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Abstract

This paper presents long-term estimates of gross fixed capital formation for 1951-2007 that are disaggregated by categories of productive assets. These data, combined with approximations of probable average asset lives and a feasible asset retirement method are used in a Perpetual Inventory Method to estimate gross fixed capital stock in Indonesia for 1950-2007 disaggregated by productive assets. Most of Indonesia's capital stock long consisted of residential and non-residential structures. Total capital stock grew significantly since the late-1960s at about 10% per year, until the 1997-98 economic crisis. The high capital-output ratio in 1997 suggests that part of Indonesia's high economic growth during the 1990s was due to unsustainable resource accumulation.

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Capital Formation and Capital Stock in Indonesia, 1950-2007

1. Introduction

What is the stock of capital goods in Indonesia and to what extent has it contributed to the generation of output and income in the country? These questions were long difficult to answer because of the lack of good estimates of Indonesia's capital stock. Statistics Indonesia (*Badan Pusat Statistik*, BPS) has published Indonesia's national accounts annually since the 1960s, but it does not publish official estimates of capital stock. There are crude capital stock estimates in the academic literature, while sophisticated estimates of capital stock were also made in recent years at BPS and at Bank Indonesia (BI), the country's central bank (BPS 1996; Yudanto *et al.* 2005). However, as will be explained below, these estimates are imperfect. The estimates at BPS and BI served to gauge the degree to which the Indonesian economy suffered from productive overcapacity since the 1997-98 crisis in the light of low post-crisis rates of economic growth. They were not made for the purpose of times series analysis of productivity change and the contribution of capital to long-term economic growth in Indonesia, and there are no indications that this work will be continued.

This paper builds on the capital stock estimates made at BPS and BI. It discusses the construction of consistent long-term estimates of Gross Fixed Capital Formation (GFCF) for 1951-2007 that are disaggregated by categories of productive assets. The paper also explains how these data are then combined with approximations of probable average asset lives and a feasible asset retirement method in a Perpetual Inventory Method to estimate Gross Fixed Capital Stock (GFCS) in Indonesia for 1950-2007, disaggregated by productive assets. The estimation process relies on informed decisions and assumptions, as well as underlying data that are not necessarily entirely accurate. Throughout the discussion, the paper will explain the decisions and assumptions, as well as the accuracy of the underlying data, in a transparent manner. This will serve the purpose of fostering further research and as well as the analysis of the findings.

Section 2 discusses the relevance of capital formation in economic growth. Section 3 considers previous research into estimating capital formation and capital stock in Indonesia, in particular the shortcomings in this research. Section 4 discusses briefly how in broad terms investment was financed. Section 5 then explains the basic steps taken to estimate capital formation during 1951-2007. Section 6 describes how these estimates were then used to estimation of capital stock during 1950-2007. Section 7 discusses the results of the estimates in section 6 and compares them with a rough estimate for 1940. Section 8 concludes.

2. Relevance of the estimates: Capital formation in economic growth

A country's capital stock comprises all durable, reproducible, tangible, fixed goods that are used in the production of other goods and services. They are durable if they last for more than one year. Capital stock includes residential and non-residential structures, transport equipment, and machinery and other equipment. Not included are non-reproducible assets such as natural forests, land and mineral deposits. Also excluded are intangible assets such as patents, software and property rights. The fact that capital stock is fixed implies that inventories of final products and intermediate goods are excluded. Military goods are also excluded. A country's capital stock accumulates over the years as a consequence of annual investments by companies and governments in the assets it comprises. The productive use of these assets contributes to the generation of output and income in a country's economy.

A low rate of investment in capital formation, caused by either limited savings or restricted access to foreign sources of investment funds, has been identified in the literature on economic growth as one of the main impediments to economic development. Especially during the 1950s, low savings rates and low rates of capital formation were widely regarded as the prime bottleneck in economic development (Abbas 1955: 5). At that time, development economists such as W.W. Rostow suggested that a sudden increase of the Capital-Output Ratio (COR) marked an initial phase in a country's economic development, which in the past had lifted now-developed countries out of stagnation and into a phase of self-sustaining economic growth during which the COR increased further.

Later studies indicated that now-developed countries actually offer little evidence that the COR has moved in any specific direction over time (Kuznets 1963; Ohkawa 1984; Le Thanh 1988). Kuznets (1964: 41) maintained that the contribution of the increases in the stock of labour (unweighted by skill and education) and capital (reproducible and non-reproducible) to the increase of per capita income over long periods in the major developed countries ranged only between 15-20%, and concluded: 'By far the major proportion in the course of modern economic growth must be attributed to changes in skill, education, and so on, of the labour force, or to other sources of the large increase in productivity per man-hour combined with the unit of material capital - and not to any increase in inputs per head.' Other authors, including Kendrick (1993), noted that improved efficiency in the use of resources and the movement of resources from less productive to more productive sectors were more important for sustained long-term economic development than capital formation.

Although the contribution of capital formation to overall economic growth may possibly be more limited than initially thought, there are still good reasons to approximate it. Particularly the process of technical change in manufacturing tends to be characterised by an increasing use of capital goods in the production process, because they facilitate a sustained increase in output per worker. Maddison (1991: 41) pointed out that, even though the COR may not increase very significantly, economies do devote an

increasing proportion of GDP to investment in capital goods during the process of economic development. Fast growing economies generally do use a greater share of total expenditure for capital formation than countries with low growth rates of output.

The role of capital formation in early phases of development should not be overestimated. It is easy to see that in the early phases of development immediate changes in the major economic sectors of developing countries do not require large-scale capital formation, for instance in agriculture, trade, crafts and small industries. As far as historical evidence goes, much of capital-intensive public infrastructure (roads, railways, etc.) was developed in the course of economic development, not prior to it. Viewed in that light, a higher rate of capital formation is perhaps not a precondition for economic development, but is certainly concomitant to that process.

Establishing the degree to which capital formation contributed to long-term economic growth depends crucially on the availability of both national accounts data and estimates of capital stock. This is not the case for all countries, including Indonesia. While national accounts data are often available, capital stock data that are consistent over time and across countries are limited. Maddison (1995) summarised the development of efforts to measure capital stock since the 1940s. Significant advances for individual now developed countries, such as the USA, UK, Germany and Australia, greatly enhanced the quantitative analysis of economic growth in those countries. Since the 1980s, the Organisation for Economic Cooperation and Development (OECD) has been instrumental in fostering and standardising the estimation of capital stock across countries (Blades 1983, 1993; OECD 2001). Economic historians have added retrospective estimates of capital stock to facilitate the analysis of long-term economic growth for countries such as The Netherlands (Groote *et al.* 1995) and Spain (Prados and Rosés 2008).

Such advances largely bypassed less-developed countries, where the unavailability of suitable data long prevented the consistent estimation of capital stock. Retrospective estimates of capital stock have been made based for a few countries on the basis of reconstructions of GFCF. As a consequence, long-term estimates of capital stock are now available for *e.g.* India (Sivasubramonian 2004: 134-148) and Korea (Kim 2008: 329-331), while the statistical authorities of for example India and Thailand now publish estimates of capital stock, in these cases reaching back to 1950 and 1982 respectively.

For most other less-developed countries estimates of capital stock that take account of all available relevant data are still not available. Substitute indicators have been used since the 1950s to gauge the contribution of capital formation to economic growth. An example is the Incremental Capital-Value Added Ratio (ICVAR), or the Incremental Capital-Output Ratio or Marginal Capital-Output Ratio, *i.e.* the ratio of the increase in GFCF during a year relative to the increase in GDP during the same year. Although of some relevance, the ICVAR can vary considerably from one year to the next, and such fluctuations are difficult to interpret. Other studies created their own estimates of capital stock for the purpose of multi-country quantitative analysis of economic growth. on the

basis of available GFCF data and arbitrary estimates of depreciation (*e.g.* Nehru and Dareshwar 1993; King and Levine 1994) While these estimates are still widely used in further multi-country studies of economic growth, a discussion of their results for Indonesia below will show that these estimates are crude and that considerable caution should be take in using them, despite the convenience of their availability. Others also reached this conclusion. For example, Bu (2006) has argued that the assumed single depreciation rates of fixed assets in such studies are unrealistic.[2]

National accounts do not normally include estimates of capital stock. However, they do include in principle key ingredients that can be used to estimate capital stock, particularly: (1) GFCF or investment (*I*), the annual addition to the capital stock (*K*), and (2) depreciation (*D*), which according to the UN's *1993 System of National Accounts* consists of both (a) the annual loss of value of capital stock due to wear and tear, or aging, of capital goods, reflecting the decline in the relative efficiency of each vintage of a capital good as it ages, and (b) foreseen obsolescence, or the scrapping of capital goods over their service life.

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

To estimate time series of *K*, all that is needed are an estimate of the initial *K* and time series of *I* and *D* (at constant prices), all ideally disaggregated by types of capital goods and possibly by industry.

Due to the absence of wealth surveys that offer an estimate of initial *K* in many countries, an indirect method, the Perpetual Inventory Method (PIM), is often used to approximate initial *K* and the growth of *K*. It is also the recommended method in the *1993 System of National Accounts*. Apart from times series of *I*, the method uses assumptions about the productive life of different categories of capital goods, as well as the method of depreciation that best approximates the typical pattern of the loss or efficiency as well as retirement of the different categories of capital goods.

The data that inform the assumptions about capital goods retirement are generally collected in the form of surveys into the service life and depreciation of productive assets. However, for many countries such surveys have not been conducted, or relevant secondary data on which estimates of both can be based are not available. In addition, the national accounts do not generally offer data on *I* and *D* disaggregated by types of capital goods and industries. Consequently, multi-country studies that created estimates of capital stock on the basis of available GFCF data were forced to make arbitrary assumptions in order to be able to use the PIM, which necessarily made the results unrealistic where the assumptions about initial capital stock and *D* deviated considerably from the actual situation.

2. At the same time, the estimated depreciation rate of fixed assets in Bu (2006) for Indonesia in 1997-98 of 84% is unrealistic as well. It is most likely a consequence of Bu's use of company accounts during Indonesia's economic crisis to estimate depreciation. Many Indonesian firms are likely to have opted for accelerated depreciation of their assets for accounting purposes during these years of high inflation.

3. Estimates of capital formation for Indonesia

The role of capital formation and the measurement of capital formation in Southeast Asia received considerable attention in the 1950s and 1960s. At the time, debate indicated that the available statistical evidence on low rates of saving and capital formation was actually very weak, due to underdeveloped national accounting procedures. It was also pointed out that published rates of capital formation were based on investment in equipment and buildings and often ignored capital formation in agriculture and small-scale industries.[3] In this respect, the inclusion and valuation of farm structures was deemed important, because of the relative size of the agricultural sector and the fact that structures generally have a much higher capital-output ratio than equipment and machinery.

In Indonesia, the need to measure capital formation in Indonesia increased in the early 1950s, largely as part of the process of macro-economic planning at the former State Planning Bureau (*Biro Perancang Negara*, BPN), which would culminate in the first Five-Year Plan for 1956-60. A large part of the early work at BPN focused on identifying ways to spur the rate of capital formation in order to achieve a rate of investment that would propel Indonesia's 'take-off' into sustained economic growth (*e.g.* BPN 1957: 496-506, Mears 1961: 39-43). National accounting was still in its infancy and information on Indonesia's financial system was incomplete (Reksopoetranto 1960). The first estimates of GFCF and depreciation for national accounting purposes[4] during the 1950s were necessarily rough and incomplete (Paauw 1960: 84-90).[5] Imports of capital goods were the core of these estimates. They were multiplied by a rough estimate of the degree to which such goods were produced domestically, to which an approximation of 'village investment' was added (BPN 1957: 496-504). Depreciation was assumed to be a fixed rate of 3% of Net Domestic Product.

BPS was given responsibility for the compilation of national accounts in 1960, which included making new estimates of GFCF. The exact procedures BPS used are not known, but the BPS estimates for 1958-59 were significantly higher than the estimates made at BPN for the same years.[6] BPS has since generated and published estimates of GFCF in current and constant prices since 1958, which underwent several revisions, coinciding with changes in the benchmark years used for the calculation of constant price series: 1958-73 in 1960 prices, 1971-83 in 1973 prices, 1983-93 in 1983 prices, 1988-2003 in 1993 prices, and

3. Abraham (1958, 1967), Oshima (1961), Hooley (1964, 1967) and Ramamurti and Pedersen (1965) discussed the statistical inaccuracies and differences in concepts used in the estimation of GFCF and capital stock in Asia in the 1950s and 1960s.

4. As will be explained below, depreciation for national accounting purposes refers only to the scrapping or retirement of capital goods.

5. See *e.g.* estimates for 1951-52 Neumark (1954: 354-55) or 1951-55 (BPN 1957: 496-506; Muljatno 1960: 165-66, 189). The latter are the same as in the 1951-59 estimates (Joesoef 1973: p.32; ECAFE 1964: 211) made at the successor of BPN, the Bureau of Finance and Economics (*Biro Keuangan dan Ekonomi*, BKE) at the State Secretariat (*Sekretariat Negara*). BKE continued work on Indonesia's national accounts after BPN ceased to exist in August 1959 (Interview with Professor Mulyatno Sindhudarmoko, 5 February 2005).

6. For example, where BKE estimated GFCF in 1958 at 8.2 billion Rupiah, BPS estimated 19.8 billion Rupiah. 1958-59 from BPS (1969); 1960-68 from Sudirman (1972) and BPS (1970).

2000-07 in 2000 prices.[7] These revisions involved a change of the benchmark year for the constant prices series, as well as upward revisions of GFCF.

