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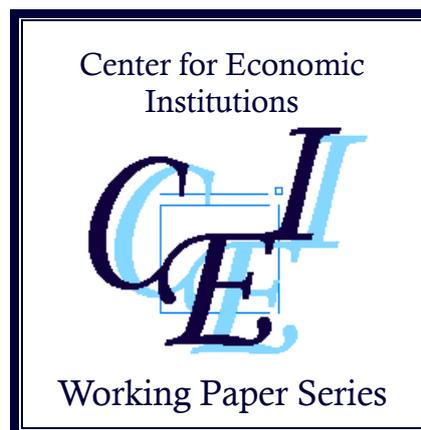
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**“Mining and Indonesia’s Economy: Institutions and
Value Adding, 1870-2010”**

Pierre van der Eng

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Institute of Economic Research
Hitotsubashi University
2-1 Naka, Kunitachi, Tokyo, 186-8603 JAPAN
<http://cei.ier.hit-u.ac.jp/English/index.html>
Tel:+81-42-580-8405/Fax:+81-42-580-8333

Mining and Indonesia's Economy: Institutions and Value Adding, 1870-2010

Pierre van der Eng*

Indonesia Project, Crawford School for Public Policy
ANU College of Asia and the Pacific
The Australian National University
Canberra ACT 0200
Australia
Tel: +61 2 6125 6215
E-mail: pierre.vandereng@anu.edu.au

Abstract

Indonesia has long been a major producer of minerals for international markets. Starting in 2014, it implemented legislation banning exports of unprocessed minerals and requiring producers to invest in processing facilities to add more value before export. This paper establishes what light past experiences in Indonesia with mining sheds on this recent development. It quantifies and discusses the growth of mining production in Indonesia since 1870. It analyses the institutional arrangements that past governments used to maximise resource rents and domestic value adding. The paper finds that production and exports of mining commodities were long dominated by oil, but increased and diversified over time, particularly since the 1960s. The development of the mining sector depended on changes in market prices, mining technologies and the cost of production, but particularly on the institutional arrangements that guided the decisions of foreign investors to commit to mining production and processing in Indonesia.

Key words: natural resources, mining sector, Indonesia, resource rents

JEL-codes: L71, L72, L78, N55, O13, Q32

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Mining and Indonesia's Economy: Institutions and Value Adding, 1870-2010

1. Introduction

Indonesia is one of the world's leading exporters of copper and nickel ore, refined tin and thermal coal, as well as a major producer of gold, natural gas and bauxite. Many of the producers are foreign-owned, and most mineral exports were refined in other countries. Indonesia's 2009 Mining Law decreed that all minerals, except for fuels, would have to be processed domestically before export in order to add more value domestically, starting in 2014. This law appealed to nationalist sentiments at a time when commodity prices were high and expectations were that mining firms could afford to invest in the required smelters and refineries. But with commodity prices falling and firms reluctant to invest in processing facilities, Indonesia's earnings from mining exports have started to decrease.

What light do past experiences with the development of the mining sector in Indonesia shed on this issue? Why did most processing take place outside Indonesia? Did this limit the role of the mining sector been in Indonesia's long-term economic growth? What institutional arrangements did past governments put in place to maximise the share of Indonesian society in the generated resource rents in mining? How successful were these arrangements in maximising value adding in mining before exports from Indonesia? What were the wider macro-economic repercussions of Indonesia's increasing reliance on exports of mining commodities?

There is no literature that discusses the long-term economic development and political economy of Indonesia's mining industry. There are quite a lot of publications about mining during the Dutch colonial period, and some other publications have assessed developments since 1945 (*e.g.* Moenir *et al.* 1985; Jasjfi 2000; Darmono *et al.* 2009). However, most tend to focus on the geological, technological and local aspects of mining, as well as the public administration of mining activities. Some offer snapshots of production statistics, the political economy and the economics of mining in Indonesia, but no consistent and sustained analysis of long-term trends. Historical studies discuss individual mining companies (*e.g.* Lindblad 1985; Baks 1989; Scholte 1989; Erman 2005; Zubir 2006), but it is unclear whether these can be generalised. The oil sector has attracted a lot of attention (*e.g.* Ooi 1982; Bush Aden 1985; Lindblad 1989), but these studies do not yield ready answers to the questions above.

This paper seeks to capture broad trends for the purpose of addressing the questions above. To that end, the next section starts with a quantification of long-term trends in the role of mining in the Indonesian economy from 1870 to 2010 to establish reference points for further discussion. Section 3 offers a narrative of the long-term trends in the expansion of Indonesia's mining sector. Section 4 explains in broad terms the institutions that governments in Indonesia over time created to maximise the share of society in the resource rents that mining activities generated, before quantifying the share of public revenue from

mining in mining value added and the public revenues.¹ Section 5 discusses issues relevant to the role of the mining sector in Indonesia's economy, in terms of employment creation and the impact of commodity price fluctuations on Indonesia's terms-of-trade and the international competitiveness of its other tradable goods. Section 6 addresses the question to what degree the processing of commodities before export added value to Indonesia's economy. The final section concludes with reference to the questions above.

2. Long-term quantitative trends in mining production and exports

A common way to capture the role of the mining sector in a national economy is to analyse the share of mining in gross domestic product (GDP) and in commodity exports. There are two problems with the first option: (a) Indonesia's current national accounts are only consistent since 2000 (Van der Eng 2005, 2010); (b) the national accounts only identify 'oil and gas', 'other mining', and 'quarrying' without further disaggregation of gross value added (GVA) in the mining sector. Indonesia's quinquennial Input-Output (I-O) Tables since 1971 offer a higher degree of disaggregation, and are summarised in Table 1.

[Table 1 about here]

Panel A shows that the share of mining in GDP almost quadrupled from 7% in 1971 to 26% in 1980, before it decreased and stabilised at 11 to 12%. The growth of oil production during the 1970s, together with the growth of gas production since the late-1970s and the rapid increase in international oil and gas prices, are the main reasons for this development. Panel B confirms that oil and gas production dominated value adding in Indonesia's mining sector since 1971. It contributed 85% to mining GVA in 1971, rising to 95% in 1980s, before declining gradually as mining GVA diversified in favour of coal, copper ore, and to a lesser extent gold, silver and iron and manganese ores. Panel C shows that by 1980 85% of oil and gas was exported, decreasing to 40% by 2000 in favour of increasing domestic consumption of oil and gas. On average, Indonesia exported 40 to 45% of total mining output. The remainder was used for further processing in manufacturing, and eventually for domestic intermediate consumption, investment or exports.

Data from the I-O Tables, particularly the input-output ratios, were used in this paper to generate new long-term estimates of value added in mining during 1870-2010. These estimates are also based on the construction of long-term production and price series for Indonesia's mining commodities from a wide range of disparate sources. Together, these data yielded estimates of gross output and GVA in current and constant 2000 prices, as well as implicit price indices for Indonesia's mining commodities. Figure 1 shows this paper's

¹ In line with North (1990), the institutional arrangements discussed in this paper are essentially the regulations, laws and government agencies that expressed and detailed the stance of mining-related government policy, and that impacted on the decisions and productive activities of mining companies operating in Indonesia.

estimates of GVA in constant 2000 prices, compared with linked estimates of GVA in mining in constant prices from Indonesia's national accounts. The difference is caused by the fact that Statistics Indonesia (*Badan Pusat Statistik*, BPS) used different, but unspecified commodity prices, I-O ratios and possibly different production data than this paper.² In addition, the GVA data from the national accounts splice series in respectively 1960, 1971, 1983, 1993 and 2000 prices, while the constant price estimates for this paper are based on 2000 prices only. Implicitly, the latter overestimates GVA in earlier years, because the price of crude oil was significantly lower relative to other commodities, particularly before the 1970s. Nevertheless, Figure 1 demonstrates that oil and gas dominated mining GVA until 1990 when oil production started to stagnate, and until 2000 when oil production declined and mining production diversified.

