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Abstract

This paper revisits the discussion about the contribution of Total Factor Productivity (TFP) growth to Indonesia's economic growth during 1970-2007. 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 was on average -0.2% per year during 1971-2007. Capital stock growth and education-augmented employment growth explained 70% and 34%, respectively, and TFP growth -4%. Only during 2000-07 was TFP growth 1.7% per year, explaining 33% of GDP growth. The paper doubts that these results imply that the Indonesian economy did not experience the impact of technological change, as much of it may be embodied in the capital stock estimates.

Keywords: economic growth, Indonesia, productivity
JEL-codes: N15, O11, O47, O53
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Total Factor Productivity and Economic Growth in Indonesia

1. Introduction

Much of the literature on the economics of macroeconomic growth in Asia continues to be dominated by this discussion about the degree to which Total Factor Productivity (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 four-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 studies that often used readily available multi-country data sets in order to estimate TFP growth in different parts of the world, on the assumption that the growth accounting residual represents TFP growth.[2]

The multi-country studies that estimated TFP growth all yielded different results. One of the reasons was that authors were forced to make very rough 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 statistical agency (*Badan Pusat Statistik*, BPS) 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. For example, in the case of Indonesia, the estimates of gross fixed capital formation and capital stock 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 2008a). If that is the case for one country, it is likely to be the case for others, which should be a warning to anyone considering using these multi-country data sets, or adhering unqualified credence to the results of these studies.

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 exact proximate causes underlying the country's high economic growth since the mid-1960s remain unclear. As a major Asian country Indonesia has, of course, been part of the multi-country studies referred to above which almost all found positive TFP growth, albeit to varying degrees (see section 3 of this paper). However, there are no reasons to

[2] See *e.g.* Chen (1997), Felipe (1999) and Weerasinghe and Fane (2005) for critical summaries of the results of these studies for Asian countries.

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).[3] Notably, he found that TFP growth in Indonesia was significantly negative during 1980-2000 and that economic growth during 1980-2000 was largely driven by capital accumulation.[4] These findings are in sharp contrast with the results of the multi-country studies referred to above. They also contrast with studies that used data from the annual survey among firms in Indonesia to explore the contribution of TFP to the growth of output in manufacturing industry. These studies revealed positive TFP growth, suggesting that that economic growth in Indonesia was not purely a consequence of resource mobilisation (see section 3).

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 2007b), new long-term estimates of capital stock in Indonesia in 2000 constant prices (Van der Eng 2008a), 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 1971-2007. Unlike the multi-country studies, this paper is based on statistical data that have been corrected for inconsistencies. The next section outlines the methodology and data used in the paper. Section 3 estimates key 'proximate'[5] sources of economic growth in Indonesia. It discusses whether the growth accounting residual can indeed be considered as an indication of TFP. Section 4 discusses the prominent role of the expansion of capital stock in Indonesia's growth experience and some of the factors that constrained new investment in recent years.

2. Estimation of output and inputs

2.1 Methodology of estimating TFP

[3] Osada (1994) also made direct use of data from Indonesia's BPS, but was less concerned about issues of data availability, accuracy and consistency.

[4] Sigit's TFP estimates for Indonesia for 1980-2000 make it a remarkable 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 growth), 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%).

[5] Maddison (1988) explains the difference between the proximate and ultimate sources of economic growth. Proximate sources are measurable factors such as capital accumulation and technological change, the growth of labour input and human capital, the exploitation of natural resources etc. Ultimate sources are factors that shape the conditions under which proximate factors operate. They include geographic, social and political conditions.

This paper uses a simple, direct accounting method to estimate the contribution of TFP growth to economic growth, based on Oguchi (2004: 24-29). 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.

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

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.

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

Dividing both sides by Q_t yields equation 3.

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

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

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

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 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:

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

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

$$L_t^* = L_t e^{\alpha Y_t} \qquad \text{(Equation 6)}$$

Where L_t^* = education-adjusted employment, L_t = number of gainfully employed, α = the elasticity of output for each additional year of education and Y_t = the accumulated number of years of education per person employed. Substituting L_t for L_t^* in equation 1 and differentiation with respect to time yields a modified equation 4. Inserting equation 5 into the modified equation 4 yields equation 7.

$$g_t^{TFP} = g_t^Q - (1 - s_l) g_t^K - s_l g_t^{L^*} \qquad \text{(Equation 7)}$$

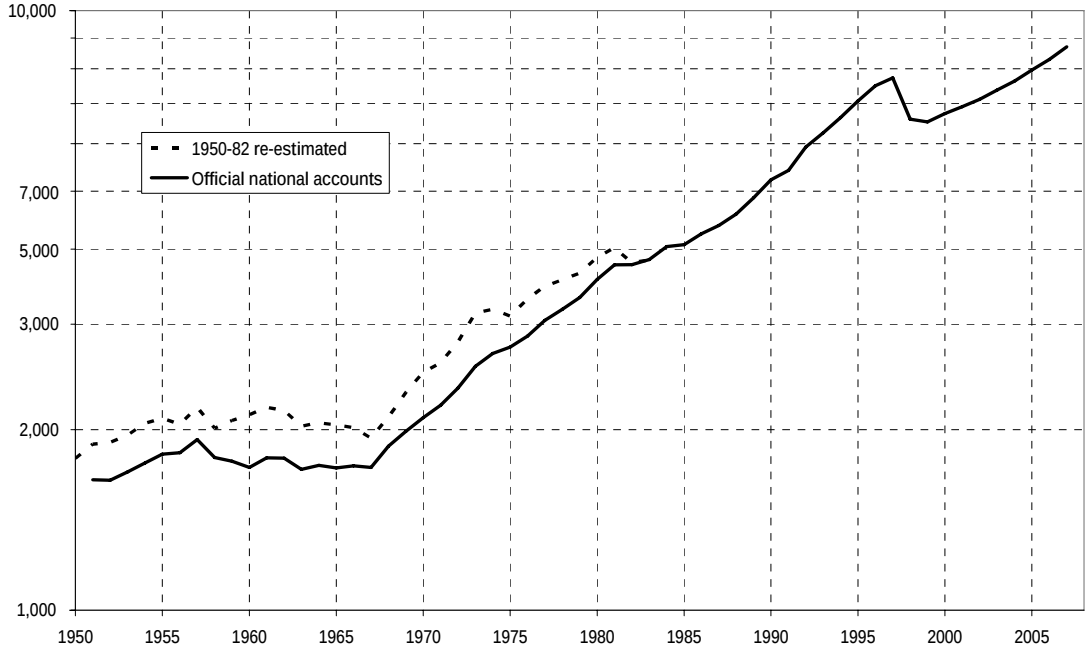
Hence, the key data required to estimate the contribution of TFP to economic growth are annual data on GDP and capital stock in constant prices, education-adjusted employment, and the labour income share in GDP. Since this paper is concerned with the national economy of Indonesia, it uses nation-wide 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 to 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 to the 2000 I-O Table. Extrapolation of these data for 2000-07 back in time with existing national accounts data for 1983-2000 and broad indicators of economic activity yields GDP per capita estimates shown in Figure 1 (Van der Eng 1992, 2002, 2007b).

