

# **Accounting for Indonesia's economic growth: Recent past and near future**

Pierre van der Eng

School of Management, Marketing & International Business  
College of Business and Economics  
The Australian National University  
Canberra ACT 0200  
Australia  
Fax: +61 2 6125 8796  
E-mail: pierre.vandereng@anu.edu.au

Paper to be presented at the *Seminar on World Economic Performance: Past, Present and Future, Long Term Performance and Prospects of Australia and Major Asian Economies*, on the occasion of Angus Maddison's 80<sup>th</sup> birthday  
University of Queensland, Brisbane, 5-6 December 2006.

Version 1, 1 December 2006

**Please do not quote without permission from the author**

## **Abstract**

This paper revisits the discussion about the contribution of Total Factor Productivity (TFP) growth to Indonesia's economic growth during 1971-2005. It re-estimates the contribution of TFP to economic growth during this period on the basis of new estimates of GDP, capital stock, education-adjusted employment, and factor income shares. After accounting for the growth of capital stock and education-adjusted employment, the residual TFP growth found to have been on average -0.1% per year, contributing -2% to 1971-2005 GDP growth. Capital stock growth and employment growth explained around 75% and 25%, respectively. Using the results of this estimation and assumptions about the expected growth of capital stock, labour force and education, the paper notes that Indonesia's economy may potentially grow at a rate between 5.3 and 7.8% per year up to 2030. The growth rate will depend crucially on an increase of investment.

Keywords: economic growth, Indonesia, productivity

JEL-codes: N15, O11, O47, O53

## **Accounting for Indonesia's economic growth: recent past and near future**

### **1. Introduction**

In a way, this paper combines some of Angus Maddison's research interests and the research interests I developed since Angus invited me to become his PhD student. During 1986-90, when I worked as his student on agricultural growth in Indonesia, Angus frequently commented on my work by saying: 'Why don't you do GDP?'. I believed there was enough to occupy me and stubbornly refused to be drawn into making estimates of long-term economic growth in Indonesia. While Angus graciously allowed me the freedom to explore a range of topics that were tangential to my PhD thesis, some of which were later published, I eventually could not resist the opportunity to also explore the issue of long-term economic growth, which was equally tangential to my PhD thesis. Not sure whether Angus was really happy with the work I produced on the thesis, I reasoned that doing a paper on GDP would at least take care of that recurring comment. Although I was somewhat embarrassed about the crudeness of the estimates, the paper seemed to appease Angus and was accepted for publication (Van der Eng 1992).

With his continuous encouragement during 1986-90, Angus had cleverly sown seeds that I found difficult to discard after completing my PhD thesis in 1993. My interest in long-term economic growth in Indonesia continued. A revision of the GDP estimates was later published (Van der Eng 2002), and I am currently engaged in a long-term effort to properly compile the historical national accounts of Indonesia since 1870. This paper is part of that interest and work.

In terms of explaining economic growth, Angus has published widely on both the 'proximate' and 'ultimate' sources of long-term economic growth around the world. Concerning the first, Angus' work taught me that the mobilisation of natural resources, labour and capital was over time increasingly augmented by technological progress and education that enhanced both the quality of capital and labour inputs and the combined productivity of these inputs (*e.g.* Maddison 1991, particularly chapter 3). Although Angus preferred a growth accounting approach (*e.g.* Maddison 1995a: 41-42) to estimating the contribution of Total Factor Productivity (TFP) to economic growth and disaggregating it, his explanation is supported by other literature on economic growth during recent decades that sought to identify the degree to which TFP contributed to economic growth on the basis of formal, econometrics-based approaches.

Much of the literature on the economics of macroeconomic growth in Asia, continues to be dominated by this discussion about the degree to which TFP growth explains the 'Asian economic miracle' of high economic growth in recent decades. It is well-known that Young (1994) argued, on the basis of a 4-country study, that the 'miracle' was more the result of the mobilisation of factors of production (labour and capital) than productivity growth, *i.e.* 'perspiration' rather than 'inspiration', as

Krugman (1994) summarised the findings. This incited a series of other studies that often used readily available multi-country data sets in order to estimate TFP growth in different parts of the world.<sup>1</sup>

The multi-country studies estimating TFP growth all found different results. One of the reasons for the different results was, that authors of the multi-country studies were forced to cobble together estimates of capital input on the basis of available national accounts data. In the case of Indonesia, close scrutiny of the data from these multi-country studies reveals inexplicable discrepancies with the original national accounts data produced at the Central Statistics Agency (Badan Pusat Statistik, BPS) and its predecessor in Indonesia. Moreover, studies using multi-country data sets take national accounts data for granted. They do not account for revisions in these data over time, while their capital stock estimates depend on heroic assumptions, such as depreciation and lifetime of different categories of assets. In the case of Indonesia, the estimates of gross fixed capital formation and capital stock, for example, deviate significantly from estimates that take close account of the idiosyncrasies in Indonesia's statistical data and the composition of investment and capital stock (Van der Eng 2006b). If that is the case for one country, it is likely to be the case for others, which should be a warning to anyone who considers using these multi-country data sets.

Indonesia's remarkable development experience since the mid-1960s has been the subject of a range of studies (*e.g.* Hill 1999). Most of them focused on the key ultimate reasons for Indonesia's development in terms of changes in institutions and economic policies conducive to economic growth. However, the proximate causes underlying the country's high economic growth since the mid-1960s remain unclear. As a major Asian country it has, of course, been part of the multi-country studies referred to above which all found positive TFP growth, albeit to varying degrees (see section 3 of this paper). However, there are no reasons to regard the results of these studies to be conclusive, as these studies have not explicitly considered the quality and availability of Indonesian statistical data.

The only economy-wide approximation of TFP that discussed and accommodated the significant problems related to the availability, accuracy and consistency of the macro-economic data is by a former Director of Indonesia's BPS, Hananto Sigit (2004).<sup>2</sup> Notably, he found that TFP growth in Indonesia was negative during 1980-2000 and that economic growth during 1980-2000 was largely driven by capital accumulation. These findings contrast sharply with the results of the multi-country studies and also with other studies that used the annual survey among firms in Indonesia as the data source to explore the contribution of TFP to the growth of output in manufacturing industry. They uncovered positive TFP growth, suggesting

---

<sup>1</sup> See *e.g.* Chen (1997), Felipe (1999) and Weerasinghe and Fane (2005) for summaries of the results of these studies for Asian countries.

<sup>2</sup> Osada (1994) also made direct use of data from Indonesia's BPS, but was less concerned about issues of data availability, accuracy and consistency.

that that economic growth in Indonesia was not purely a consequence of resource mobilisation, rather than productivity growth (see section 3 of this paper).

In an effort to resolve these inconsistent findings in the literature, this paper follows the approach of Sigit (2004), but enhances it on the basis of new long-term estimates of GDP in 2000 prices (Van der Eng 2006a), new long-term estimates of capital stock in Indonesia in 2000 constant prices (Van der Eng 2006b), new estimates of the share of labour income, new estimates of education-adjusted employment, the inclusion of educational attainment, and an extension of the timeframe of analysis to 1971-2005. The next section of the paper outlines the methodology and data used in the paper, while section 3 estimates the 'proximate' sources of economic growth in Indonesia. Section 4 uses the results of this estimation and also assumptions about the expected growth of capital stock, labour force and education, in order to establish Indonesia's potential for economic growth up to 2025.

## 2. Estimation of output and inputs

### 2.1 Methodology of estimating TFP

This paper uses a simple, direct accounting method to estimate the contribution of TFP growth to economic growth. The model in equation (1) indicates that output during a given year is a function of the productive employment of the total stocks of capital and labour.

$$Q_t = A_t f(K_t, L_t) \quad (\text{Equation 1})$$

Where  $Q_t$  is real output and  $K_t$  and  $L_t$  are the stock of capital and employment, respectively, in year  $t$  and  $A_t$  is the efficiency term. Differentiating with respect to time yields equation 2.

$$\frac{dQ}{dt} = \frac{dA}{dt} f(K_t, L_t) + A_t \frac{\partial f}{\partial K} \frac{dK}{dt} + A_t \frac{\partial f}{\partial L} \frac{dL}{dt} \quad (\text{Equation 2})$$

Dividing both sides by  $Q_t$  yields equation 3.

$$\frac{dQ}{dt} / Q_t = \frac{dA}{dt} / A_t + \frac{\partial f}{\partial K} \frac{dK}{dt} / f(K_t, L_t) + \frac{\partial f}{\partial L} \frac{dL}{dt} / f(K_t, L_t) \quad (\text{Equation 3})$$

Replacing the marginal productivities by factor prices then gives us equation 4.

$$g_t^Q = g_t^{TFP} + (rK_t / Q_t) g_t^K + (wL_t / Q_t) g_t^L = g_t^{TFP} + s_k g_t^K + s_l g_t^L \quad (\text{Equation 4})$$

Where  $g_t^Q$ ,  $g_t^{TFP}$ ,  $g_t^K$  and  $g_t^L$  are the annual growth rates of output, TFP, capital and employment, respectively,  $r$  and  $w$  are the per unit service prices of capital and labour, respectively, and  $s_k$  and  $s_l$  are the relative shares of income from capital and labour in national income. Assuming constant returns to scale, or perfect elasticity of substitution between capital and labour, yields equation 5:

$$s_k + s_l = 1 \text{ or } s_k = 1 - s_l \quad (\text{Equation 5})$$

While it is difficult to incorporate quality changes in the stock of capital goods, it is possible to incorporate quality changes in the stock of employment by adjusting it for educational attainment, as equation 6 shows.

$$L_t = N_t e^{\alpha Y_t} \quad (\text{Equation 6})$$

Where  $L_t$  = education-adjusted employment,  $N_t$  = number of gainfully employed,  $\alpha$  = the elasticity of output for each additional year of education and  $Y_t$  = the accumulated number of years of education per person employed. Differentiation with respect to time yields equation 7, which can be substituted in equation 4 to yield equations 8 and 9.

$$g_t^L = g_t^N + g_t^{\alpha Y} \quad (\text{Equation 7})$$

$$g_t^Q = g_t^{TFP} + s_k g_t^K + s_l (g_t^N + g_t^{\alpha Y}) \quad (\text{Equation 8})$$

$$g_t^{TFP} = g_t^Q - s_k g_t^K - s_l (g_t^N + g_t^{\alpha Y}) \quad (\text{Equation 9})$$

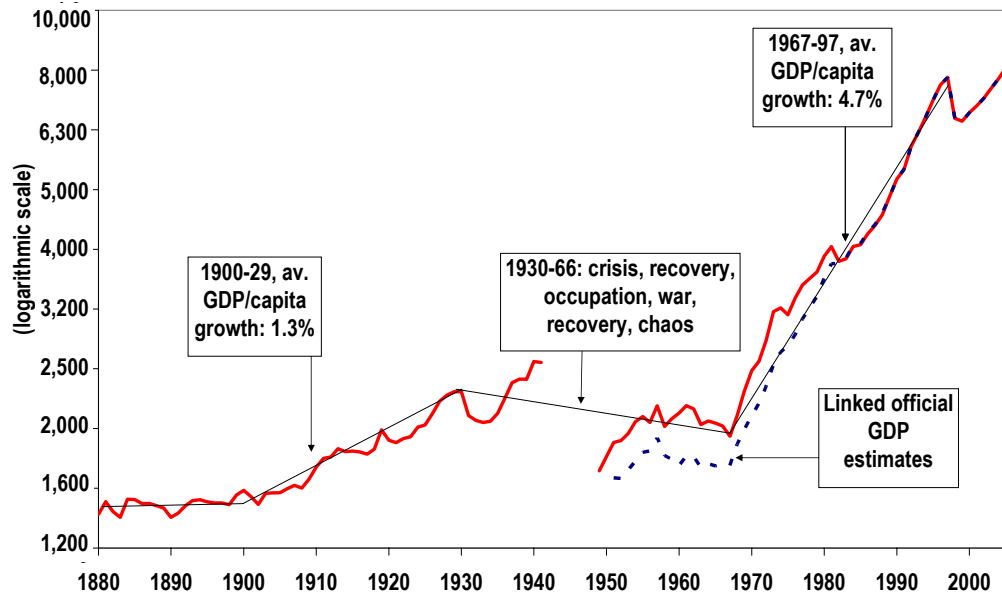
Hence, the key data required to estimate the contribution of TFP to economic growth are annual data on GDP and capital stock in constant prices, education-adjusted employment, and the labour income share in GDP. Since this paper is concerned with the national economy of Indonesia, it will use national data.

