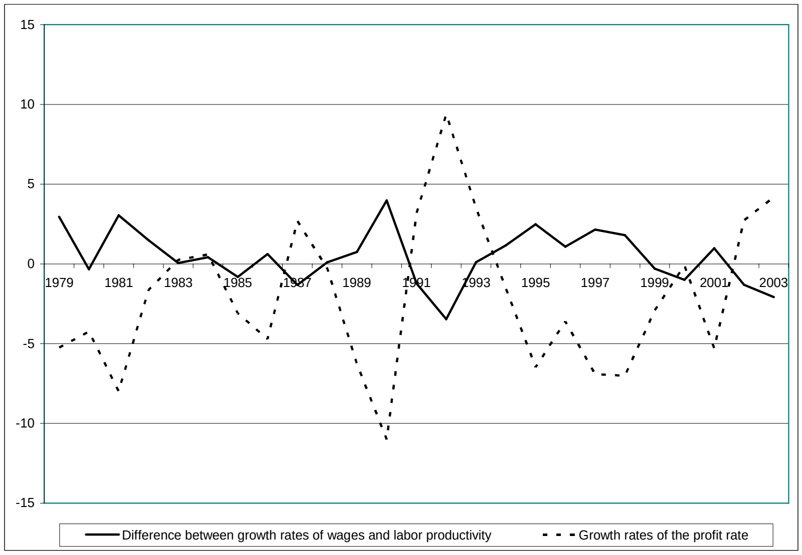
$$(1-\pi_t)(\hat{w}_t - \hat{q}_t) \equiv -\pi_t [\hat{r}_t + (\hat{K}_t - \hat{Y}_t)] \qquad (11)$$

where $\hat{q}_t$ is the growth rate of labor productivity. This expression operates as a dynamic constraint on the economy for being an identity. It shows very neatly the basic way in which capitalist economies develop due to the interaction between the accumulation process (and the resulting growth of productive capacity) and the conflict over income distribution. The important message of the relationship is clear: there is an inescapable link between changes in the distribution of income, accumulation and growth.[24]

Figures 9 and 10 graph the series $(\hat{w} - \hat{q})$ and $\hat{r}$ for the two countries. The two series move, in general, in opposite directions, although this is much more clear in the case of China, where capital productivity is decreasing.

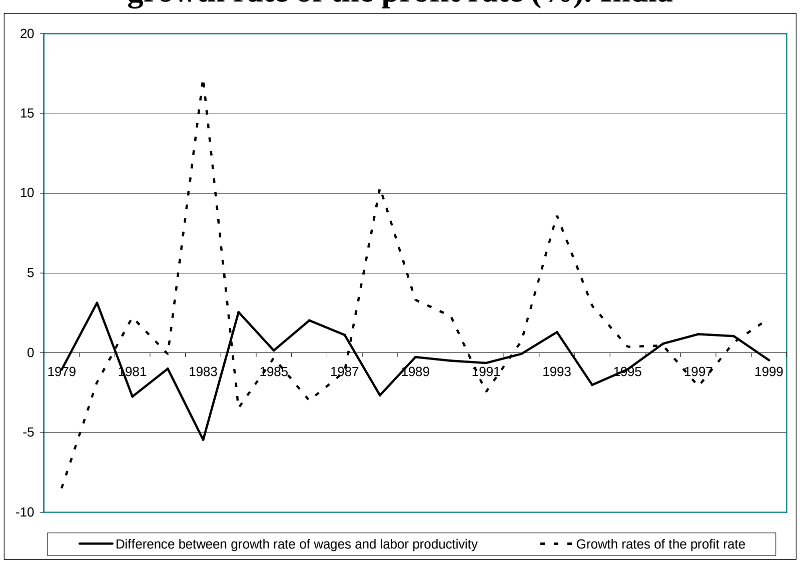
Figure 9. Growth rate of wage rate minus that of labor productivity and growth rate of the profit rate (%). China

[24] Expression (11) can also be written as $\hat{q}_t \equiv \hat{w}_t + (s_t^K / s_t^L)[\hat{r}_t + (\hat{k}_t - \hat{y}_t)]$, which indicates that positive productivity growth generates an income "surplus" that vents into real wage growth, profit rate growth and/or capital-output ratio growth.



Source: GDP 1952-1995 and GDP 1995-2003-Historical Data on China's Gross Domestic Product, Datastream

Figure 10. Growth rate of the wage rate minus that of labor productivity and growth rate of the profit rate (%). India



Source: United Nations National Accounts Statistics; Extended Penn World Table

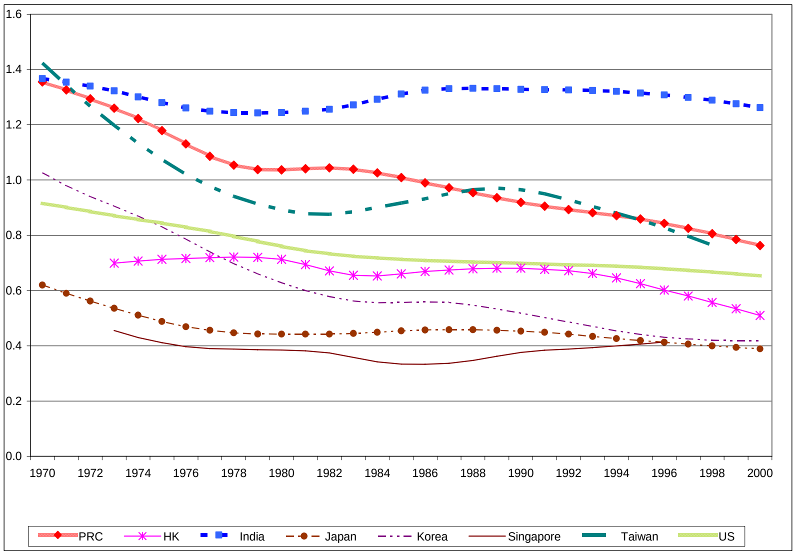
5.1. Declining Capital Productivity and Marx Biased Technical Change

Is China's declining capital productivity a puzzle? While much has been said in the literature about labor productivity and its importance, little is known about capital productivity. In order to place the India-China experience in an international perspective,

Figure 11 graphs the capital productivity of these two countries alongside those of Hong Kong, Japan, Korea, Singapore, Taiwan and the US for 1970-2000.[25]

Figure 11. Capital productivity of selected countries

Measured at PPP 1996 US$ prices



Source: Extended Penn World Table

Figure 11 reveals an interesting pattern. This is that capital productivity has not increased over time in any of the economies graphed. Either it has declined or stayed approximately constant. India had one of the highest capital productivities in 1970, together with China and Taiwan. Moreover, in 2000 India had a level of capital productivity that was two to three times that of the other countries in the graph, including China which, together with Taiwan, had undergone a sharp decline.