Apart from disclosures that BPS has estimated GFCF on the basis of the commodity flow method, BPS has not formally published the procedures it used to estimate GFCF. It therefore remains unclear what the reasons for the revisions of GFCF and what the changes in methodology have been. The commodity flow method to estimate GFCF is commonly used in national accounts and essentially involves allocation of output and imports of each individual good to final consumption, GFCF, inventories or export on the basis of direct surveys of enterprises and administrative records. An unpublished BPS note suggests that a more intricate method was used since 1958 (BPS 1969). In essence, during the 1960s imports of construction materials and machinery and equipment remained an important component, but these data were augmented with administrative data on the production and use of construction materials, as well as production data of machinery and equipment from the annual survey of manufacturing and the 1963 Census of Manufacturing to cover production by small and medium sized firms. Similar information about later procedures to estimate GFCF is not available. It is likely that BPS used the results of the Input-Output (I-O) Tables for that purpose, although the first of these with disaggregated data on GFCF was not published until 1977 (IDE 1977).[8]

As a consequence of using the commodity flow method, BPS does not distinguish between GFCF in the public and private sectors. In addition, given that BPS long estimated household expenditure as a residual, it seems likely that GFCF by households and small unincorporated enterprises are either not or imperfectly included. Lastly, BPS assumed that depreciation was a simple fixed and flat rate of 5% of GDP.[9]

Figure 1 shows that GFCF increased quickly from an average level of 7.5% until the mid-1960s to an average of 24% in the 1980s and a significant average of 27% in the 1990s until the 1997-98 crisis. It only recovered from this set-back in 2007 when it reached 25%. The comparison with data from the I-O Tables shows that GFCF may have been significantly underestimated in the early 1970s, as Table 1 confirms for 1971, 1975 and 1980. Table 2 reveals that most of GFCF according to both sources was for structures, machinery and equipment, and transport equipment.

4. The financing of capital formation in Indonesia

How was GFCF financed? Indonesia's published national accounts do not offer details on this, but a rough indication can be given based on Equation 2. The equation specifies that GFCF (I) equals the sum of domestic savings by households and private companies (S^{HC}),

7. Indonesia's national accounts do not use chain-linking in the estimation of deflators.
8. The first 1969 I-O Table was published in 1973 (Leknas-Kyodai 1973), but BPS was not formally involved in its creation.
9. Although the implicit depreciation rate during 1960-1983 was 6.5%. Neumark (1954) also assumed 5%, while BPN/BKE assumed 3% in the 1950s (Muljatno 1960: 164).

government saving (S^G) including savings by state-owned enterprises, external borrowing for private investment (X) and net foreign investment (F).

$$I_t \equiv S_t^G + X_t + S_t^{HC} + F_t \qquad \text{(Equation 2)}$$

Domestic savings are normally an important source of finance. They take the form of liquid assets such as bank deposits, purchases of shares and bonds, or relatively liquid assets such as gold, jewellery and collectibles, or less-liquid assets such as land, livestock, durables and real estate. A developed financial system serves the purpose of mobilising and concentrating savings in the form of liquid assets. Post-war statistical information on the activities of financial institutions was long incomplete, as it excluded small financial firms and non-bank financial firms. Still, savings and time deposits in the formal financial system were only 0.5 to 0.8% of GDP during 1953-57 (Reksopoetranto 1960: 14-16).

Table 3 shows estimates of the contribution of the main sources of savings to GFCF, expressed as a percentage of GDP in current prices. In absence of detailed information, total government investment was estimated at one-third of GFCF.[10] This would have been largely in infrastructure and financed on the basis of government savings and foreign aid and borrowing. Bank Indonesia exerted strict control over Indonesia's capital account until the early 1990s and most foreign borrowing was government-guaranteed, and most of it used for investment purposes rather than to finance current government expenditure. This item is therefore grouped together with government saving, which is the remainder.

Private foreign direct and portfolio investment are on balance of payments basis. Foreign direct investment (excluding re-invested earnings of foreign-owned firms in Indonesia) and portfolio investment in Indonesia's private enterprise were both low during the 1950s and 1960s, increased during the 1970s, and particularly the early 1990s in the wake of the lifting of restrictions on foreign investment. Foreign investment turned negative in the wake of the 1997-98 economic crisis, when foreign investors called in their short-term loans to Indonesian firms and divested their shares in Indonesian companies. Some foreign firms sold their assets in Indonesia and departed.

Table 3 confirms that domestic savings have been the most important source to finance GFCF. Term and savings deposits are the deposits at all financial institutions that reported to Bank Indonesia, the coverage of which improved over time. Bank deposits remained very low during the 1960s, but rose to an average of 35% of GDP since 1990. This confirms that in the 1950s and 1960s saving in the form of bank deposits was very low and that most savings took other forms of which no comprehensive records exist. Indonesia's equity market was very small in the 1950s. In terms of market capitalisation, it remained modest up to the mid-1990s. It is not known what proportion of credit extended by the

10. The only estimates of public capital formation are for 1981-99 (Everhart and Sumlinski 2003). They suggest an average share of 34% public investment. For 1951-59, BPN/BKE data showed a 32% average share of public investment (Joesoef 1973: p.32), but this most likely underestimated private sector investment.

formal financial sector on the basis of received deposits and own capital was used to finance investment rather than current operations and investment in inventories. The banking sector was from the late-1950s until the early 1990s dominated by state-owned banks that concentrated on lending to state-owned enterprises. It is therefore likely that – as in the 1950s (Paauw 1960: 94-100) – GFCF by private firms was largely in two forms: (a) household savings for investment in small-scale enterprises; (b) reinvested past and current earnings for other firms.[11] The negative net savings by households and companies shown in Table 3 since 1990 can be understood as a consequence of the deregulation and subsequent development of the financial sector since the late-1980s (Cole and Slade 1996). Increased competition in the financial sector may have enhanced the attractiveness of time and savings deposits. On a net basis, private firms thus started to draw more on borrowing from financial institutions rather than reinvested earnings to finance their investments.

5. Estimates of capital stock for Indonesia

Unlike other countries, a wealth survey on which capital stock estimates could be based does not exist for Indonesia.[12] The usefulness of wealth surveys can be queried for the purpose of quantitative studies of economic growth, because they tend not to correct the value of capital goods for the lower productive capacity of older vintages. Still, it is generally useful to use the results of such surveys as a comparator for the results of other approaches, such as the PIM (*e.g.* Prados and Rosés 2008: 10-11), particularly when these results are based on approximated historical GFCF data.

The BPS estimates of capital formation in constant prices have been used to estimate capital stock. Sundrum (1986: 55, 68) was the first to use GFCF and depreciation from the national accounts to extrapolate a rough guess of total net capital stock in 1960 to generate a net capital stock series for 1960-81 in 1973 prices.

Keuning (1988, 1991) offered an intricate estimation procedure. He estimated aggregate GFCF for three types of capital goods (structures, imported and domestically produced machinery) during 1953-85 by linking data from the national accounts and other sources and scaling them up to match the 1971 I-O Table and the 1975 and 1980 Social Accounting Matrices. He estimated Gross Value Added (GVA) for 22 industries during 1953-80 in a similar way and then used the 1980 I-O Table to achieve an allocation of GFCF during 1975-85 to 22 industries. Combining the GFCF and GVA estimates yielded ICVARs for 1975-80, which Keuning then combined with the estimates of GVA in 1980

11. This was also the main way in which privately owned foreign companies in colonial Indonesia were financed. Van der Eng (1998: 309) estimated that at least two-thirds of foreign-owned assets in 1938 had beeen financed with re-invested profits during 1820-1938.

12. Since 1948, the Financial Audit Board (*Badan Pemeriksa Keuangan*) and its predecessors estimated the book value of government-owned assets (structures, public works, state-owned companies, military assets etc.) in Indonesia (Teulings 1953: 186). However, only the results of the 1949 survey have been published, see Ek (1950).

prices to estimate GFCF in 1980 prices for 22 industries by three types of capital goods for 1953-85. These he then used to estimate GFCS for 1975-85 on the basis of a PIM.

While intricate and ingenious, Keuning's study resulted in COR estimates for the whole economy that were high in retrospect: 2.2 in 1975, rising to 2.8 in 1985. Extrapolation of Keuning's GFCS estimates on the basis of total GFCF and depreciation from the national accounts resulted in an implausible COR of over 3.9 by 1999 (Van der Eng 2002: 148-52, 174-75). Even after correcting GDP before 2000 for the degree of underestimation found in the 2000 revision of Indonesia's national accounts (Van der Eng 2005), the COR remains implausibly high. Keuning's methodology may have overestimated GFCS, either because his assumed productive life of assets (45 years for construction and 22.5 years for machinery and equipment) was too long or possibly also because his 1975-85 ICVARs and therefore his estimates of 1953-85 GFCF and of GFCS were too high.

As part of their multi-country studies, Nehru and Dareshwar (1993) and King and Levine (1994) used data on GFCF in Indonesia reported by international agencies to construct estimates of capital stock in constant prices using a PIM approach, while others have used these estimates to extend them to later years, *e.g.* Collins and Bosworth (1996). None of them took account of inconsistencies and the underestimation in these GFCF data, while their assumptions about the average service life of capital goods were largely arbitrary. The resulting capital stock estimates should therefore be treated with considerable caution.

BPS and Bank Indonesia made elaborate estimates of capital stock. In an unpublished study, BPS estimated gross and net fixed capital stock in current and 1993 prices for 1980-94 (BPS 1996, 1997). The methodology consisted of first disaggregating GFCF from the national accounts into the relevant categories of capital goods identified in the 1980, 1985 and 1990 I-O Tables, interpolations of these benchmark years and then using a PIM and assumptions about the average service life of capital goods and the retirement function of these goods to estimate GFCS. However, due to the very short time span of the GFCF, the fact that the study did not use an initial capital stock in 1980, and the chosen method of depreciation, the implicit rate of depreciation was too high in 1981 and too low in 1994, and the result not usable.

Sigit (2004: 101-103, 124-125) considered this BPS report for his study into Total Factor Productivity growth in Indonesia, but decided against using it. He used existing GFCF series for 1960-2000, albeit corrected for consistency and underestimation, to estimate total GFCS in 1993 prices for 1975-2000 on the basis of a PIM. He assumed an average service life of productive assets of 15 years and depreciation to be 3%. He then allocated GFCS to 9 economic sectors on the basis of BPS (1996) for 1980-1994, extrapolating 1995-2000 on the basis of regressions. The resulting sectoral estimates of GFCS are necessarily crude.

A research team at Bank Indonesia estimated gross and net fixed capital stock in 1993 prices for 1960-2002 (Wicaksono 2002; Wicaksono and Ariantoro 2003; Yudanto *et al.* 2005). It used a similar approach as BPS, but included results from the 1995 and 2000 I-O

Tables. The team interpolated the GFCF benchmark years from the I-O Tables to obtain a new time series of GFCF for 29 capital goods during 1980-2000. It then apportioned GFCF to 9 categories of capital goods and to 10 economic sectors on the basis of the I-O tables to generate disaggregated GFCF data in current prices. The current price series were then combined with assumptions of average life of 9 capital goods and assumptions about their retirement, in order to produce estimates of capital stock in current prices. Wholesale price indices for the 9 different categories were then used for deflation and the creation of series in constant 1993 prices. As the longest time span of assets was assumed to be 20 years (for buildings), the first 'complete' estimate of capital stock was for 1999. That year was extrapolated on the basis of a 'gross-up' method, first for 1980-1998 and then for 1960-1979.

These Bank Indonesia estimates offer a viable methodology, although they still contain a few shortcomings, such as:

1. Underestimation of GFCF. Saleh (1997: 4) noted that the BPS estimates of GFCF are incomplete, as they only cover the acquisition of domestically produced new capital goods and new and used imported capital goods (all estimated on the basis of the commodity flow method). Estimates of GFCF therefore exclude investment in cultivated assets, particularly in agriculture, such as perennial crops and livestock.[13] They also exclude new investment for the improvement of existing assets (such as roads and other existing infrastructure). Nor is the disposal of capital goods through exports (*e.g.* ships and aeroplanes) accounted for. Another problem is that the use of various materials in the construction industry, such as steel and electrical equipment, is not fully accounted for (Rachman 2004: 2, 4).
2. 1980 starting point. The choice of 1980 as the starting point for the study ignores information available from the 1971 and 1975 I-O Tables.
3. Methods. The 'gross-up' method and the methods used to allocate GFCF to types of capital goods and to economic sectors are not unambiguously explained and are therefore not immediately replicable.
4. Average asset life. Estimates of average asset lives were obtained from BPS, which in turn attained them from Decrees of the Minister of Finance of Indonesia (No.961/1983 and 826/1984 on taxation) containing allowable rates of depreciation for accounting purposes for broad asset groups (BPS 1996: 3, 5; BPS 1997: 3).[14] The experience of

13. Hooley (1967: 202) already noted this as a serious omission in GFCS estimates in less-developed countries. The coverage of investment in livestock is incomplete in the I-O Tables and non-existent in the national accounts. Investment in perennials is not covered at all. A major prerequisite for the analysis of long-term economic growth in Indonesia would be the estimation of capital formation and capital stock in agriculture, given the prominence of the agricultural output in the economy until the 1970s. Possible methodologies are outlined in Shukla (1965) and Nomura (2006).

14. The Indonesian government simplified its tax system in 1984 (with further changes in 1995 and 2000) with Law No.7/1983, which gave depreciation rates for buildings and 4 asset groups by useful life (Uppal 2003: 20-21, 157-158). Further regulations (*e.g.* No.961/KMK.04/1983) interpreted these rules. The latest regulation, Decree of the Minister of Finance (*Keputusan Menteri Keuangan*) No.138/KMK.03/2002, specified a range of specific assets in each of these 4 groups. Neither the Indonesian accounting standards issued by the Indonesian Institute of Accountants (*Pernyataan Standar Akuntansi Keuangan* (PSAK),

other countries has indicated that tax office estimates of depreciation do not always resemble true asset lives (see *e.g.* Lützel 1977: 69; Blades 1983: 5; OECD 2001: 47-48). Indonesia is not likely to be an exception. For example, the Indonesian taxation rules allow companies in capital-intensive industries to employ accelerated depreciation rates relative to other countries (Gordon 1998: 25). Indeed the average asset lives used by BPS and Bank Indonesia are very low compared to those of other countries (see *e.g.* Blades 1993). Consequently, both may have underestimated capital stock.