[Figure 1 about here]

Figure 2 shows that in the late-19th century, the production of tin ore and concentrate dominated GVA in mining, but that throughout the 20th century crude oil production occupied the major share. Tin production remained significant until the 1960s, when it slumped. It recovered in the late 1970s and after, but by then most tin ore and concentrate was processed in Indonesia and counted as GVA in basic metal manufacturing. The chart confirms that Indonesian mining production diversified significantly during the last 20 years, and that particularly the shares of coal and copper ore in GVA increased.

[Figure 2 about here]

To assess the role of the mining sector in the Indonesian economy, Figure 3 reveals different estimates of the share of mining GVA in GDP since 1880. The 1951-2010 shares from the national accounts are unreliable up to the 1980s. The 1880-2010 estimates were obtained by substituting the rough estimate of GVA in mining in 2000 prices in Van der Eng (2010) with the new estimates presented above. However, the 2000 price of particularly oil and gas overestimates the contribution of GVA in mining in this series before at least the 1970s, which explains the discrepancy between the shares of mining in GDP in 2000 prices and in current prices. A compromise is the share of mining in GDP with oil and gas at 'pre-1973' shadow prices. Thus, both series in constant 2000 prices represent minimum and maximum estimates of the share of mining GVA in GDP. Together they confirm that mining output already increased faster than the economy as a whole during the 1950s and 1960s, because the sector's share increased from 5 to 10% in the early 1950s to 15 to 30%

² For example, there are significant discrepancies between the mining production data for recent years available from BPS and from Indonesia's Ministry of Energy and Mineral Resources (*Kementerian Energi dan Sumber Daya Mineral*). Since 1980, BPS bases its estimates on an annual survey of mining companies. In contrast, the Ministry bases its production estimates on the annual reports that all companies holding mining licenses are required to submit to it.

by the late 1970s. For 1900-40, both estimates in Figure 3 suggests a gradual increase in the share of mining GVA in GDP by a factor of four to 5 to 10% by 1940.

[Figure 3 about here]

Figure 3 also shows the share of mining commodities in Indonesia's total exports. The trend was clearly driven by exports of crude oil and refined oil products, which were joined in the late-1970s by liquefied natural gas (LNG) exports. Until 1900, the share of mining products (largely tin concentrate) was less than 10%, rising to an average of 25% by the 1930s and increasing further to a very substantial 62% during the oil boom of the 1970s, and 65% in the 1980s, before decreasing to 32% in the 1990s and 2000s. Clearly, with shares exceeding 25% since the 1930s, Indonesia's export earnings were dependent on mining commodities, particularly oil and gas.

3. The long-term expansion of mining production and exports

Indonesians have been mining metal ores (gold, silver and tin) and other minerals (such as diamonds and other precious stones) for many centuries in different parts of the country. Until the mid-19th century, these operations were small. They employed basic technologies, and produced small quantities of minerals. Mining activity increased slowly in the course of the 19th century, roughly in line with the establishment of effective Dutch colonial rule radiating from the core island of Java to the other islands of Indonesia.³

Following the nationalisation of the chartered United East Indies Company (*Vereenigde Oost-Indische Compagnie*, VOC) in 1789, the Dutch colonial government continued the VOC's practice of banning all private mining operations in the areas under its direct rule. To maximise its share in the resource rents⁴, it reserved all mining rights in Indonesia for itself. Like the VOC, it effectively usurped existing seigneurial rights of local rulers in Indonesia. In areas under indirect colonial rule, the government continued existing arrangements with local rulers. For example, it continued the monopoly granted in 1755 by the Sultan of Palembang to the VOC on the purchase of tin ore from small indigenous and ethnic Chinese miners on Bangka island off the coast of Sumatra.

³ Unless indicated otherwise, the descriptive discussion until 1941 draws on Van Lier (1918), *Encyclopaedie* (1918-1941), Van Bemmelen (1941), Ter Braake (1944), and *Jaarboek van het Mijnwezen* (1872-1939).

⁴ Resource rent is the difference between revenues from mining and the extraction, marketing and processing cost of a mineral up to the stage of delivery for manufacturing production or export. Depending on institutional arrangements, these rents are normally shared between producers and government agencies. The latter collect it and channel it through budgetary processes for transformation into productive public assets that sustain economic development and benefit society at large. Resource rents can be unexpectedly high due to (a) a superior quality of mineral deposits than specified in a contract, (b) product scarcity in markets that drive up the market price, or (c) superior technical or marketing skills of the producers. In that case there is an argument for the ultimate owners of the resource to claim a higher share beyond what producers are contractually obliged to share with them.

During the first half of the 19th century, the colonial government expected to establish further mining ventures for fiscal purposes, as most of its budget at the time was financed with revenues from the mobilisation of agricultural commodities for export. Nevertheless, it opened just one coal mine in Southeast Kalimantan in 1846 to produce coal for the Navy. This experience clarified that it required the involvement of private enterprise; both to finance the required capital outlay to establishing the mining ventures and the facilities that they required (processing, transport, port facilities *etc.*), as to manage them.

The principle that the development of mining would serve fiscal purposes, and the acknowledgement of necessary private sector involvement, were the basis for Indonesia's mining legislation after 1850 (see section 3). To encourage private sector interest, the government established in 1872 a Mining Service (*Dienst voor het Mijnwezen*, from 1923 *Dienst van den Mijnbouw* and later *Jawatan Pertambangan Negara*).⁵ The Service hired geologists and mining engineers to conduct studies of minerals in different parts of the country in order to identify the potential of known mining deposits, as well as studies of the geology of parts of Indonesia to discover further deposits.⁶ The Service was also tasked with the management of state-owned mining ventures, the sale of produce from these ventures, and issuing and administering concessions to private firms.

A problem with the explorations for minerals was the relative remoteness of potential deposits and their location in inaccessible, often forested terrain. This not only hampered the search effort, but also the commercial viability of concessions. Nevertheless, publications by engineers and geologists of the Service, as well as discoveries of local public servants, adventurers, and would-be entrepreneurs in various regions of Indonesia led to the establishment of a growing number of mining ventures. This started with tin mining on Belitung island (1852) by a firm that later became the multinational *NV Billiton Maatschappij* (now *BHPBilliton*) and with coal mining in Southeast Kalimantan (1853).

Nevertheless, by the 1870s, the biggest mining ventures were still the two tin operations on Bangka and Belitung. The government granted increasing numbers of exploration licenses and concessions for the exploitation of mineral deposits in other regions. Although only around 25% of applications for exploration licenses were successful, Table 2 indicates that there was a spate of speculative interest in exploration permits during 1897-1909, particularly for gold and oil, following the high profitability of the first few oil companies in Indonesia.

⁵ All activities are duly recorded in the annual report of the service ('*Verslag van het Mijnwezen*'), published in the annual *Jaarboek van het Mijnwezen* until 1939. The Mining Service was during 1907-33 part of the Department of Public Works, and during 1934-59 part of the Department of Economic Affairs.

⁶ The *Jaarboek* contains many studies by geologists and engineers employed by the Service. In addition, the service published monographs on individual minerals and the geology of regions in Indonesia. This research continued into the early-1950s, and was since 1922 conducted by separate agency, the Geological Service (*Geologische Dienst*, later *Jawatan Tambang dan Geologi*). It is unclear to what degree this research led to productive mining ventures. Van Bosse (1959) claims that most ventures were the result of private initiatives, and that research only led to some mining ventures: gold in Banten and sulphur in Priangan (both in West Java), silver in South Sumatra and nickel in Central Sulawesi. Bauxite mining on Bintan island could be another example.