This seems to indicate that declining capital productivity is the ‘norm’ across the world in market economies. Falling capital productivity, alongside rising labor productivity, has also been noted by other researchers. For example, Foley and Michl (1999) have documented that while labor productivity has increased persistently over the last two centuries, capital productivity has declined in many countries, including the US, Japan and across the European Union. At a theoretical level, perhaps the first economist to note this path of economic development was Marx. As such, technical progress characterized by labor-saving and capital-using, which leads to a higher capital labor ratio, higher labor productivity, and lower capital productivity is referred to as *Marx-biased technical*

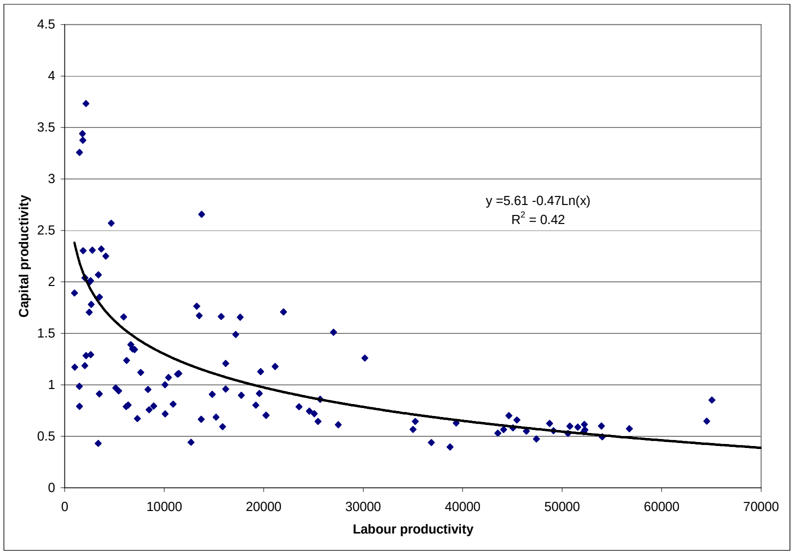
[25] These figures are from the extended Penn World Table constructed by Adalmir Marquetti: http://homepage.newschool.edu/~foleyd/epwt/. These figures are in PPP terms, and hence are different from our estimated values for China and India which are in local currency constant prices. The important point remains, however, that capital productivity in China has declined, while it has not in India.

change (Foley and Michl 1999).[26] Foley and Marquetti (1999) and Marquetti (2003) have documented that the Marxian bias is prevalent across developed and developing economies.

These changes stem from the interplay between the capital-labor ratio (k), capital productivity (θ), and labor productivity (y) (note that $y = \theta \times k$). It is widely acknowledged that a rising capital-labor ratio leads to higher labor productivity. However, when the rate of capital accumulation rises faster than GDP growth, capital productivity falls. This raises the vexing question of whether falling capital productivity combined with rising labor productivity is an *unavoidable* path of economic development. The available empirical evidence for many countries seems to suggest so.

Moreover, when one considers a cross-section of countries, there appears to be a negative correlation between labor productivity and capital productivity, as shown in Figure 12.

Figure 12. Capital productivity and labor productivity in 2000
Measured at PPP 1996 US$ prices

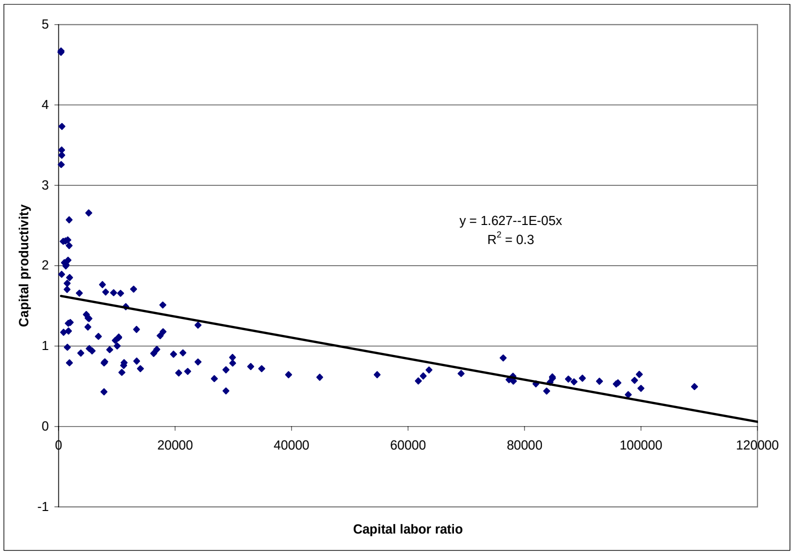


Source: Extended Penn World Table

And the negative relationship between the capital-labor ratio and capital productivity is captured in Figure 13

Figure 13. Capital labor ratio and capital productivity in 2000
Measured at PPP 1996 US$ prices

[26] The Classical interpretation of increasing labor productivity and decreasing capital productivity is that this is a reflection of the bias in the adoption of technical change in market economies. The Neoclassical interpretation, on the other hand, is that these movements occur along the isoquant of a stable production function.