While it cannot take account of the first point, this paper will address the issues raised under points 2-3 in the next section.

6. New estimates of Capital Formation and Capital Stock

Having discussed the available data and estimates in sections 3 and 5, this paper will now present new estimates of GFCF in 2000 prices for 1951-2007, which will be apportioned to 28 types of capital goods on the basis of the I-O Tables. Assumptions about asset lives and a simple PIM will then be used to aggregate the GFCF data and estimate GFCS. Unfortunately it is not possible to apportion GFCF also to key sectors. While the published I-O Tables specify the economic sector delivering the different types of capital goods, they do not identify the economic sector for which the capital goods are destined. Unlike Keuning (1988, 1991), BPS (1996) and Yudanto *et al.* (2005), we did not have access to the unpublished I-O data that would have identified the destination.

6.1 Re-estimating Gross Fixed Capital Formation, 1951-2007

The following steps were taken to re-estimate GFCF:

a. Creation of a (single) GFCF price index by linking the implicit deflators of GFCF from the national accounts for 1951-58, 1958-71, 1971-83, 1983-88, 1988-2000 and 2000-07 to form a new price index with 2000 = 100 for 1951-2007.
b. Interpolation of total GFCF from the benchmark years of the I-O Tables for 1971, 1975, 1980, 1985, 1990, 1995 and 2000 with growth rates of GFCF in current prices from the national accounts in order to correct for underestimation of GFCF in the national accounts, particularly in 1971, 1975 and 1980, as Table 1 showed.[15] This yields a new time series of total GFCF 1971-2000 in current prices.
c. Deflation of total GFCF with the GFCF price index from step a. to form a new time series of total GFCF 1971-2000 in 2000 prices.

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particularly No.46 *Standar Akuntansi Pajak Penghasilan*), nor the Indonesian public service accounting standards (*Standar Akuntansi Pemerintahan Peryataan*, particularly No.07 *Tentang Akuntansi Aset Tetap*) propose depreciation rates for specific types of assets. The first set of standards has no legal grounding, so that there is no legal obligation on companies to follow them. However, a cursory check of the financial statements of some major public companies in Indonesia suggests that they follow the tax rates.

15. The 1969 I-O Table was not used, because it did not offer a comparable breakdown of GFCF.

d. Extrapolation of total GFCF in 2000 prices for 1951-70 with growth rates of GFCF in constant prices from the national accounts for 1958-71 and from Joesoef (1973: 32) for 1951-58, to create a series of total GFCF 1951-2007 in constant 2000 prices.
e. GFCF was apportioned to 28 categories of capital goods for 1971-2000 by using the interpolated shares shown in Table 4 for the benchmark years of the I-O Tables and GFCF from step d. Table 4 shows that most GFCF was in the form of structures. Its share increased from 53% in 1971 to 76% in 2000. To the detriment of the share of machinery and equipment which decreased from 41% to 21%.
f. Extrapolation for 1958-70 of the total of categories 7-20 and 21-26 on the basis of GFCF in 1960 prices in 'construction and works' and 'machinery and equipment' from BPS (1969), Sudirman (1972), BPS (1970), Donges *et al.* (1973: 212). Deduction of these two groups from the GFCF series for 1958-70 from d. created the group 'other'. The results were then allocated to individual categories in these 3 groups, on the basis of their 1971 shares shown in Table 4.
g. Extrapolation of 1951-57 CFCF from d. by using 1958 shares of the 28 categories from f.
h. Extrapolation for 2000-07 GFCF in the 4 groups of capital goods shown in Table 2 from CEIC Asia Database, apportioned to 28 categories in the 4 groups on the basis of their 2000 shares in Table 4.

The results are included in Appendix Table A.1. They are summarised in Figure 2, which shows that GFCF quadrupled from the mid-1960s to the mid-1980s, and then quadrupled again to the mid-1990s. The 1997-98 crisis and its aftermath caused a considerable fall in GFCF, although the trough in 1999 was still at a level comparable to 1991. GFCF recovered to 1997 levels in 2007. The chart also indicates that the trend was largely driven by non-residential capital stock, particularly non-residential structures.

6.2 Estimating Gross Fixed Capital Stock, 1950-2007

The estimates of GFCF in Appendix Table A.1 are used to estimate capital stock on the basis of a PIM, as recommended in the UN's *1993 System of National Accounts*. This can take the form of Gross Fixed Capital Stock (GFCS or K^G) or Net Fixed Capital Stock (K^N) in constant prices, as shown in Equations 3 and 4.

$$K_t^G = K_{t-1}^G + I_t - R_t = \sum_{j=0}^{L} (I_{t-j}^G \times r(j)) \qquad \text{(Equation 3)}$$

$$K_t^N = K_{t-1}^N + I_t - R_t - V_t = \sum_{j=0}^{L} (I_{t-j}^G \times r(j) \times v(j)) \qquad \text{(Equation 4)}$$

The difference between both is in the disaggregation of depreciation into (a) foreseen obsolescence, or the retirement of capital goods (*R*) over their service life (*L*) so that only a proportion remains of each vintage (*j*) of a capital good in a given year, and (b) the annual loss of value of capital stock due to wear and tear, or aging, of capital goods, reflecting the decline in the relative efficiency of each vintage of a capital good as it ages, or the conventional definition of depreciation for accounting purposes (*V*). In addition, *r(j)* is the retirement function and *v(j)* is the depreciation function.

To analyse economic growth, K^G it is the most appropriate concept to use, assuming that repair and maintenance compensate for wear and tear until the end of the service life of a capital good. It is arguably less appropriate for this purpose to estimate K^N and account for the decline of asset efficiency with age. K^N is a useful concept for the purpose of surveying a country's national wealth, as it takes account of the age composition of different categories of capital goods. It is certainly appropriate for company and tax accounting purposes where depreciation records the loss of the value of assets used for production purposes to approximate the 'fair value' of assets. However, when depreciation is faster (for instance for reasons of taxation) than the actual efficiency decline of capital goods, the net fixed capital concept is likely to understate the capital stock actually employed for production purposes. In addition, there is no conclusive evidence of the rate of efficiency decline of capital goods, while the rates of depreciation used for accounting and taxation purposes in Indonesia seem high, as mentioned above in Section 5.

To estimate K^G, or GFCS, we need indications of the average service life of the different categories of capital goods, as well as choose *r(j).* Table 5 summarises the available information on average asset lives in Indonesia. As noted in section 5, the information for Indonesia used in the BPS and Bank Indonesia studies is largely based on taxation data. To indicate that these estimates may be rather low, estimates of the service life of assets used in the calculation of capital stock in the India, Japan and the USA are included in Table 5. Particularly the 20 years assumed for constructions in Indonesia appears to be quite low.

As far as available, estimates of asset service lives differ considerably across countries (Blades 1983: 12-15, Blades 1993: 13-16). Such differences seriously impair inter-country comparisons of capital stock, as Maddison (1995) argued. It led him to re-estimate capital stock in several countries using USA-based standardised asset lives of 39 years for 'non-residential structures' and 14 years for 'machinery and equipment'. The choice of standardised asset lives may in principle facilitate comparison, but where different asset lives across countries reflect actual observations of these asset lives standardise asset lives would introduce an element of arbitrariness.

There are no historical data on the asset lives of productive assets in Indonesia. To accommodate the 28 asset categories, this study uses average asset lives shown in Table 5, which are based on asset lives identified in the more detailed studies for the USA, Japan and India. The asset lives used here are generally higher than those used in the BPS and Bank

Indonesia studies. It is possible to assume that the average service life of particular categories of productive assets in Indonesia changed over time. They may have decreased, as has been the experience for other countries (Blades 1983: 16; Blades 1993: 25-30; OECD 2001: 50-51). Indeed, casual impressions may suggest that public structures in Indonesia such as railway stations and irrigation structures built in the past may have lasted longer than those built in recent decades, although that also depends crucially on whether regular maintenance work was carried out. However, there is no way to generalise such impressions.

Little with general validity is known about the actual retirement of capital goods by companies in Indonesia during their service life. Several possible retirement patterns can be assumed. One is the 'one-hoss shay' or simultaneous exit method whereby a capital good delivers the same services for each vintage and is scrapped at the end of its service life. While anecdotal evidence may suggest that capital goods have been kept productive for long periods in Indonesia, it is unlikely that this would have applied to all capital goods or all vintages. It is more likely to assume a rate of retirement. Different patterns can be assumed, such as straight line retirement, which reduces the stock of a vintage of a capital good by the same amount each year, or geometric retirement, which reduces the stock of a vintage of a capital good by the same rate each year, until the last remaining vintage is at the end of its service life (Blades 1983: 17-21; Blades 1993: 18-20; OECD 2001: 53-58. Comparisons of the different methods of retirement indicated that – except for the simultaneous exit pattern – GFCS estimates are relatively insensitive to the retirement pattern used (Blades 1983: 27; O'Mahony 1996; Yudanto *et al.* 2005: 186-87). For the sake of simplicity, we use a linear retirement function *r(j)* as shown in Equation 5 for all capital goods in an asset category. This implies that equal amounts of the value of a capital stock of a given vintage are deducted from the capital stock for every year until the maximum service life of an asset has been reached.

$$r(j) = \frac{(L - j)}{L} \text{ with } 0 \leq j \leq L \qquad \text{(Equation 5)}$$

The disaggregated annual estimates of GFCF, combined with average asset lives and the method of depreciation for national accounting purposes allow the estimation of GFCS on the basis of a PIM. The results are contained in Appendix Table A.2 and are summarised in Figure 3. As the longest lifespan of our asset categories is 40 years, the first 'complete' estimates of GFCS are for 1990. The chart shows that during 1990-97 GFCS doubled before the rate of growth slowed following the 1997-98 crisis. The chart also indicates that the trend was largely driven by non-residential capital stock, particularly non-residential structures, as Figure 2 already suggested. Figure 4 confirms these impressions. During 1971-97, growth of total GFCS has on average been 10% per year, broadly in line with the trend in the category non-residential structures, rather than machinery and equipment.

Figure 5 shows the shares of the main categories of GFCS. It indicates that the share of non-residential structures increased significantly since the early 1990s. This was in part a consequence of the growth of this category in GFCF.

Figure 6 shows the implicit rate of depreciation as a percentage of GDP resulting from the retirement of productive assets during their service life. It is clear that the total rate of depreciation after 1990 exceeds the implicit 5% rate of depreciation in the national accounts during 1983-2007 by far. Most of the depreciation is driven by non-residential capital stock, comprising both non-residential structures and machinery and equipment. It is likely that the rate of depreciation was higher than the 5% of GDP used by BPS. In the absence of detailed capital stock data, BPS measured the consumption of fixed capital stock on the basis of an assumed rate, as was the case in other countries. However, advances in the measurement of capital stock have led to more substantiated estimates that often exceeded the previously assumed rates. Consequently, the national accounts of developed countries now estimate the consumption of fixed capital stock on the basis of capital stock estimates that are PIM-based. For example, in Australia it is now estimated to be 15 to 16% of GDP (ABS 2007) and in the USA no less than 16 to 20% of GDP (BEA 2008).

Figure 7 shows the Capital-Output Ratio for 1950-2007 that is a consequence of the calculations outlined above, as well as two CORs that are the result of the backward extrapolation of total GFCS from 1990 on the basis of GFCF and two assumptions about the rate of retirement of productive assets (5%, which is the 1983-2007 implicit rate from the national accounts, and 7.6%, which approximates the 1990 implicit depreciation rate) according to Equation 6.

$$K^G_{t-1} = K^G_t - I_t + \rho Y_t \qquad \text{(Equation 6)}$$

Whereby K^G = GFCS, I = GFCF, ρ = rate of depreciation (or rather retirement of productive assets) as % of GDP, and Y = GDP (all in constant prices). Figure 7 shows that the COR based on the assumption that ρ = 5% follows the COR based on GFCS estimated above, which we know is incomplete until 1990. Hence, the COR based on the assumption that ρ = 7.6% is likely to be more realistic. It shows a gradual decline during 1950-67, which reflects the fact that the growth of GDP was low at 2.8% per year and GFCF modest. This was followed by a rapid decline during 1967-73 and stagnation during 1973-81, a period when economic growth accelerated to 7.8% per year, higher than the growth of GFCF. During 1981-97 the COR increased quickly from 1.0 to 1.9 in 1997 as the growth of GFCF outpaced that of GDP. The COR jumped to 2.3 in 1999 due to the fall in GDP in the wake of the 1997-98 crisis.