Figure 1 confirms that the 1951-82 national accounts data were underestimated. 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. The 1997 level of GDP per capita was regained in 2004.

Figure 1: GDP per Capita in Indonesia, 1950-2007 (thousand 2000 Rupiah)



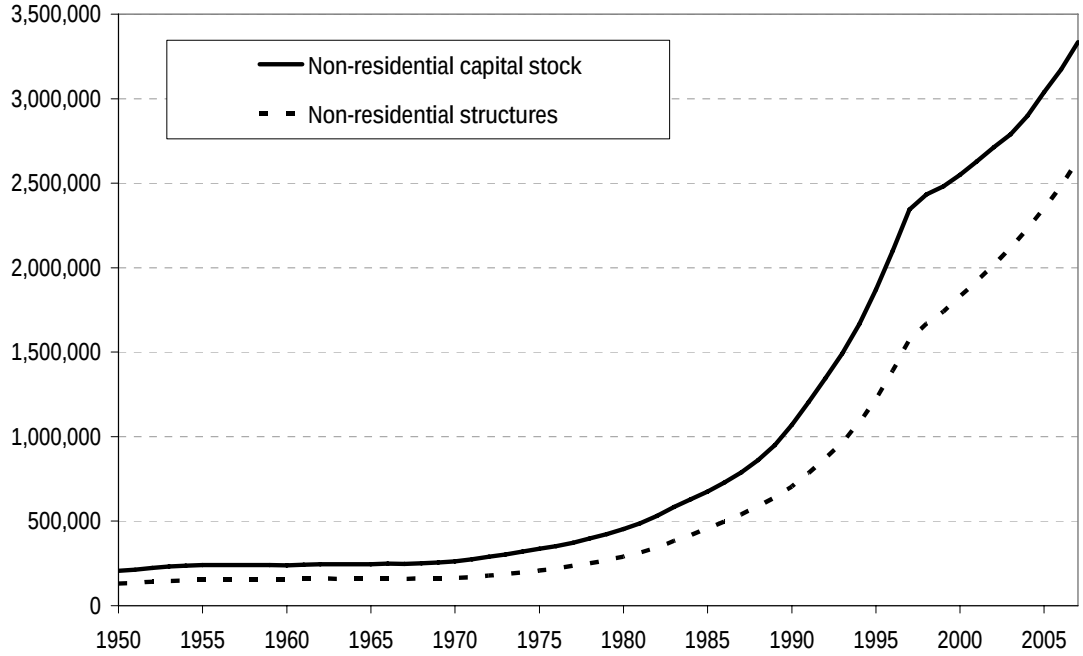
Source: Van der Eng (2008b) and Indonesia's national accounts.

2.2 Capital stock data

Closely scrutinised estimates of capital stock in Indonesia are rare. Keuning (1991) offered the first comprehensive estimates for 1975-85. In hindsight, these appear to have been 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 2008a).

Estimates of capital stock have recently been made at Bank Indonesia, the country's central bank, based on disaggregation of the growth of investment with the quinquennial I-O Tables (Yudanto *et al.* 2005). These estimates did not take account of all historical information on investment and offered insufficient consideration of key assumptions, particularly 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 1951, with the longest asset lifetime of 40 years (Van der Eng 2008a). Hence, the first 'complete' estimate is for 1990, which was re-estimated back to 1950 for non-residential capital stock on the basis of annual Gross Fixed Investment and assumed rates of depreciation that resembled the 1991-95 average implicit rates of depreciation.

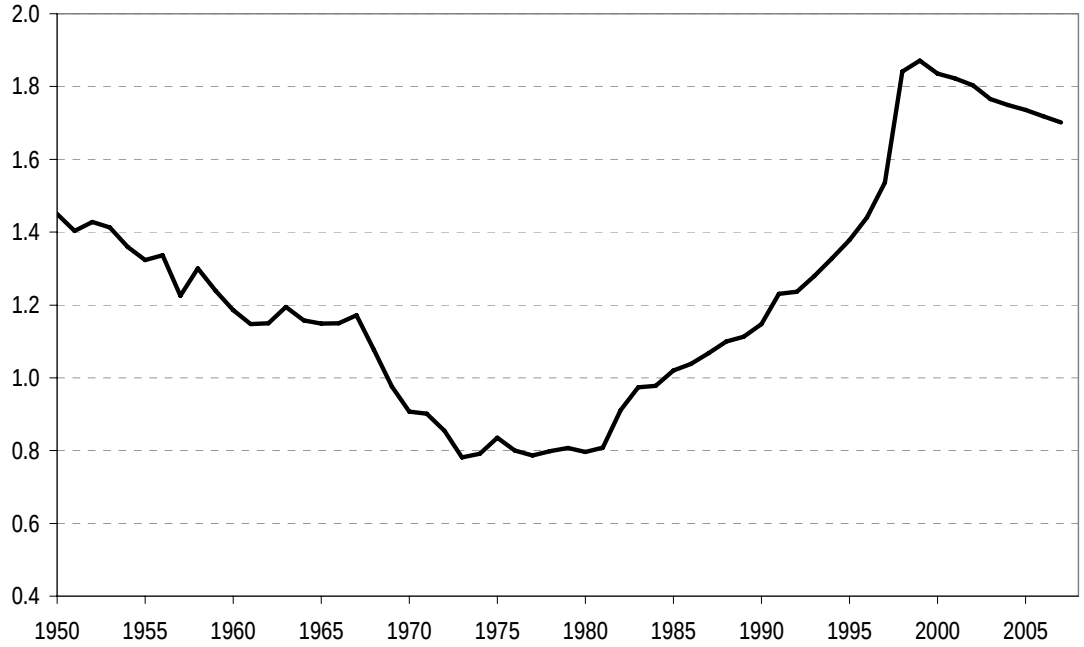
Figure 2: Gross Fixed Non-residential Capital Stock in Indonesia, 1960-2007 (bln 2000 Rupiah)



Source: Van der Eng (2008a).

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 non-residential capital stock consists of non-residential structures. Figure 3 shows 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.