## 2.2 Output data

Indonesia's national accounts data underwent at least six major revisions since the 1950s. These revisions were in part due to the adoption of new estimation procedures, improved estimation procedures, improved coverage of estimation, and changes in the base-year for constant price estimates (see Van der Eng 1999, 2005). Since the 1983 revision, Indonesia's national accounts have been anchored on the

quinquennial Input-Output (I-O) Tables. Consequently, the output approach still offers the main substantiation of the national accounts. The last of these revisions was anchored on the 2000 I-O Table. Extrapolation of these data for 2000-05 back in time with existing national accounts data for 1983-2000 and broad indicators of economic activity for 1880-1983 (Van der Eng 1992, 2002), yields GDP per capita estimates shown in Figure 1. The chart confirms that the 1951-82 national accounts data were underestimated (Van der Eng 1992). The chart also shows that Indonesia's growth spurt during 1967-97 has been momentous. With average population growth at 2.0% per year, average GDP growth was a significant 6.7% per year. Indonesia's economy contracted drastically in 1998, but growth resumed in 1999 and the 1997 level of GDP per capita was re-achieved in 2004.

Figure 1: GDP per Capita in Indonesia, 1880-2005 (thousand 2000 Rupiah)



Source: Van der Eng (2006a), see also Table A1.

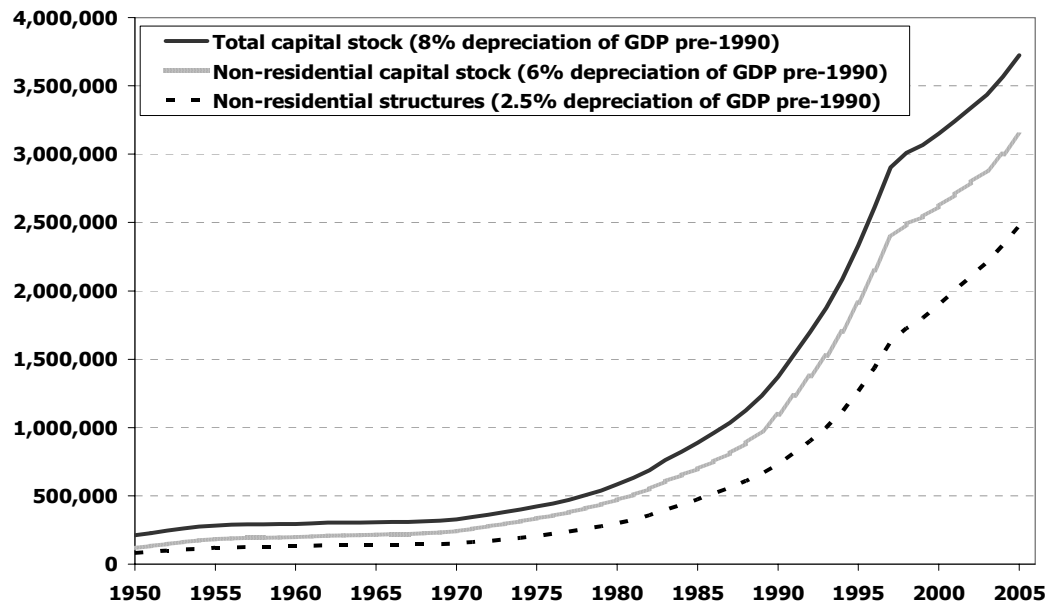
## 2.2 Capital stock data

Closely scrutinised estimates of capital stock in Indonesia are rare. The first comprehensive estimates for 1975-85 were published by Keuning (1991). However, in hindsight they appear to be much too high, possibly as a consequence of the methodology used, which relied considerable on the extrapolation of short-term disaggregated Incremental Capital-Value Added Ratios (Van der Eng 2006b).

In recent years, estimates of capital stock have been made at Bank Indonesia, the country's central bank, based on disaggregation of growth investment with the quinquennial I-O Tables (Yudanto *et al.* 2005). However, these estimates did not take due account of historical information on investment and offered insufficient consideration of key assumptions, such as the lifetime of different categories of

capital goods. This left an opportunity for new capital stock estimates based on the perpetual inventory method applied to 26 categories of productive assets since 1950, with the longest asset lifetime of 40 years (Van der Eng 2006b). Hence, the first 'complete' estimate is for 1990. Total, total non-residential and non-residential structures capital stock were estimated backwards on the basis of the annual data on Gross Fixed Investment and assumed rates of depreciation of respectively 8%, 6% and 2.5% of GDP, which are the 1991-95 average implicit rates of depreciation (different from the standard 5% assumed rate of depreciation used in the national accounts). Figure 2 shows the results of this new estimate of capital stock. It reveals a significant acceleration of the growth of capital stock since 1980 and a slow-down in 1997-98. It also shows that most of the capital stock consists of non-residential capital stock, of which non-residential structures occupy the biggest share.

Figure 2: Gross Fixed Capital Stock in Indonesia, 1950-2005 (bln 2000 Rupiah)

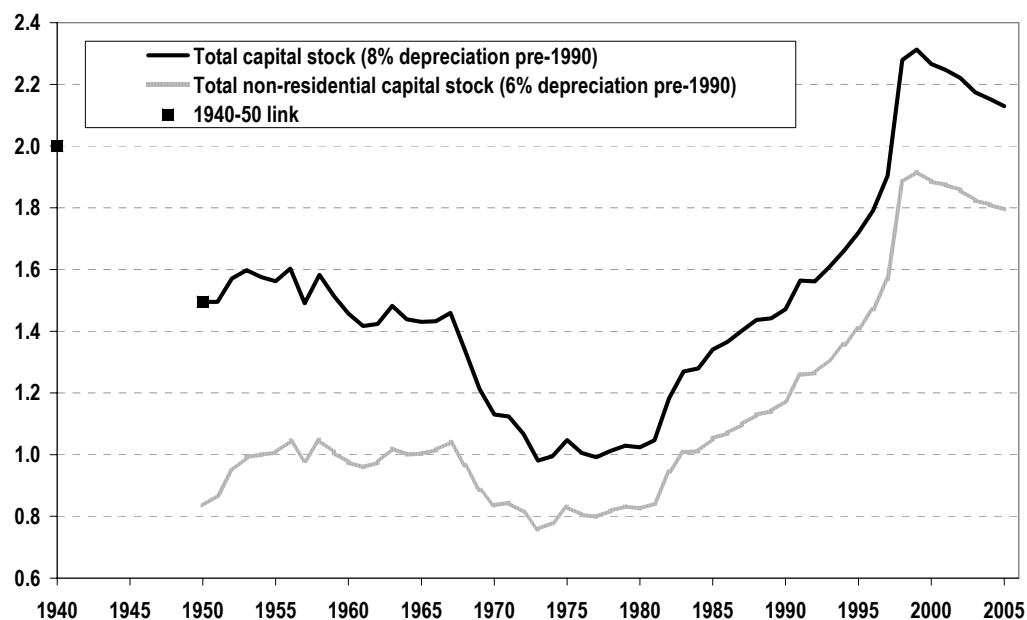


Source: Van der Eng (2006b), see also Table A1.

Figure 3 shows the results from Figure 2 as a capital-output ratio for 1950-2005, adding an estimate for 1940. It indicates that the capital-output ratio decreased during 1967-80, which suggests that the main sources of high growth during these years were capital-extensive. This is possibly related to the fact that natural resource exploitation, particularly the rapid growth of oil production for export, underlies much of the economic expansion during these years, in combination with the mobilisation of labour. The ratio increased significantly during 1980-97, which suggests that economic growth during 1980-97 was of a more capital-intensive nature and depended, at least partly, on the mobilisation of productive capital. This may have been related to the significant growth of export-

oriented manufacturing industry since the early-1980s. For the purpose of calculating TFP growth, this paper uses non-residential capital stock.

Figure 3: Capital-Output Ratio for Indonesia, 1940-2005



Note: Capital stock includes residential structures.

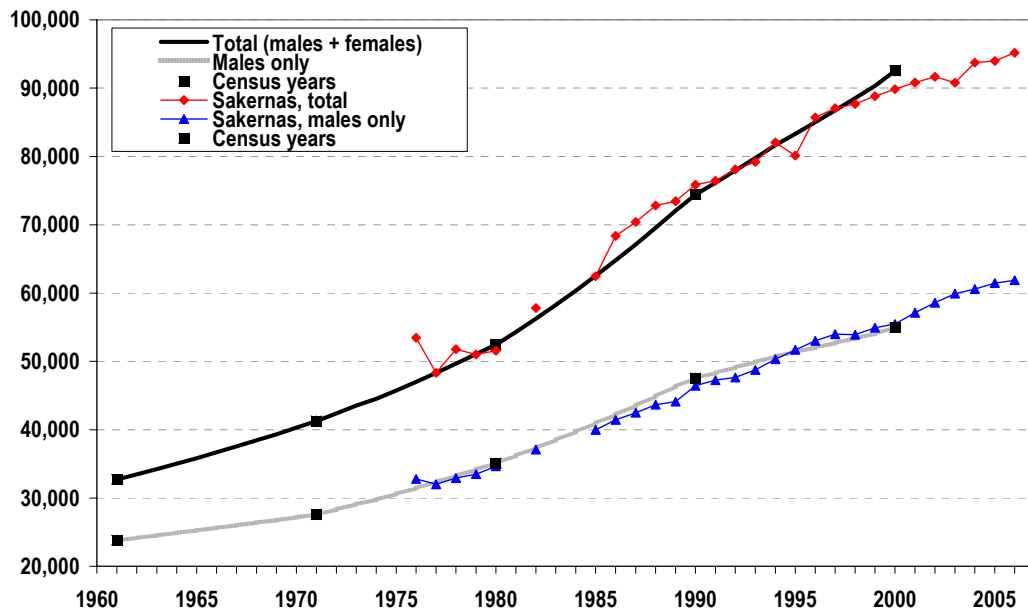
Source: Van der Eng (2006ab), see also Table A1.