The increase in the COR since 1981 can be interpreted as a consequence of accelerated structural change away from agriculture towards greater economic dependence on production, income and employment in more capital-intensive exploits, particularly manufacturing industry. The share of agriculture in total GDP in current prices, with

presumably a lower COR than in the industrial sector, decreased continuously from an average of 35% in the 1960s to 12% in 1997. In addition, the share of industrial production increased from a lowly 15% during the 1960s to 40% in 1997, which suggests that new investment in manufacturing industry is likely to have contributed to the increase in the COR. In addition, particularly during the 1990s, the growth of the share of investment in non-residential structures shown in Table 4 may indicate overinvestment in sectors that were able to absorb such investment rapidly, particularly in real estate business services, retail trade and hotels.[16]

Figure 8 compares the COR estimated in this paper with the COR estimates for Indonesia from other studies. It is clear that all trends are of similar proportions to our estimates, ignoring the very low levels in the BPS (1996) estimates for 1980-91, which is due to the 'build up' of aggregated GFCF from the first 'instalment' in 1980. The Bank Indonesia (BI) estimates are significantly lower than ours, which is largely due to the shorter asset lives used in the Bank Indonesia study (see Table 5), particularly for structures. The estimates of Dasgupta et al. (2003) and Yoshioka (2002) seem unrealistic, while the discrepancies between our estimates and those of Sundrum (1986), Keuning (1988, 1991) - and by implication Van der Eng (2002) – and Sigit (2004) are due to the differences in methodologies outlined above. The significant differences between our estimates and those of Nehru and Darashvar (1993) and King and Levine (1994) are difficult to explain in absence of detailed information about data sources and estimation procedures for Indonesia in these studies. But it clear that the significantly different trends in the COR suggest that caution is appropriate when using the capital stock data fro these studies, at least for Indonesia.

How plausible are the COR estimates shown in Figure 8? A possible plausibility check is through comparison with COR estimates of countries at a similar level of development. Snodgrass (1966: 68, 75) estimated the COR for Malaya to be 1.4 to 1.7 in 1954 and 1.8 to1.9 in 1963. Chou (1966: 73) suggested a COR of 2 for Malaya (including Singapore) in the early 1950s, while Abraham and Gill (1969: 52) estimated an average 1.45 for 1960-66 for West-Malaysia. These estimates are all broadly comparable to this study's estimates shown in Figures 7 and 8.

A major problem with COR estimates of different countries is that their data on capital formation and capital stock are based on different definitions and methods of calculation. Maddison (1995) offered estimates of GFCS based on average asset lives that are to an extent comparable to the averages in this paper (generally 30-40 years for structures and 10-16 years for machinery and equipment). Figure 9 compares our estimates of the non-residential COR with those of Maddison for Japan, UK and USA, and with data for India and Australia, which also used comparable asset lives. Figure 9 suggests that the

16. We cannot be definite about this suggestion, because the output of capital goods by industry sector is identified (at producer and purchaser's prices) in the I-O Tables, but not the allocation by industry sector of the produced capital goods.

estimates of capital stock in Indonesia relative to GDP were comparable with those for other countries in the 1950s, particularly Japan and India. The COR was around 0.8 in the 1970s, which is quite low in international perspective. It increased to internationally comparable levels during the 1980s and 1990s, which suggests that our estimates of GFCS are not too low for those decades.

Even so, Indonesia is still a less-developed country where the contribution of manufacturing industry in GDP has increased, but where a large part of that sector is still more labour-intensive than capital-intensive, and where agriculture and services with low capital-output ratios are still significant. Consequently, Indonesia's COR in 1998-99 of 2.5 to 3 and higher for total GFCS in Figure 8 and 2.5 for non-residential GFCS in Figure 9 appear to be very high, even though the 1998-99 spike in both CORs was not a consequence of a sudden increase of GFCS, but rather a significant fall in GDP following the 1997-98 monetary crisis. The high COR in 1998-99 suggests considerable underutilisation of productive capacity, particularly in the form of structures rather than machinery and equipment, and therefore overinvestment in earlier years.

A curious aspect in Figures 8 and 9 is that Indonesia's COR increased significantly from 1980 onward, akin to India during 1950-80, Australia during 1960-83, Japan during 1960-91 and the UK during 1955-82, but very different from the USA during 1950-91. It is surprising to find such a significant increase at a still early stage in Indonesia's economic development process. During this stage there should still be significant opportunities to absorb technology and improve productivity in order to sustain economic growth, rather than rely increasingly on the mobilisation of investment capital for this purpose. Kosai (2005) discussed this phenomenon in the case of Japan, arguing that Japan left the growth trajectory led by technological development and productivity growth in the 1970s in favour of growth led by capital mobilisation. This process continued during the 1990s, with Japan reaching a COR of 4.0 in 2003, compared with 2.3 in the USA and 1.7 in the UK (Maddison 2007: 305, 385). While capital accumulation in Indonesia appears to have followed a similar path as Japan during the early 1990s, that development clearly came to an end in 1998. During the 1997-98 crisis GFCF contracted substantially, which implies that producers were forced to seek ways to enhance the productive use of existing capital goods (Ishihara and Marks 2005), rather than seek finance for new investments.

7. Comparison with 1940

No official estimates of GFCF exist for the years before World War II, except for a 1938 estimate made by the Dutch Central Bureau of Statistics of ƒ272 million, or 8.1% of GDP (CBS 1948).[17] This is comparable to the rate of investment in the 1950s in Figure 1.

17. That is, ƒ42 million investment by Indonesian firms and ƒ225 million by foreign-owned firms (CBS 1948). ƒ5 million was added as government investment in public infrastructure in 1938 (CEI3 1977).

The only known estimate of pre-war total capital stock, including buildings, suggests a total of ƒ10,150 million in 1940 (Sitsen 1943: 12). The source does not specify the basis of the calculations but it seems that the author capitalised interest and dividend information to estimate 'so-called commercial capital', which excludes investment in 'irrigation works, highways and bridges, dwellings and harbour works, etc' as well as 'land values and national debts'. The estimate compares to an accumulated investment of ƒ4.9 billion in the productive assets of foreign-owned and government enterprises only during 1910-39, or roughly ƒ6 billion during 1880-1939 (both without depreciation or correction for inflation, CEI3 1977: 25). Ek (1950) offers data on the value of government-owned assets (structures, public works, state-owned companies, military assets etc) in 1949 of ƒ6.25 billion. This would be ƒ1.84 billion in 1940, assuming that prices increased by a factor of 34.

Little is known about the total damage that Indonesia's capital stock sustained during the Japanese occupation and the war of independence in the 1940s. In 1946 the colonial government intended to record this damage for the purpose of claiming reparations from Japan, but these plans never came to fruition (Keppy 2006: 61-63). Fruin (1947: 47) and NIG (1947: 86) offer very rough estimates of war damage in 1940s. Losses and damage were estimated at ƒ4.1 billion on the basis of pre-war replacement cost, which would have been 34% of the 1940 capital stock. Of this, some ƒ2.2 billion (half the capital stock of enterprises) consisted of damage to foreign-owned enterprises, and the rest was damage to infrastructure. This would have been a very high level of damage, as the loss of capital stock in Japan was estimated to have been 26%, Germany 16%, The Netherlands 10% and France 8% of prewar capital stock (Maddison 1995). On the other hand, the damage included defensive destruction of machinery and equipment by the Dutch colonial government in 1942, the dismantling and shipment overseas of factories and railway stock by the Japanese military government, as well as damage sustained during the war of independence, particularly during 1946 and 1947. If Indonesia indeed lost 34% of its capital stock between 1940 and 1950, the 1940 capital stock may have been Rp 401 trillion in 1940 (in 2000 prices), which yields a COR of 2.21 in 1940.

8. Conclusion

The studies into the estimation of capital stock at Bank Indonesia significantly advanced the debate about the measurement of the country's capital stock and the possibility of a better informed discussion about long-term growth and structural change in Indonesia. As noted above, not all aspects of the BI study are clear, while some aspects could be re-considered. This paper has drawn attention to the fact the BI opted to use 1980 as the starting point for its estimation, thus ignoring earlier information on GFCF in Indonesia and estimating capital stock with assumed asset lives that may be too low.

This paper highlighted these issues and used historical data on GFCF to estimate GFCS from 1951. It may be obvious that more work on estimating GFCF and GFCS in

Indonesia can be done. Firstly, for historical estimates of GFCF, the methodologies used for estimation of GFCF at BPS in the past need to be revisited, made consistent where possible and augmented where necessary in order to re-estimate GFCF back in time. Secondly, the sensitivity of the estimates of GFCS to different assumptions about the service asset of capital goods needs to be assessed, possibly on the basis of alternative information on asset lives in Indonesia if it exists.

Despite these shortcomings, the paper has indicated that the levels of GFCF in Indonesia during the 1980s and 1990s had no precedent and they sustained a rapid increase in the country's GFCS. The ratio of capital stock and GDP indicated that the increase in CFCS during 1990-97 was so substantial, that the productive capacity most likely expanded to levels that were unsustainable, contributing to excess productive capacity particularly in the form of structures. As such, overcapacity contributed to the economic woes that engulfed the country during and after the 1997-98 economic crisis. Since 1999, Indonesia sustained modest but significant rates of growth since 1999, despite low levels of GFCF growth (Van der Eng 2004: 3). Such low levels of investment increased the utilisation of existing productive capacity (Ishihara and Marks 2005). GFCF returned to pre-crisis levels in 2007, but the COR decreased. In combination with sustained economic growth, this indicates an improvement in the productive use of available capital goods.

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Table 1: Gross Fixed Capital Formation in Indonesia, 1969-2000

	1969	1971	1975	1980	1985	1990	1995	2000
A. Total gross fixed capital formation (billion Rupiah)								
Input-Output Tables	270	937	2,846	10,550	21,780	59,568	140,245	272,637
National Accounts	317	580	2,572	9,485	22,367	59,758	129,218	275,881
B. *Idem*, as % of GDP								
Input-Output Tables	9.9	22.0	20.8	21.8	22.3	20.7	26.2	20.0
National Accounts	11.7	15.8	20.3	20.9	23.1	28.3	28.4	19.7

Sources: National Accounts and Input-Output Tables of Indonesia.

Table 2: Four Main Asset Categories in Gross Fixed Capital Formation in Indonesia, 1958-2005

	National accounts					Input-Output Tables			
	Structures	Machinery	Transport equipment	Other		Structures	Machinery	Transport equipment	Other
1958	61.9%	—— 38.1% ——		-					
1963	53.3%	—— 46.7% ——		-					
1969	59.1%	—— 38.7% ——		-	1969*	70.1%	13.0%	12.5%	4.4%
1970	54.3%	—— 45.7% ——		-	1971	52.8%	31.4%	10.5%	5.2%
					1975	62.6%	18.9%	15.8%	2.7%
					1980	64.9%	14.5%	18.3%	2.3%
					1985	74.4%	14.8%	7.9%	2.9%
1991	58.5%	28.6%	9.1%	3.9%	1990	60.2%	27.3%	8.2%	4.3%
1995	73.1%	16.5%	6.6%	3.7%	1995	67.8%	21.4%	8.2%	2.7%
2000	76.0%	13.3%	7.1%	3.5%	2000	76.4%	13.8%	7.2%	2.6%
2005	79.8%	12.0%	5.3%	2.9%					

* The 1969 I-O Table gives data at factor costs, rather than market prices. GFCF originating from transportation, warehousing and trade is therefore excluded.

Sources: 1958 from BPS (1969); 1963 Sudirman (1972); 1969 BPS (1970); 1970 from Donges *et al.* (1973: 212); 1991 and 1995 from Saleh (1997: 7-8); 2000 and 2005 CEIC Asia Database; Input-Output Tables of Indonesia.

Table 3: Sources of Savings as Percentage of GDP, 1951-2007 (annual averages)

	1950s	1960s	1970s	1980s	1990-97	1998-07
Households and businesses (residual)	5.3	5.2	10.9	15.0	15.2	17.0
Term and savings deposits	0.5	0.6	4.1	9.0	34.3	35.7
Other savings (implicit)	4.8	4.6	6.8	6.0	-19.1	-18.7
Government (33% of GFCF)	2.6	2.8	6.2	7.9	9.2	7.2
Government savings (implicit)	1.8	0.5	2.8	4.7	8.9	6.2
Foreign borrowing/aid (net)	0.8	2.3	3.4	3.2	0.3	1.0
Foreign investment, private (net)	0.0	0.4	1.6	0.9	3.3	-2.7
Direct	0.0	-0.1	0.7	0.4	1.6	-0.4
Portfolio	0.0	0.5	0.9	0.5	1.7	-2.3
GFCF	7.9	8.4	18.7	23.8	27.7	21.5

Sources: GFCF and GDP 1951-1957 Joesoef (1973) and ECAFE (1964), 1958-2007 National Accounts; bank deposit data and balance of payments data from the annual reports of Bank Indonesia and http://www.bi.go.id/web/id/Statistik/, converted with official exchange rates.