Figure 3: Capital-Output Ratio for Indonesia, 1960-2007

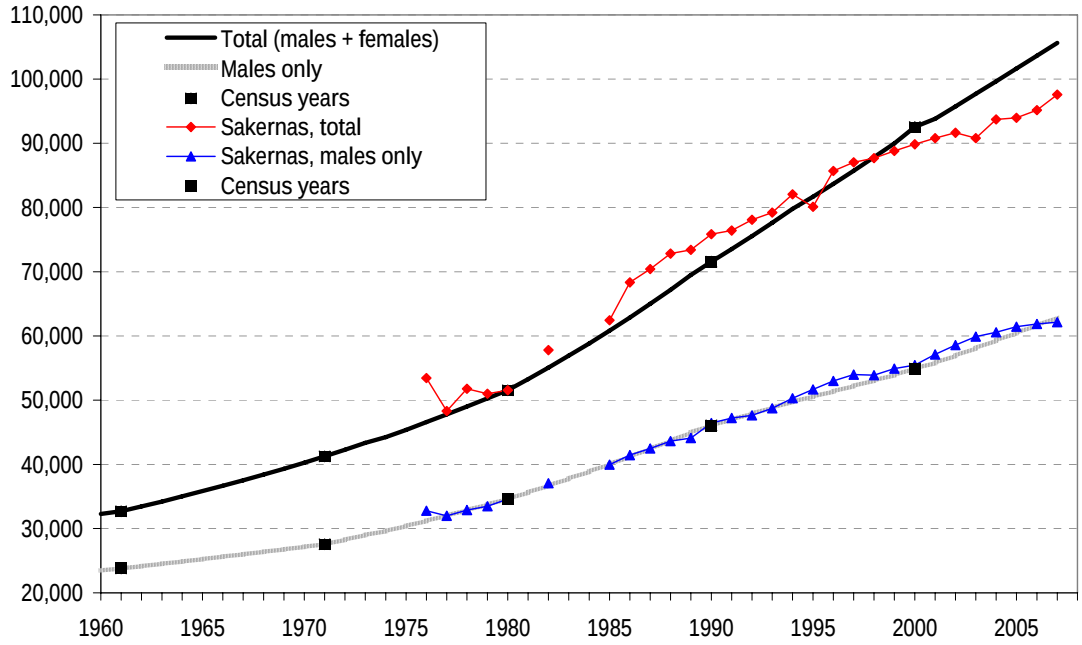


Note: Capital stock excludes residential structures.
Source: Van der Eng (2008a, 2008b).

2.3 Employment data

Consistent long-term estimates of employment in Indonesia are hampered by the fact that only the population censuses of 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 1985-2007. The Sakernas definitions of employment also differed over the years (Sigit 2000a: 28-29).

Figure 4: Employment in Indonesia, 1961-2007 (thousands)

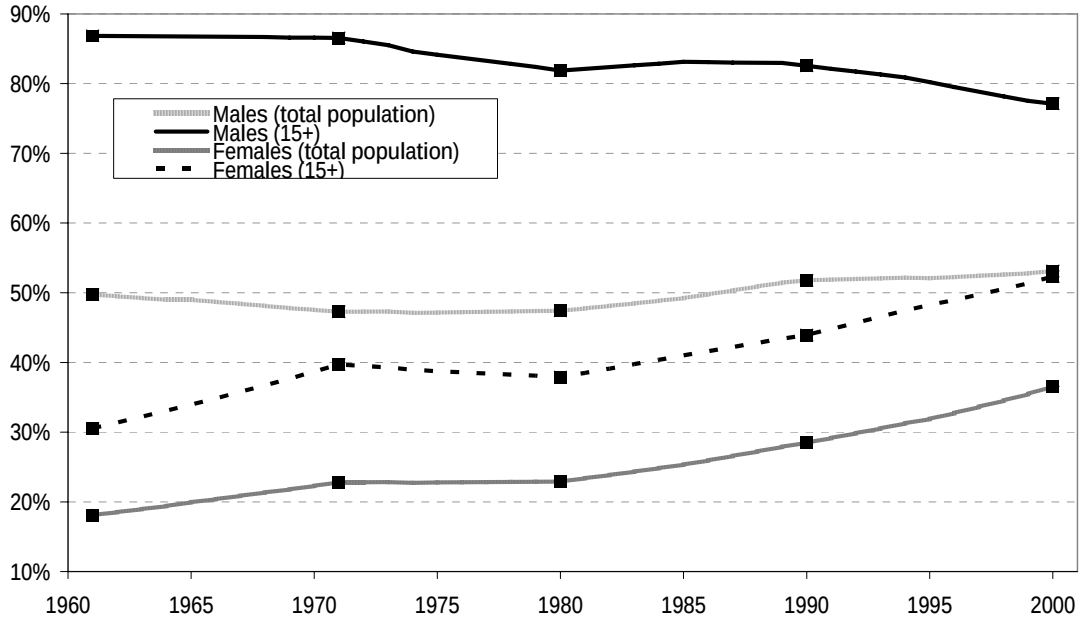


Sources: Population census data 1961, 1971, 1980, 1990 and 2000 (interpolated, taking account of population growth 10 years previously); 1976-80, 1982 and 1985-2007 Sakernas data.

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 since 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). Many 10-14 year olds remained gainfully employed in Indonesia and comprised 3.7%, 2.9% and 2.9% of total employment in 1980, 1990 and 2000 respectively, according to the census data.

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 from 30% in 1961 to over 52% in 2000 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.

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



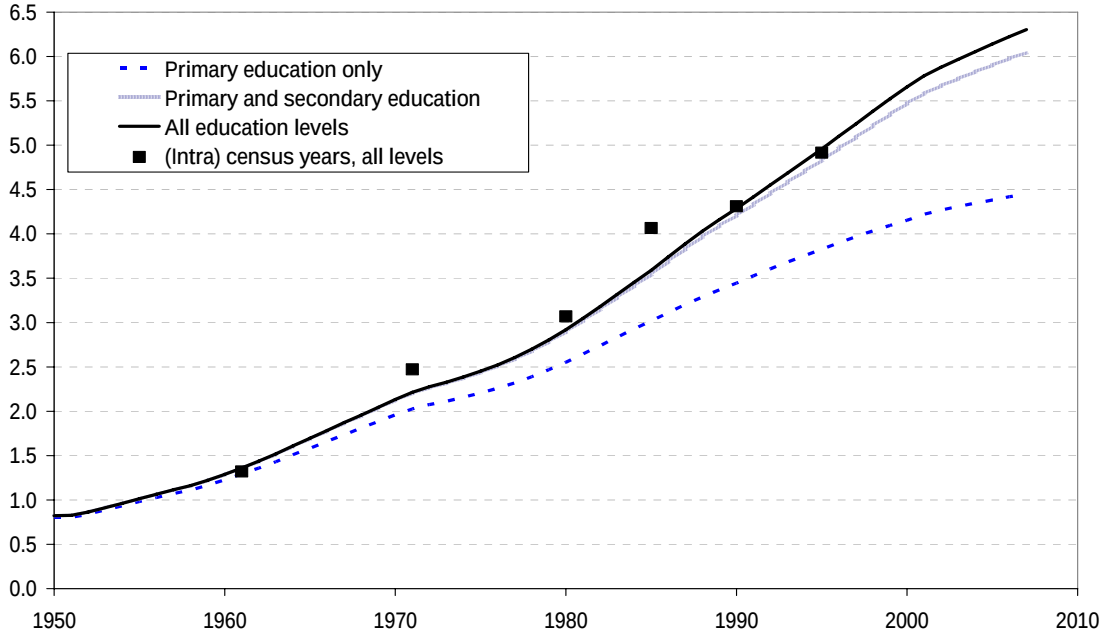
Sources: See Figure 4.

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.

Educational attainment grew at a very significant rate of 5.0 per cent per year during 1950-67 and 3.0 per cent during 1967-2007. Up to the 1970s, 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. The share of tertiary education remains small in 2007. 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.