[Table 2 about here]

Most exploration licenses did not lead to concessions, and most of the concessions never reached the production stage. Many entrepreneurs failed to raise the required capital for the establishment of ore production facilities and/or the infrastructure needed for basic processing and transport to ports. In other cases, explorations revealed that deposits were less promising than expected. Even if exploitation started, profitability could be illusory, as was the case with the Pulau Laut concession (1903) in Kalimantan operated by the *NV Steenkolen-Maatschappij Poeloe Laoet* (Baks 1989). Such disappointing results, combined with a temporary ban on new exploration licenses for oil and coal during 1913-16, due to geopolitical concerns about preserving fossil fuel deposits in Indonesia, caused the number of licenses to dwindle to just 7 in 1917. Roughly 55 to 70% of concessions failed to reach production stage; 75 to 85% in case of precious metals, 30 to 45% for oil and gas, and 20 to 30% for coal. Concessions lapsed when their holders had not started production after an agreed period.

Tin ore production and exports dominated mining activity until about 1900, after which the number of mining operations increased significantly, as Table 2 indicates. The volume of production increased even faster. Apart from tin, mining production included coal (particularly after 1870), gold and silver (1880), crude oil (1889), copper iodine (1897), wolframite (1897), manganese ore (1904), lead ore (1904), natural gas (1915), asphalt (1928), sulphur (1928), phosphate rock (1929), bauxite (1935), monazite (1936), copper ore (1937), nickel ore (1938), platinum ore (1938), and a wide range of quarrying products such as sandstone, marble, limestone, volcanic trass, kaolin clay, sand, and also quicklime for cement production. The available production statistics are based on the annual reports that concession holders submitted to the Mining Service, the annual reports of the Service on the state-owned mining ventures, and annual reports that public companies released to their shareholders. They exclude production by informal local ventures, except where they sold produce to companies operating registered concessions.

As exploitation of mineral deposits increased, some successful companies evolved into sizeable operations operating multiple concessions in Indonesia. By the late-1930s, the biggest mining operations and companies were:

- (a) the Bangka and Belitung tin mining ventures, both government-owned after 1924, when the government took a 62.5% share in a new joint venture with *NV Billiton* (the *Gemeenschappelijke Mijnbouwmaatschappij Billiton*, GMB) that henceforth operated the Belitung concession;
- (b) the private oil company *NV Koninklijke Maatschappij tot Exploitatie van Petroleumbronnen in Nederlandsch-Indië* (or the 'Royal Dutch'), which merged with *Shell* in the UK in 1907 and internationalised its operations. Its local subsidiary, the *NV Bataafsche*

Petroleum Maatschappij (BPM) explored deposits and operated all *Shell* concessions in Indonesia, producing over 75% of all oil;

(c) the state-owned Ombilin (West Sumatra), Bukit Asem (Palembang) and Pulau Laut (Southeast Kalimantan) coal mines;

(d) the state-owned Cikotok gold and silver mine (West Java) operated by the *NV Mijnbouw Maatschappij Zuid-Bantam* (a subsidiary of *NV Billiton*).

The largest two coal mines were established from the outset as state-owned operations for three reasons: (a) to maximise the government share of the resource rents; (b) to overcome perceived market failure, as coal deposits were not easily accessible, the coal quality was low, and the high infrastructure cost of the required local railways for transport from mine to port limited private sector interest and precluded private operations of the mines; (c) to reduce Indonesia's dependence on coal imports from Europe and secure a regular supply of coal for the Navy, interisland steam shipping and the state-owned railways in Java.

At the other end of the scale were many small, unregistered quarrying operations run by local groups of Indonesian miners and/or immigrant Chinese. The most significant ones yielded diamonds, gold and silver in Kalimantan and Sulawesi. Others produced coal in Kalimantan. Their production was only partially recorded, often by the registered ventures that purchased their produce for processing and/or marketing.

Indonesia's independence in the late-1940s brought continuity and change in mining operations.⁷ The government of the Republic of Indonesia continued the institutional arrangements for the mining sector, including the colonial government's state-owned and public-private joint ventures. The pre-war system of permits and concessions remained in place until 1960, so that there was continuity in the administration and monitoring of mining operations. The Mining Service continued its operations and became the Department of Basic Industry and Mining (*Departemen Perindustrian Dasar dan Pertambangan*) in 1959.⁸ This continuity underpinned the quick recovery of tin ore production to pre-war levels during 1949-55. Oil production reached pre-war levels in 1951 before doubling by 1960. The production of manganese ore in Java and of bauxite on Bintan island also recovered quickly on the back of the commodity boom sparked by the 1950-53 Korean War. But the production of other commodities remained below pre-war levels.

On the other hand, the Indonesian parliament decided in 1951 to revise existing mining legislation and postpone the granting of new concessions. Recovery of production therefore depended on firms resuming and expanding activities on existing concessions. Many foreign-owned firms experienced difficulties regaining control over their mining concessions. Regional insecurity, or the occupation of mining assets by local interests, such

⁷ Unless indicated otherwise, the descriptive discussion draws on Sigit *et al.* 1969, Moenir *et al.* 1985, Darmono *et al.* 2009, and *United States Geological Survey Minerals Yearbook* (1963-2012).

⁸ The ministry changed name several times. It became the Ministry of Mining, Oil and Gas (*Kementerian Pertambangan dan Migas*) in 1966 and is now the Ministry of Energy and Mineral Resources (*Kementerian Energi dan Sumber Daya Mineral*).

as workers and local authorities, prevented them from resuming activities. Other companies balked at having to raise new investment capital to recover production facilities that had been damaged or neglected during the Japanese occupation and the war of independence.

In the course of the 1950s, foreign-owned private companies were placed under government control and converted into state-owned enterprises (SOEs). Firstly, several Dutch-owned ventures faced legal uncertainties. For example, workers occupied *BPM*'s concessions in North Sumatra in the 1940s, until the local military ended the occupation to resume oil production (Lindblad 2008: 153-54). In 1955, the government formally took control of these concessions, arguing that *BPM* had not resumed production, but without nationalising the *BPM* facilities. A year later it decided not to return these concessions to *BPM* but to run them as a state-controlled venture that became state-controlled limited liability company (*Perusahaan Terbatas*) *PT Permina* in 1957.

Secondly, public-private joint ventures were converted into PTs and later SOEs (*Perusahaan Negara*, PN) that were run as branches of government departments. For example, *NV Billiton* secured an extension of its GMB joint venture in 1953 to mine tin ore in Belitung. But it experienced disruptive interventions from the representative of the majority shareholder in the operations of GMB, and agreed in 1958 to dissolve it (Van de Kerkhof 2005). Likewise, the public-private joint-venture *NV Nederlandsch-Indische Aardolie Maatschappij* (NIAM) in Jambi became state-controlled *PT Permindo* in 1958 and SOE *PN Pertamina* in 1959.

Thirdly, in 1956, the government put an ultimatum to all companies that had not yet resumed production on their concessions. They had to submit investment plans and nominate dates by which they would resume production, or face annulment of the concessions. In other words, several concessions, including the structures and equipment they contained, were *de-facto* nationalised during 1956-57. They were generally put under the management of the local military, which had some capacity to run them, awaiting the establishment of state-controlled companies to assume their management.