Table 4: Shares of Capital Goods in Gross Fixed Capital Formation in Indonesia, 1971-2000 (percentages)

	1971	1975	1980	1985	1990	1995	2000
1. Livestock	1.1	0.1	0.0	0.0	0.0	0.1	0.1
2. Furniture, fixtures (non-metal)	0.9	0.3	0.4	0.4	0.4	0.3	0.0
3. Glass, glass products	0.0	0.1	0.1	0.3	0.2	0.0	0.0
4. Kitchen ware, hand and agricultural tools	0.1	0.1	0.3	0.5	0.2	0.2	0.2
5. Furniture, fixtures (metal)	1.0	1.0	0.2	0.1	0.1	0.1	0.6
6. Other manufactured metal products	1.2	0.6	0.6	0.4	1.5	0.5	0.4
7. Prime movers engines	*1.3*	*0.7*	*0.5*	0.5	1.1	1.1	0.8
8. Non-electrical machinery	*25.8*	*13.4*	*9.7*	10.7	21.6	13.7	7.1
9. Electric generators, motors	*0.1*	*0.1*	*0.0*	0.0	0.8	0.8	0.7
10. Electrical machinery	2.5	2.5	1.5	1.3	0.2	0.6	0.6
11. Communications equipment	0.7	0.9	1.4	0.8	2.3	3.0	3.1
12. Household electrical appliances	0.0	0.3	0.2	0.2	0.2	0.3	0.5
13. Other electrical appliances	0.0	0.2	0.0	0.0	0.0	0.1	0.1
14. Ships, ship repair	0.3	3.6	9.6	4.0	2.7	1.9	2.0
15. Trains, train repair	0.2	0.1	0.2	0.2	0.1	0.1	0.0
16. Motor vehicles	8.8	8.9	5.9	1.1	3.5	3.4	2.6
17. Motor cycles	0.4	1.2	0.8	0.4	0.4	1.1	1.0
18. Other vehicles	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19. Aircraft, aircraft repair	0.9	1.9	1.7	2.3	1.4	1.7	1.4
20. Measuring, photographic, optical equipment	1.1	1.0	1.1	1.3	1.2	1.7	1.0
Subtotal machinery and equipment	41.9	34.6	32.7	22.8	35.5	29.5	21.0
21. Residential buildings	14.8	15.5	*23.5*	*26.4*	*17.6*	*18.2*	*17.4*
22. Non-residential buildings	10.9	12.1	*17.7*	*19.9*	*13.3*	*13.7*	*13.1*
23. Public works, agriculture	2.6	2.8	4.9	5.9	5.0	6.8	9.2
24. Public works, roads, bridges, harbours	3.7	6.0	10.3	12.4	16.5	20.0	30.0
25. Installation electricity, gas, communication	2.5	6.1	2.2	2.4	3.1	4.2	3.7
26. Other construction	18.3	20.0	6.2	7.4	4.8	4.9	3.1
Subtotal structures	52.8	62.6	64.9	74.4	60.2	67.8	76.4
27. Repair services	0.0	0.0	0.0	0.6	1.8	1.2	1.0
28. Other	0.9	0.6	0.8	0.7	0.1	0.3	0.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Notes: The 1969 I-O Table does not offer a comparable disaggregation of GFCF and is excluded. Categories 7-9 1971-85 estimated on the basis of 1990 proportions of 'non-electrical machinery'; categories 21-22 1980-2000 estimated on the basis of 1971-75 average proportions of 'residential and non-residential buildings'.

Source: Input-Output Tables of Indonesia.

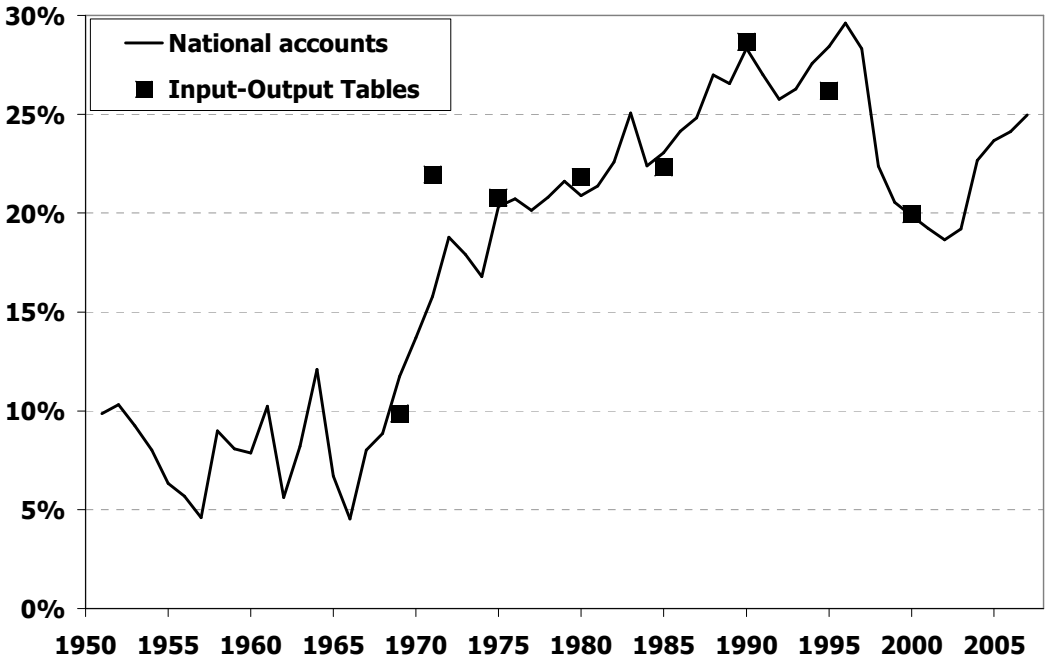
Table 5: Average Service Lives of Productive Assets: Indonesia, India, Japan and USA

Country	Indonesia			India	Japan	USA	This
Source	MK	BPS	BI	K&M	Nomura	BEA	study
1. Livestock	-	3	3	-	3	-	3
2. Furniture, fixtures (non-metal)	4	3	5	20	6	10-14	12
3. Glass, glass products	4	5	5	-	-	10	10
4. Kitchen ware, hand and agricultural tools	4	5	5	-	10	10-11	10
5. Furniture, fixtures (metal)	8	5	5	20	10	11-14	12
6. Other manufactured metal products	8	-	5	15	13	18	18
7. Prime movers engines	8-20	7	16	10	13	8-10	10
8. Non-electrical machinery	16	-	16	20	6-10	16	16
9. Electric generators, motors	16	7	18	25	26	32	32
10. Electrical machinery	16	-	18	15	9-30	16	16
11. Communications equipment	8	7	10	15	9	11-15	13
12. Household electrical appliances	4	10	10	15	19	9-11	10
13. Other electrical appliances	4	-	10	15	5-16	9-11	10
14. Ships, ship repair	16-20	10	10	15	21	27	27
15. Trains, train repair	20	10	10	20-33	15	28	28
16. Motor vehicles	4-8	7	10	10	9-15	9-14	12
17. Motor cycles	4	3	10	10	5	8-10	10
18. Other vehicles	8-16	-	10	8	5	9-14	12
19. Aircraft, repair	16	7	10	10	7	12-20	12
20. Measuring, photographic, optical equipment	8	6	5	15	12	10	10
21. Residential buildings	20	20	20	20-80	27	20-80	30
22. Non-residential buildings	20	20	20	80	21-26	30-50	30
23. Public works, agriculture	20	20	20	30-100	36	-	20
24. Public works, roads, bridges, harbours	20	20	20	55-100	50-56	60	40
25. Installation electricity, gas, communication	20	20	20	45	38-40	40-45	40
26. Other construction	20	20	20	35	13	60	40
27. Repair services	-	-	16	-	-	-	5
28. Other	-	-	16	-	-	5	5

Note: MK, BPS, BI, K&M, Nomura and BEA refer to the sources, see below. None of the sources identified each of the 28 categories of capital goods explicitly. The service lives from the sources have been broadly applied to the 28 categories.

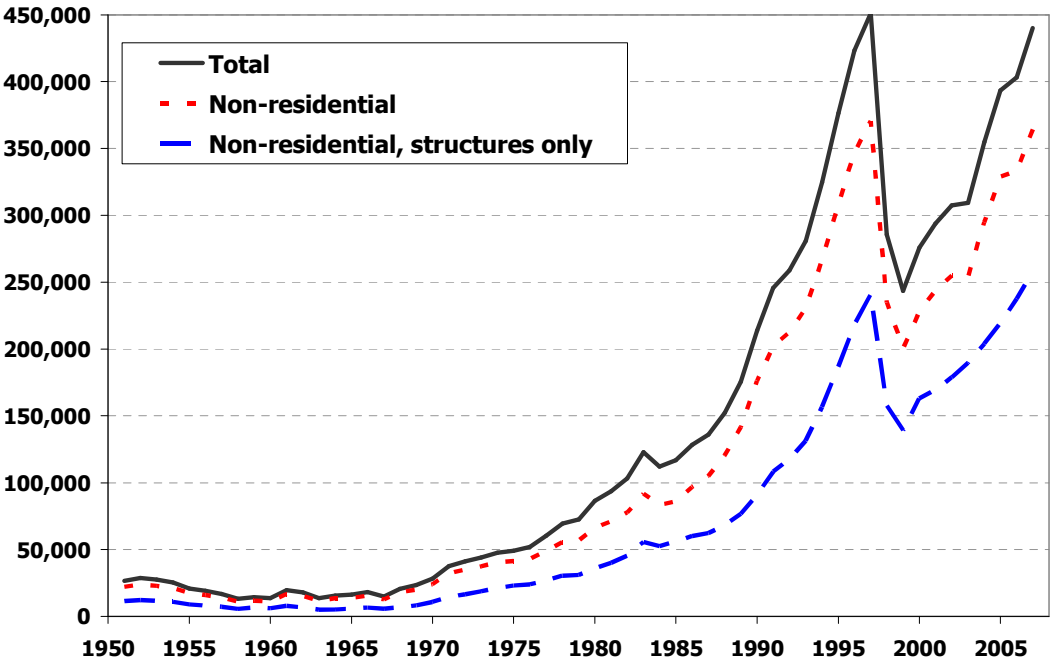
Sources: MK from Ministry of Finance of Indonesia, Keputusan Menteri Keuangan No. 138/KMK.03/2002 (http://kanwilpajakkhusus.depkeu.go.id/penyuluhan/pph/golharta.htm); BPS from BPS (1996: 5); BI from Yudanto *et al.* (2005: 187); K&M from Kulshreshtha and Malhotra (1998: 14); Nomura from Nomura (2005a: 37) and Nomura (2005b: 21); BEA from BEA (2003).

Figure 1: Share of Gross Fixed Capital Formation in GDP in Indonesia, 1951-2007



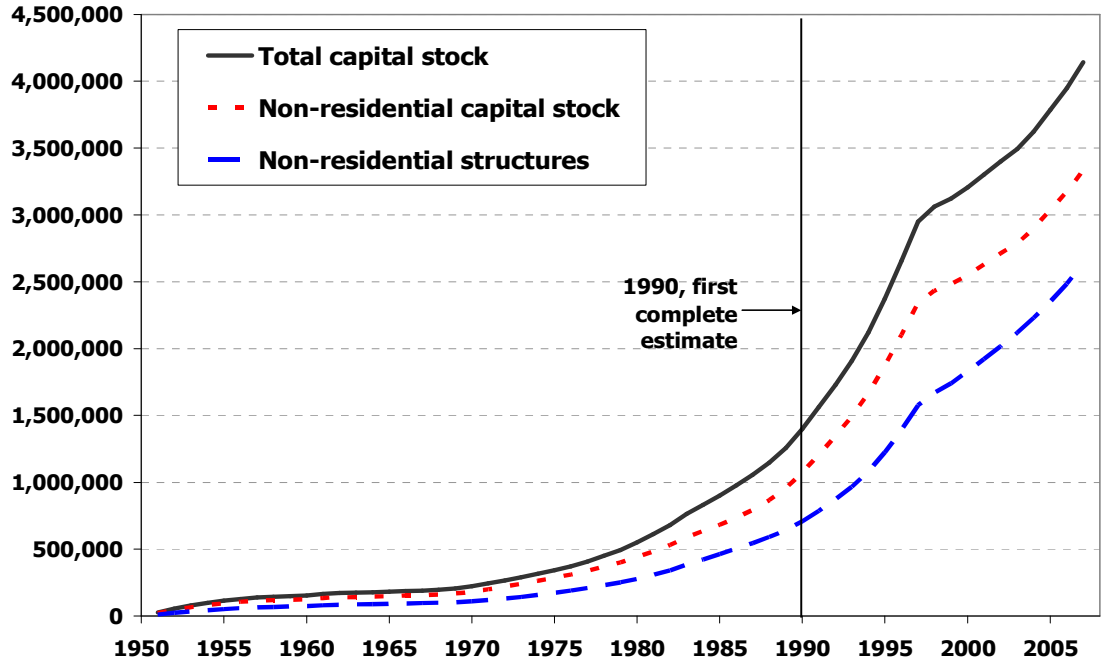
Note: Calculated from current price series.
Sources: Calculated for 1951-57 from Joesoef (1973) and ECAFE (1964), 1958-2007 from National Accounts, 1969, 1971, 1975, 1980, 1985, 1990, 1995 and 2000 from Input-Output Tables of Indonesia.

Figure 2: Gross Fixed Capital Formation in Indonesia 1951-2007 (bln 2000 Rupiah)



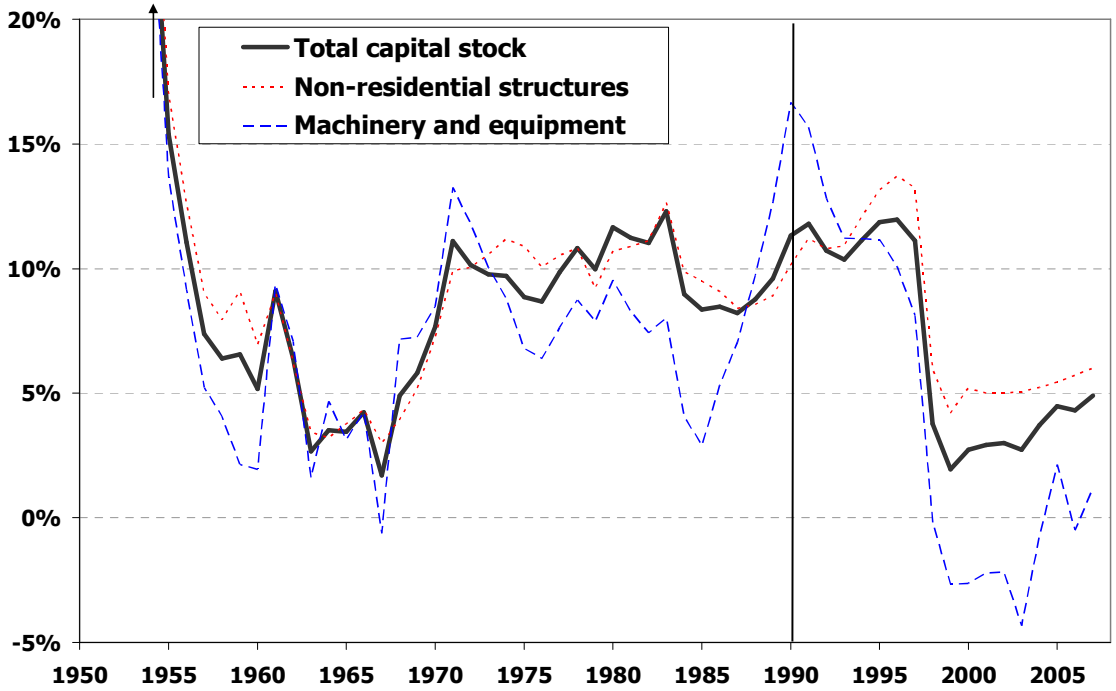
Sources: See main text and Appendix Table A1.