### 2.3 Employment data

Consistent long-term estimates of employment in Indonesia are hampered by the fact that only the population censuses of 1930, 1961, 1971, 1980, 1990 and 2000 are the key sources of data, even though the definitions of employment in each were slightly different. The census results were used to extrapolate the data of the National Labour Force Survey (*Survei Angkatan Kerja Nasional, Sakernas*), which has been conducted for 1976-80, 1982 and 1985-2006. The Sakernas definitions of employment also differed slightly over the years (Sigit 2000a: 28-29).

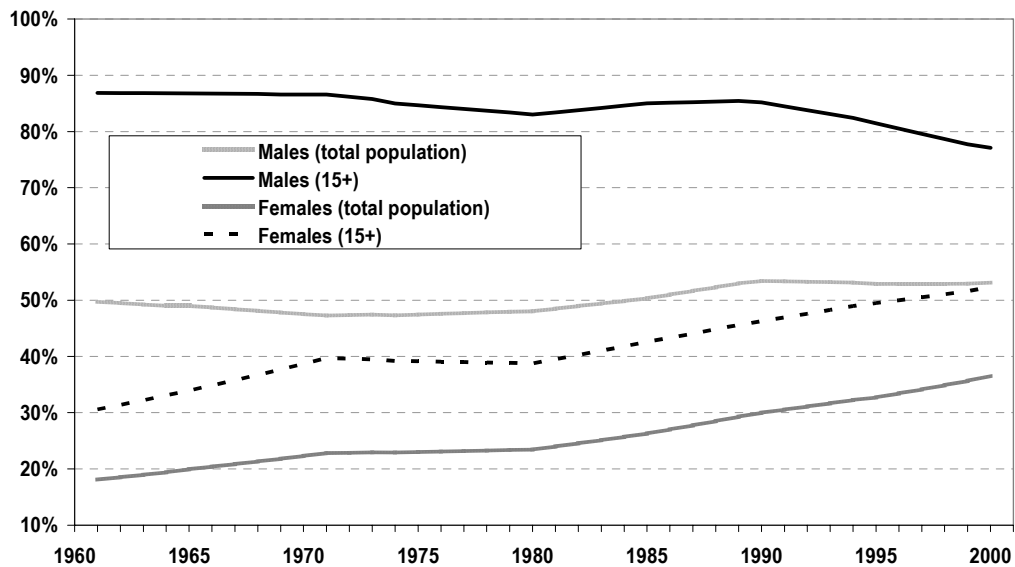
Figure 4 shows the interpolated employment data from the population censuses and also the Sakernas data. The interpolations and the Sakernas data track each other closely until 2000. The deviation in total employment in 2000 is possibly caused by the change in the definition of employment in Sakernas to exclude 10-14 year old workers, starting in 1998 (Sigit 2000a: 8). However, many 10-14 year olds are gainfully employed in Indonesia and comprised 3.7%, 2.9% and 2.9% of employment in 1980, 1990 and 2000 respectively.

Figure 4: Employment in Indonesia, 1961-2006 (thousands)



Sources: Population census data 1961, 1971, 1980, 1990 and 2000 (interpolated, taking account of population growth 10 years previously); 1976-80, 1982 and 1985-2006 Sakernas data, see also Table A1.

Figure 5: Crude Participation Rates in Indonesia, 1961-2000 (percentages)



Sources: See Figure 4.

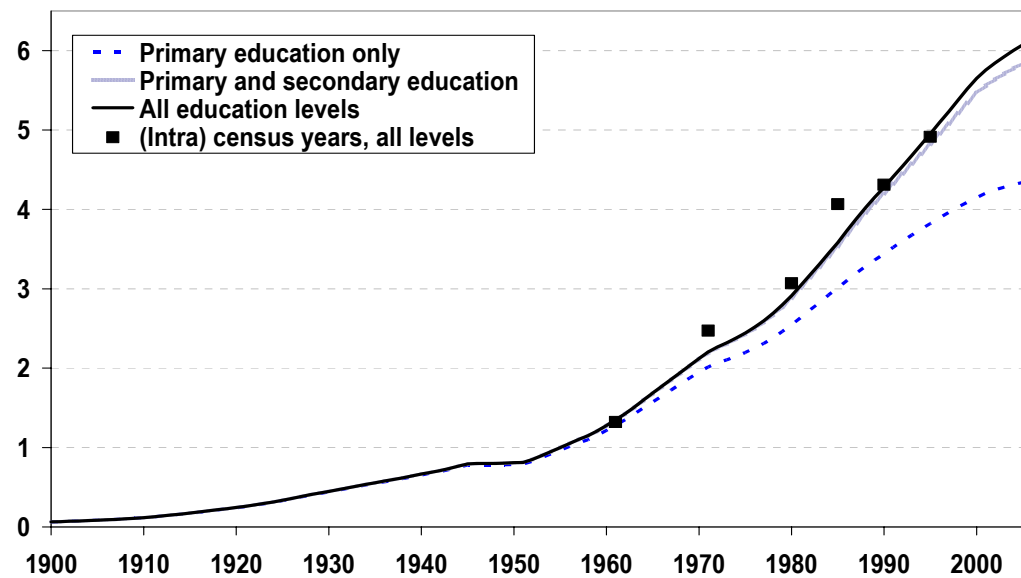
Figure 5 shows the participation rates of men and women in employment as percentages of both the total male/female population and the population aged 15 years and over. The significant increase in the participation rate of women is partly

due to changes in definition, but particularly a reflection of the increasing participation of women in gainful employment, rather than household-based occupations.

## 2.4 Educational attainment data

To augment the labour force data, the paper uses an indicator of per capita educational attainment in Indonesia, shown in Figure 6. It is an approximation of long-term changes based on annual enrolments in institutions for primary, secondary and tertiary education. Figure 6 shows that the results closely track the population census results, which suggests that they approximate the trend. Improvement in human capital was obviously a gradual process.

*Figure 6: Educational Attainment in Indonesia (average years of schooling per person), 1900-2005*



*Notes:* (Intra) census years calculated by assuming that those reported as having 'incomplete primary education' had an average of 2 years of schooling, those with primary education 6 years of schooling, completed secondary education 9 years (6 years + 3 years for high school), and tertiary education 15 years (6 + 3 + 2 years of college + 4 years at university). Other estimates are derived from data on primary, secondary and tertiary education enrolments during 1880-2005. Student years were accumulated on the assumption that the working life of a primary school graduate was 50 years, that of a secondary school graduate 45 years, and of a university graduate 40 years. The series of accumulated education in terms of student years were divided by population. This procedure assumes that all enrolled students actually went to school during the year. It makes no adjustment for quality differences between the types of schooling or between public and private universities.

*Sources:* 1961-80 census benchmarks from Hugo *et al.* (1987: 282), 1990 from BPS (1992: Table 11.9), enrolments 1880–2005 from annual statistical publications and from the website of the Department of Education in Indonesia, <http://www.depdiknas.go.id/statistik/> See also Table A1.

Educational attainment grew at a very significant rate of 3.9 per cent per year during 1929-67 and 3.2 per cent during 1967-2005, but of course from low levels. In the first half of the century, the gains were mainly due to the expansion of primary education. The share of secondary education increased after 1970, possibly in reaction to changes in the labour market where the demand for educated labour increased. As the method used to estimate educational attainment in Figure 6 does not allow us to disaggregate educational attainment by age groups, the paper uses per capita educational attainment as a proxy for the educational attainment per person gainfully employed.

Data on the output elasticity of educational attainment are not available. However, Sakernas contains wage income data that are disaggregated by the highest form of education that employees completed. As the number of years for each form of education is known, it is possible to estimate the income elasticity of each additional year of education. For the years 1989-99, the income elasticity of educational attainment appeared to be a fairly constant 0.11, meaning that each additional year of education yields on average an 11% increase of income.<sup>3</sup> This number is taken as a proxy for the elasticity of output with respect to education for the entire period.

## 2.5 Labour income share data

Although efforts are underway to estimate national income in Indonesia from the income side of the economy (Saleh and Jammal 2002), Indonesia's national accounts do not yet offer such estimates. The main sources on labour income are the quinquennial I-O Tables and Indonesia's System of Economic and Social Accounting Matrices and Extension (SESAME) that use the I-O tables as their 'anchor' (Keuning and Saleh 2000). The income data in the I-O Tables only comprise the sum of wages and salaries received, which is generally estimated on the basis of Sakernas. They do not include in-kind incomes, particularly the incomes of unpaid household workers. The income of the self-employed and of household-based ventures is included in the total operating surplus of all companies, which is not disaggregated.<sup>4</sup>

Non-cash labour income is, however, identified in SESAME. The SESAME data are shown in Table 1 for 1975, 1980, 1985, 1990, 1993, 1995, 1998 and 2000, while an estimate for 1971 is added on the basis of the 1971 I-O Table. Labour income in the intermediate years was estimated by calculating per employed worker labour income for each benchmark year, using the totals shown in Figure 4, interpolating

---

<sup>3</sup> Collins and Bosworth (1996: 152) found an East-Asia average of 10.7%.

<sup>4</sup> Osada (1994: 481) did not account for this. Sigit (2004: 103-104) solved this by multiplying average income of waged employees from Sakernas with the total number of gainfully employed, as expressing the total as a percentage of GDP. However, this estimate yields lower labour income shares than in the SESAME tables. In addition, there is no correction for the fact that the definitions of income varied in the different Sakernas years (Sigit 2000b: 7-9 and 17-18).

per worker labour income and multiplying it with total number of employed workers. For 2001-05, the labour income share was assumed to be the same as in 2000.