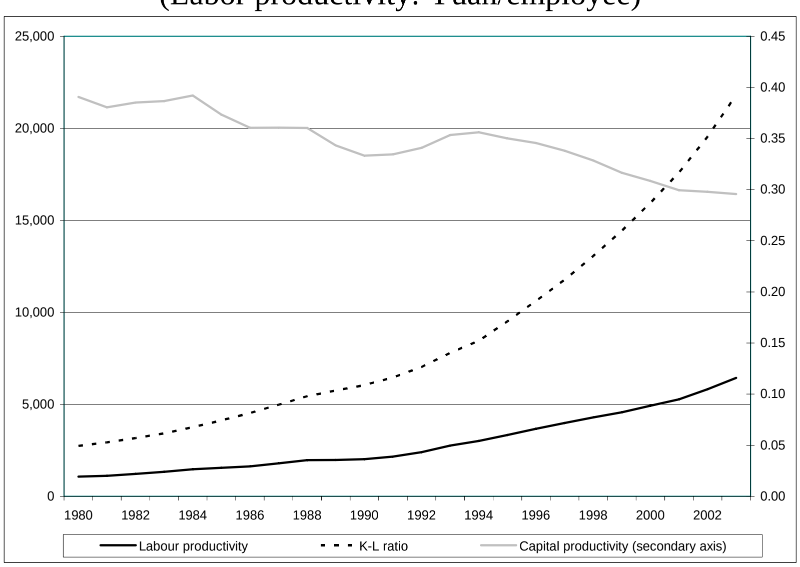


Source: Extended Penn World Table

Figures 14 and 15 plot labor and capital productivity and the capital-labor ratio for both countries. Figure 14 shows that, in China, capital productivity and labor productivity, as well as the capita-labor ratio, move in the opposite directions. Figure 15 for India indicates that the three variables move in the same direction. Between 1980 and 2003, China's labor productivity rose at an annual average rate of 8.0% and the capital labor ratio at a rate of 9.5%, while capital productivity decreased at a rate of 1.3% per annum. In contrast, between 1981 and 1999, India's labor productivity increased at an annual average rate of 4.1%, the capital labor ratio at a rate of 2.6%, and capital productivity at a rate of 1.5%.

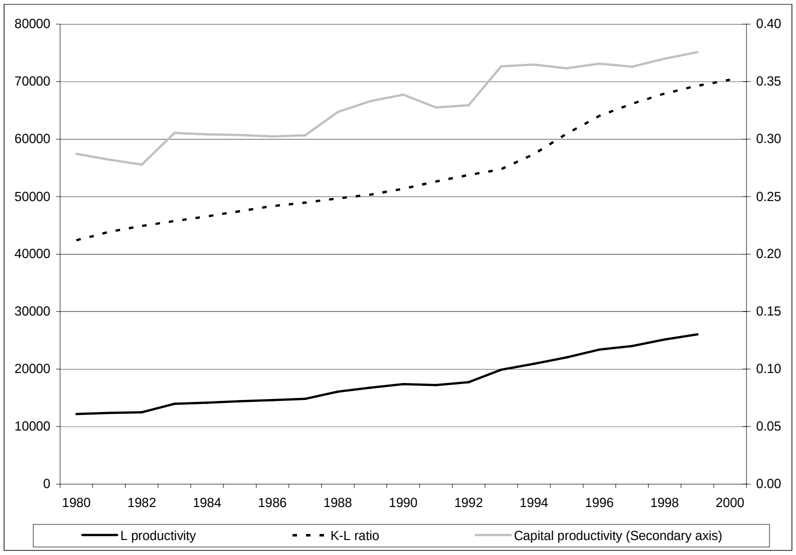
Figure 14. Labor productivity, capital productivity, capital labor ratio in China

(Labor productivity: Yuan/employee)



Source: GDP 1952-1995 and GDP 1995-2003-Historical Data on China's Gross Domestic Product.

Figure 15. Labor productivity, capital productivity, capital labor ratio in India
(Labor productivity: Rupee/employee)



Source: United Nations National Accounts Statistics;

The above therefore indicates that, perhaps, the *anomalous* path of capital productivity seems to have taken place in India, and not in China. China has witnessed the process of a rising capital-labor ratio, rising labor productivity, and declining capital productivity experienced by many other countries. What is noticeable in China is the sharp decline in capital productivity. Indeed, between 1980 and 2003, labor productivity rose at an annual average rate of 8.0% and the capital labor ratio at a rate of 9.5%, while capital productivity decreased by 1.3% on average per annum. India differs from China in that labor productivity, capital productivity, and capital-labor ratio all increased moderately. Between 1981 and 1999, labor productivity increased at an annual average rate of 4.1%, the capital-labor ratio at a rate of 2.6%, and capital productivity at a rate of 1.5%. These changes have important implications for economic growth in the two countries, as will be shown later.

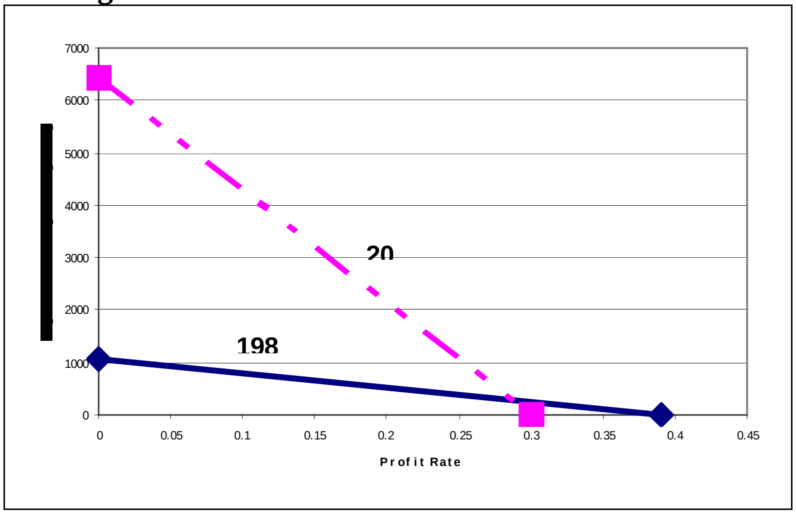
The degree of labor-saving technological progress can be measured by the percentage increase in labor productivity ($\hat{y}$). Likewise, the degree of capital-saving technical change can be measured by the percentage increase in capital productivity ($\hat{\theta}$). Equation (7) can be used to analyze the nature of technical progress in a country. At the macroeconomic level, technical change from period to period is reflected in movements in the growth-distribution schedule. Expression (7), the growth-distribution schedule, indicates that in an economy there is a trade-off between wage and profit rates, given the value of output. Moreover, it indicates that the maximum value of the wage rate is given by labor productivity (when the profit rate equals zero) and the maximum profit rate is given by capital productivity (when the wage rate is zero). It can be used to represent technical progress (Hahn and Matthews 1964, p.830). Any arbitrary pattern of technical change can be decomposed into a combination of labor-saving and capital-saving technical changes. Technical change that increases the capital-labor ratio and leads to lower capital productivity is referred to as capital-using. It corresponds to the case $\hat{y} > 0$ and $\hat{\theta} < 0$, and is referred to as Marx-biased technical change. The case where $\hat{y} > 0$ with $\hat{\theta} = 0$ is referred to as Harrod-neutral technical progress. And the case $\hat{y} = \hat{\theta}$ is referred to as Hicks-neutral technical change.