Figure 6: Educational Attainment in Indonesia (average years of schooling per person), 1950-2007



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 1870-2007. 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, and does not take account of overseas education.
Sources: 1961-80 census benchmarks from Hugo *et al.* (1987: 282), 1990 from BPS (1992: Table 11.9), enrolments 1880-2007 from annual statistical publications and from the Department of Education in Indonesia, http://www.depdiknas.go.id/statistik/

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 was a fairly constant 0.11, meaning that each additional year of education yields on average an 11% increase of income.[6] This number is taken as a proxy for the elasticity of output with respect to education for the entire period. Equation 6 then

[6] Collins and Bosworth (1996: 152) found an East-Asia average of 10.7% They assumed a flat 7% in their growth accounting study involving China and India (Bosworth and Collins 2008: 47) .

allows the calculation of education-adjusted employment, using the extrapolated population census data shown in Figure 4.

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.[7] Non-cash labour income is, however, identified in SESAME.

The SESAME data are shown in Table 1, 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 labour income per employed worker for each benchmark year, using total employment shown in Figure 4, interpolating per worker labour income, and multiplying it with total number of employed workers.

Table 1 indicates significant changes over time in the labour income share, from a peak of 54 per cent in 1978 – just before investment and the capital-output ratio increased significantly (see Figure 3) – and a maximum of 57% in 2003, to a very low minimum of 28 percent in 1998 at the height of the crisis, when wage rates were eroded by a drastic inflation spike. For most years, the labour income share moved in a band between 40 and 50% of GDP.[8] As some of these fluctuations appear

[7] Osada (1994: 481) did not account for the income of self-employed and of household-based ventures. Sigit (2004: 103-104) solved this by multiplying average income of waged employees from Sakernas with the total number of gainfully employed, expressing the total as a percentage of GDP. However, this estimation yields significantly 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).

[8] A labour income share of 40-50% may appear to be low, given that *e.g.* Bosworth *et al.* (1995: 18) use a fixed 70% for developed countries and 60% of less-developed countries, as well as for China and India in their recent study (Bosworth & Collins 2008: 62), and that the share was 55-60 per cent in India during 1950-89 (Sivasubramonian 2003: 175). However, it should be noted that labour income shares of 70-75% were only achieved after World War II in countries like the UK or France (Prados and Rosés 2003: 12-13), and after 1970 in Japan (Hayami and Ogasawara 1999: 3-4). Before the war, at lower levels of GDP per capita, the shares of labour income were significantly lower. In addition, capital income included the imputed income from the productive use of land, most of which was owned by small farming households. Hence, in an economy with agriculture as the most important single sector in terms of employment and income, income from land use may have been relatively significant.

unreasonable, the last column shows a simple interpolation of labour income shares. For 2006-07, the labour income share was assumed to be the same as in 2005.

Total GDP at factor cost in Table 1 was estimated in a few steps: (1) by deducting total net indirect taxes from GDP at current market prices from the national accounts for 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, which yields GDP at market prices for the intermediate years.

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.

Table 1: Share of Labour Income in GDP in Indonesia, 1971-2007 (bln Rupiah)

	Labour income			Capital income	Total GDP (factor cost)	Total GDP (market prices)	Labour income Shares (%)	
	Wages, salaries	Income in kind	Total				(1)	(2)
1971			*1,918*	*1,991*	4,260	4,270	45.0%	45.0%
1972			*2,693*		*5,207*	*5,443*	*51.7%*	*43.5%*
1973			*3,508*		*7,510*	*7,838*	*46.7%*	*42.1%*
1974			*4,344*		*11,644*	*12,091*	*37.3%*	*40.7%*
1975	2,853	2,393	5,245	8,097	13,342	13,686	39.3%	39.3%
1976			*7,637*		*16,282*	*16,972*	*46.9%*	*39.1%*
1977			*10,158*		*20,040*	*20,886*	*50.7%*	*38.9%*
1978			*12,813*		*23,671*	*24,700*	*54.1%*	*38.6%*
1979			*15,609*		*32,867*	*34,172*	*47.5%*	*38.4%*
1980	9,491	9,044	18,535	29,976	48,511	48,913	38.2%	38.2%
1981			*21,791*		*57,010*	*58,763*	*38.2%*	*39.4%*
1982			*26,229*		*61,748*	*63,880*	*42.5%*	*40.6%*
1983			*30,960*		*79,525*	*81,976*	*38.9%*	*41.8%*
1984			*35,998*		*90,687*	*93,410*	*39.7%*	*43.1%*
1985	22,904	19,537	42,441	53,176	95,617	98,407	44.4%	44.4%
1986			*51,334*		*97,970*	*104,499*	*52.4%*	*44.9%*
1987			*60,818*		*119,341*	*126,471*	*51.0%*	*45.4%*
1988			*70,924*		*134,299*	*143,332*	*52.8%*	*45.9%*
1989			*81,687*		*167,870*	*180,315*	*48.7%*	*46.5%*
1990	55,738	37,049	92,787	104,570	197,357	210,867	47.0%	47.0%
1991			*111,337*		*234,449*	*249,598*	*47.5%*	*47.7%*
1992			*130,717*		*263,667*	*281,679*	*49.6%*	*48.4%*
1993	91,479	59,484	150,963	156,458	307,420	329,776	49.1%	49.1%
1994			*205,853*		*391,959*	*416,679*	*52.5%*	*50.2%*
1995	163,376	98,983	262,359	248,633	510,993	542,755	51.3%	51.3%
1996			*267,547*		*569,344*	*597,843*	*47.0%*	*50.4%*
1997			*272,865*		*626,652*	*664,481*	*43.5%*	*49.5%*
1998	168,585	109,731	278,316	700,126	978,442	989,573	28.4%	28.4%
1999			*547,299*		*1,075,489*	*1,093,439*	50.9%	*37.7%*
2000	397,579	244,495	642,074	725,941	1,368,015	1,379,770	46.9%	46.9%
2001			*793,041*		*1,647,865*	*1,679,291*	*48.1%*	*50.0%*
2002			*954,195*		*1,828,843*	*1,900,030*	*52.2%*	*53.4%*
2003	690,975	430,548	1,121,523	849,657	1,971,180	2,045,854	56.9%	56.9%
2004			*1,300,667*		*2,402,907*	2,273,142	54.1%	*54.7%*
2005	1,064,463	421,705	1,486,168	1,348,467	2,834,635	2,770,960	52.4%	52.4%
2006			*1,699,395*		*3,241,333*	3,339,476	*52.4%*	*52.4%*
2007			*2,015,042*		*3,843,379*	3,941,522	*52.4%*	*52.4%*

Note: Data in italics are estimated values, non-italic data are from the sources below. Labour income shares (1) are estimated by calculating labour income per employed worker for each benchmark year, interpolating per worker labour income, and multiplying it with total employment. Labour income shares (2) are estimated with simple interpolation of the shares, except for 1996-97, which is an interpolation of 1995 and 2000, ignoring the 1998 value.
Sources: IDE/BPS (1977), BPS (1996: 72), BPS (1999: 27), BPS (2003: 35), BPS (2005: 11), BPS (2008: Appendix 5) and Indonesia's national accounts.

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.