Fourthly, mining ventures operated by the former Mining Service were converted to state-controlled enterprises. For example, in 1955 the government ordered state-owned *Bank Industri Negara* to invest in recovering the Cikotok gold mine, which had been idle since 1942. The mine resumed production in 1958 under the management of what would become state-controlled *PT Tambang Emas Tjikotok*, which in 1968 became part of SOE *PN Aneka Tambang* (now *PT Antam*). Establishment of SOEs was further compounded by the nationalisations of the operations and assets of Dutch-owned companies in Indonesia during 1957-58 (Lindblad 2008). While nationalised ventures were initially operated by the local military, incorporated SOEs assumed their management; either as a PN or a PD (*Perusahaan Daerah*).⁹ For example, *PT Permigan* (later *PN Permigan*) operated the nationalised oil sites in Central Java and Eastern Indonesia until 1966. The provincial

⁹ A PN company was effectively a branch of a government department. In 1974 PN companies were re-converted into government-owned limited liability companies (PT).

governments of West Java and Yogyakarta established *PD Pertambangan Djawa Barat* and *PD Pertambangan Mangan*, respectively, to resume manganese mining at the nationalised Sukabumi and Kliripan sites of the pre-war *NV Algemeene Industriele Mijnbouw en Exploitatie Maatschappij*.

Although notionally supervised by the Department of Mining, the SOEs operated effectively outside the direct authority of the Department, generally in close association with the local military that had the capacity and manpower to organise these ventures, as well as an interest in raising revenues for off-budget military-related expenditure (Purwanto 2009ab). But the SOEs generally lacked capital and expertise. To overcome that, a new arrangement was enshrined in the new 1960 mining legislation, which involved a ‘Contract of Work’ (CoW or *kontrak karya*) between a local and foreign company that included production sharing arrangements. For example, in 1960 the *North Sumatra Oil Development Corp*, a consortium of Japanese oil companies, was one of the first to conclude a 13-year CoW containing a production sharing arrangement with *PT Permina* for the rehabilitation of the former *BPM* facilities in Aceh and North Sumatra (Gibson 1966: 60-63; Clark 1968: 68-70). The Japanese consortium members lent \$52 million for the delivery of equipment, machinery and technical assistance from Japan in return for crude oil for their refineries in Japan. The sharing of production was effectively an in-kind payment for contracting services and supplies, and in some cases in-kind repayment of loans that foreign contractors extended to SOEs to finance operations and/or investments. Payment in kind allowed contractors to evade Indonesia’s unrealistic official exchange rates.

After the concessions of the three dominant foreign oil companies *Stanvac*, *Caltex* and *Shell* ended in 1960, all three agreed in 1963 to be retained as contractors to the SOEs that took control of their former concessions and to which they sold oil refineries and assets for the distribution of oil products: *PT Permina* worked with *Stanvac*, *PT Pertamina* with *Caltex*, and *PT Permigan* with *Shell*. These arrangements were suspended when British and American-owned mining companies were effectively nationalised and their operations taken over by SOEs during the Indonesia’s ‘confrontation’ with Malaysia in 1963-67 (Redfern 2010: 182-459; White 2012: 1297-1301).

Following amalgamations of mining SOEs in 1968, four of them dominated the mining industry: *PN Pertamina* (oil and gas), *PN Aneka Tambang* (bauxite, gold, nickel, diamonds and iron ore), *PN Tambang Timah* (tin) and *PN Tambang Batu Bara* (coal). Together they controlled around 90% of mining activity. Each engaged foreign companies under CoWs and production sharing arrangements in the exploration and exploitation of new and existing mineral deposits in Indonesia on the basis of the 1960 and 1967 mining laws (see Section 4) (Gibson 1966; Redfern 2010: 140-43). Foreign firms made technological expertise and investment capital for the purchase of equipment available. In return, they recouped their investment with the revenues from exporting produce, before sharing the remainder with the SOEs (Darmono *et al.* 2009: 182-190). SOEs exported or

processed their share of produce and used the proceeds for various investments, including in facilities to refine ores, or produce crude metals, oil derivatives or LNG.

Table 3 shows the number of non-oil and gas mining sites around 1970. The 1971 population census estimated employment in oil and gas mining to be 43,200 and in other mining ventures 42,600. Assuming that most employees in small scale mining ventures were occupied in mining as a sideline activity and not included in the census, Table 3 seems reasonably complete, with the exception of nickel and copper mining ventures in Sulawesi and West Papua. The number of 119 sites operated by formal companies is lower than the 350 pre-war mining sites in Table 3. Few new sites were added during 1940-70, so that the remaining sites most likely produced oil and gas.¹⁰ Of the 119 sites, the largest 23 were operated by SOEs, which together employed 46% of workers in non-oil and gas mining. Altogether, 22% were employed by smaller registered private companies and 32% by small informal local enterprises, particularly in the mining of gold, diamonds and quicklime.

[Table 3 about here]

Despite these changes during the 1950s and 1960s, production and export of mining commodities continued to increase, as Figures 1 and 3 showed. Much of this was driven by the recovery and expansion of oil production. However, output of some other commodities increased quickly as well; particularly bauxite (since 1963), nickel and iron ore/sands (since 1965), iodine, copper and silver (since 1973), gold (since 1980) and also coal (since 1986). All developments involved increasing numbers of foreign companies under CoWs.

For example, nickel ore production started to increase after *PT Sulawesi Nickel Development* (a subsidiary of 4 Japanese companies) in 1963 accepted a 10-year CoW with the Ministry of Mining and private domestic firm *PT Nikkel Indonesia* to improve existing mining operations in Southeast Sulawesi. The deal included \$1.35 million credit to import of equipment and technical assistance from Japan, which was paid back with ore deliveries to the consortium's smelters in Japan (Gibson 1966: 64-65; Clarke 1968: 71-72; Hunter 1968 78). In 1968 Canadian firm *International Nickel Company Ltd* (Inco, now part of *Vale Canada Ltd*) obtained a 40-year CoW for the exploration and development of large new deposits in South Sulawesi. Copper ore production increased since 1972, after US company *Freeport Sulphur Co* (now *Freeport-McMoran Copper & Gold Inc*) invested on the basis of CoWs in the exploration and later in the exploitation of copper and gold deposits in West Papua to supply its smelters in the Americas.

By 1971, there were just 17 non-oil CoWs in place (Semay 1971: 137), but their number increased quickly. Nevertheless, foreign direct investment (FDI) under CoWs for non-oil ventures was small relative to the accumulation of FDI that international oil companies poured into Indonesia under CoWs for the exploration and exploitation of new

¹⁰ The remaining number is 231. Ooi (1982: 135) notes that Indonesia had 237 oil fields in 1976, which includes new fields identified during 1960-76 that may have compensated depleted and abandoned fields.

oil and gas deposits. Since 1968, *Pertamina* handled all government interests in CoWs involving oil and gas. Due to the rapid increase of oil production in the 1970s, it was by far the largest of the mining SOEs. Until its monopoly was dismantled in 2001, *Pertamina* was a 'state within a state' (Booth 1998: 319). Despite a major liquidity crisis in 1975, the company was engaged in exporting crude oil, but also in oil refining, shipping oil, the distribution of oil-based products such as petrol and kerosene, and an increasing range of non-oil pursuits ranging from property development to manufacturing. The surpluses generated by *Pertamina* benefited the government budget, but the company was also closely associated with the Indonesian military and facilitated off-budget military expenditure.