Thus, equation (7) can be plotted in the (w,r) space. This is a straight line with its horizontal intercept equal to capital productivity (θ) and its vertical intercept equal to labor productivity (y). The growth-distribution schedule graphed at different points in time can help discern the nature of technical progress. In the (w,r) space, the Marx-biased technical change corresponds to a clockwise rotation of the schedule around the horizontal intercept. Given that the slope of the schedule is given by the (negative of) the capital-labor ratio, this movement implies in increase in capital intensity.

Figure 16 reveals that Marx biased technical change has taken place in China. India, on the other hand, seems to be better characterized possibly by something that resembles Hicks-neutral technical change (Figure 17).[27] China has experienced substantial increase in labor productivity, wage rates, and capital labor ratio since the early 1980s. On the other hand, capital productivity and the profit rate declined. This is exactly as predicted by Marx. In India, however, labor productivity, wage rates, capital labor ratio, capital productivity, and profit rate have all increased moderately over the past two decades. In China, the rapid rise in labor productivity was achieved by high rate of capital accumulation, leading to increasing capital labor ratio. This offsets the effect of declining capital productivity. The growth of the capital labor ratio in China was spurred by high investment growth. In India, moderate growth rates in capital productivity and capital labor ratio are associated with moderate growth of labor productivity.

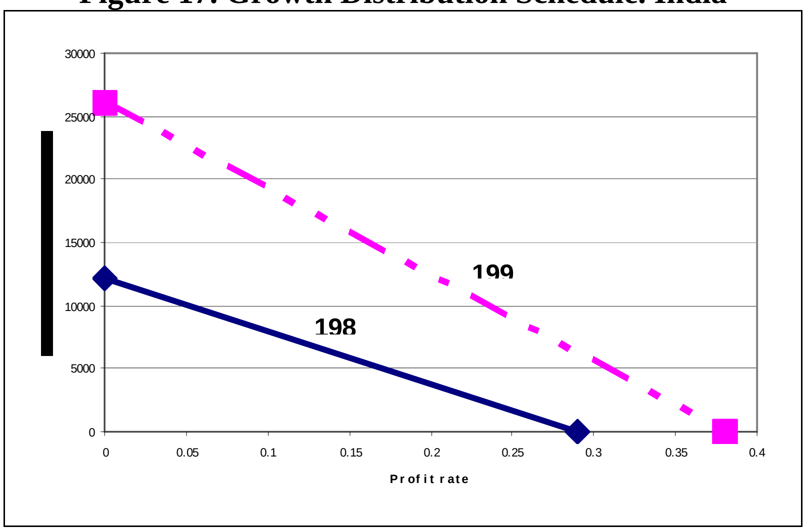
[27] It is important to note that Steedman (1985) showed that Hicks-neutrality is an internally inconsistent and impossible (not just empirically implausible) concept at the level of the aggregate economy in the presence of produced inputs. Steeman derived the sufficient conditions to make Hicks-neutral technical progress impossible (e.e., the ex-ante payment of wages, sectors have differential profit rates).

Figure 16. Growth Distribution Schedule. China



Source: Authors' estimates

Figure 17. Growth Distribution Schedule. India



Source: Authors' estimates

5.2. Is declining capital productivity a paradox?

In this subsection we digress momentarily from the discussion of China and India and address an important theoretical question. While the relevance of labor productivity is well established theoretically and documented empirically for it relates to important variables like long-run growth, living standards and inflation, much less is known about capital productivity. The relevance of the latter, nevertheless, has been raised by some authors. The "general belief" is, probably, that capital productivity should, like labor productivity, increase. For example, Lewis (2004) indicated that:

"To understand growth potential, you have to understand two things. You have to understand how fast labor productivity can grow and whether adequate capital is available for additional capacity. Labor productivity always tells you the amount of goods and services produced by the people who are working. If we just increased labor productivity and added no capacity, then the amount of goods and services produced would stay the same and lots of people would be unemployed. We have to build new factories and office buildings to provide places for these people to work. That requires *additional capital*. Since capital also can be applied with different efficiencies, we have to understand *capital productivity* and how fast it can increase. The more efficiently we use capital, the less capital we need to create additional capacity and new jobs for growth"

(Lewis 2004, p.253; italics added).[28]

Therefore, higher labor productivity can be considered an objective in itself since it is the most important determinant of living standards. In this sense, increasing the capital-labor ratio, and further, declining capital productivity can be seen more as instruments toward achieving increases in labor productivity growth. In order to achieve high labor productivity, capital accumulation has to be rapid. As Lewis (2004, p.250) indicates, becoming a rich country without any additional capital is virtually impossible.

The Marxian bias is thus associated with the desirable outcomes of higher labor productivity and per capita income. However, there is another side to the story. Marx biased technical change is also related to the decline in the profit rate. Declining capital productivity (θ), together with an approximately constant capital share (π) lead to such a result. As noted above, the evolution of the rate of profit is determined by changes in the capital share and in capital productivity.