Table 2: Decomposition of Economic Growth, 1971-2007 (annual averages)

	s_l	g_t^Q	g_t^K	g_t^L	$g_t^{L^*}$	g_t^{TFP}
1971-85	44.1%	5.8	6.5	3.0	4.1	0.3
1986-97	49.4%	7.2	10.9	2.8	4.3	-0.5
1998-99	35.4%	-6.5	2.9	2.1	3.6	-9.7
2000-07	51.9%	5.0	3.8	2.0	3.0	1.7
1971-07	47.0%	5.4	7.2	2.6	3.9	-0.2
Contributions to GDP growth:						
1971-85			63%		32%	5%
1986-97			77%		30%	-6%
1998-99			-29%		-20%	148%
2000-07			36%		31%	33%
1971-07			70%		34%	-4%

Note: The annual averages are calculated as simple averages for each period. Annual average TFP growth is estimated with labour income shares (1) in Table 1.
Sources: See Figures 1-6 and Table 1.

Table 2 reveals that TFP growth was marginally negative during 1971-2007 and contributed only -4% to economic growth during 1971-2007.[9] During 1971-85, TFP growth was on average positive, but it still contributed only marginally to output growth. In all, 71% of output growth during the high-growth period 1971-97 is explained by the expansion of capital stock, and most of the rest by the growth of education-adjusted employment. Only during the years of economic recovery 2000-07 did the contribution of TFP growth become positive and significant at 33%, although the growth of capital stock and of education-adjusted employment together continued to explain most of economic growth.

These results are very different from the 30-40% contribution of TFP growth to GDP growth in China and India during 1978-2004 recently estimated by Bosworth and Collins (2008: 49). The main reasons for the differences between Indonesia and China and India are that annual employment growth in Indonesia was 2.6% compared with 2.0% in China and India, and in the apparently arbitrary assumption that the capital shares in GDP in both China and India are a flat 35%. In addition, their procedure of estimating capital stock growth is opaque and may be another source of

[9] The use of labour income shares in the last column of Table 1 made hardly any difference. TFP growth during 1971-2007 was in that case also -0.2% per year and contributed -4% to GDP growth.

differences. Hence, without comparing growth accounting results obtained with similar assumptions and methods of estimating capital stock, it is difficult to compare Indonesia, China and India.

The same conclusion can be drawn from a comparison of TFP estimates for Indonesia in other studies. Table 3 compares this paper's estimates of TFP growth and its contribution to economic growth with other studies. The table includes, as far as possible, information from the calculations in other studies in order to trace the possible reasons for the significant differences in all studies, particularly between studies 2-11 and studies 1 and 12-15.[10] 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 (as this study identified them in section 2) were constructed, (d) variables actually used to account for growth, or any combination of these factors.

As studies 1 and 3-11 are all multi-country studies that paid minimal attention to the intricacies of Indonesia's national accounts and their consequences for growth accounting, the results of those studies may have to be interpreted with caution. The multi-country studies often used different data sets and/or different ways to process the data, but 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, for Indonesia there are many 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 benchmarks of the International Comparisons Project, 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.

[10] The information in this table is incomplete, because many studies do not give the basic data or the processed data by country, which impedes comparison and identification of the possible reasons for the different outcomes.

Table 3: TFP Contribution to Economic Growth in Indonesia in Various Studies (Annual Averages)

			Unweighted		Weighted				Unweighted		Weighted			TFP
Study	Period	*g(Q/L)*	*g(K/L)*	*g(Y/L)*	*g(K/L)*	*g(Y/L)*	*g(TFP)*	*g(Q)*	*g(K)*	*g(L)*	*g(K)*	*g(L)*	*g(TFP)*	contribution*
1. Baier *et al*. (2006: 45)	1951-2000	1.8	4.4	1.4	1.5	0.9	-0.6							-37%
2. UNIDO (Firdausy 2005: 12)	1961-2000							5.7	6.9	3.0			-1.5	-27%
3. Drysdale and Huang (1997: 208)	1962-90							6.7			2.6	2.0	2.1	31%
4. Bosworth *et al.* (1996: 111)	1960-92	3.3			2.3	0.4	0.6							17%
5. Collins and Bosworth (1996: 157)	1960-94	3.4			2.1	0.5	0.8							24%
6. Lindauer and Roemer (1994: 3)	1965-90	4.3						6.5					2.7	42%
7. Ikemoto (1986: 376)	1970-80							7.7	7.4	3.6	3.0	2.2	2.5	32%
8. Young (1994: 243)	1970-85	5.0					1.2							24%
9. Kawai (1994: 384)	1970-90							6.2					1.5	24%
10. Sarel (1997: 29)	1978-96	4.7	9.0				1.2							24%
11. World Bank (1993: 58)	1980-90							5.6					1.6	29%
12. Osada (1994: 480)	1985-90							6.3			9.7	4.0	-2.7	-43%
13. Sigit (2004: 104-5)	1980-2000	2.9	5.9		3.8		-0.9	5.4	8.4	2.5	5.4	0.9	-0.8	-16%
14. Sutanto (2004: 11)	1992-2002							3.8	7.2	1.7	4.5	0.6	-1.4	-37%
15. This study	1971-2007	2.7	4.4	2.9				5.4	7.2	3.9	3.8	1.8	-0.2	-4%

* TFP contribution is to labour productivity growth for studies 1, 4, 5, 8 and 10, and output growth in other studies.

Note: Unweighted means that no account is taken of the income shares, weighted means that growth is weighted with the income share of capital, respectively labour. *g* = annual average growth rate, *Q* = GDP, *K* = capital stock, *L* = employment, *Y* = human capital (generally expressed as years of education).

Sources: See references in the table.

Other possible problems are a consequence of the creative ways in which studies resolved the unavailability of data for countries such as Indonesia. For example, multi-country studies often took capital stock data from Nehru and Dhareshwar (1993), which were based on aggregated investment data obtained from the World Bank 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. Van der Eng (2008a) showed the significantly different results of estimates of capital stock in Indonesia from several studies. Different capital stock estimates feed into different TFP growth estimates. In addition, factor income shares in GDP do not exist for Indonesia, which led *e.g.* Sarel (1997: 44-48) to estimate them for 1978-96 on the basis of data for 26 other countries, while other studies made assumptions without due acknowledgement of what income shares may have been in Indonesia. 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 the processing of the data. For the same reason it is not possible to explain in detail the differences in the results of other studies and this paper. Only in the case of Sigit (2004) is it possible to explain the discrepancy, because Sigit over-estimated capital stock growth, which he based on an estimate of capital stock from a then unpublished BPS study, extrapolated back in time with investment data. He also underestimated the share of labour income in total income by counting only wage income from Sakernas and excluding income in kind.

Several studies 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.

What does it mean that the contribution of TFP growth was only -4% during 1971-2007, and why does this result contrast with the significantly positive contribution of TFP growth in manufacturing? The results in Table 2 do not necessarily indicate that there has been no technological change in Indonesia that contributed to economic growth. There are at least two fundamental issues that make it difficult to automatically equate the residual from growth accounting with the contribution of technological change to economic growth: (1) TFP growth is estimated as a residual; (2) the paper's calculation assumes perfect elasticity of substitution of labour and capital.

Table 4: TFP Growth in Manufacturing Industry in Indonesia in Various Studies

	Study	Period	Annual average TFP growth	TFP contribution to output growth
1.	Aswicahyono *et al.* (1996: 357)	1976-91	1.4	11%*
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	35%*
5.	Osada (1994: 184)	1985-90	3.6	22%
6.	Hayashi (2005: 99, 107)	1986-96	1.9 (SMEs) 2.3 (LEs)	22% 17%
7.	Ikhsan (2006: 3 and 12)	1988-2000	1.6	16%

* These sources do not specify manufacturing output growth, which for this table is calculated from the national accounts data.
Sources: See references.