*Table 1: Share of Labour Income in GDP in Indonesia, 1971-2005 (bln Rupiah)*

	Labour income		Total	Capital income	Total GDP (factor cost)	Total GDP (market prices)	Labour income share
	Wages, salaries	Income in kind					
1971			<i>1,918</i>	<i>1,991</i>	4,260	4,270	45.0%
1972			<i>2,693</i>		<i>5,207</i>	<i>5,443</i>	<i>51.7%</i>
1973			<i>3,508</i>		<i>7,510</i>	<i>7,838</i>	<i>46.7%</i>
1974			<i>4,344</i>		<i>11,644</i>	<i>12,091</i>	<i>37.3%</i>
1975	2,853	2,393	5,245	8,097	13,342	13,686	39.3%
1976			<i>7,637</i>		<i>16,282</i>	<i>16,972</i>	<i>46.9%</i>
1977			<i>10,158</i>		<i>20,040</i>	<i>20,886</i>	<i>50.7%</i>
1978			<i>12,813</i>		<i>23,671</i>	<i>24,700</i>	<i>54.1%</i>
1979			<i>15,609</i>		<i>32,867</i>	<i>34,172</i>	<i>47.5%</i>
1980	9,491	9,044	18,535	29,976	48,511	48,913	38.2%
1981			<i>21,791</i>		<i>57,010</i>	<i>58,763</i>	<i>38.2%</i>
1982			<i>26,229</i>		<i>61,748</i>	<i>63,880</i>	<i>42.5%</i>
1983			<i>30,960</i>		<i>79,525</i>	<i>81,976</i>	<i>38.9%</i>
1984			<i>35,998</i>		<i>90,687</i>	<i>93,410</i>	<i>39.7%</i>
1985	22,904	19,537	42,441	53,176	95,617	98,407	44.4%
1986			<i>51,334</i>		<i>97,970</i>	<i>104,499</i>	<i>52.4%</i>
1987			<i>60,818</i>		<i>119,341</i>	<i>126,471</i>	<i>51.0%</i>
1988			<i>70,924</i>		<i>134,299</i>	<i>143,332</i>	<i>52.8%</i>
1989			<i>81,687</i>		<i>167,870</i>	<i>180,315</i>	<i>48.7%</i>
1990	55,738	37,049	92,787	104,570	197,357	210,867	47.0%
1991			<i>111,337</i>		<i>234,449</i>	<i>249,598</i>	<i>47.5%</i>
1992			<i>130,717</i>		<i>263,667</i>	<i>281,679</i>	<i>49.6%</i>
1993	91,479	59,484	150,963	156,458	307,420	329,776	49.1%
1994			<i>205,853</i>		<i>391,959</i>	<i>416,679</i>	<i>52.5%</i>
1995	163,376	98,983	262,359	248,633	510,993	542,755	51.3%
1996			<i>267,547</i>		<i>592,601</i>	<i>621,099</i>	<i>45.1%</i>
1997			<i>272,865</i>		<i>681,081</i>	<i>718,910</i>	<i>40.1%</i>
1998	168,585	109,731	278,316	700,126	978,442	989,573	28.4%
1999			<i>547,299</i>		<i>1,203,861</i>	<i>1,221,811</i>	<i>45.5%</i>
2000	397,579	244,495	642,074	725,941	1,368,015	1,379,770	46.9%
2001			<i>775,763</i>		1,652,855	1,684,281	46.9%
2002			<i>857,339</i>		1,826,663	1,897,850	46.9%
2003			<i>920,193</i>		1,960,581	2,045,854	46.9%
2004			<i>1,037,543</i>		2,210,608	2,273,142	46.9%
2005			<i>1,255,996</i>		2,676,049	2,729,768	46.9%

*Note:* Data in italics are estimated values, non-italic data are from the sources below. *Sources:* IDE/BPS (1977), BPS (1996: 72), BPS (1999: 27), BPS (2003: 35 and 38), and Indonesia's national accounts.

Total GDP at factor cost in Table 1 was estimated in several steps: (1) by deducting total net indirect taxes from GDP at market prices in current prices from the national accounts 1971-2000 (prior to the 2000 revision), (2) calculating the ratio by which GDP at factor cost was underestimated in the national accounts before 2000 on the assumption that GDP at factor cost was correctly calculated in SESAME for the benchmark years, (3) interpolating the ratio for the benchmark years and multiplying GDP at factor costs from the national accounts with this ratio, (4) adding net indirect taxes yielded GDP at market prices for the intermediate years.

Table 1 indicates significant changes over time in the labour income share, from a maximum 54% in 1978 – just before investment and the capital-output ratio increased significantly (see Figure 3) – to a very low minimum of 28% in 1998, when wage rates were eroded by a drastic inflation spike.

The data presented in this section are necessarily rough, given the difficulties in the compilation of statistical data in Indonesia in past and present. These difficulties increase the further back in time. Still, the data are based on the best possible available information and are reasonably robust.

### 3. Sources of economic growth

The data presented in the previous section now allow us to estimate TFP growth and its contribution to economic growth. The results are shown in Table 2 and Figure 7.

*Table 2: Decomposition of Economic Growth, 1971-2005 (annual averages)*

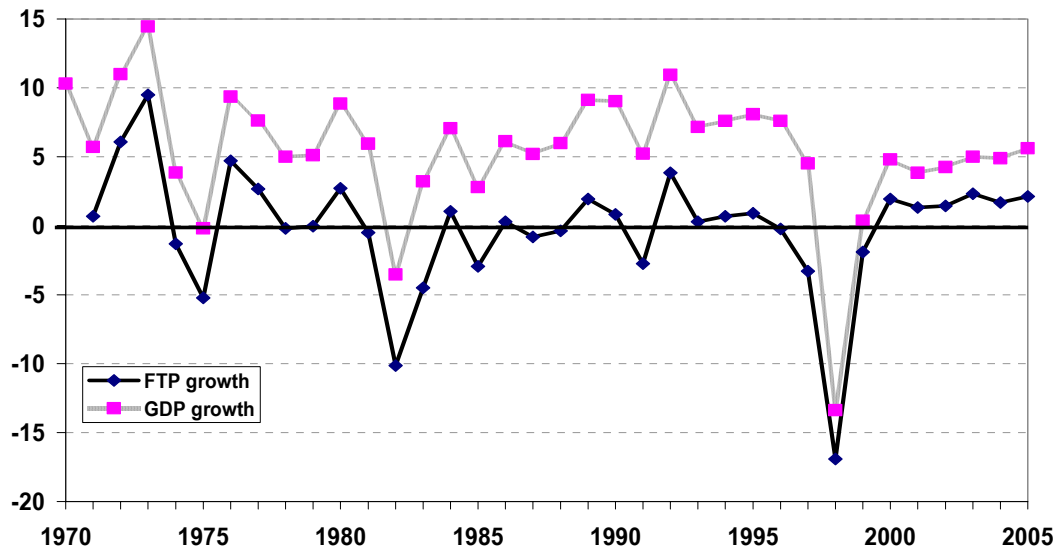
	$s_t$	$g_t^O$	$g_t^K$	$g_t^N$	$g_t^{\alpha Y}$	$g_t^N + g_t^{\alpha Y}$	$g_t^{TFP}$
1971-85	44.1%	5.8	7.3	3.0	0.4	3.4	0.2
1986-97	48.9%	7.2	10.8	2.8	0.4	3.1	0.1
1998-99	37.0%	-6.5	3.1	2.1	0.3	2.4	-9.4
2000-05	46.9%	4.7	3.6	2.0	0.2	2.2	1.8
1971-05	45.8%	5.4	7.6	2.7	0.3	3.0	-0.1
Contributions to GDP growth:							
1971-85			71%			26%	3%
1986-97			77%			21%	2%
1998-99			-30%			-13%	144%
2000-05			40%			22%	38%
1971-05			77%			26%	-2%

*Note:* The annual averages are calculated as simple averages for each period.

*Source:* Appendix Table.

Table 2 reveals that the contribution of TFP growth to economic growth has on average been marginally negative during 1971-97, mainly due the high negative rates of TFP growth during 1982 and 1998, as Figure 7 shows. During 1971-97, TFP growth was positive and contributed marginally to output growth. In all, 77% of output growth is explained by the expansion of capital stock, and the rest by the growth of education-adjusted employment. Only during the years of economic recovery 2000-05 did the contribution of TFP growth become positive and significant at 38%, although the growth of capital stock and of education-adjusted employment together continued to explain most of economic growth.

Figure 7: GDP and TFP Growth Rates in Indonesia, 1971-2005 (percentages)



Sources: Appendix Table.

Table 3 compares this paper's estimates of TFP growth and its contribution to economic growth with those of other studies. The table shows significant differences in all studies, but particularly between studies 2-10 and the estimates of Baier *et al.* (2006), Osada (1994), Sigit (2004) and this study. As the studies 1-10 are all multi-country studies that appear to have paid minimal attention to the intricacies of Indonesia's national accounts and their consequences for growth accounting, it may be necessary to accept the results with caution.

*Table 3: FTP Contribution to Economic Growth in Indonesia in Various Studies*

Study	Period	Annual average TFP growth	FTP contribution to output growth
1. Baier <i>et al.</i> (2006: 45)	1951-2000	-0.7	-37%
2. Drysdale and Huang (1997: 208)	1962-90	2.1	31%
3. Bosworth <i>et al.</i> (1995: Table A2)	1960-92	0.5	17%
4. Collins and Bosworth (1996: 157)	1960-94	0.8	23%
5. Lindauer and Roemer (1994: 3)	1965-90	2.7	42%
6. Ikemoto (1986: 376)	1970-80	2.4	31%
7. Young (1994: 243)	1970-85	1.2	24%
8. Kawai (1994: 384)	1970-90	1.5	24%
9. Sarel (1997: 29)	1978-96	1.2	25%
10. World Bank (1993: 58)	1980-90	1.6	29%
11. Osada (1994: 480)	1985-90	-2.7	-28%
12. Sigit (2004: 104-5)	1980-2000	-0.8	-15%
13. This study	1971-2005	-0.1	-2%

*Note:* The different results are due to differences in (a) the period considered, (b) the basic data used, (c) the ways in which the key variables for growth accounting were constructed, (d) variables used to account for growth.

*Sources:* See references.

One of the key reasons for the different results is, as Chen (1997: 23-26) noted, the fundamental difficulty of measuring capital input, and the fact that FTP is consequently a fairly arbitrary concept. An additional explanation is in the fact that authors often used different data sets and/or different ways to process the data, generally without regard for the inherent problems in the underlying data sets. For example, several of the multi-country studies obtained output data from the Penn World Tables (PWT), which in turn obtained them from the World Bank's *World Development Indicators*. However, there are many strange, unexplained anomalies between these data and the official data from the Indonesian statistics agency BPS. For example, PWT gives total population estimates for Indonesia as 124.7 million in 1971, 154.4 million in 1980, 188.0 million in 1990 and 224.1 million in 2000, while Indonesia's population censuses give totals of respectively 118.4, 147.0, 178.5 and 206.2 million. PWT also offers GDP in international prices, even though Indonesia only featured twice in the six PWT benchmarks, in respectively 1980 and 1996. Hence, PWT estimated the key expenditure components of GDP for most years in its Indonesian time series on the basis of its multilateral 'shortcut approach', but without consideration of the degree of underestimation in Indonesia's national accounts data. In addition, the multi-country studies often take capital stock data from Nehru and Dhareshwar (1993), which were based on aggregated investment data obtained from the World Bank's that took no account of underestimation, and from which capital stock was estimated on the basis of arbitrary assumptions, such as a single 'decay rate' of 4% for all countries in the sample. Baier *et al.* (2006) used Mitchell's

handbooks of historical statistics as key sources, but without accounting for inconsistencies in *e.g.* the national accounts data, and simply interpolating years for which data were missing, without due account of the availability of other data for Indonesia.