From a theoretical standpoint, Marx argued that the tendency for the profit rate to fall had to be explained in conjunction with rising labor productivity due to induced technical change. The key question is: why do entrepreneurs introduce technologies that lower the profit rate? The answer to this question lies in the difference between how the individual entrepreneur behaves and what happens at the aggregate level (Foley and Michl 1999, pp.120-123).

The essence of a market economy is competition for markets. In the final analysis, the crucial variable which determines a firm's survival is the cost of the product: the lower the price of a product for a given quality, the higher the chances of success for any firms. This is why firms are continually worried about the idea of lowering costs, for this is the way to increase the profit rate. Each individual entrepreneur is under constant pressure to be the first to adopt technologies that lower costs and increase profit rates.

The reduction in unit costs is achieved mainly through increases in labor productivity. The drive to raise productivity leads to an ever-increasing mechanization of the production process. However, as more and more fixed capital per worker is required, machines replace workers (i.e., new equipment is labor-saving whereas there is an excess labor supply). But if mechanization is to be successful in the competition struggle, it must reduce unit costs. Large-scale plants and equipment require greater amounts of fixed

[28] See also Klein and Palanivel (2000, pp.42-44) for India, who emphasize the country's need to increase the efficiency of capital.

capital per unit of product. This way, higher fixed costs are traded off in return for lower variable costs.

As individual entrepreneurs race to adopt more profitable technologies, there is a general increase in labor productivity, which eventually will lead to increases in real wages. If the wage rate increases proportionally to labor productivity, so that the labor share remains approximately constant, and technical change is Marx-biased, the profit rate will fall.[29]

To understand how this happens, it is important to understand the difference between how each individual entrepreneur behaves and what happens at the level of the whole economy. Each individual entrepreneur decides whether or not to adopt a new technology on the basis of the rate of return that she anticipates at the individual level. It takes some time before competitors catch up with the innovator. This means that innovators are motivated to adopt techniques that raise the rate of profit at the current level of wages and prices (i.e., entrepreneurs evaluate the rate of profit that they would get if they adopted the new technology while paying the current wage rate) by the prospect of reaping temporary above-normal profits. Indeed, once a new, lower cost method becomes feasible, the investment picture changes. The first few firms to adopt the new method are in a position to lower their selling prices, undersell their competitors and expand their own shares of the market, i.e., first-mover advantages. All firms now face a round of falling prices. Under these new circumstances, the firms with the lowest unit costs will be the ones with the greatest chance of survival. The reason is that price reductions damage the anticipated profit rates of the higher cost methods more than those of the lower cost processes.

At the aggregate level, on the other hand, the average profit rate of the economy is determined by what happens to wages as labor productivity rises. The Classical school accepted that wages could be affected by institutional and political factors. Unions and labor market policies such as the minimum wage put an upward pressure on wages during periods of rising labor productivity. When all entrepreneurs behave on the assumption that that a new technology will increase their rate of profit, the corresponding increase in labor productivity will eventually lead to a more-or-less proportional increase in wage rates. The average rate of profit declines due to a fallacy of composition, that is, actions that appear advantageous to individual firms (due to how individual entrepreneurs evaluate the possibility of introducing a new technique) are not always advantageous when all firms try to pursue them. Moreover, the expectation of increasing wages as a result of the social aggregate behavior only increases the pressure on individual entrepreneurs to adopt labor-saving techniques in an effort to protect their rate of profit from the erosion caused by the increase in wages (Foley and Michl 1999, pp.120-123).

This theory provides an explanation for why entrepreneurs introduce technologies that are capital-using, leading to higher wage rates, higher capital-labor ratios, higher labor productivity, lower capital productivity, and most importantly, lower average profit rates.

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[29] $r = \frac{\Pi}{K} = \frac{\pi}{(1/\theta)}$. With π constant, if θ decreases, r will decline.

In other words, the individual firm's pursuit of higher profit rates leads to labor saving technical change and eventually lowers profit rate at the aggregate level. The essence of this theory lies in the difference between the behavior and expectations of individual firms and the outcome at the aggregate level. Due to the falling profit rate, at the *aggregate level*, however, Marx-biased technical change is not sustainable. A falling profit rate can eventually slow down the accumulation of capital and the growth of output. At some point, the lower profit rate will translate into very low or even negative capital accumulation through depreciation and obsolescence, and the capital stock of the economy would decrease. Most real economies tend not to reach this point because periods of declining capital productivity are followed by periods of increasing capital productivity.

Thus, Marx biased technical change embodies an intrinsic dilemma and contradiction. On the one hand, an increasing capital-labor ratio leads to higher labor productivity, a factor that is closely linked with per capita income, as well as to a higher wage rate. On the other hand, an increasing capital-labor ratio is associated with lower capital productivity, and a declining profit rate. The latter can constrain capital accumulation and limit economic growth. Economic development may lie in a balance of these two countervailing forces.

6. The Challenges facing India and China

The conventional growth accounting framework (Solow 1957) is a useful starting point to analyze the impact of investment on growth. In this framework, technological progress is regarded as exogenous, i.e., it is independent of variables such as investment. As is well-known, the growth accounting equation is derived by differentiating the production function, expressing it in growth rates and assuming that the factors of production are paid their marginal products. Algebraically:

$$\hat{Y} = \varphi_t + \pi_t \hat{K} + (1 - \pi_t)\hat{L} \qquad (12)$$

where $\hat{Y}$ is the growth rate of GDP, φ_t is the growth rate of technical progress, $\hat{K}$ is the growth rate of the capital stock, $\hat{L}$ is the growth rate of employment and π_t and $(1 - \pi_t)$ are the capital and labor shares in GDP, respectively. Finally, φ_t denotes the growth rate of total factor productivity (TFP), a proxy for the growth rate of technological progress.