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 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 one-third of the 34% contribution of education-adjusted employment to economic growth during 1971-2007 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.

While this paper only accounted for quality changes in the labour force, there is a wide range of other factors that could be included in the process, which would yield a more intricate Denison/Maddison-type exercise to account for the proximate

factors of economic growth (*e.g.* Maddison 1987). Such factors could be related to factor inputs, such as changes in hours worked, the age-sex composition and average skills in the case of employment, or the average age of capital stock. Or they may be other factors, such as the structural change effect, economies of scale consequences, catch-up and capacity use effects, changes in trade barriers, natural resource windfalls *etc*. If it is possible to quantify these for a country like Indonesia, they would help to whittle down the unexplained residual. While this methodology presupposes the availability of a wide range of reliable quantitative data, which may be difficult to obtain for a country like Indonesia, it would get the exercise of accounting for growth closer to understanding the residual, and the degree to which the residual is related to technological change.

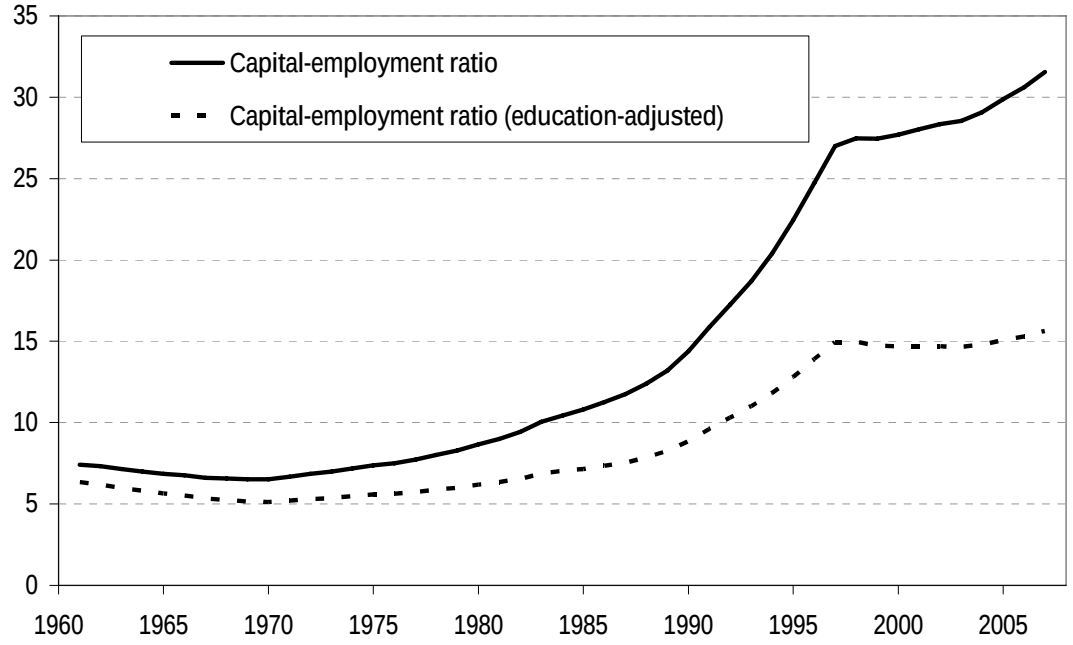
This paper's measure of TFP growth – and that of other studies as well – may be less a measure of technological change than simply an unexplained residual that comprises a wide range of factors related to peculiarities of Indonesia's business environment, many of which impacted on the efficiency of production. If so, marginal TFP growth during 1971-97 may rather reflect a multitude of inefficiencies in Indonesia's economy rather than the lack of technological change. If positive TFP growth was indeed a reflection of significant technological change in manufacturing industry, as the studies in Table 4 suggest, the inefficiencies may have largely existed in non-manufacturing sectors of the economy. 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 merely measures the residual is the fact that during 2000-07 the residual became consistently positive, explaining on average a significant 33% of GDP growth, while it had been erratic and on balance only marginally positive before 1997. Of course, capital accumulation was relatively low during 2000-07, while the growth of employment was steady. In addition, there may have been productive overcapacity by 1999 that became more efficiently used during 2000-07. 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. Likewise, new capital market regulation imposed greater discipline on listed firms. While such changes may have increased uncertainty among foreign investors about investing in Indonesia, at the same time they may have been an encouragement for domestic and foreign 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).

Secondly, and related to the first point, available growth accounting studies implicitly assume that there is perfect elasticity of substitution between labour and capital. This study did the same in Equation (5).[11] However, as Rodrik (1998: 84-8) has argued, it cannot be automatically assumed that this is the case.[12] 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 yields 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 7 shows, particularly during 1988-97. The ratio even increased for education-adjusted employment, but to a 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 7: Capital-Employment Ratio in Indonesia, 1961-2007 (million 2000 Rupiah per person)



Sources: See Figures 2, 4 and 6.

[11] In turn, this assumption is based on a range of underlying assumptions, including perfect competition (see section 4 below).

[12] An econometric approximation of factor shares during 1971-2007 for Indonesia seems to support the suggestion that the elasticity of substitution between capital and labour is imperfect. Linear multiple regression to estimate the coefficients in Equation (4) yielded 0.57 for s_k and a low 0.38 for s_l (F (2, 35) = 31.0, adjusted R^2= 0.61), adding up to 0.95 rather than 1.

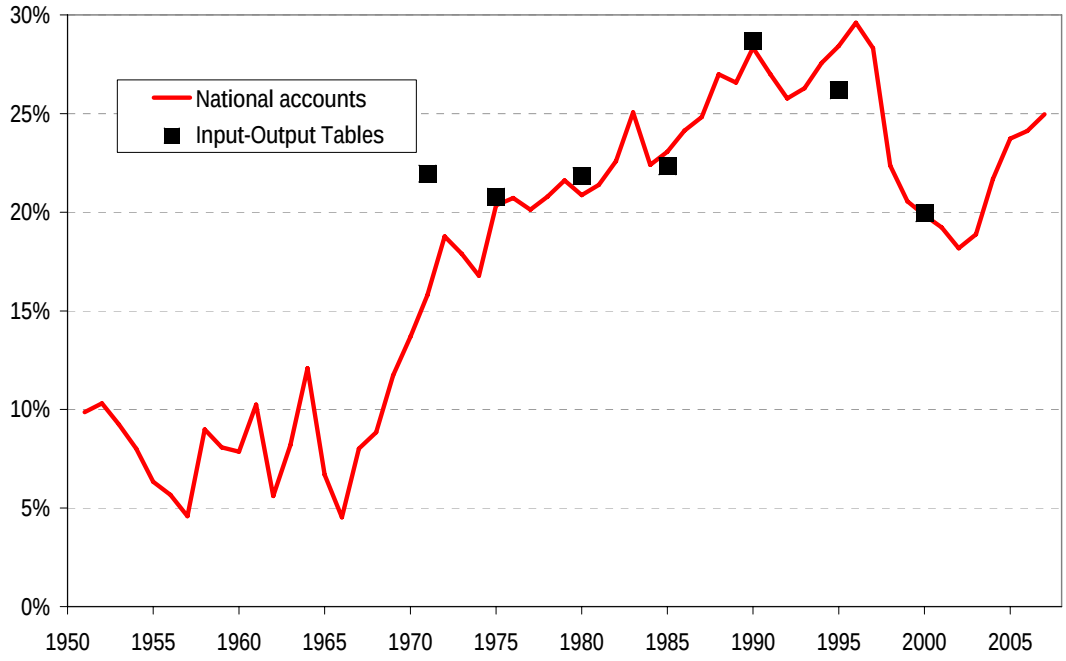
4. The contribution of investment to economic growth in recent years