Figure 3: Gross Fixed Capital Stock in Indonesia, 1951-2007 (bln 2000 Rupiah)



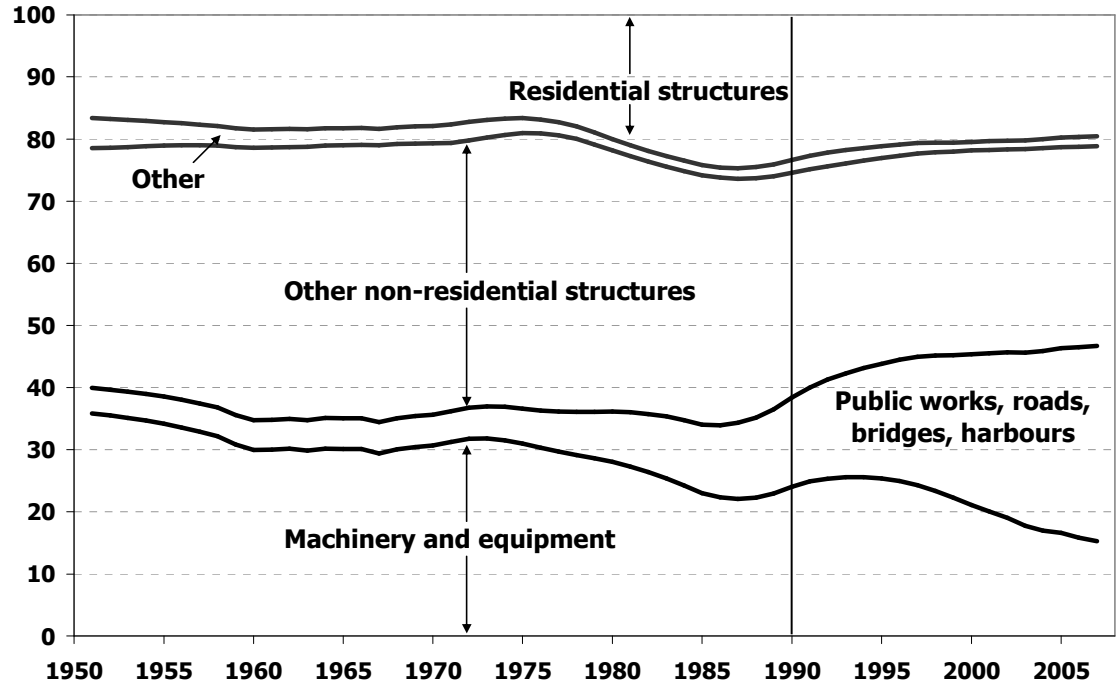
Sources: See main text and Appendix Table A2 for 1990-2007.

Figure 4: Annual Growth of Gross Fixed Capital Stock in Indonesia, 1952-2007 (percentages)



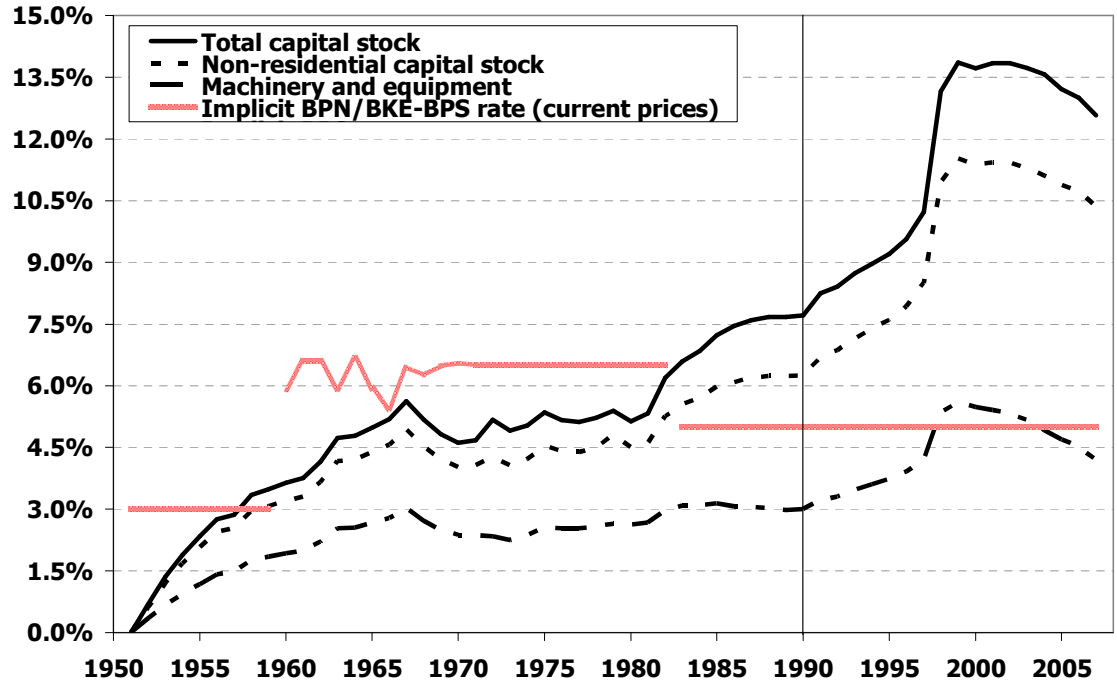
Sources: See main text and Appendix Table A2 for 1990-2007.

Figure 5: Cumulative Shares in Gross Fixed Capital Stock in Indonesia, 1951-2007 (percentages)



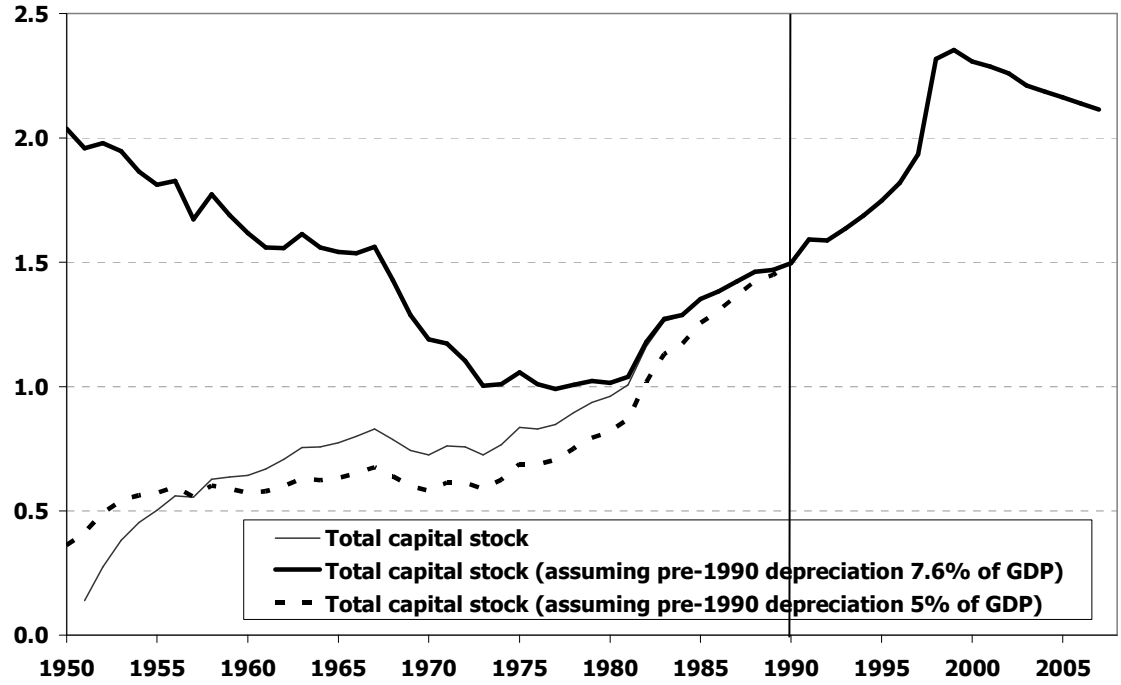
Sources: See main text and Appendix Table A2 for 1990-2007.

Figure 6: Implicit Rate of Depreciation of Capital Stock as % of GDP, 1951-2007



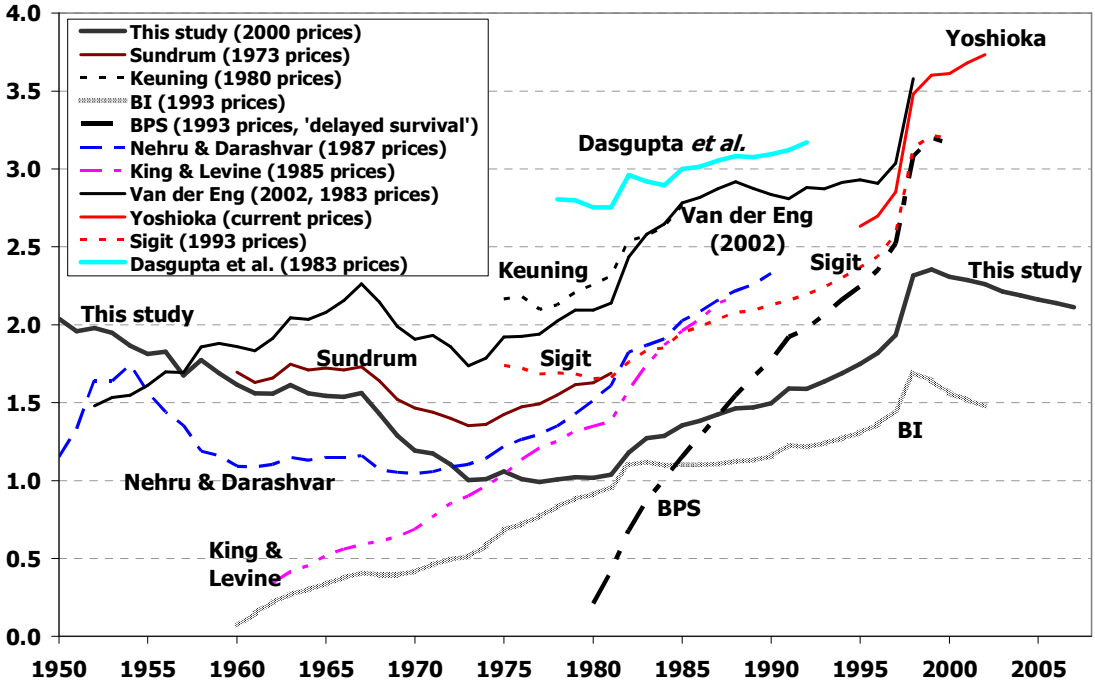
Sources: Implicit BPN/BKE rate 1951-59 from Joesoef (1973: p.32); implicit BPS rate from the National Accounts; implicit other rates from this study expressed as a ratio of new GDP estimates for 1880-2007 (2000 prices) from Van der Eng (2008).

Figure 7: Capital-Output Ratio, Indonesia 1950-2007



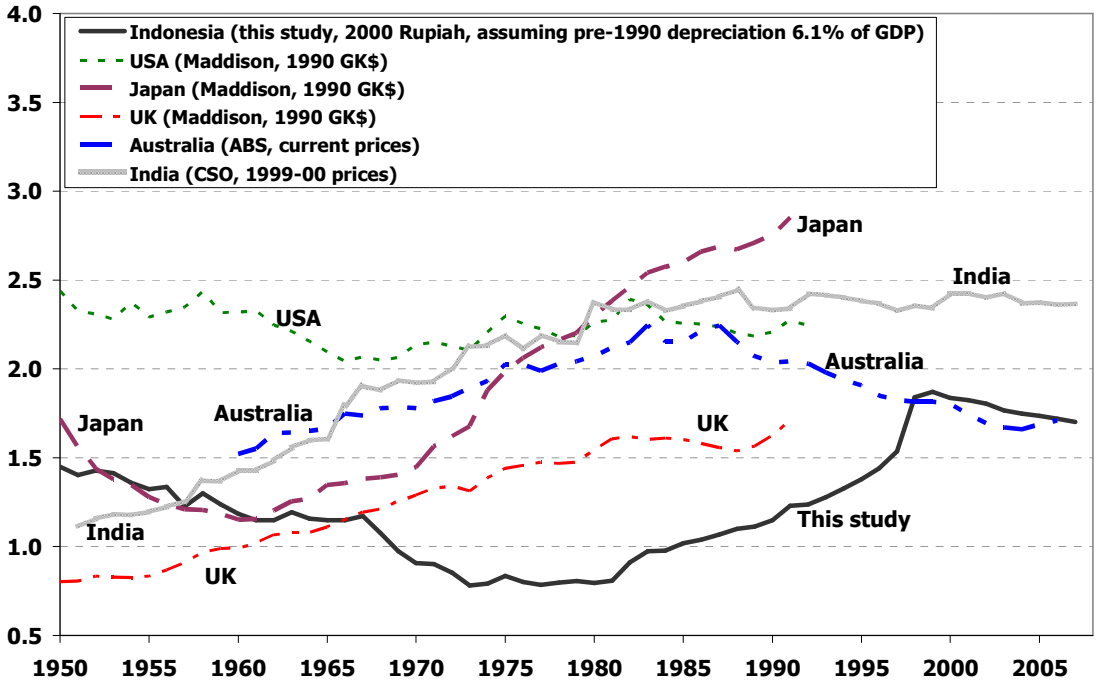
Sources: See main text and Appendix Tables A2 and A3.