Rodrik and Subramanian (2004) have recently used this framework to project India's future potential output growth rate through to 2025. Using the framework of equation (12), they assumed a Cobb-Douglas production function with constant returns to scale and assigned a (constant) capital share of $\pi = 0.35$. The capital stock was assumed to grow by 8.3% annually compared to the actual growth rate of 4.7% between 1980 and 2003, based on the assumption that the dependency ratio will decline. This, in turn, will lead to a higher savings rate and greater investment growth. The labor force was assumed to grow by 1.9% based on the current rate of increase in the working age population. Finally, the assumed that TFP growth would grow by 2.5% a year, the same rate of the previous two decades. Under these assumptions, Rodrik and Subramanian (2004) come up with a growth forecast of 7% per year for output, and 5.6% for per capita output for the next 20 years for India. They refer to it as the "potential output growth" of the economy. They argue that India can grow at least by this figure.

Goldman Sachs (2003) has produced forecasts of GDP and GDP per capita and real GDP growth for Brazil, China, India, Russia, France, Germany, Italy, Japan, UK and US, until 2050. They also assume a Cobb-Douglas production function with a capital share of 0.33. This study differs from Rodrik and Subramanian (2004) in that total factor productivity (TFP) growth was assumed to be determined by the income per capita gap between a country and the US, rather than being taken as a constant. The lower the income per capita compared to that of the US, the faster the TFP will grow. They authors conclude that China's growth rate will remain at about 10% until 2015, and then it will start decreasing to settle at about 5.5% in 2045-2050. In the case of India, they argue that the growth rate will stay at about 7-7.5% until 2025 and then increase to 8-9% to 2045. The authors project that by 2050 China will have a GDP per capita about 1.8 times as high as that of India. This implies a slight reduction with respect to today's gap, 2.37 times.

It is worth noting the resemblance between the identity equation (8) and the neoclassical growth accounting equation (12). Since the former is an identity, a comparison implies that $\varphi_t \equiv \pi_t \hat{r}_t + (1-\pi_t)\hat{w}_t$. This is a very useful piece of information if one wants use the growth accounting equation to understand and forecast growth the way Rodrik and Subramanian (2004) did. Indeed, according to Table 1, $\varphi_t \equiv \pi_t \hat{r}_t + (1-\pi_t)\hat{w}_t =$ 3% for 1980-1999. But assuming this same value for the future is unwarranted. Sooner or later the profit rate will decline in India, and hence φ_t will be affected. Of course it is possible that despite this φ_t may increase, as in China, due to, for example, a much higher growth rate of the capital stock. But assuming that the growth of the capital stock will almost double, as Rodrik and Subramanian (2004) did, without affecting the other variables (in particular the growth rates of the wage and profit rates, as shown in equation (11)) is surely incorrect.

6.1. India: The need for additional investment

A noticeable feature of the Chinese economy over the past two decades is its high and increasing investment share. India's investment share is about half that of China, and there are no discernable upward trends. Classical theory and the Harrod-Domar model indicate that investment is an important determinant of growth through its role in capital accumulation and productivity growth. The differences in the investment shares of the two countries may well be a major factor in explaining their different growth performance.

Despite its importance, though, investment is not the only factor determining capital accumulation. As shown in the decomposition (3), the growth rate of the (net) capital stock equals the product of the investment rate times capital productivity, that is, $\hat{K}_t = [\tau_t \times \theta_t] - \delta$. Thus, equation (12) can be rewritten as

$$\hat{Y} = \varphi_t + \pi_t \left[(\tau_t \times \theta_t) - \delta \right] + (1 - \pi_t) \hat{L}_t \qquad (13)$$

This simple framework allows one to evaluate the impact of an increase in investment on output growth, *ceteris paribus*. With capital productivity in India at about 0.36, a 5 percentage point rise in the investment-to-GDP share (τ), for example, would raise the growth rate of the capital stock ($\hat{K}$) by 1.8%, i.e., $\tau \times \theta = 5\% \times 0.36$ (δ, the depreciation rate, is assumed constant). The growth rate of GDP ($\hat{Y}$) would then be raised by $\pi \times 1.8\% = 0.45 \times 1.8\% =$0.81%. This is a short-term effect. The decrease in capital productivity ($\hat{\theta} = (\hat{Y} - \hat{K}) < 0$) of about 1.0% would subsequently reduce the impact of the higher investment share on the growth rate of the capital stock, so that the increments to the growth rate would also fall off. Output would converge to a new higher level.

Thus far investment has played a dominant role in determining capital accumulation in China and India. China's high and increasing investment growth has led to a high investment-to-GDP ratio. This has offset the effect of declining capital productivity. While India's capital productivity has been increasing, it has only been higher than that of China since 1996, and only by a moderate margin. In 1999, India's capital productivity was above that of China by 3.9 percentage points. On the other hand, the gap between the investment shares of the two countries has widened. Between 1981 and 1999, China's investment share was above India's by 12.9 percentage points on average. In 1999, the gap was 17.9 percentage points. Thus, the rising investment share has played a major role in explaining China's rapid capital accumulation and, therefore, the difference in capital accumulation between the two economies. This indicates that although capital productivity matters, a high investment share is needed to increase the speed of capital accumulation.

Given that capital productivity only changes slowly, and that it may be more difficult to influence it through policies, India needs to speed up capital accumulation through faster investment growth so as to achieve the economic growth that China has experienced. The low ratio between the rate of capital accumulation and the profit rate in India documented in section 4 suggests that India possesses a large untapped investment potential. As such, it is imperative to understand and address the impediments to its full utilization. Existing studies suggest that, despite economic reforms, hurdles to investment are still high as the investment climate is far less favorable than in China (Dollar et al. 2004). The economy is also less open to foreign investment. As noted by Lewis (2004): "India has by far the most restrictions and barriers on the development of the manufacturing and service industries of all the countries we have studied. Restricting the manufacturing of 836 products to small scale industries and prohibiting investment in India by the world's most productive retailers from France, the UK, and the US are just two examples" (Lewis (2004, p.xxix).[30] This poses a big hindrance to competitiveness in business that might

[30] It must be noted that almost every budget since 1991has freed more industries from "reservation" for small firms.

benefit from economies of scale. And: "[1991] Licenses to do business were abolished in most industries. However, abolishing licenses merely removed the outer peel of the onion. Underneath this lay a morass of barriers to India's economic progress" (Lewis 2004, p.216). Meanwhile, a large government deficit and public debt impair much needed public investment. Although it is clear that India needs reforms, more research is needed to disentangle obstacles to investment. To unleash its growth potential, India needs to implement policies to ease barriers to investment.