In contrast to non-oil mining, in 1970 *Pertamina* already administered 42 CoWs, rising to 55 in 1975, 78 in 1985 and 92 in 1995 with foreign oil and gas companies, including the world's largest such as *Shell* (UK), *Chevron/Texaco* and *Conoco* (USA) (Moenir *et al.* 1985: 315-323; Darmono *et al.* 2009: 224). The details of each contract varied. The contracts could *e.g.* be for surveying, exploration, production, both on and off-shore, or the construction of *Pertamina*'s processing facilities. In case of production, the contracts specified how any physical production of oil and gas would be shared and what bonuses foreign contractors were entitled to, depending on the investment they made. To carry out production contracts, foreign companies were required to establish a local subsidiary company for the duration of the project. Upon completion of the contract, all equipment and fixed production facilities of the local company would generally fall to *Pertamina*. The same applied to non-oil and gas operations involving foreign firms under CoWs and the SOEs that held the mining permits.

FDI inflows and *Pertamina*'s reinvested earnings carried the accelerated expansion of oil production from 175 million barrels per year (mby) in 1965 to a peak of 615 mby in 1978. Production stabilised at around 550 mby until 1998. This was broadly in line with the quota allocated to Indonesia by the Organisation of Petroleum Exporting Countries (OPEC), of which Indonesia had been a member since 1962. After 2002, Indonesia struggled to meet its OPEC quota and it left the organisation in 2009. The slump in oil production to 345 mby in 2010 was largely due to flagging FDI. Section 4 explains that legal changes since 1999 created uncertainties, causing foreign oil companies to restrict investment in the exploration of oil deposits in Indonesia. Oil production decreased as existing sites became depleted.

In the 1960s and 1970s, tin and coal production were exceptions to the growth of mining output. For tin, a reason was that international tin prices were relatively low from the mid-1950s to the late-1960s. But the key reason was the inefficiently operation of tin and coal ventures by SOEs *PN Tambang Timah* and *PN Tambang Batu Bara*. Company and site managers tended to be political appointees without mining experience (Hunter 1968: 80-81). These SOEs were also treated as cash cows in the 1960s; their contributions to the state coffers in the form of taxes, levies and royalties were over 45% of revenues (Hunter 1968: 75, 81-82). Including contributions to off-budget expenditure, that share may have been 80% (Gillis and Jenkins 1978: 135). Consequently, funds for salary payments and

investments in new technology to improve efficiency were limited until in 1967 SOEs were again allowed to reinvest most of their net earnings (Nikle 1970: 70).

Rising tin prices during the 1970s helped *PN Tambang Timah*, when the stockpiling strategy of the International Tin Council created an artificial tin shortage. Indonesia's tin production soon followed tin prices due to FDI inflows under CoWs in a new fleet of large dredges for off-shore tin mining, as well as new investment in the rehabilitation of *PN Tambang Timah*'s operations. Investment also updated the refining facilities at Mentok on Bangka, eliminating Indonesia's tin ore exports in favour of tin (Lloyd 1975: 336-337).

Despite foreign aid from East Germany and Poland, coal production long remained below pre-war levels due to management inefficiencies, deterioration of equipment, as well as a lack of capital and foreign exchange to restore it, as most coal was used domestically rather than exported. Demand for coal decreased when the state railways phased out its use of steam locomotives in Java in 1967 (Hunter 1968: 75-76). In the 1980s, the government reconsidered its energy policy, acknowledging the need for coal to electric power and cement plants. Rehabilitation of the Ombilin, Bukit Asem and Pulau Laut mines increased coal production, but most of this came on the back of FDI in new coal mining operations, particularly by *BP* and *Conzinc Riotinto of Australia Ltd* in the large *PT KalTim Prima Coal* venture in East Kalimantan during 1982-2003.

[Table 4 about here]

The expansion and diversification of mining production since the 1970s was underpinned by sustained increases in the numbers of CoWs held by foreign companies and mining permits held by SOEs and Indonesian private companies. By 1975 the total number of permits was 321 (Lloyd 1975: 330), rising to 597 by 2000. Section 4 explains that the new 2009 Mining Law phased out the CoW system in favour of a licensing system. By the end of 2009 no less than 8,020 mining licenses had been issued, of which 31% for production and the rest for surveying and exploration (MEMR 2011: 31). By 2012 the total number was over 10,000 as Table 4 shows. More than 99% of these had been issued by provincial and district governments and included many of the small-scale operations that had hitherto been informal and/or illegal. Just 4,151 of these licenses were judged to be 'clear and clean', *i.e.* not subject to competing claims and held by a company registered for taxation purposes (*Jakarta Post*, 26 July 2012). Nevertheless, this exceeds the 597 permits in 2000 by far. Given high commodity prices in recent years, the number is reminiscent of the speculative boom in exploration permits issued prior to World War I, as Table 2 showed.

[Table 5 about here]

4. Institutional arrangements to distribute the resource rents

The growth and diversification of mining activities discussed in sections 2 and 3 generated resource rents, particularly at times when international commodity prices were high. To secure a fair share of those resource rents for the benefit of Indonesia's society, past governments put in place legal institutions that maximised their share in those rents. Such arrangements necessarily had to leave sufficient guarantees that foreign companies would be able to recoup their investments and pay for foreign expertise, as well as generate a reasonable return on FDI during the life of a venture. This section describes the essence of these changing institutional arrangements for the purpose of assessing their impact on mining development.

Section 3 noted that from 1850 the colonial government allowed private companies to start mining in Indonesia. Government regulations of 1850 and 1873 determined the general conditions under which private mining firms operated. They separated subsoil and surface rights for specified minerals and made exploration and exploitation of their deposits dependent on permits. Exploration licenses could be granted by regional governments for a maximum of 8 years. Concessions for the exploitation of deposits would only be issued by the central government for areas under direct colonial rule. The concessions stipulated the particular conditions that applied to individual operations, such as a due date for production to start, and the annual royalty to be paid to the government after starting production. Royalties were generally defined as an annual *f*0.25 per *bahu* (0.71 hectares), and companies paid an additional 4 to 10% of the annual net profit of the venture. The 1872 Mining Service administered these regulations and supervised their application in private mining operations.

The 1873 regulation required further clarification during subsequent years. For example, to specify the minerals the regulation applied to. The principles of the regulation and the accumulation of clarifications were included in the 1899 Mining Law and an implementing 1906 government ordinance that came into effect in 1907. The law established the general principles, while its details were clarified in the ordinance. Together, they separated surface and subsoil rights unambiguously, effectively vested rights to minerals in the government and specified that concessions would only be granted to entities holding exploration rights to avoid encouraging speculative interest in exploration rights. For judicial reasons, only citizens, residents and companies registered in The Netherlands or Netherlands Indies qualified for exploration licenses and concessions. Exploration licenses were valid for 3 years and could be extended twice for a maximum of a year each. They applied to a maximum of 10,000 hectares and could be withdrawn if explorations had not started within a year. Concessions were granted for a maximum of 75 years, and a maximum of 2,000 hectares. Exploration licenses attracted an annual fee of *f*0.025 per hectare plus a royalty of 4% of the gross value of any produce generated during the term of

the license in excess of *f*5,000. Concession holders paid a royalty of *f*0.25 per hectare, plus 4% of the gross value of their annual mining production.¹¹

This legislation did not apply to the self-governing regions in colonial Indonesia, unless local rulers had agreed with the central government that they would. The main reason for this arrangement was that local legal customs did not distinguish between subsoil and surface rights. If local rulers agreed, the Mining Service would monitor the licenses and concessions in these areas, and central and regional governments would then share the proceeds. Small-scale mining operations run by local people were exempted from the legislation, but the 1899 law reserved the right for the government to determine that sizeable local operations would no longer be exempted. Lastly, exploration and exploitation of minerals not specifically mentioned in the law would be subject to licensing by local authorities. The only exception was salt, which remained a government monopoly.