Figure 8: Comparison of Capital-Output Ratios in Indonesia, 1950-2007



Sources: Keuning (1988, 1991); BI, Yudanto *et al.* (2005); BPS (1996); Nehru and Darashvar (1993); King and Levine (1994); Van der Eng (2002); Yoshioka (2002); Sigit (2004); Dasgupta *et al.* (2003). Except the COR calculated with CFCS in this study (Appendix A2), all capital stock estimates expressed as a ratio of GDP given in these sources or from the national accounts. Capital stock from this study in Appendix Tables A2 and A3 expressed as a ratio of new GDP estimates for 1950-2007 (2000 prices) from Van der Eng (2008).

Figure 9: Non-Residential Capital-Output Ratios, 1950-2007



Sources: USA, Japan, UK from Maddison (1995: 149-156), GDP from Maddison (2003); Australia from ABS (2007); India from CSO (2007) and CSO (2008); capital stock from this study in Appendix Tables A2 and A3 expressed as a ratio of new GDP estimates for 1950-2007 (2000 prices) from Van der Eng (2008).

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Appendix Table A1: GFCF in Indonesia, 1951-2007 (bln 2000 Rupiah)

		1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962
1	Livestock	214	231	219	202	166	152	133	133	136	135	209	197
2	Furniture, fixtures (non-metal)	183	198	187	173	142	130	114	114	116	116	179	169
3	Glass, glass products	8	9	8	8	6	6	5	5	5	5	8	7
4	Kitchen ware, hand and agricultural tools	14	15	15	13	11	10	9	9	9	9	14	13
5	Furniture, fixtures (metal)	195	211	200	185	151	139	121	121	124	123	191	180
6	Other manufactured metal products	232	250	237	219	180	165	144	144	147	146	227	213
7	Prime movers engines	230	248	235	217	178	163	142	142	132	140	237	233
8	Non-electrical machinery	4,668	5,028	4,770	4,407	3,615	3,318	2,888	2,892	2,691	2,844	4,822	4,733
9	Electric generators, motors	15	16	15	14	12	11	9	9	9	9	16	15
10	Electrical machinery	456	491	466	430	353	324	282	282	263	278	471	462
11	Communications equipment	120	129	122	113	93	85	74	74	69	73	124	121
12	Household electrical appliances	7	8	8	7	6	5	5	5	4	4	8	7
13	Other electrical appliances	1	1	1	1	0	0	0	0	0	0	1	1
14	Ships, ship repair	49	53	50	46	38	35	30	30	28	30	51	50
15	Trains, train repair	37	40	38	35	29	26	23	23	21	23	38	38
16	Motor vehicles	1,590	1,713	1,625	1,501	1,232	1,130	984	985	917	969	1,643	1,612
17	Motor cycles	77	83	79	73	60	55	48	48	45	47	80	79
18	Other vehicles	0	0	0	0	0	0	0	0	0	0	0	0
19	Aircraft, aircraft repair	155	167	158	146	120	110	96	96	89	94	160	157
20	Measuring, photographic and optical equipment	192	207	196	181	149	136	119	119	111	117	198	195
21	Residential buildings	3,523	3,795	3,600	3,326	2,729	2,505	2,180	2,183	2,610	2,369	3,056	2,600
22	Non-residential buildings	2,584	2,784	2,641	2,440	2,001	1,837	1,599	1,601	1,914	1,737	2,242	1,907
23	Public works, agriculture	623	671	636	588	482	443	385	386	461	419	540	460
24	Public works, roads, bridges, harbours	877	944	896	828	679	623	542	543	649	589	760	647
25	Installation electricity, gas, communication	597	644	611	564	463	425	370	370	443	402	518	441
26	Other construction	4,365	4,702	4,460	4,121	3,381	3,103	2,701	2,704	3,234	2,935	3,787	3,222
27	Repair services	0	0	0	0	0	0	0	0	0	0	0	0
28	Other	184	198	188	173	142	131	114	114	116	116	179	169
	Total	21,196	22,834	21,660	20,012	16,417	15,069	13,116	13,131	14,343	13,729	19,759	17,928

Appendix Table A1 (continued)

		1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
1	Livestock	151	182	181	204	160	242	264	308	409	348	265	170
2	Furniture, fixtures (non-metal)	129	156	155	175	137	207	226	263	350	317	268	213
3	Glass, glass products	6	7	7	8	6	9	10	11	15	21	27	35
4	Kitchen ware, hand and agricultural tools	10	12	12	14	11	16	18	20	27	29	30	31
5	Furniture, fixtures (metal)	138	166	165	186	145	221	240	281	373	408	436	471
6	Other manufactured metal products	163	197	196	221	173	262	285	333	443	423	387	346
7	Prime movers engines	179	229	219	246	184	304	320	359	478	461	426	387
8	Non-electrical machinery	3,633	4,642	4,445	4,998	3,735	6,180	6,501	7,299	9,701	9,357	8,644	7,858
9	Electric generators, motors	12	15	14	16	12	20	21	24	31	34	37	39
10	Electrical machinery	355	453	434	488	365	603	635	713	947	1,034	1,101	1,184
11	Communications equipment	93	119	114	128	96	158	167	187	249	294	338	390
12	Household electrical appliances	6	7	7	8	6	10	10	11	15	44	76	114
13	Other electrical appliances	0	1	1	1	0	1	1	1	1	17	35	55
14	Ships, ship repair	38	49	47	52	39	65	68	77	102	453	850	1,313
15	Trains, train repair	29	37	35	40	30	49	52	58	77	77	74	71
16	Motor vehicles	1,237	1,581	1,514	1,703	1,272	2,105	2,214	2,486	3,305	3,639	3,911	4,244
17	Motor cycles	60	77	74	83	62	103	108	121	161	259	365	490
18	Other vehicles	0	0	0	0	0	0	0	0	0	0	0	0
19	Aircraft, aircraft repair	121	154	147	166	124	205	216	242	322	459	604	775
20	Measuring, photographic and optical equipment	149	191	183	205	154	254	267	300	399	432	456	486
21	Residential buildings	1,984	2,005	2,265	2,558	2,244	2,660	3,230	4,187	5,565	6,177	6,691	7,315
22	Non-residential buildings	1,455	1,470	1,661	1,876	1,646	1,951	2,369	3,071	4,082	4,608	5,075	5,636
23	Public works, agriculture	351	354	400	452	397	470	571	740	984	1,102	1,204	1,328
24	Public works, roads, bridges, harbours	494	499	564	636	558	662	804	1,042	1,385	1,755	2,131	2,576
25	Installation electricity, gas, communication	336	340	384	434	380	451	548	710	944	1,409	1,909	2,495
26	Other construction	2,458	2,484	2,807	3,169	2,780	3,296	4,002	5,188	6,895	7,734	8,463	9,344
27	Repair services	0	0	0	0	0	0	0	0	0	0	0	0
28	Other	129	156	156	175	137	207	226	264	350	353	344	336
	Total	13,715	15,583	16,188	18,241	14,850	20,712	23,371	28,296	37,608	41,242	44,146	47,701

Appendix Table A1 (continued)

		1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
1	Livestock	55	49	47	42	31	22	19	17	14	8	3
2	Furniture, fixtures (non-metal)	140	157	193	235	259	323	352	390	466	429	450
3	Glass, glass products	41	48	61	77	87	112	145	185	252	259	299
4	Kitchen ware, hand and agricultural tools	31	56	91	135	172	242	302	376	499	503	574
5	Furniture, fixtures (metal)	483	429	401	351	250	159	152	146	147	110	90
6	Other manufactured metal products	282	298	345	397	414	491	506	529	595	513	502
7	Prime movers engines	323	324	354	383	374	414	458	514	623	581	617
8	Non-electrical machinery	6,553	6,575	7,190	7,776	7,599	8,414	9,301	10,442	12,657	11,794	12,522
9	Electric generators, motors	40	39	41	43	40	42	44	48	56	50	51
10	Electrical machinery	1,211	1,179	1,246	1,293	1,204	1,257	1,334	1,438	1,673	1,496	1,525
11	Communications equipment	426	508	654	828	943	1,215	1,199	1,191	1,262	1,014	910
12	Household electrical appliances	149	152	170	187	187	213	213	216	233	192	179
13	Other electrical appliances	75	64	56	43	22	0	0	0	0	0	0
14	Ships, ship repair	1,755	2,492	3,622	5,014	6,120	8,330	7,965	7,600	7,647	5,721	4,638
15	Trains, train repair	63	76	98	124	142	183	198	217	257	235	244
16	Motor vehicles	4,379	4,335	4,668	4,959	4,748	5,131	4,652	4,121	3,710	2,304	1,267
17	Motor cycles	601	593	636	673	641	689	667	648	667	515	439
18	Other vehicles	0	0	1	1	2	2	5	7	11	13	16
19	Aircraft, aircraft repair	922	958	1,088	1,226	1,253	1,457	1,689	1,980	2,499	2,417	2,656
20	Measuring, photographic and optical equipment	493	536	636	750	801	975	1,095	1,249	1,536	1,451	1,561
21	Residential buildings	7,605	8,903	11,296	14,124	15,926	20,337	22,573	25,442	30,955	28,948	30,843
22	Non-residential buildings	5,950	6,896	8,678	10,775	12,077	15,342	17,029	19,193	23,352	21,838	23,268
23	Public works, agriculture	1,392	1,690	2,208	2,828	3,253	4,225	4,759	5,440	6,706	6,350	6,845
24	Public works, roads, bridges, harbours	2,928	3,558	4,651	5,961	6,861	8,914	10,053	11,501	14,192	13,449	14,510
25	Installation electricity, gas, communication	3,009	2,787	2,762	2,639	2,191	1,932	2,126	2,375	2,866	2,658	2,810
26	Other construction	9,808	8,971	8,743	8,152	6,515	5,367	6,047	6,912	8,522	8,070	8,700
27	Repair services	0	0	0	0	0	0	109	240	428	522	681
28	Other	307	342	415	500	544	674	709	758	873	773	779
	Total	49,022	52,015	60,352	69,512	72,658	86,465	93,701	103,172	122,698	112,212	116,976

Appendix Table A1 (continued)

		1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1	Livestock	4	4	5	7	9	49	93	146	220	315	352
2	Furniture, fixtures (non-metal)	485	506	558	632	757	832	837	864	950	1,043	961
3	Glass, glass products	324	338	373	422	506	482	403	322	241	126	118
4	Kitchen ware, hand and agricultural tools	558	516	494	471	455	536	579	643	762	903	943
5	Furniture, fixtures (metal)	96	99	108	122	145	170	182	202	238	281	770
6	Other manufactured metal products	832	1,179	1,655	2,290	3,258	3,230	2,862	2,516	2,231	1,798	1,990
7	Prime movers engines	814	1,008	1,293	1,677	2,273	2,642	2,817	3,090	3,615	4,237	4,499
8	Non-electrical machinery	16,532	20,480	26,263	34,065	46,158	49,172	47,749	47,354	49,665	51,632	52,450
9	Electric generators, motors	244	458	738	1,107	1,663	1,909	2,011	2,178	2,517	2,915	3,179
10	Electrical machinery	1,401	1,198	1,019	802	525	790	1,030	1,331	1,786	2,356	2,617
11	Communications equipment	1,391	1,891	2,585	3,515	4,937	6,002	6,673	7,612	9,240	11,212	12,715
12	Household electrical appliances	198	212	240	279	344	463	560	684	881	1,125	1,394
13	Other electrical appliances	0	0	0	0	0	49	104	169	261	378	451
14	Ships, ship repair	4,771	4,720	4,911	5,222	5,833	6,304	6,224	6,293	6,753	7,215	8,186
15	Trains, train repair	245	236	237	242	258	268	252	240	240	235	234
16	Motor vehicles	2,003	2,774	3,837	5,258	7,429	8,483	8,885	9,573	11,003	12,670	13,630
17	Motor cycles	495	539	620	733	916	1,362	1,761	2,263	3,027	3,981	4,460
18	Other vehicles	21	26	33	43	58	63	62	63	68	72	74
19	Aircraft, aircraft repair	2,688	2,608	2,653	2,745	2,967	3,579	3,951	4,478	5,405	6,524	7,096
20	Measuring, photographic and optical equipment	1,673	1,730	1,891	2,124	2,521	3,172	3,634	4,256	5,288	6,551	6,712
21	Residential buildings	31,586	31,085	32,152	33,943	37,598	43,520	46,202	50,459	58,788	68,613	76,443
22	Non-residential buildings	23,828	23,450	24,255	25,606	28,363	32,831	34,854	38,065	44,349	51,761	57,668
23	Public works, agriculture	7,284	7,479	8,111	9,031	10,625	13,092	14,729	16,979	20,808	25,466	30,675
24	Public works, roads, bridges, harbours	16,963	19,082	22,618	27,474	35,211	42,198	46,305	52,194	62,673	75,291	93,167
25	Installation electricity, gas, communication	3,266	3,655	4,312	5,215	6,659	8,181	9,180	10,559	12,914	15,777	17,314
26	Other construction	8,870	8,685	8,928	9,358	10,276	11,855	12,544	13,655	15,858	18,449	19,206
27	Repair services	1,058	1,452	1,996	2,725	3,839	4,124	4,043	4,055	4,311	4,556	4,966
28	Other	719	618	531	426	292	396	482	592	765	980	1,114
	Total	128,350	136,029	152,417	175,534	213,875	245,755	259,008	280,837	324,855	376,459	423,386

Appendix Table A1 (continued)