6.2. China: The Limits to Growth

As shown above, capital accumulation depends on the investment share as well as on capital productivity. While China's investment share has increased, its capital productivity has declined. The rising investment share, however, has been the dominant factor, leading to rapid capital accumulation. Between 1980 and 2003, China's capital stock grew by 11.3% per annum on average, far outpacing the annual average of 1.6% growth in labor. The increased capital intensity further contributed to labor productivity and per capita income growth.

The Chinese experience since 1978 has largely been a success story. Rising capital intensity (i.e., the capital-labor ratio) has offset the effect of falling capital productivity, leading to higher labor productivity and rapid growth of per capita income. The changes in labor, capital, wage rates, and profit rates imply a growth rate of about 10.0% (Table 1). The question confronting China is how long can the high investment growth continue? In this sense, three factors discussed deserve careful consideration: (i) falling capital productivity, which indicates inefficiencies and wastage of capital; (ii) falling profit rate, which will affect investment; and (iii) the fact that the rate of capital accumulation outstrips the profit rate, which indicates creation of excess capacity.

A falling profit rate is closely related to declining capital productivity. While profit rates tend to decline as economic development proceeds, the speed of this decline may be a cause for concern in China. Glyn (1997) provides estimates of the manufacturing net profit rate for a number of developed countries. Between 1960 and 1972, Japan's profit rate was above 30% and the USA and Germany had profit rates above 20% during the 1960s.[31] Currently, the profit rate in China is about 8.5%.

The declining profit rate and capital productivity cannot go on forever, as noted above. Eventually, a low profit rate will curb investment, constrain capital accumulation, and impede economic growth. For example, the sharp fluctuations in profitability in advanced countries since the mid-1960s were considered as a major reason for the end of the golden age of the 1950s and 1960s due to their dampening effect on investment (Bhaskar and Glyn 1995). The fact that the rate of capital accumulation far exceeds the profit rate further points to possible 'over-investment' and the need for correction. This overshadows the performance of China and raises questions about the sustainability of its economic growth.

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[31] Glyn's (1997) survey indicates large variations in cross country profit rates.

Thus, increasing capital intensity in China seems to be a double-edged sword. On the one hand, it contributes to rising labor productivity and per capita income. On the other hand, it is associated with a declining profit rate and capital productivity, which can constrain investment and growth. The challenge facing China is how to maintain the high growth momentum. The experience of the advanced economies shows that the economic growth rate slows down as economies become more developed. However, the slowdown should not come prematurely as per capita income is still low in China.

The relatively fast decline in capital productivity also raises questions about China's investment efficiency. Indeed, despite China's high output growth, even higher investment growth has prompted some to question its efficiency. As Martin Wolf (2005) points out: "Given the opportunities it enjoyed and its investment effort, China should have grown even faster." The inefficiency of investment in China is further confirmed by its large number of non-performing loans (NPLs). Despite large scale recapitalization of the stated owned banks, NPLs were as high as 13.2% of total loans or 12.6% of GDP at the end of 2004 (China Banking Regulatory Commission, www.cbrc.gov.cn).). The high NPLs are indicative of the huge waste in China's investment.[32] While this may overshadow the performance of China and raises questions about the sustainability of its economic growth, it may also imply that there may be substantial efficiency gains to explore so that there still lies a great growth potential in China. To improve investment efficiency, China needs to deal with the existing stock of NPLs. More importantly, it needs to tackle the fundamental factors that led to the formation of NPLs in the first place. Deepening financial and industrial reforms are especially important in this regard.

7. Conclusions

The robust growth of the Chinese economy and the rising growth rate of the Indian economy have generated much interest in comparing the economic performance and prospects of the two economies. This paper has used an exploratory framework, based on a series of simple causal relationships and decompositions derived from accounting identities, in order to document a number of stylized facts about the Chinese and Indian economies. Two commonly asked questions are: (i) what factors underlie the differences in growth between China and India; and (ii) whether India can match China's growth performance. This paper has tried to shed light on these questions by documenting the evolution of a number of macroeconomic variables and trace the possible causes behind the differences in investment growth in China and India.

A summary of the key findings is as follows:

(i) The most important factor underlying differences in growth between China and India is capital accumulation. This is mostly the result of a much higher investment-to-GDP ratio in China.

[32] Recently *The Economist* ("A Great Big Banking Gamble", October 29th 2005, pp.69-71) reported that China's banks generated a very low return on assets in 2004, less than 0.5%, by far the lowest in East Asia.

(ii) The two indicators of profitability calculated, the profit rate and the incremental profit rate, are higher in India than in China. This was a particularly puzzling finding given that investment growth and accumulation are substantially higher in China.

(iii) The rate of capital accumulation has been close to, and even exceeded, the profit rate in China. This ratio is taken to be an indicator of the capacity for investment and of the growth potential of the economy. The ratio in India has been much lower. Thus, India differs from China also in how much profit has been plowed back to investment.

(iv) The profit rate has declined in China and increased in India over the past two decades. Profit rates can be decomposed into the product of the profit share multiplied by capital productivity. In the case of China, both the profit share and capital productivity have fallen. These results help explain the decline in the profit rate. In India, on the other hand, the profit share has been constant while capital productivity has increased. The latter variable explains the increase in India's profit rate.

(v) China's pattern of development fits the so-called Marx-biased technical change. This is characterized by increasing labor productivity and decreasing capital productivity together with a decreasing profit rate. Such technical change appears to be the norm across the world. Technical change in India seem sot be Hicks-neutral.

(vi) If the current structures of the two economies are maintained, India will not be able to catch up or surpass China. To do so, India needs to increase its investment growth and rate of capital accumulation.