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 (*i.e.* Gross Fixed Capital Formation, GFCF) has indeed increased significantly, as Figure 8 shows, from 4.5% in 1966 to almost 30% in 1996, before decreasing to 19% in 2002 and recovering to 25% in 2007. 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 criteria to gauge economic recovery from the 1997-98 crisis – which it is not, of course – Indonesia's recovery was achieved in 2005.

Despite the recovery of the investment ratio to a 'normal' level in 2005-07, 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.[13] 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, domestic firms in Indonesia are a much more significant source of investment than foreign firms. 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 post-1997 withdrawal of some Japanese firms from Indonesia, the number of Japanese subsidiary firms in Indonesia actually increased from 671 in 1999 to 698 in 2004 (Van der Eng 2007). 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.

[13] It is difficult to know the degree to which FDI into Indonesia decreased, as statistical data are incomplete (Lindblad and Thee 2007: 20-21). However, balance of payments data indicate that net FDI inflows were US$ -1.6 billion per year during 1997-2003, and US$ 5.2 billion per year during 2004-07.

Figure 8: Share of Gross Fixed Capital Formation in GDP in Indonesia, 1951-2007



Note: The ratio is calculated form current price data.
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.[14] 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;

[14] 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 and Shiraishi (2007), and the triennial 'Survey of Recent Developments' in the *Bulletin of Indonesian Economic Studies*.

- 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.

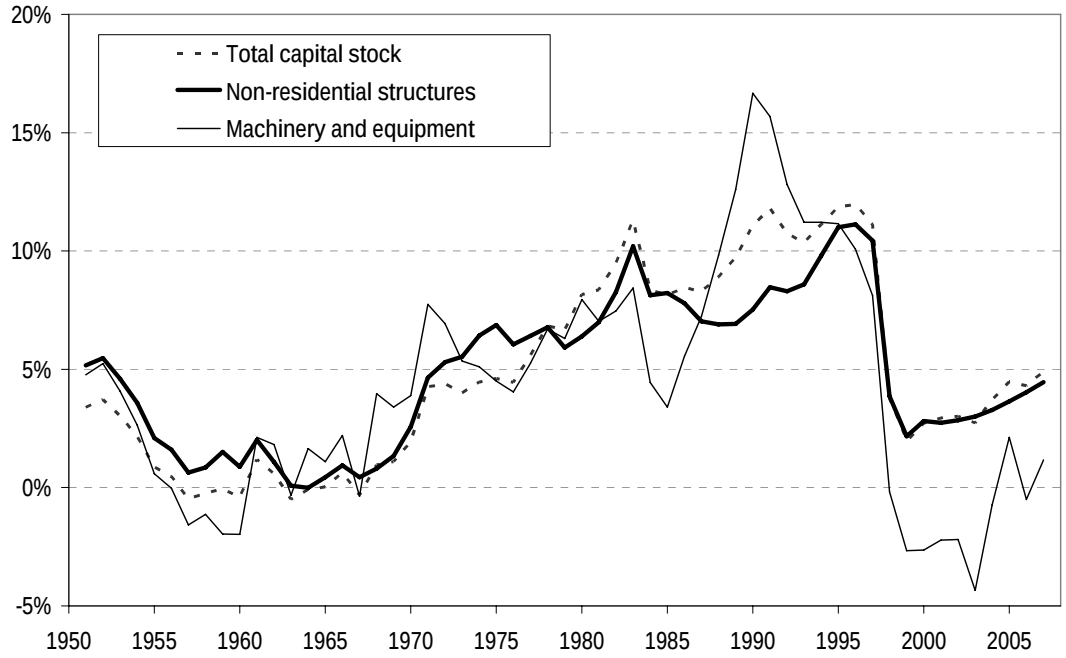
Several surveys among firms has indicated continued concerns, often reflecting the points above, but also listing issues that were already frequently mentioned as concerns before 1997. As a consequence, foreign firms with operations in Indonesia experienced new challenges, and have expressed their concerns about them, but without necessarily concluding that a withdrawing 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, which in turn may have influenced would-be new foreign investors.

For example, many international agencies place Indonesia well down the list of countries. In 2006, the Japan Center for Economic Research ranked Indonesia 45th out of 50 countries according to competitiveness (JCER 2006), while the World Bank ranked the country 135th out of 175 countries according to the 'ease of doing business' (World Bank 2006: 6). 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. Still, such rankings 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 an explanation for the country's poor FDI record. FDI inflows indeed remained low compared to inflows during the 1980s and 1990s, and 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; JICA 2007).

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 2000-07. Hence, without fresh FDI, investment rates may remain lower than what they were just before the crisis, but are unlikely to plummet to zero.

Figure 9 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, after which it plummeted to about 2.5% when investment decreased drastically. Despite the increase in the investment-GDP ratio to 25% in recent years, this ratio is not only reflects investment growth, but also the fact that real GDP has grown only modestly in recent years. Consequently, the growth of capital stock (after accounting for implicit depreciation) has only inched up to just below 5% during 2005-07. This underlines that the contribution of capital stock growth was still a significant 36% during 2000-07, as Table 2 showed, but not enough to contribute to achieving the kind of GDP growth that Indonesia experienced during 1971-97.

Figure 9: Annual Growth of Non-residential Gross Fixed Capital Stock in Indonesia, 1960-2007 (percentages)



Source: Van der Eng (2008a).

As the country achieves economic recovery, and as the dust of the economic and political uncertainties in the business environment settles and investors regain their courage, it is not implausible to assume that Indonesia will re-achieve a rate of growth of capital stock that exceeds 5% per year. Crucial to achieving this rate of growth will be the recovery of the rate of growth of the stock of machinery and equipment. This has been negative during 1998-2004, implying that investment was insufficient to compensate for implicit depreciation of capital goods.

5. Conclusion

This paper estimated TFP growth as the residual growth, after accounting for the growth of capital stock and education-adjusted employment. Residual growth was on average -0.2% during 1971-2007, contributing -4% to GDP growth. It also estimated that most of GDP growth, 70%, was explained by the growth of the capital stock and 34% by the growth of education-adjusted employment. As such, the case of Indonesia 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 growth is more likely a reflection of a wide range of factors that impact on economic growth, but that the paper has not been able to account for, rather than only productivity growth. Given that the measured residual TFP growth was marginally negative, it may reflect a range of inefficiencies that existed in the Indonesian economy and that cancelled out positive productivity growth, such as in manufacturing industry.