In other words, it is difficult to check whether the different estimates of TFP growth from the multi-country studies are true differences or the consequences of measurement errors and/or the assumptions underlying data processing. For the same reason it is not possible to explain with detail the differences in the results of studies 1-10 and the findings of this paper. This paper's findings are consistent with those of Sigit (2004), which have been extensively scrutinised for publication in a multi-country study of TFP (Oguchi 2004).<sup>5</sup>

Several studies have estimated TFP on the basis of the firm-level data from the annual survey among industrial firms in Indonesia employing 20 or more people. The results are shown in Table 4. They all suggest that in manufacturing industry TFP growth has been modest, but significant and positive, which contrasts with the economy-wide findings of this paper.

*Table 4: FTP Growth in Manufacturing Industry in Indonesia in Various Studies*

Study	Period	Annual average TFP growth	FTP contribution to output growth
1. Aswicahyono <i>et al.</i> (1996: 357)	1976-91	1.4	-
2. Aswicayhono and Hill (2002: 148)	1975-93	2.7	21%
3. Timmer (1999: 87-89)	1975-95	2.8	22%
4. Vial (2006: 367)	1976-96	3.5	-
5. Osada (1994: 184)	1985-90	3.6	22%
6. Ikhsan (2006: 3 and 12)	1988-2000	1.6	16%

Sources: See references.

To put the results of this study in context, it is necessary to appreciate that the results in Table 2 do not necessarily indicate that there has no technological change in Indonesia that contributed to economic growth. There are at least two fundamental problems with this paper's calculation of TFP growth: (1) it is estimated as a residual, and (2) the paper's calculation assumes perfect elasticity of substitution of labour and capital.

The measurement of TFP growth as a residual means that TFP fails to account for the fact that some aspects of technological change may already have been captured in the measurement of capital stock and education-adjusted employment. As capital accumulation tends to be the main vehicle of technological change, much of the technology is embodied in the stock of capital goods. This

<sup>5</sup> Notably, Sigit's TFP estimates for Indonesia for 1980-2000 make it an outlier among the countries covered in Oguchi (2004: 6-8), such as India (2.1% annual growth of TFP, 41% of output growth explained by TFP), Japan (1.8%, 68%), South Korea (1.8%, 25%), Malaysia (1.3%, 20%), Nepal (1.1%, 22%), Singapore (0.8%, 11%), China (1.9%, 25%), Thailand (1.0%, 17%) and Vietnam (3.3%, 51%), except for the Philippines (-0.4%, -15%).

fundamental issue is likely to be significant for Indonesia in recent decades, given the high rate of capital accumulation since the early 1980s, as Figure 2 showed. Hence, most of the non-residential capital stock is of recent vintage, and is likely to embody the most recent technologies. In addition, in manufacturing industry, investment in machinery and equipment was predominant and sustained most of the rapid growth of output in that sector (Timmer 1999: 83 and 89). While some technological change and efficiency gains were captured in the rates of TFP growth in manufacturing industry in Table 4, other gains were most likely captured in the measured industrial capital stock. On the other hand, as most investment outside manufacturing industry may have been in the form of non-residential structures, particularly investment in public infrastructure, the embodied efficiency gains may not have been as significant as was the case in manufacturing industry.

Likewise, the measurement of education-augmented employment may have captured some technological change that would otherwise be measured as part of TFP. After all, the significant improvement in educational attainment explains almost 5 percentage points of the 38% contribution of employment to economic growth during 1971-2005, as Table 2 indicated. Several of the studies in Table 3 did not adjust for changes in educational attainment. Hence, without the education adjustment, TFP growth in Table 2 would have been positive and higher.

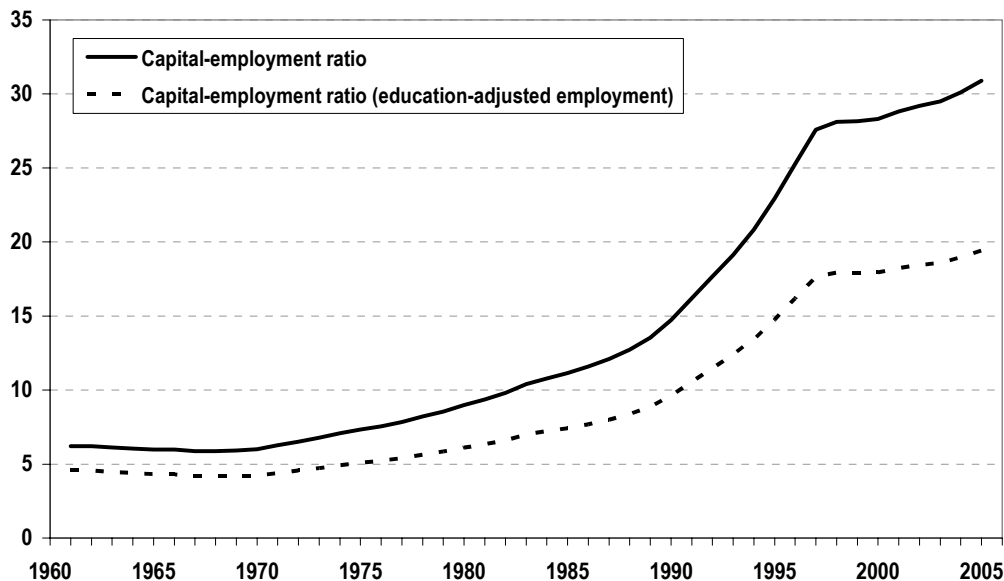
For those reasons, this paper's measure of TFP growth – and that of other studies as well – may be less a measure of technological change than simply an unexplained residual that comprises a wide range of factors related to Indonesia's business environment as they impacted on the efficiency of production. Hence, negative TFP growth during 1971-97 may rather reflect a multitude of inefficiencies in Indonesia's economy. If TFP growth was indeed positive in manufacturing industry, as the studies in Table 4 suggest, the inefficiencies may have existed largely outside manufacturing industry. They may for example have taken the form of imperfections in particularly non-tradable sectors in non-manufacturing industry and services, such as transport and communications, or in labour, capital and commodity markets, possibly due to inhibiting regulations, the lack of exposure to foreign competition, the dominance of state-owned enterprises, and/or the presence of opportunities for anti-competitive behaviour.

A possible indication that TFP growth measures the residual is the fact that during 2000-05 the residual became consistently positive, explaining on average a significant 38% of GDP growth, while it had been erratic and on balance negative before 1997, as Figure 7 showed. Of course, capital accumulation was relatively low, while the growth of employment was steady. In addition, there may have been productive overcapacity by 1999 that became more efficiently used during 2000-05. Still, this change may be understood as an improvement in efficiency caused by the many growth-enhancing, or rather inefficiency-decreasing institutional changes that recent successive governments have introduced in Indonesia. For example, deregulation and re-regulation in various ways enhanced competition in previously

non-tradable sectors. New capital market regulation imposed greater discipline on listed firms. While these changes may have increased uncertainty among foreign investors about investing in Indonesia, they may at the same time have been an encouragement for firms in Indonesia with a more intimate knowledge of past and current idiosyncrasies and risk in Indonesia's business environment, and ways to hedge it (see section 4).

Lastly, it cannot be automatically assumed that there is perfect elasticity of labour and capital, as Rodrik (1998: 84-8) has argued. If, for example, economic growth and technological change had either a labour-saving or a capital-saving nature, the elasticity of substitution would be more than, respectively less than 1. Hence, if technological change in Indonesia in recent decades was to a degree labour-saving and capital-absorbing, it will yield a downward bias of the estimated rate of TFP growth. The bias may be in proportion to the capital-labour ratio, which indeed increased significantly in Indonesia, as Figure 8 shows, particularly during 1988-97. The ratio even increased for education-adjusted employment, although to a much lower degree. Although this point can be readily made, it is not easy to quantify its implications for efforts to account for economic growth.

Figure 8: Capital-Employment Ratio in Indonesia, 1961-2005 (million Rp per person)



Sources: See Figures 2, 4 and 6.

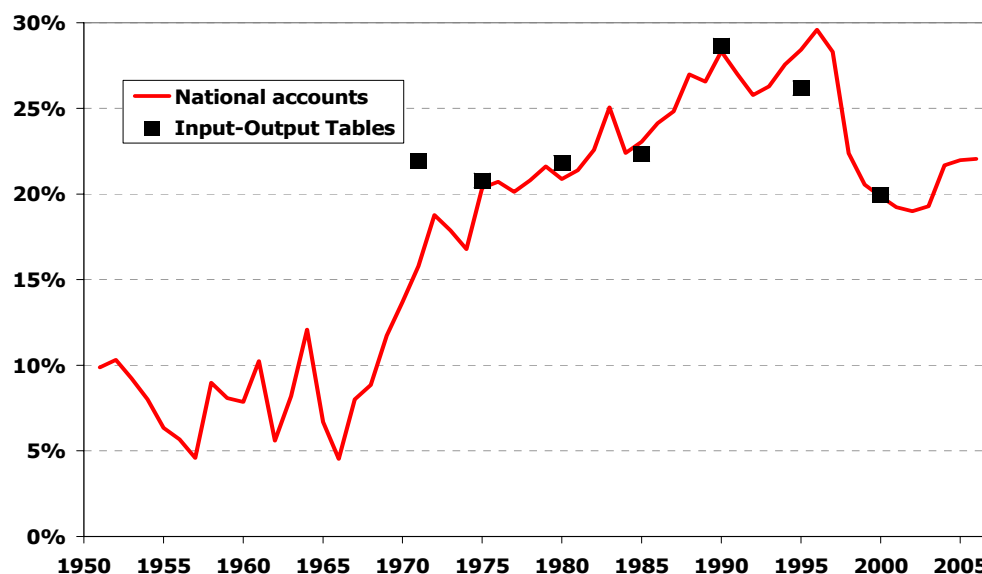
#### 4. The near future of economic growth in Indonesia

The previous section has shown that the accumulation of capital has been the main driver of economic growth in Indonesia since 1971. As a percentage of GDP, investment has indeed increased significantly, as Figure 9 shows, from 4.5% in 1966 to almost 30% in 1996, before decreasing to 19% in 2002 and recovering to 22% in

2005 and 2006. The chart shows that the ratio was at an unprecedented level immediately before the 1997-98 crisis and that a more 'normal' ratio was 24% of GDP, the 1975-97 average according to the national accounts, and the 1971-95 average according to the I-O Tables. If this ratio were the only yardstick – which it is not, of course – Indonesia's economic recovery may be near.

Despite the near-recovery of the investment ratio to a 'normal' level, there has been considerable concern in Indonesia and in assessments of Indonesia's economy about what has been regarded as a low ratio of investment to GDP. Much of this pessimism is reflected in the very low, if not negative levels of foreign direct investment (FDI) that reached Indonesia since 1997. To the extent that FDI is a key vehicle for technological change, this is indeed a concern. On the other hand it should be noted that during 1980-97 FDI contributed only 3.4% to total investment, and – after excluding a non-FDI item from the notional balance of payment data on direct investment – that number was still only about 6.5% during 1998-03 (World Bank 2005: 86). Hence, firms in Indonesia are a much more significant source of investment. In addition, there are no indications that foreign firms operating in Indonesia have left the country in large numbers. For example, despite wide media coverage given to the withdrawal of some Japanese firms from Indonesia in recent years, the number of Japanese subsidiary firms in Indonesia actually increased from 671 in 1999 to 698 in 2004 (Van der Eng 2006c). In addition, a survey among these firms indicated that about 60% of Japanese subsidiary firms reported in each year that their operations were profitable, while 20-25% remained at 'break-even' level.