This legislation created the certainty that private companies required to invest in exploration and exploitation of mineral deposits, and Table 2 showed that both increased. Depending on the actual deposits in concessions and the development of market conditions, the legal terms soon proved relatively generous to some private enterprises. For example, the first private investors in oil production made windfall profits at a time when oil prices remained high while the demand for petrol for motor vehicles was expanding quickly in the 20 years before World War I. To prevent such cases, the government implemented several ways to increase its share in the resource rents. For example, it reserved concessions with rich deposits for state exploitation upon expiry of existing concessions. This started in 1905 with a few of the small gold and silver mining ventures in the Lembong area in Bengkulu (South Sumatra). They were subsequently run as government ventures, particularly since 1918. The government would also deny new concessions in areas where deposits seemed rich and where exploitation as a government venture was preferable. Another example was a 1910 amendment, which allowed the government to deviate from the details of the law if it was in its interest to do so. For example, oil companies were subsequently required to pay an additional royalty per ton and an additional 20% profit tax for new ‘article 5’ concessions, while new oil concessions were limited to 40 years in 1928.

Not only rich deposits led to greater state involvement. For example, in 1913, the government took over the private loss-making Pulau Laut coal concession, in part for geostrategic reasons (Baks 1989). A further way to maximise the government’s share of the resource rents was to arrange secret bidding for oil concessions, rather than grant them to the first applicant. This was scheduled to start with new oil concessions in Jambi (South Sumatra) in 1915, although it did not proceed in this case because the government decided to exploit the reserves as a government venture (Lindblad 1989 55-56). Altogether, these institutional arrangements indicate that political opinion was shifting in favour of state-controlled exploitation of mineral deposits.

¹¹ All concessions and the conditions under which they were granted can be found in the annual report ‘Verslag van het Mijnwezen’.

This shift in policy stance was formalised with a 1918 amendment to the Mining Law. It specified that deposits of coal, crude oil, iodine and iodine compounds could no longer be exploited by private companies through new concessions, but only by the government and/or private firms contracted by the government. Greater government involvement in key mining industries was the result. For example, in 1921 the government formed a 40-year joint venture with *BPM – NV NIAM* – for the exploitation of oil concessions in Jambi. Net revenues were split evenly between both partners, but the management of the venture remained in the hands of *BPM*. Another example is the government taking a 62.5% share in *GMB* in 1928, which controlled the Belitung tin mining venture, but left management of the venture to *NV Billiton*.

A further indication of the intention to maximise the government share in the resource rents was the ‘Contract of Work’ (*aannemingscontract*) system. It had been included in the 1910 amendment, but only started in 1924. It was based on the notion that the government should maintain maximum control over mining ventures, but that the expertise of private enterprise was necessary to manage and operate these ventures. The management and operation of explorations or concessions took the form of a contract with conditions that would yield better returns to the government than the regular system of exploration permits and exploration concessions. The contract specified the remuneration for the contracted private company. In addition, the government started to make greater use of Article 5a in the 1899 Mining Law, which allowed it to conclude contracts with private firms for the development of sites under conditions that differed from the general specifications in the law.

Consequently, coal and particularly oil and gas mining increasingly took place by state-owned ventures, state-controlled joint-venture companies or by private firms operating as contractors for the government. The requirements in these contracts were quite restrictive for the purpose of maximising government benefits from these mining operations. The number of concessions stagnated and further expansion of mine sites took the form of CoWs and Article 5a contracts, as Table 2 shows. The joint ventures remained limited to a few large cases.

Thus, the conditions under which mining firms operated in Indonesia were relatively uniform until 1918, when they clearly started to vary for large projects that generated high resource rents. To an extent they became subject to fierce negotiations between government and private companies about the details of contracts and concessions. It offered the government an opportunity to maximise its share in the resource rents, but it also created a degree of uncertainty for private companies. The outcome of the negotiations may well have depended on the merits of each case, and the degree of dependence of either party on the other. That is, the government needed the private foreign companies, and the private companies needed the government for a range of public goods associated with mining venture (energy and transport infrastructure, security, social facilities like education for workers families *etc.*).

Due to this variation in the conditions under which private firms operated in Indonesia, it is difficult to state what on balance the share of government and firms was in the resource rents. For example, American oil company *Standard Oil Co. of New Jersey* estimated that its *NV Nederlandsche Koloniale Petroleum Maatschappij* subsidiary in Indonesia shared around 50% of its revenues with the government before World War II, comprising 4% of the gross value of crude oil production, a 20% tax on net revenues under Article 5a, and a general corporate income tax of 20% (Higgins 1957: 41).

After 1945, mining operations resumed on the basis of the pre-war legislation, which continued to be in force after Indonesia's independence. However, as Section 3 mentioned, the institutional arrangements that divided the resource rents were about to change. Not only did rural insecurity, destruction and take-overs by workers and local authorities make it difficult for foreign managers to return to the mining sites of their companies, but regulatory uncertainty affected new investment in mining production on existing concessions.

This uncertainty did not directly stem from Article 33(3) in the 1945 Constitution of the Republic of Indonesia, which specified that the 'land, water and the natural resources contained within them are to be controlled by the State and used for the greatest possible prosperity of the people'.¹² Arguably, this clause continued the stance of the pre-war mining policy that effectively vested rights to minerals in the government and favoured significant government control over mining ventures for the purpose maximising society's share in the resource rents, except that under the concession system in the 1899 Mining Law the government granted ownership over resources to the companies that mined them.¹³ Further debate about the implications of this clause, combined with growing suspicion about the role of foreign enterprise in Indonesia's economy, guided parliament's call in 1951 for a new mining law, and a moratorium on new exploration licenses and new concessions pending its drafting (*Nieuwsblad voor Sumatra*, 2 July 1951).

A National Committee for Mining submitted a draft of the new law in 1955 with a proposal for separate legislation for the oil industry. This separation of oil and non-oil was possibly related to the fact that the oil industry by then comprised much bigger companies and was also a much bigger foreign exchange earner than other mining sectors. Both factors enhanced the bargaining position of private oil companies relative to the government. For example, unlike other foreign companies, the three remaining foreign oil companies (*Shell*, *Stanvac* and *Caltex*) had concluded 'let alone' agreements with the government (Lindblad 2008: 58-59, 172-74; Redfern 2010: 158-59). The conditions varied, but essentially these companies could retain foreign exchange earnings from exports for the purpose of servicing their foreign borrowing to finance the recovery and expansion of production facilities in Indonesia. In return, they would not demand scarce foreign exchange allocations from the

¹² During 1950-59, Indonesia actually had a 1950 Provisional Constitution in which Article 38(3) repeated Article 33(3) of the 1945 Constitution. It also had an Article 37(3) decreed that the government would prevent 'the existence of private monopolistic organisations which are harmful to the national economy.'

¹³ Nevertheless, the 1949 Federal Constitution of Indonesia did not express this explicitly. Thus, while the 1950 Provisional Constitution almost entirely copied the 1949 constitution, it added new Articles 37(3) and 38.

government's Foreign Exchange Fund that controlled foreign exchange earnings and allocations for imports. The government wanted them to maximise returns and foreign exchange earnings, as well as make new investments to recover and expand production plant. In all, the investment of \$350 million up to 1963 by these three companies helps to explain the rapid expansion of oil production (Redfern 2010: 157).

In principle, the system of permits and concessions administered by the Mining Service under the 1899 Mining Law continued until 1960. In practice, however, the basis for the operations of foreign-owned mining ventures changed depending on the case and the local circumstances that it faced, as explained in Section 3. In legal terms, there were some changes in relevant bylaws, but circumstances like the 1955 elections, changes of government in 1956 and 1957, regional secessions and internal warfare, and nationalisation of Dutch-owned mining companies in 1957-58 prevented the committee from submitting new draft legislation until 1959.