Support for that suggestion was found in the fact that TFP growth during 2000-07 was consistently positive, contributing 33% to GDP growth. This may indicate a reduction of these inefficiencies as a consequence of a multitude of changes in Indonesia's business environment, and possibly a shift from a development pattern away from accumulation-based growth towards efficiency-based growth. A down-side of the reduction of these inefficiencies may have been that the required regulatory changes increased the uncertainty that particularly would-be foreign investors perceived about Indonesia's business environment. At the same time, firms already in Indonesia were able to use their accumulated experience in the country in order to absorb the idiosyncrasies in the country's business environment. A reasonably high investment-GDP ratio during 2003-07 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. Addressing these concerns will be a major prerequisite for acceleration of economic growth to levels that will again make a very significant difference to employment and average incomes, as was the case in earlier decades.

The paper has indicated that the intricacies of the statistical data available for Indonesia require a cautious approach for the purpose of estimating TFP growth. It confirms the caution about interpreting TFP growth estimates that Felipe (1999) expressed in his survey of the literature on TFP growth in Asia. Given that caution, the paper underlines that the proximate results of accounting for growth are possibly useful in setting the stage for further analysis of the ultimate factors that are too often regarded as exogenous to economic growth, including the evolution of markets and the institutions that impacted on them, as well as the actual processes of innovation and technological change.

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Table A.1: Key data used in the paper, 1960-2007

	GDP (market prices)	Non-residential capital stock	Employ-ment	Educational attainment per person	Share of labour income	Annual % growth rates				
						GDP	Capital stock	Em-ploy-ment	Education Adjusted Employment	TFP
	(bln 2000 Rp)		(x 1000)	(years)	GDP (1)					
1960	201,729	239,112		1.36		4.06	-0.39			
61	211,594	242,907	32,709	1.44		4.89	1.59			
62	213,249	245,226	33,456	1.52		0.78	0.95	2.29	3.22	
63	204,692	244,472	34,225	1.61		-4.01	-0.31	2.30	3.32	
64	211,704	245,136	35,016	1.70		3.43	0.27	2.31	3.29	
1965	214,125	245,997	35,834	1.78		1.14	0.35	2.34	3.31	
66	216,123	248,497	36,672	1.87		0.93	1.02	2.34	3.35	
67	211,841	248,181	37,534	1.96		-1.98	-0.13	2.35	3.30	
68	234,102	251,953	38,430	2.05		10.51	1.52	2.39	3.39	
69	262,505	256,081	39,318	2.13		12.13	1.64	2.31	3.31	
1970	289,556	262,527	40,279	2.21		10.30	2.52	2.45	3.36	
71	306,102	275,898	41,261	2.28	45.0%	5.71	5.09	2.44	3.15	1.50
72	339,775	290,237	42,377	2.33	51.7%	11.00	5.20	2.70	3.28	6.79
73	388,839	303,973	43,523	2.39	46.7%	14.44	4.73	2.70	3.39	10.34
74	403,867	319,723	44,486	2.45	37.3%	3.86	5.18	2.21	2.94	-0.48
1975	403,132	336,548	45,726	2.52	39.3%	-0.18	5.26	2.79	3.60	-4.79
76	440,898	352,766	47,000	2.61	46.9%	9.37	4.82	2.79	3.71	5.07
77	474,478	372,879	48,310	2.70	50.7%	7.62	5.70	2.79	3.86	2.85
78	498,220	397,876	49,657	2.81	54.1%	5.00	6.70	2.79	3.99	-0.23
79	523,661	422,664	51,041	2.92	47.5%	5.11	6.23	2.79	4.09	-0.11
1980	569,993	454,022	52,421	3.05	38.2%	8.85	7.42	2.70	4.18	2.67
81	603,877	488,314	54,294	3.18	38.2%	5.94	7.55	3.57	5.09	-0.67
82	582,523	530,510	56,238	3.32	42.5%	-3.54	8.64	3.58	5.14	-10.69
83	601,351	585,571	58,254	3.45	38.9%	3.23	10.38	3.59	5.17	-5.12
84	643,954	629,553	60,347	3.59	39.7%	7.08	7.51	3.59	5.14	0.51
1985	661,993	675,304	62,519	3.74	44.4%	2.80	7.27	3.60	5.34	-3.61
86	702,617	729,207	64,774	3.89	52.4%	6.14	7.98	3.61	5.29	-0.44
87	739,212	789,059	67,114	4.03	51.0%	5.21	8.21	3.61	5.24	-1.49
88	783,522	861,529	69,543	4.16	52.8%	5.99	9.18	3.62	5.14	-1.05
89	855,043	950,963	72,064	4.29	48.7%	9.13	10.38	3.63	5.04	1.35
1990	932,355	1,070,367	74,396	4.42	47.0%	9.04	12.56	3.24	4.75	0.16
91	980,988	1,206,918	76,137	4.55	47.5%	5.22	12.76	2.34	3.88	-3.32
92	1,088,305	1,345,078	77,928	4.69	49.6%	10.94	11.45	2.35	3.87	3.25
93	1,166,327	1,491,961	79,768	4.82	49.1%	7.17	10.92	2.36	3.90	-0.30
94	1,255,025	1,665,387	81,660	4.96	52.5%	7.60	11.62	2.37	3.92	0.02

	GDP (at market prices)	Non-residential capital stock	Employ-ment	Educational attainment per person	Share of labour income in GDP	Annual % growth rates				
						GDP	Capital stock	Em-ploy-ment	Education Adjusted Employment	TFP
	(bln 2000 Rp)		(x 1000)	(years)						
1995	1,356,565	1,870,200	83,311	5.10	51.3%	8.09	12.30	2.02	3.63	0.24
96	1,459,622	2,101,457	85,003	5.24	47.0%	7.60	12.37	2.03	3.59	-0.64
97	1,525,511	2,342,447	86,738	5.38	43.5%	4.51	11.47	2.04	3.68	-3.56
98	1,321,365	2,432,764	88,517	5.52	28.4%	-13.38	3.86	2.05	3.64	-17.18
99	1,326,026	2,480,787	90,342	5.66	50.9%	0.35	1.97	2.06	3.56	-2.29
2000	1,389,771	2,550,632	92,059	5.78	46.9%	4.81	2.82	1.90	3.31	1.76
01	1,442,985	2,629,659	93,818	5.88	48.1%	3.83	3.10	1.91	3.01	0.77
02	1,504,381	2,712,872	95,738	5.97	52.2%	4.25	3.16	2.05	3.05	1.15
03	1,577,171	2,788,177	97,689	6.06	56.9%	5.00	2.78	2.04	3.02	2.08
04	1,655,517	2,899,091	99,665	6.14	56.9%	4.89	3.98	2.02	2.98	1.45
2005	1,750,656	3,037,607	101,652	6.23	56.9%	5.66	4.78	1.99	2.95	1.85
06	1,847,293	3,172,832	103,635	6.30	56.9%	5.52	4.45	1.95	2.84	1.91
07	1,963,974	3,333,858	105,632	6.38	56.9%	6.32	5.08	1.93	2.78	2.45

Sources: see the main text.

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