Figure 9: Share of Gross Fixed Capital Formation in GDP in Indonesia, 1951-2006



Note: The ratio is calculated from current price data. 2006 is estimated on the basis of data for quarters 1 and 2.

Sources: National accounts (current prices) and Input-Output Tables of Indonesia.

That does not mean that foreign firms in Indonesia have no concerns about their operations in Indonesia. After all, Indonesia has gone through major economic and political changes since the onset of the crisis in mid-1997. The following is a list of several of the changes that firms in Indonesia have had to deal with.<sup>6</sup> In the economic sphere, for example:

- macro-economic instability, particularly high inflation and interest rates, a significant depreciation of the currency followed by exchange rate instability;
- changes in trade policy, including efforts to curb luxury imports through temporary surcharges;
- Indonesia's involvement in trade liberalisation within AFTA and in bilateral trade agreements and its obligation to lower trade barriers, countered by domestic protectionist pressures in specific sectors.

In the sphere of public policy, for example:

- democratisation, a subsequent diffusion of political power, and increased political influence of special interest groups;
- decentralisation starting in 2001 and an increase in the authority of local governments to determine e.g. minimum wages and local taxes, sometimes amounting to increasing domestic trade barriers;
- regulatory reforms. They affected for instance capital markets, but also some deregulated sectors such as telecommunications, while changes in competition policy increased scrutiny of collusive inter-firm relations, and campaigns to combat corruption may have decreased overt corruption in the centres of decision making but probably led to a decentralisation of corruption. Changes in the system of customs procedures and also tax assessment and collection added to the confusion caused by changing regulations, while changes in labour regulations enhanced uncertainty in the procedures determining the hiring and dismissing of employees. While the regulatory reforms may have increased confusion, they are also likely to have increased the cost of compliance.
- public infrastructure delays causing problems related to poor communications and transport are an additional factor caused by the fact that budget shortages forced governments to delay infrastructure projects that depended on public investment in e.g. transport, electricity and communications.

A range of surveys among firms has indicated continued concerns, often reflecting the points above, but also listing issues that were already frequently mentioned as concerns before 1997. As a consequence, foreign firms with operations in Indonesia have experienced new challenges, and have expressed their concerns about them, but without drawing the conclusion that a withdrawal from Indonesia would be the best option. In expressing their concerns, they may have enhanced the perception that Indonesia's business environment is complex, costly and rife with risk,

---

<sup>6</sup> For more in-depth assessments of the economic and policy changes impacting on the business environment, see e.g. Van der Eng and Basri (2004), Hill (2006), and the triennial 'Survey of Recent Developments' in the *Bulletin of Indonesian Economic Studies*.

which in turn may have influenced would-be new foreign investors. For example, assessments by international agencies such as credit ratings agencies place Indonesia well down the list of countries. In 2006, the Japan Center for Economic Research ranked Indonesia 45<sup>th</sup> out of 50 countries according to competitiveness (JCER 2006), while the World Bank ranked the country 135<sup>th</sup> out of 175 countries according to the 'ease of doing business' (World Bank 2006: 6).

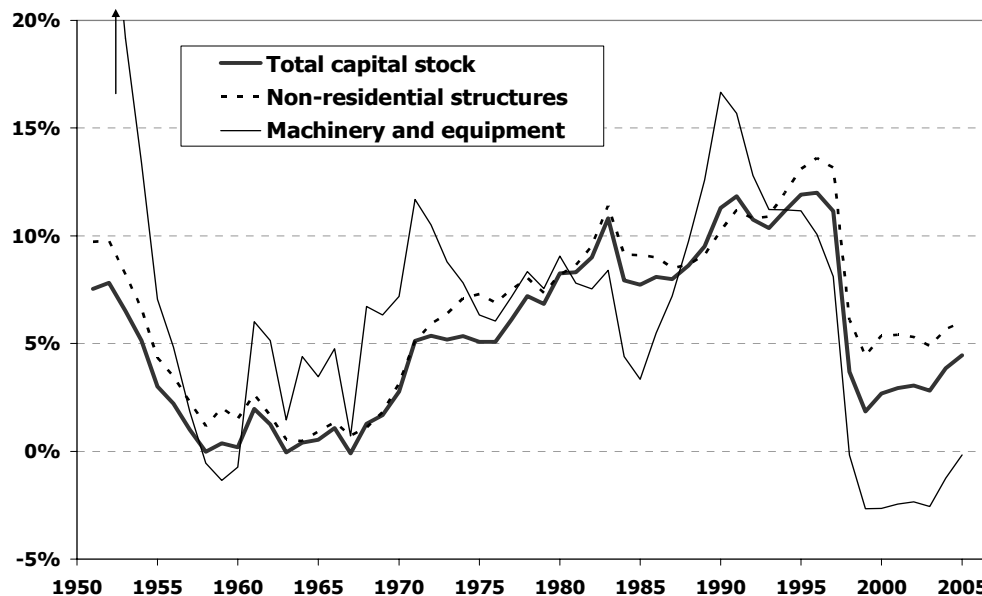
While it is possible to quibble about the measures that have been used to compile these rankings and their relevance to firms already operating in Indonesia, such rankings are likely to capture perceptions of Indonesia's business environment among foreign firms that could consider operations in the country. Worse, such rankings may influence foreign firms that are about to consider investing in Indonesia. At a time when other Asian countries, particularly China, are bracing themselves as major competitors to Indonesia for resource-seeking foreign investment aiming to take advantage of Indonesia's relatively low labour costs, negative perceptions about the country's business environment may be a key explanation for the country's poor FDI record. FDI inflows have remained low compared to inflows during the 1980s and 1990s, and also compared to other Asian countries. While other agencies monitoring the changes in Indonesia's business environment have indicated improvements, they also note that much remains to be done (see *e.g.* Kuncoro *et al.* 2005).

It is clear that the multitude of changes, including improvements in the business environment still need to crystallise before there will be a marked change in the general perception of Indonesia's business environment. Still, that may not prevent domestic firms and foreign firms that are already in the country from increasing their investments, as they have appeared to have done during 2000-05. Hence, without fresh FDI, investment may remain lower than what it was just before the crisis, but it is unlikely to plummet to zero.

Figure 10 shows the rates of growth of capital stock, which were calculated with capital stock data after deduction of implicit depreciation of capital goods. The trend is largely determined by non-residential structures, with the growth of the stock of machinery and equipment fluctuating around it. The rate of growth increased from around 5% in the early-1970s to more than 10% by the mid-1990s. Hence, the 'normal' rate of growth of capital stock may be put at around 7.5%. Figure 8 shows that this rate was not achieved during 2000-05. However, as the country achieves economic recovery, as the dust of the economic and political uncertainties in the business environment will settle and investors regain their courage, it is not implausible to assume that Indonesia will re-achieve a 5% rate of growth of capital stock, if not somewhat higher. Crucial to achieving this rate of growth will be the recovery of the rate of growth of the stock of machinery and equipment, which has been negative in recent years, as Figure 10 shows. This implies that investment has been insufficient to compensate for implicit depreciation

of capital goods. For the purpose of predicting future economic growth, the paper will assume scenarios of 5%, 7.5% and 10% annual growth of capital stock.

*Figure 10: Annual growth of Non-residential Gross Fixed Capital Stock in Indonesia, 1952-2005 (percentages)*



*Source: Van der Eng (2006b).*

Population growth during 2001-30 has been taken from the most recent BPS projection of Indonesia's population to 2025 (BPS 2005). These data have been extrapolated to 2030. Employment growth during 2001-30 has been estimated as an extrapolation of male and female employment in 2000. The extrapolation consisted of an estimation of the population of males and females of 15 years and older, based on population growth 15 years prior, assuming that young people start to enter the work force at that age. Constant crude participation rates of 77% of males and 52% for females were applied to these population data to estimate employment (see Figure 5). The rate of growth of employment decreases from 2.0% in 2006 to 0.7% in 2030.

Average educational attainment was extrapolated on the growth of age cohorts of children attending primary, lower and upper secondary, and tertiary education (BPS 2005), assuming improvements in the enrolment ratios. In 2004, the enrolment ratios were 96.8% for primary education, 83.5% for lower secondary, 63.5% for upper secondary and 12.1% for tertiary education (BPS 2006: 24). It was assumed that these ratios will increase to respectively 100%, 100%, 80% and 30% by 2030. Average educational attainment was then calculated as explained for Figure 6. The estimated per capita educational attainment in 2030 is 7.3 years. The gains appear small, but it should be noted that the share of under-educated people in Indonesia's employment is still high. In 2005, about 60% still had only partly or

entirely completed primary school. Hence, the main gains in educational attainment are largely made through the passing of these generations of under-educated people and/or the upgrading of the quality of education. The improvement in educational attainment is insufficient to compensate for the decreasing rate of employment, as the education-adjusted rate of employment growth slows from 2.1% in 2006 to 0.7% in 2030.

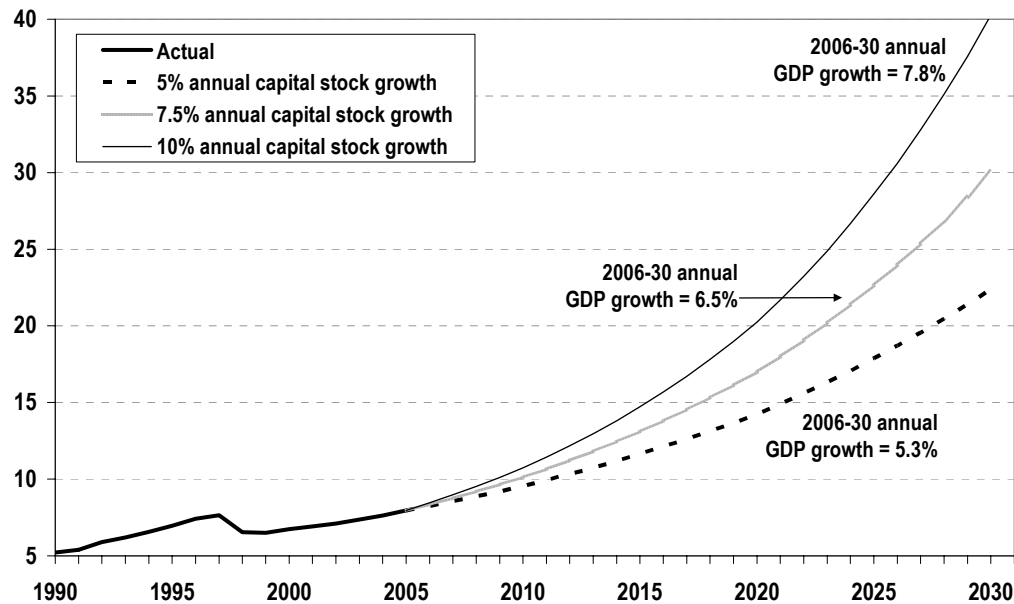
The consistently positive rate of growth of TFP during 2000-05 was taken as an indication that the Indonesian economy is gradually shedding a range of inefficiencies that this residual captured. If so, the paper tentatively assumed moderate TFP growth of 1.5% per year during 2006-10, 2.0% during 2011-20 and 2.5% during 2021-30, roughly in line with the findings of TFP growth in other Asian countries in Oguchi (2004).