(vii) China's success story to date owes much to the rapid growth in investment and capital accumulation. Rising capital intensity, however, may be a double-edged sword. On the one hand, it has paved the way for increased labor productivity and per capita income. On the other hand, it is associated with falling capital productivity and profit rates. The latter, together with the fact that the rate of capital accumulation far outstretches the rate of profit, overshadows the performance of China and raises questions about the sustainability of its economic growth. This suggests that the two economies are confronted by two different challenges. For China, the question is how to sustain the high economic growth rate; while for India the question is how to accelerate economic growth. These are not easy tasks.

Appendix

The main data sources are the National Income and Product Accounts (NIPA) of both countries. These were supplemented with data from the Word Development Indicators (WDI), CEIC, Penn World Tables, extended Penn World Table and Datastream.

The NIPA information for China used in this paper derives from the publications *GDP 1995-2003 - Historical Data on China's Gross Domestic Product 1995-2003*, and *GDP 1952-1995 - Historical Data on China's Gross Domestic Product 1952-1995*. These contain information on GDP from the income side for all Chinese provinces. They were aggregated to form the national totals. The income side of the National Accounts is not available in the *Statistical Yearbook of China*. The sum of provincial value added (production or income approach) since the mid-1990s is several percentage points higher than the national GDP figure. The largest discrepancy is typically located in the tertiary sector and it is uncertain which value is the more accurate. Since the NBS expects that the economic census of 2004 will result in large upward revisions to the national tertiary sector's value added figures, it could well be that the provincial date are more accurate than the national data (Holz 2005).

For India, the national income information is from the United Nations Systems of National Accounts. GDP figures from the expenditure side for both countries are from the World Bank's *World Development Indicators*.

Young (2002) meticulously discusses the construction and shortcomings of the Chinese national accounts data. For investment, we have chosen the series that do not include the 'changes in stocks'. As Young (2002) points out, the changes in stocks figures for developing countries are frequently a residual and fabricated item used to conceal large discrepancies between the production and expenditure sides of the accounts. In addition, the proper measurement of inventory changes, including the adjustment for differences between current valuations and accounting conventions, is technically more challenging than the measurement of the flow value of investment in fixed capital. In the context of China, considering the unsold inventories of state enterprises as a productive element of the capital stock would seem to be erroneous. For these reasons, we exclude the changes in stocks from the measure of investment and capital stock, and focus on gross fixed capital formation alone.

Compensation of employees, as defined in the System of National Accounts, includes all wages, salaries, and supplements earned by employees, the value of any income in kind they receive from their employers, and employer payments for their social or private pensions. The implicit labor income of proprietors, unpaid family members and the self -employed is supposed to be captured, along with elements of the return to capital, under items such as 'income from unincorporated enterprises' (Young 2002). Self employment used to be fairly rare in China, although it is now increasing. In 2003, self-employed individuals accounted for about 6% of total employment. Moreover, the Chinese national accounts impute labor income to the self-employed, assuming that where self-employment is found, all income is labor income, and going so far as to conclude that the entire output of some sectors, e.g., personal and social services, contains no capital income component whatsoever, allocating all of the output of the sector between compensation of employees and depreciation. Consequently, there is no reason to modify the reported Chinese estimates of the labor share (Young 2002).

In India, the implicit labor income of proprietors, unpaid family members and the self –employed were included in the operating surplus figures prior to 1993. There is explicit information on such income, labeled as 'mixed income', from 1993 onwards. To obtain consistent data, some adjustment needed to be made. While information on the amount of mixed income was not readily available before 1993, the average for 1993-1999 shows that mixed income accounts for a relatively stable share of gross profit. Based on information from 1993 to 1999, we therefore subtracted a fixed proportion (18%) from operating surplus before 1993. Implicitly, we included mixed income within the compensation of employees' category.

Data on the capital stock for India was drawn from the CEIC, which was originally compiled by the Central Statistics Office (CSO) of India. Economy wide data on capital stock is not readily available for China. A number of researchers have made attempts to construct a capital stock series for China. Among them, Chow's (1993) work is well known. A major problem relating to Chow's data is that initial-year capital stock is limited to five material production sectors and that accumulation by individuals was excluded (Holz 2005). In a recent study, Chow and Li (2002) constructed new capital stock figures for China. They used Chow's initial total capital stock figures and derived capital stock data until 1978 by adding the total accumulation for every year. For later years, the perpetual inventory method was used. We have not used this series for two reasons. First, their initial capital stock still includes data for five sectors. And second, inventories were included in the capital stock calculation. Holz (2005) constructed a number of capital stock series for China. While his work is thorough, he used the scrape rate rather than the rate of depreciation to construct capital stock. We cannot directly use this information for our comparative study as the Indian capital stock data were not constructed in this manner.

We constructed capital stock information for China using the following method. For the initial year (i.e., 1978), the economy wide depreciation data directly from the national income accounts was divided by the depreciation rate to obtain fixed asset values. After obtaining this initial year capital stock, we then used the perpetual inventory method:

$$K_t = (1-d)K_{t-1} + I_t \qquad \text{(A1)}$$

where K is capital stock, I is investment at a constant price, d is the depreciation rate, and t denotes time. A constant depreciation rate of 5% was used, as is frequently done in the literature. Holz (2005) calculated the depreciation rate for China. For the years since 1980, the numbers are very close to 5%. For consistency with other series, the capital stock was measured in 1990 prices. The initial year (1978) capital stock was converted into constant 1990 prices using the GDP deflator from the WDI. As pointed out by Chow and Li (2002, p. 248), between 1952 and 1978, prices of investment goods in China remained almost constant. Thus, accumulation in current prices can be treated as accumulation in constant prices. After 1978, when economic reforms started, prices of investment goods began to change. Information on investment in 1990 prices is from the WDI. Information on investment at constant prices is from the *World Development Indicators*. The capital stock we constructed is broadly in line with information from other studies. The fact that we have been able to derive reasonable information such as profit rates also reaffirms that our capital stock figures lie within a reasonable range.

Given that we have the total real wage bill (W) and the number of workers (L) and we know that $W \equiv wL$, the average real wage rate (w) can be inferred.

While much effort was made to select and construct comparable information for India and China, needless to say, caution needs to be exercised when interpreting results due to differences in the definition and quality of data between the two countries.

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