In the meantime, the state-owned and nationalised mining ventures were supervised by the Ministry of Mining, but run in a semi-autonomous way by appointed managers in close collaboration with the local military until the establishment of state-controlled and later state-owned enterprises that henceforth managed them. For example, the *GMB* joint-venture on Belitung was run by the military after 1957 under Ministry supervision, until it was absorbed into *PN Tambang Timah* in 1968, which already controlled the Bangka tin mining venture.

In 1960, Indonesia's parliament passed Law 37/1960 on Mining and Law 44/1960 on the Mining of Oil and Gas. The first ended the system of mining permits and concessions and decreed that mining could only be carried out by Indonesian legal entities and in the case of 'strategic' minerals (*e.g.* tin and nickel) only by government agencies such as SOEs, albeit that foreign companies could be engaged under CoWs with production-sharing arrangements (Redfern 2010: 161). Law 44/1960 contained similar rules, but tailored to the oil sector. Both provided a reasonable basis for some foreign firms to commit to CoWs. But most of them preferred to wait with new commitments until after the enactment of Law 1/1967 on Foreign Investment and the concomitant Law 11/1967 on the Basic Provisions for Mining.

Law 1/1967 granted foreign firms exceptions from import and customs duties for imported machinery, equipment, tools *etc.* related to a specific project. It also permitted repatriation of profits, provided taxes had been paid, and accelerated depreciation of a company's fixed assets in Indonesia. Law 11/1967 extended Laws 37/1960 and 44/1960. It reiterated that domestic legal entities (private companies, SOEs, cooperatives) and individuals could engage in mining ventures on the basis of permits issued by the Ministry of Mining. It reserved the mining of 'strategic' minerals (oil, gas, tin, nickel *etc.*) to government agencies, such as SOEs. The Ministry would issue permits in the case of 'strategic' and 'vital' (gold, silver, zinc, lead *etc.*) minerals, while provincial governments issued them for other minerals.

Permits were henceforth required for prospecting (1 year validity), exploration (3 years) and exploitation (30 years for oil companies), as well as processing, transportation and the sale of mining commodities. Foreign-owned firms could only operate in the mining sector on the basis of a CoW issued by an SOE or a government agency that held the relevant mining permit. A CoW would be for the same activities and periods as specified in the permits held by local entities. A foreign firm holding a CoW for exploration purposes would also be granted exclusive CoWs for subsequent development and production on the site for a period equivalent to those of the permits. For oil and gas production, the CoW included a production-sharing agreement by which the agency or SOE would receive a minimum of 60% of production. For non-oil and gas production, this could be a production or a revenue-sharing arrangement. The agreement left a foreign contractor to finance the project and carry the risk of all operating costs, although it could recover such costs to an annual maximum of 40% (changed to a uniform 20% after 1976) of the value of production. Local and foreign firms were expected to pay land rent for the contract area, as well as property tax, royalties, corporate income tax, export tax, import duties and sales tax. For non-oil and gas, foreign CoW holders were obliged to process ores and produce concentrated ores before export, although they tended to do that as a matter of course anyhow in order to save of transport costs, with the exception of bauxite.

Together, these 1967 laws provided reasonable security to foreign firms operating in Indonesia's mining sector, as well as competitive and predictable royalty rates, and they were the basis for increasing FDI in mining. In later years, the basis for new CoWs was revised several times to accommodate new requirements, for example in relation to income tax and tax concessions, royalties and duties on imported capital goods. This created several 'generations' of contracts with increasingly restrictive conditions for foreign firms (Emerson *et al.* 1984: 114-118; Darmono *et al.* 2009: 189; O'Callaghan 2010: 220). For example, later CoWs for non-oil production required foreign companies to gradually divest until Indonesian share ownership reached 51%. In 1981 a special Coal CoW (CCoW) was introduced to allow coal mining operations by both foreign and domestic private investors (Lucarelli 2010: 19-23). And production sharing arrangements were phased out as Indonesia's balance of payment situation improved.

The oil SOEs were merged in 1968 to form *PN Pertamina* which operated largely on the basis of CoWs and the production sharing arrangements they contained. Law 11/1967 did not prescribe how production was shared. In oil production, after foreign firms had recovered their cash operating costs, capital depreciation and interest payments in the form of a percentage of annual production, the remainder was generally split 60-40% or 65-35% in favour of *Pertamina*. After income tax, the *Pertamina*/government-foreign enterprise distribution was around 85-15% for oil and 70-30% for natural gas, but this differed across CoWs (Emerson *et al.* 1984: 114-115; Bahl and Tumennasan 2004: 211; Fane 2012: 185-186). As international oil prices increased in the 1970s, the details of new CoWs were adjusted to include production sharing arrangements more favourable for *Pertamina*. Its

activities thus yielded windfall revenues that facilitated off-budget spending to benefit the military forces, and its transfers to the government facilitated an increase in central government discretionary spending.

However, *Pertamina* was also a source of inefficiency and blatant rent seeking related to its selective awarding of contracts to local private firms for *e.g.* the trade and transport of the company's oil supplies and the distribution of derivatives. This was only mitigated after the abdication of President Soeharto in 1998 and the first unfettered elections in 1999. Several new laws soon changed the institutions that determined the activity of domestic and foreign mining companies in Indonesia. For example, Law 22/2001 on Oil and Gas required *Pertamina* to give up its control over CoWs and production sharing arrangements for oil (but not gas and LNG production) within two years, in favour of a new regulatory agency to supervise such contracts but not handle produce itself. Since then, *Pertamina* has been an SOE that operates production-sharing contracts on a commercial basis in competition with other domestic firms.

Since 1999, several new laws redefined the public shares in mining-related resource rents, partly devolved authority related to the administration of mining concessions to regional governments, and gave regional governments (27 provinces and 341 districts and municipalities at the time) authority to impose new local taxes on mining ventures. Law 22/1999 on Regional Autonomy ended the highly centralised administrative system in Indonesia and delegated responsibilities to regional authorities. Law 25/1999 on Fiscal Decentralisation and Law 33/2004 on Fiscal Balance specify that regional governments are allowed to keep 80% of the net tax revenues from mining, forestry and fisheries operations in their territories, as well as 30% from natural gas and 15% from oil (except Aceh and Papua that are allowed 70%) (Agustina *et al.* 2012: 5-6). The central government uses the remainder for distribution to other provinces. Other clauses require mining companies to engage in environmental protection and community development in areas in the vicinity of their mining ventures.

Law 34/2000 on Regional Taxes and Levies allows regional governments to impose additional local taxes, subject to approval from the central government, while Government Regulation 75/2001 amended the 1967 Mining Law to allow district governments to issue mining permits for all minerals.¹⁴ Consequently, large mining companies had to associate much more with local communities and governments, which imposed numerous *ad-hoc* taxes and regulations affecting mining operations (Bahl and Tumennasan 2004: 206-207; O'Callaghan 2010: 222; Devi 2013: 44-48). But firms found that regional government services had limited capacity to live up to new authorities. Inconsistencies between central and local legislations compounded the range of uncertainties (Rusli and Duek 2010; Lucarelli 2010: 61-65). Local support for the rapid expansion of small-scale mining

¹⁴ In addition, Law 44/1999 on Forestry banned open pit mining operations from forested areas, and made other mining operations in forested areas subject to permission from the Minister of Forestry, leading to an effective ban on explorations in such areas by foreign companies, even though they were holding CoWs issues before 1999.

operations, often illegal and encroaching on the large mining ventures, was part of the new issues that foreign firms faced (Spiegel 2012; Lucarelli 2010: 66-67). Some foreign firms divested their interests in Indonesia, while others put new projects on hold.