Lastly, on the basis of Table 1, the paper assumes that the income shares of labour and capital would on average be even during 2006-30, or 50% each. Table 5 summarises the assumptions made.

*Table 5: Key Assumptions to Estimate of Future Economic Growth in Indonesia, 2006-30 (annual averages)*

	$s_t$	$g_t^K$	$g_t^N$	$g_t^{\alpha Y}$	$g_t^{TFP}$	$g_t^Q$
a.	50%	5.0	1.3	0.1	2.1	5.3
b.	50%	7.5	1.3	0.1	2.1	6.5
c.	50%	10.0	1.3	0.1	2.1	7.8

*Figure 11: Projected GDP per Capita in Indonesia, 1990-2030 (million 2000 Rupiah)*



Sources: 1990-2005 Figure 1, 2006-30 see main text.

On the basis of these assumptions, the likely rate of growth of GDP is estimated in the last column of Table 5. The results varied depending on the rate of capital growth. They are shown in Figure 11 as changes in the level of GDP per capita. If the Indonesian economy re-achieves a minimal rate of growth of capital stock of 5%, GDP per capita in 2030 could be 21.5 million 2000 Rupiah, which is 2.8 times the 2005 level, or roughly US\$ 2,600. The average annual rate of GDP growth will in that case be 5.3%, slightly higher than the 2002-05 average. If, however, the investment climate improves to the extent that the annual growth of capital stock resumes at the level of around 1990, 10%, GDP per capita in 2030 could be 40.3 million 2000 Rupiah, 5.1 times the 2005 level, or roughly US\$ 4,800. However, in that case, the economy will have to resume growth at record levels, exceeding Indonesia's 1971-97 average rate of growth.

While countries like Japan, South Korea and Taiwan may have achieved such levels in the past, they did so under conditions that will be difficult to replicate in Indonesia. For example, Japan achieved such high rates of growth during the 1950s-1970s when it had favourable access to the US market, was the only country to pursue a strategy of export-oriented industrialisation, and could use trade and industry policies to favour particular exports and discourage imports. Today, Indonesia is one of many countries, including formidable opponent China, seeking to replicate Japan's industrialisation strategy at a time when international trade agreements have blunted the tools of trade and industry policy. While South Korea and Taiwan achieved high rates of growth during the 1960s-1980s under authoritarian regimes, Indonesia has recently transformed itself in a rough-and-tumble democracy that requires dialogue and compromise in the formulation of policies affecting economic growth.

In other words, it may be more likely that Indonesia's economic growth will travel an intermediate path, as indicated in Figure 11. If the average annual growth of capital stock resumes at 7.5% per year, GDP per capita in 2030 could be 30.1 million 2000 Rupiah, 3.8 times the 2005 level, or roughly US\$ 3,500. The key caveat is of course that the growth trajectory will not be interrupted. Looking back at Indonesia's development experience, it would be difficult to exclude that possibility. The 30 years of near-uninterrupted high growth during 1967-97 were not without major issues that could have blown the country's economy off course. For example, the drastic fall in oil prices and oil-related export earnings in the early-1980s could have interrupted the growth trajectory of the economy, if it had not been for the fact that the tenet of economic policy almost seamlessly changed to export-oriented industrialisation. Indonesia will face major challenges in the form of *e.g.* regional trade liberalisation and the fact that it will become increasingly dependent on imported energy.

## 5. Conclusion

The paper estimated that the residual TFP growth, after accounting for the growth of capital stock and education-adjusted employment, was on average a marginally negative -0.1% per year during 1971-2005, contributing -2% to GDP growth. It also estimated that most of GDP growth, 77%, was explained by the growth of the capital stock. As such, the paper appears to offer support for Krugman's 'perspiration'-based explanation of economic growth in East Asia.

However, the paper noted that the estimated capital stock in Indonesia is likely to contain embodied technology, while the education-adjustment of employment is also likely to capture part of productivity growth. Hence, residual TFP growth is more likely a reflection of a wide range of factors that impact on economic growth, but that the paper has not accounted for. Given that the measured residual TFP growth was negative, it most likely reflected a range of inefficiencies that existed in the Indonesian economy.

Support for that suggestion was found in the fact that TFP growth during 2000-05 was consistently positive, which may indicate a reduction of these inefficiencies as a consequence of a multitude of changes in Indonesia's business environment. While these changes increased at the same time increased uncertainty about the business environment, particularly among would-be investors, it is possible that firms currently in Indonesia were less pessimistic as they were able to use greater flexibility in absorbing the idiosyncrasies of Indonesian's business environment. A reasonably high investment-GDP ratio seems to underscore that suggestion.

The fact that increasing investment is the key to the resumption of higher levels of economic growth in Indonesia points to the urgency of improvements, or at least stabilisation of change in the country's business environment. The paper mentioned several issues that are of concern to private enterprise and that may have impinged on domestic investment, and particularly new foreign investment. Still, even the resumption of a modest level of investment is likely to generate economic growth that will yield significantly higher levels of GDP per capita by 2030.

## References

- Abimanyu, Angito (1995) 'The Indonesian Economy and Total Factor Productivity', *Singapore Economic Review*, 40(1) 25-40.
- Aswicahyono, Haryo; Bird, Kelly and Hill, Hal (1996) 'What Happens to Industrial Structure when Countries Liberalise? Indonesia since the mid-1980s', *Journal of Development Studies*, 32(3): 340-63.
- Aswicahyono, Haryo and Hill, Hal (2002) "'Perspiration" versus "Inspiration" in Asian Industrialisation: Indonesia before the Crisis', *Journal of Development Studies*, 38(3): 138-63.
- Baier, Scott L.; Dwyer, Gerald P. and Tamura, Robert (2006) 'How Important are Capital and Total Factor Productivity for Economic Growth?', *Economic Inquiry* 44(1): 23-49.
- Basri, Mohammed Chatib and Van der Eng, Pierre (eds.) *Business in Indonesia: New Challenges, Old Problems*. Singapore: Institute of Southeast Asian Studies.
- Bosworth, Barry P., Collins, Susan M. and Chen Y.C. (1995) 'Accounting for Differences in Economic Growth', *Brookings Discussion Papers in International Economics, No.115*. Washington DC: The Brookings Institution.
- BPS (1992) *Penduduk Indonesia: Tabel Hasil Sensus Penduduk 1990. Seri S.2*. [The population of Indonesia: Table with the results of the 1990 population census] Jakarta: Biro Pusat Statistik.
- BPS (1996) *Sistem Neraca Sosial Ekonomi Indonesia 1993* [The system of socio-economic accounts of Indonesia in 1993]. Jakarta: Biro Pusat Statistik.
- BPS (1999) *Sistem Neraca Sosial Ekonomi Indonesia 1998* [The system of socio-economic accounts of Indonesia in 1998]. Jakarta: Badan Pusat Statistik.
- BPS (2003) *Sistem Neraca Sosial Ekonomi Indonesia 2000* [The system of socio-economic accounts of Indonesia in 2000]. Jakarta: Badan Pusat Statistik.
- BPS (2005) *Proyeksi Penduduk Indonesia 2000-2025* [Population projection for Indonesia, 2000-2025]. Jakarta: BPS/Bappeda/ UNFPA.
- BPS (2006) *Beberapa Indikator Penting Sosial-Ekonomi Indonesia* [Selected socio-economic indicators of Indonesia]. Jakarta: Badan Pusat Statistik.
- Chen E.K.Y. (1997) 'The Total Factor Productivity Debate: Determinants of Economic Growth in East Asia', *Asian-Pacific Economic Literature*, 11(1): 18-38.
- Collins, Susan M. and Bosworth, Barry P. (1996) 'Economic Growth in East Asia: Accumulation versus Assimilation', *Brookings Papers on Economic Activity*, 2: 135-203.
- Drysdale, Peter and Huang Yiping (1997) 'Technological Catch-Up and Productivity Growth in East Asia', *Economic Record*, 73: 201-11.
- Felipe, Jesus (1999) 'Total Factor Productivity Growth in East Asia: A Critical Survey', *Journal of Development Studies*, 34(4) 1-41.
- Hill, Hal (1999) *The Indonesian Economy since 1966: Southeast Asia's Emerging Giant*. Cambridge: CUP.

- Hill, Hal (2006) 'The Indonesian Economy: A Decade after the Crisis.' Paper presented at the *Asian Economic Policy Review Conference on East Asia A Decade After the 1997-98 Crisis*, Japan Center for Economic Research, Tokyo, 1 October 2006.
- Hill, Hal; Aswicahyono, Haryo and Bird, Kelly (1997) 'What Happened to Industrial Structure during the Deregulation Era?' in H. Hill (ed.) *Indonesia's Industrial Transformation*. (Singapore: ISEAS) 55-80.
- Hugo, Graeme J. *et al.* (1987) *The Demographic Dimension in Indonesian Development*. Singapore: Oxford UP.
- IDE-BPS (1977) *Input-Output Table Indonesia, 1971*. Tokyo/Jakarta: Institute of Developing Economies – Biro Pusat Statistik (2 volumes).
- Ikemoto, Yukio (1986) 'Technical Progress and the Level of Technology in Asian Countries', *The Developing Economies*, 34(4) 368-90.
- JCER (2006) *Potential Competitiveness Ranking 2005*. Tokyo: Japan Center for Economic Research. <http://www.jcer.or.jp/eng/pdf/potential2005.pdf>
- Kawai, Hiroki (1994) 'International Comparative Analysis of Economic Growth', *The Developing Economies*, 32(4) 373-97.
- Keuning, Steven J. (1991) 'Allocation and Composition of Fixed Capital Stock in Indonesia: An Indirect Estimate Using Incremental Capital Value Added Ratios', *Bulletin of Indonesian Economic Studies*, 27(2): 91-119.
- Keuning, Steven J. and Kusmadi Saleh (2000) 'SAM and SESAME in Indonesia: Results, Usage and Institutionalization' in *Studies in Methods, Series F, No.75/Vol.2, Handbook of National Accounting: Household Accounting. Experience in Concepts and Compilation, vol.2, Household Satellite Extensions*. (New York: United Nations, Department of Economic and Social Affairs, Statistics Division) 355-97.
- Krugman, Paul (1994) 'The Myth of Asia's Miracle', *Foreign Affairs*, 73(6): 62-78.
- Kuncoro, Ari *et al.* (2005) *Monitoring Investment Climate in Indonesia: A Report from the Mid 2005 Survey*. Jakarta: Institute for Economic and Social Research, University of Indonesia.
- Lindauer, David L. and Roemer, Michael (1996) 'Legacies and Opportunities', in Lindauer, David L. and Roemer, Michael (eds.) *Asia and Africa: Legacies and Opportunities in Development*. (San Francisco: ICS Press) 1-24.
- Maddison, Angus (1963) 'Growth Problems in Underdeveloped Countries', in *Planning Education for Economic and Social Development* (Paris: OECD) 17-25.
- Maddison, Angus (1991) *Dynamic Forces in Capitalist Development: A Long-Run Comparative View*. Oxford: OUP.
- Maddison, Angus (1995a) *Monitoring the World Economy 1820-1992*. Paris: OECD.
- Maddison, Angus (1995b) 'Standardised Estimates of Fixed Capital Stock: A Six Country Comparison' in A. Maddison (1995) *Explaining the Economic Performance of Nations: Essays in Time and Space*. (Aldershot: Elgar) 137-166.