		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
1	Livestock	373	235	199	225	351	328	324	437	446	479	515
2	Furniture, fixtures (non-metal)	799	362	187	74	116	108	107	144	147	158	170
3	Glass, glass products	100	47	27	15	23	22	21	29	30	32	34
4	Kitchen ware, hand and agricultural tools	928	538	417	425	664	621	614	827	845	908	976
5	Furniture, fixtures (metal)	1,305	1,132	1,227	1,686	2,633	2,461	2,434	3,278	3,349	3,599	3,871
6	Other manufactured metal products	2,086	1,298	1,088	1,211	1,892	1,768	1,749	2,355	2,406	2,586	2,781
7	Prime movers engines	4,513	2,676	2,129	2,239	2,350	2,583	2,240	3,312	4,026	3,157	3,863
8	Non-electrical machinery	49,919	27,793	20,469	19,534	20,497	22,535	19,540	28,896	35,120	27,540	33,698
9	Electric generators, motors	3,284	2,011	1,658	1,815	1,904	2,094	1,815	2,685	3,263	2,558	3,131
10	Electrical machinery	2,755	1,721	1,448	1,620	1,700	1,869	1,620	2,396	2,912	2,284	2,794
11	Communications equipment	13,666	8,717	7,494	8,561	8,983	9,876	8,564	12,664	15,392	12,070	14,769
12	Household electrical appliances	1,623	1,114	1,024	1,244	1,305	1,435	1,244	1,840	2,236	1,753	2,145
13	Other electrical appliances	509	340	305	362	380	418	363	536	652	511	625
14	Ships, ship repair	8,802	5,616	4,830	5,520	6,481	6,071	4,303	5,758	7,521	7,435	6,674
15	Trains, train repair	217	117	82	73	86	81	57	77	100	99	89
16	Motor vehicles	13,869	8,357	6,770	7,269	8,534	7,994	5,667	7,583	9,903	9,791	8,789
17	Motor cycles	4,736	2,985	2,535	2,862	3,360	3,148	2,231	2,986	3,899	3,855	3,461
18	Other vehicles	71	40	30	29	34	32	23	31	40	39	35
19	Aircraft, aircraft repair	7,307	4,460	3,665	3,996	4,691	4,394	3,115	4,168	5,444	5,382	4,831
20	Measuring, photographic and optical equipment	6,456	3,642	2,729	2,665	2,797	3,075	2,666	3,942	4,792	3,757	4,598
21	Residential buildings	80,711	50,576	42,712	47,929	49,871	52,604	55,813	59,993	64,519	69,895	75,915
22	Non-residential buildings	60,887	38,154	32,221	36,157	37,622	39,684	42,104	45,258	48,672	52,728	57,269
23	Public works, agriculture	34,865	23,430	21,149	25,292	26,316	27,759	29,452	31,658	34,046	36,883	40,060
24	Public works, roads, bridges, harbours	108,356	74,279	68,221	82,838	86,195	90,919	96,464	103,690	111,511	120,804	131,208
25	Installation electricity, gas, communication	17,996	11,095	9,214	10,160	10,572	11,151	11,832	12,718	13,677	14,817	16,093
26	Other construction	18,827	10,871	8,382	8,493	8,838	9,322	9,891	10,631	11,433	12,386	13,453
27	Repair services	5,126	3,138	2,585	2,827	4,415	4,126	4,082	5,497	5,615	6,035	6,490
28	Other	1,201	768	662	759	1,185	1,108	1,096	1,476	1,507	1,620	1,742
	Total	451,287	285,513	243,461	275,881	293,793	307,585	309,431	354,866	393,501	403,162	440,078

Appendix Table A2: GFCS in Indonesia, 1990-2007 (bln 2000 Rupiah)

		1990	1991	1992	1993	1994	1995	1996	1997	1998
1	Livestock	15	57	129	224	348	510	635	713	601
2	Furniture, fixtures (non-metal)	3,469	3,833	4,155	4,462	4,811	5,207	5,472	5,531	5,125
3	Glass, glass products	1,995	2,167	2,225	2,182	2,050	1,805	1,569	1,337	1,075
4	Kitchen ware, hand and agricultural tools	2,713	2,775	2,856	2,981	3,210	3,555	3,906	4,204	4,070
5	Furniture, fixtures (metal)	787	822	875	947	1,050	1,189	1,806	2,902	3,725
6	Other manufactured metal products	10,883	13,275	15,136	16,505	17,452	17,899	18,471	19,049	18,744
7	Prime movers engines	6,888	8,544	10,157	11,813	13,747	15,999	18,152	19,949	19,559
8	Non-electrical machinery	172,556	206,458	236,273	263,120	289,768	315,765	339,827	358,606	352,721
9	Electric generators, motors	4,506	6,259	8,053	9,952	12,122	14,612	17,275	19,945	21,239
10	Electrical machinery	10,048	9,601	9,420	9,548	10,127	11,245	12,552	13,912	14,149
11	Communications equipment	15,791	20,033	24,548	29,561	35,710	43,212	51,447	59,752	62,135
12	Household electrical appliances	1,356	1,588	1,892	2,286	2,832	3,553	4,448	5,453	5,807
13	Other electrical appliances	0	49	148	302	530	850	1,205	1,572	1,720
14	Ships, ship repair	64,829	67,819	70,497	73,016	75,763	78,725	82,392	86,374	86,847
15	Trains, train repair	2,563	2,699	2,811	2,904	2,989	3,062	3,126	3,167	3,102
16	Motor vehicles	26,085	30,632	35,270	40,282	46,315	53,441	60,781	67,416	67,489
17	Motor cycles	3,569	4,307	5,375	6,833	8,895	11,660	14,551	17,320	17,919
18	Other vehicles	183	226	264	296	329	362	391	412	398
19	Aircraft, aircraft repair	16,670	17,948	19,404	21,180	23,650	26,953	30,493	33,854	33,981
20	Measuring, photographic and optical equipment	10,341	11,830	13,574	15,700	18,587	22,353	25,781	28,448	27,830
21	Residential buildings	326,029	354,314	383,615	415,725	454,608	501,355	553,856	608,195	629,549
22	Non-residential buildings	246,247	267,594	289,713	313,925	343,221	378,423	417,940	458,855	474,894
23	Public works, agriculture	65,448	73,898	83,379	94,429	108,519	126,293	148,072	172,593	184,046
24	Public works, roads, bridges, harbours	200,395	236,688	275,979	319,981	373,175	437,490	517,764	610,914	667,267
25	Installation electricity, gas, communication	49,541	56,093	63,404	71,850	82,401	95,538	109,794	124,309	131,467
26	Other construction	144,136	150,582	157,155	164,418	173,641	185,401	197,286	208,385	211,008
27	Repair services	8,009	9,918	11,134	11,844	12,398	12,880	13,628	14,368	12,903
28	Other	1,342	1,221	1,251	1,417	1,745	2,219	2,691	3,105	2,943
	Total	1,396,396	1,561,232	1,728,693	1,907,685	2,119,995	2,371,555	2,655,313	2,950,642	3,062,313

Appendix Table A2 (continued)

		1999	2000	2001	2002	2003	2004	2005	2006	2007
1	Livestock	480	436	567	636	659	762	845	922	983
2	Furniture, fixtures (non-metal)	4,554	3,896	3,321	2,781	2,293	1,904	1,575	1,317	1,136
3	Glass, glass products	825	603	438	317	235	189	166	155	154
4	Kitchen ware, hand and agricultural tools	3,811	3,566	3,562	3,503	3,432	3,577	3,734	3,960	4,257
5	Furniture, fixtures (metal)	4,555	5,751	7,763	9,392	10,803	12,869	14,747	16,613	18,470
6	Other manufactured metal products	18,190	17,702	17,860	17,858	17,745	18,154	18,507	19,004	19,640
7	Prime movers engines	18,484	17,474	16,577	15,944	14,991	15,195	16,143	16,243	17,183
8	Non-electrical machinery	338,428	322,711	307,473	293,775	276,706	269,053	267,458	258,218	256,299
9	Electric generators, motors	22,118	23,102	24,120	25,268	26,074	27,693	29,807	31,116	32,919
10	Electrical machinery	14,095	14,227	14,432	14,794	14,879	15,713	16,978	17,481	18,386
11	Communications equipment	62,694	63,851	64,916	66,383	66,048	69,534	75,235	76,944	81,008
12	Household electrical appliances	5,984	6,307	6,601	6,940	7,001	7,602	8,504	8,811	9,475
13	Other electrical appliances	1,799	1,905	1,992	2,085	2,090	2,250	2,497	2,577	2,764
14	Ships, ship repair	86,331	86,341	87,140	87,337	85,607	85,265	86,606	87,769	88,122
15	Trains, train repair	3,000	2,889	2,791	2,687	2,559	2,451	2,366	2,280	2,185
16	Motor vehicles	65,445	63,567	62,668	60,956	56,870	54,934	55,428	55,781	55,233
17	Motor cycles	17,832	17,892	18,255	18,205	17,101	16,754	17,325	17,860	18,061
18	Other vehicles	372	344	323	300	269	250	242	237	229
19	Aircraft, aircraft repair	33,164	32,591	32,601	32,152	30,305	29,550	30,052	30,412	30,223
20	Measuring, photographic and optical equipment	26,123	24,292	22,578	21,180	19,429	19,114	19,782	19,592	20,537
21	Residential buildings	641,171	656,600	671,624	687,806	705,186	724,295	748,063	776,004	808,695
22	Non-residential buildings	483,602	495,225	506,585	518,844	532,031	546,503	564,476	585,579	610,235
23	Public works, agriculture	192,188	203,577	214,938	226,663	238,966	252,337	266,831	282,802	300,469
24	Public works, roads, bridges, harbours	715,699	777,054	839,712	904,945	973,506	1,046,826	1,125,266	1,210,190	1,302,668
25	Installation electricity, gas, communication	136,462	142,117	147,938	154,072	160,654	168,075	176,082	184,926	194,781
26	Other construction	210,843	210,936	211,263	211,908	213,117	215,325	217,937	221,393	225,984
27	Repair services	11,069	9,822	10,508	11,016	11,680	13,570	14,995	16,283	17,702
28	Other	2,640	2,453	2,737	2,930	3,129	3,642	4,025	4,371	4,752
	Total	3,121,958	3,207,233	3,301,283	3,400,678	3,493,363	3,623,386	3,785,670	3,948,836	4,142,553

Appendix Table A3: GFCS in Indonesia, 1950-1990 (bln 2000 Rupiah)

		1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960
1	Machinery and equipment	63,560	66,587	70,081	72,933	74,867	75,309	75,290	74,104	73,268	71,832	70,408
2	Public works, roads, bridges, harbours	38,338	38,453	38,616	38,693	38,648	38,420	38,140	37,701	37,321	37,001	36,582
3	Other non-residential structures	93,137	97,955	103,316	108,062	111,934	114,271	116,104	116,842	117,839	119,626	120,681
4	Other	10,302	10,724	11,210	11,609	11,884	11,957	11,968	11,821	11,721	11,598	11,442
5	Residential buildings	94,012	95,251	96,701	97,846	98,553	98,561	98,356	97,592	97,004	96,706	96,049
	Total	299,350	308,970	319,925	329,143	335,886	338,519	339,857	338,061	337,153	336,763	335,161
		1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
1	Machinery and equipment	71,908	73,213	72,984	74,188	74,997	76,648	76,371	79,406	82,110	85,302	91,906
2	Public works, roads, bridges, harbours	36,284	35,865	35,335	34,775	34,268	33,824	33,323	32,814	32,306	31,900	31,754
3	Other non-residential structures	123,113	124,451	124,547	124,539	125,080	126,256	126,798	127,815	129,530	132,868	139,038
4	Other	11,602	11,698	11,606	11,634	11,651	11,769	11,689	11,917	12,136	12,458	13,201
5	Residential buildings	95,932	95,333	94,247	93,076	92,129	91,445	90,511	89,659	88,952	88,795	89,769
	Total	338,839	340,560	338,719	338,212	338,126	339,942	338,692	341,612	345,033	351,322	365,667
		1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
1	Machinery and equipment	98,271	103,522	108,812	113,710	118,314	124,538	132,891	141,258	152,481	163,185	175,379
2	Public works, roads, bridges, harbours	31,809	31,996	32,552	33,464	34,817	37,096	40,566	44,808	50,872	57,906	66,495
3	Other non-residential structures	146,416	154,512	164,430	175,720	186,364	198,318	211,750	224,267	238,594	255,268	276,372
4	Other	13,741	13,943	13,928	13,655	13,271	12,927	12,669	12,331	12,075	11,955	12,264
5	Residential buildings	90,849	91,707	92,964	94,522	96,812	100,990	107,641	115,712	127,500	141,014	157,718
	Total	381,086	395,680	412,687	431,071	449,578	473,869	505,517	538,376	581,522	629,328	688,228
		1983	1984	1985	1986		1987		1988	1989		1990
1	Machinery and equipment	190,170	198,633	205,396	216,794		232,497		255,313	287,475		335,386
2	Public works, roads, bridges, harbours	77,680	87,910	99,110	112,560		127,946		146,647	169,846		200,395
3	Other non-residential structures	304,588	329,337	356,396	384,186		411,193		439,561	469,961		505,373
4	Other	13,133	13,674	14,402	15,668		17,423		20,008	23,682		29,213
5	Residential buildings	179,653	198,942	219,855	240,903		260,900		281,299	302,416		326,029
	Total	765,224	828,495	895,159	970,110		1,049,959		1,142,828	1,253,379		1,396,396

Note: The five categories were estimated with GFCF in each and the following values for ρ: machinery and equipment 3.0% of GDP, public works, roads, bridges and harbours 0.5% of GDP, other non-residential structures 2.2% of GDP, other capital goods 0.4% of GDP, residential structures 1.5% of GDP depreciation. This implies estimation of total capital stock with total GFCF and ρ = 7.6% of GDP.

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