- Maddison, Angus (1974) 'What is Education For?', *Lloyds Bank Review*, (April 1974) 19-30.
- Nehru, Vikram and Dhareshwar, Ashok (1993) 'A New Database of Physical Capital Stock: Sources, Methodology and Results', *Revista de Análisis Económico*, 8(1): 37-59.
- Oguchi, Noriyoshi (2004) 'Integrated Report' in Oguchi, Noriyoshi (ed.) *Total Factor Productivity Growth: Survey Report*. (Tokyo: Asian Productivity Organization) 3-29.
- Rodrik, Dani (1998) 'TFPG Controversies, Institutions, and Economic Performance' in Yujiro Hayami and Masahiko Aoki (eds.) *The Institutional Foundations of East Asian Economic Development* (London: Macmillan) 79-101
- Sarel, Michael (1997) 'Growth and Productivity in ASEAN Countries.' *IMF Working Paper No. WP/97/97*. Washington DC: International Monetary Fund.
- Sigit, Hananto (2000a) 'Telaah Data Ketenagakerjaan di Indonesia' [Analysis of employment data in Indonesia]. *Laporan No.5, STAT Project*. Jakarta: Badan Pusat Statistik.
- Sigit, Hananto (2000b) 'Earning Data in Indonesia: A Review of Existing Sources.' *Report No.10, STAT Project*. Jakarta: Badan Pusat Statistik.
- Sigit, Hananto (2004) 'Indonesia' in Noriyoshi Oguchi (ed.) *Total Factor Productivity Growth: Survey Report*. (Tokyo: Asian Productivity Organization) 98-133.
- Timmer, Marcel (1999) 'Indonesia's Ascent on the Technology Ladder: Capital Stock and Total Factor Productivity in Indonesian Manufacturing, 1975-95', *Bulletin of Indonesian Economic Studies*, 35(1): 75-89.
- Van der Eng, Pierre (1992) 'The Real Domestic Product of Indonesia, 1880-1989', *Explorations in Economic History*, 28 (1992) pp.343-373.
- Van der Eng, Pierre (1999) 'Some Obscurities in Indonesia's New National Accounts', *Bulletin of Indonesian Economic Studies*, 35(2) 91-106.
- Van der Eng, Pierre (2002) 'Indonesia's Growth Performance in the 20th Century' in A. Maddison, D.S. Prasada Rao and W. Shepherd (eds.) *The Asian Economies in the Twentieth Century*. (Cheltenham: Edward Elgar) 143-79.
- Van der Eng, Pierre (2005) 'Indonesia's New National Accounts', *Bulletin of Indonesian Economic Studies*, 41(2) 253-62.
- Van der Eng, Pierre (2006a) 'New Estimates of Long-term Economic Growth in Indonesia, 1880-2005.' Unpublished paper.
- Van der Eng, Pierre (2006b) 'Capital Formation and Economic Growth in Indonesia, 1940-2005.' Unpublished paper.
- Van der Eng, Pierre (2006c) 'Japanese Firms in Indonesia: Hard Times?' Unpublished paper.
- Vial, Virginie (2006) 'New Estimates of Total Factor Productivity Growth in Indonesian Manufacturing', *Bulletin of Indonesian Economic Studies*, 42(3) 357-69.
- Weerasinghe, P. Nandalal and Fane, George (2005) Accounting for Discrepancies among Estimates of TFP Growth in East Asia', *Economic Papers*, 24(3): 280-93.

- World Bank (1993) *The East Asian Miracle: Economic Growth and Public Policy*. Oxford: Oxford UP.
- World Bank (2005) 'Raising Investment in Indonesia: A Second Generation of Reforms.' *World Bank Report No. 31708-IND*. Washington DC: The World Bank.
- World Bank (2006) *Doing Business 2007, How to Reform: Comparing Regulation in 175 Countries*. Washington DC: The World Bank.
- Young, Alwyn (1994) 'Accumulation, Exports and Growth in the High Performing Asian Economies: A Comment', *Carnegie-Rochester Conference Series on Public Policy*, 40: 237-50.
- Young, Alwyn (1995) 'The Tyranny of Numbers: Confronting the Statistical Realities of the East Asian Growth Experience', *Quarterly Journal of Economics*, 110: 641-80.
- Yudanto, N., G. Wicaksono, E. Ariantoro and A. Reina Sari (2005) 'Capital Stock in Indonesia: Measurement and Validity Test', *Irving Fisher Committee on Central Bank Statistics Bulletin*, 20: 183-198.

Table A.1: Key data used in the paper, 1960-2005

	GDP (at market prices) (bln 2000 Rp)	Non- residential capital stock	Employ- ment (x 1000)	Educational attainment per person (years)	Share of labour income in GDP	Annual % growth rates				TFP
						GDP	Capital stock	Em- ploy- ment	Educ. attainment x 0.11	
1960	201,729	196,748		1.3		4.06	0.75		0.62	
61	211,594	202,989	32,709	1.3		4.89	3.17		0.63	
62	213,249	207,657	33,456	1.4		0.78	2.30	2.29	0.62	
63	204,692	208,975	34,225	1.5		-4.01	0.63	2.30	0.64	
64	211,704	211,770	35,016	1.6		3.43	1.34	2.31	0.66	
1965	214,125	214,793	35,834	1.7		1.14	1.43	2.34	0.60	
66	216,123	219,273	36,672	1.8		0.93	2.09	2.34	0.57	
67	211,841	220,522	37,534	1.9		-1.98	0.57	2.35	0.56	
68	234,102	226,003	38,430	1.9		10.51	2.49	2.39	0.50	
69	262,505	232,569	39,318	2.0		12.13	2.91	2.31	0.50	
1970	289,556	242,084	40,279	2.1		10.30	4.09	2.45	0.48	
71	306,102	258,509	41,261	2.2	45.0%	5.71	6.79	2.44	0.42	0.70
72	339,775	276,491	42,377	2.3	51.7%	11.00	6.96	2.70	0.32	6.08
73	388,839	294,930	43,523	2.3	46.7%	14.44	6.67	2.70	0.25	9.51
74	403,867	314,852	44,486	2.4	37.3%	3.86	6.75	2.21	0.29	-1.30
1975	403,132	334,791	45,726	2.4	39.3%	-0.18	6.33	2.79	0.30	-5.24
76	440,898	354,948	47,000	2.5	46.9%	9.37	6.02	2.79	0.32	4.71
77	474,478	379,037	48,310	2.6	50.7%	7.62	6.79	2.79	0.36	2.68
78	498,220	407,735	49,657	2.7	54.1%	5.00	7.57	2.79	0.40	-0.19
79	523,661	435,857	51,041	2.8	47.5%	5.11	6.90	2.79	0.43	-0.04
1980	569,993	470,549	52,421	2.9	38.2%	8.85	7.96	2.70	0.45	2.72
81	603,877	507,749	54,294	3.0	38.2%	5.94	7.91	3.57	0.49	-0.49
82	582,523	550,790	56,238	3.2	42.5%	-3.54	8.48	3.58	0.48	-10.14
83	601,351	606,389	58,254	3.3	38.9%	3.23	10.09	3.59	0.47	-4.51
84	643,954	650,870	60,347	3.4	39.7%	7.08	7.34	3.59	0.46	1.05
1985	661,993	697,082	62,519	3.6	44.4%	2.80	7.10	3.60	0.43	-2.94
86	702,617	751,478	64,774	3.7	52.4%	6.14	7.80	3.61	0.47	0.29
87	739,212	811,924	67,114	3.9	51.0%	5.21	8.04	3.61	0.43	-0.80
88	783,522	884,869	69,543	4.0	52.8%	5.99	8.98	3.62	0.40	-0.37
89	855,043	975,158	72,064	4.2	48.7%	9.13	10.20	3.63	0.36	1.95
1990	932,355	1,095,494	74,396	4.3	47.0%	9.04	12.34	3.24	0.33	0.83
91	980,988	1,234,740	76,137	4.4	47.5%	5.22	12.71	2.34	0.34	-2.73
92	1,088,305	1,375,866	77,928	4.5	49.6%	10.94	11.43	2.35	0.34	3.84
93	1,166,327	1,525,889	79,768	4.7	49.1%	7.17	10.90	2.36	0.32	0.30
94	1,255,025	1,702,812	81,660	4.8	52.5%	7.60	11.59	2.37	0.32	0.69

	GDP (at market prices) (bln 2000 Rp)	Non- residential capital stock	Employ- ment (x 1000)	Educational attainment per person (years)	Share of labour income in GDP	Annual % growth rates				
						GDP	Capital stock	Em- ploy- ment	Educ. attainment x 0.11	TFP
1995	1,356,565	1,911,772	83,311	5.0	51.3%	8.09	12.27	2.02	0.31	0.92
96	1,459,622	2,147,396	85,003	5.1	45.1%	7.60	12.32	2.03	0.32	-0.22
97	1,525,511	2,393,230	86,738	5.2	40.1%	4.51	11.45	2.04	0.30	-3.28
98	1,321,365	2,489,026	88,517	5.4	28.4%	-13.38	4.00	2.05	0.30	-16.92
99	1,326,026	2,542,998	90,342	5.5	45.5%	0.35	2.17	2.06	0.29	-1.90
2000	1,389,771	2,619,245	92,528	5.7	46.9%	4.81	3.00	2.42	0.26	1.96
01	1,442,985	2,704,387	93,818	5.8	46.9%	3.83	3.25	1.39	0.24	1.34
02	1,504,381	2,794,828	95,738	5.9	46.9%	4.25	3.34	2.05	0.18	1.43
03	1,579,559	2,881,249	97,689	6.0	46.9%	5.00	3.09	2.04	0.17	2.32
04	1,656,826	2,999,732	99,665	6.0	46.9%	4.89	4.11	2.02	0.16	1.68
2005	1,749,951	3,140,084	101,652	6.1	46.9%	5.62	4.68	1.99	0.15	2.13