Hence, at a time when international mining commodity prices increased, FDI inflows in mining in Indonesia fluctuated significantly. They decreased from US\$3.0 billion in 1998 to US\$500 million in 2004, before peaking at US\$3.6 billion in 2006 and falling again to US\$1.9 billion in 2010 or just 14% of FDI inflows (Darmono *et al.* 2009: 356; *Statistik Ekonomi Keuangan Indonesia*, Table V.37). During these years, foreign companies became increasingly reluctant to enter new CoWs, particularly for greenfield exploration of deposits. Non-oil exploration indeed attracted a very marginal annual average of US\$24 million per year in the 2000s (PWC, various years).

The 2009 Mineral and Coal Mining Law abolished the CoW system in favour of a license system for both exploration and exploitation. It gave regional governments the authority to issue licenses. Holding an exploration license does not guarantee exploitation rights, as exploitation licenses lasting up to 20 years (with possibly two 10-year extensions) are to be awarded by tender. The new law does not distinguish between foreign and domestic private enterprise in a sense that 100% foreign-owned companies can hold mining licenses, albeit that ownership has to be divested to minority foreign ownership within 10 years, starting 5 years after commencing production. The law confirmed the separation of the government as a market participant (via SOEs) and a regulator. SOEs are now expected to operate as commercial entities, and independent regulators will administer the law. The law also contained new rules on environmental impact and corporate social responsibility reporting, and well as bans on unprocessed mineral exports and on the operation of foreign contractors for mining services.

It took some years to phase in the new law. For example, existing CoWs continued until they expired, and the ban on unprocessed mineral exports became effective in 2014. Foreign investors and analysts expressed a range of concerns about the new law, which they expected to further enhance uncertainty in the mining industry (O'Callaghan 2010; Gandataruna and Haymon 2011). Nevertheless, total FDI in mining was \$2.4 billion per year during 2010-13; higher than US\$1.7 billion per year during 2005-09.

Given these institutional changes since 1850, what share of the resource rents were governments in Indonesia able to capture on behalf of society at large? This paper relies on published government revenue data that are unfortunately inconsistent over time, as well as incomplete. Nevertheless, as far as it can be approximated, Figure 4 shows that the share of mining-related income in total government revenues was just 2 to 5% up to the late-1890s, most of it related to tin mining in Bangka and Belitung. During 1899-1927 public revenue from mining increased significantly, broadly in line with total revenue so that the share remained roughly 5 to 15%. Global oversupply caused commodity prices to plummet during 1928-32, before revenues recovered to an average of 10%. During 1948-68 the share was broadly similar, before the oil boom caused a rapid increase in public revenue from oil to

the extent that during the 1970s and 1980s, 45 to 50% of the budget was mining-related, decreasing to an average of 30% since then.

[Figure 4 about here]

Figure 4 also shows government revenue from mining as a percentage of GVA in mining. This is an imperfect indicator of the distribution of the resource rents, because only current inputs are accounted for in GVA, not the opportunity costs of capital and labour that mining companies and contractors, as well as the government agencies and mining SOEs, necessarily had to incur in order to generate the resource rents in the first place. Nevertheless, the chart shows that during 1870-89, the share was 52% on average, the same as the 1970-2010 average. The share decreased to 23% in the 1910s as oil production increased. This decline is partly explained by the fact that oil ventures required capital investment in exploration, exploitation and particularly processing facilities, as almost all oil was refined domestically for export and domestic consumption (see section 5).¹⁵ This investment required payments of interest and dividends before the resource rents would be distributed between government and private companies.

The significant increase in the 1920s relates to two factors. A spike in the tin price to 1927 in relation to the cartelisation of global tin production (Hillman 2010: 55-59) that boosted government revenue from the Bangka and Belitung ventures, as well as the introduction of new arrangements, particularly CoWs and public-private joint ventures, and changes in the distribution of resource rents. The 1929 crisis and its aftermath clearly intervened. In line with commodity prices, the net revenues of mining companies decreased. Consequently, the government's share in mining GVA fell, but recovered to an average of 25% in the late-1930s. During the 1950s and 1960s, the average was 29 and 22% respectively, suggesting that the nationalisations of foreign companies and change to the CoW system did not immediately make any difference to the government share in GVA, although this takes no account of any off-budget spending that mining SOEs may have facilitated. The share increased to an average of 52% during 1970-2010, when higher commodity prices, the application of production sharing arrangements, and new generations of CoWs allowed the government to claim a higher share of GVA.

¹⁵ Indeed, annual investment in mining increased from an estimated low *f*2 million (5% of total) in 1900 to *f*76 million (25%) in 1929, before slumping to *f*5 million in 1933 (14%) and recovering to *f*30 million (26%) in 1940 (estimates, based on Creutzberg 1977: 54-59).

5. Mining and the wider economy

What significance did mining activity have on the wider economy, apart from its contributions to the economy, export earnings and government revenue? To start, employment in the mining sector grew significantly, but has always been relatively marginal. It increased from 44,000 (or 0.4% of total employment) in 1930, to 87,000 (0.4%) in 1961, 712,500 (1.0%) in 1990 and 1,255,000 (1.2%) in 2010.¹⁶

While densely populated Java has long had a labour surplus, most of the mining ventures were located in distant regions. Large-scale mining production was also generally capital intensive rather than labour intensive for technological reasons, but also because of the relatively high cost of recruitment of skilled migrant labour to those distant regions without amenities equivalent to urban areas. Both factors led to the creation of relatively well-endowed enclave economies that were not well-embedded in the regional economy. They depended largely on the production of a single commodity and some related basic processing and transportation for employment and income opportunities. Large companies had their own transport infrastructure, steam or diesel-driven electric power stations, as well as in-house facilities to produce charcoal for smelting of ores and timber for underground support. Other mining services would be supplied in-house, or purchased from distant, urban-based engineering companies, thus limiting the local backward linkages of mining operations.

The forward linkages were limited as well, for some commodities more than others. Section 6 discusses the different degrees to which mineral products were processed for domestic consumption, investment or export. Panel C in Table 1 already indicated that the share of output processed domestically changed from 43% in 1971 to just 15% in 1980, before increasing to 58% in 2010. Most of this was oil and gas, and when domestic consumption of particularly oil started to exceed exports, more crude oil had to be refined for domestic consumption. For metallic ores, Table 1 shows an increase from 36% of output processed domestically in 1971 to 64% in 1980, largely due to the phasing out of tin ore exports in the 1970s. The decrease to 32% in 1990 was related to the rapid increase in the production of copper ore and bauxite, before some investment in processing facilities for particularly nickel and copper brought the share to 58% in 2010. But most domestic processing mainly involved the production of basic metals, rather than refined metals, basic metal products and the use of these minerals as inputs in other production processes, such as in the chemical industry.

A major issue for the whole economy was the impact of significant changes in international commodity prices on Indonesia's real exchange rate and on the competitiveness of Indonesia's other trade-exposed economic sectors, particularly manufacturing. This effect was compounded by Indonesia also being a major exporter of agricultural commodities, particularly sugar and rubber before World War II, and rubber and palm oil

¹⁶ Calculated from the 1930, 1961, 1990 population censuses and 2010 national labour force survey.

since the war. Figure 5 shows the changes in the average prices of mining commodities. The price of oil fell significantly until just before World War I, before peaking in the late 1910s, and then plummeting again. A response of oil companies in Indonesia was to invest in processing and reduce the relative cost of transporting oil. Hence, the unit price of oil increased in the late-1920s, because it is an average of crude and processed oil products. The prices of other mining commodities, particularly tin ore, increased until a peak in 1927. As noted, this drove change in the institutional arrangements that allowed the central government to capture a larger share of the resource rents. The price movements of oil and tin ore may have cancelled each other out. After 1929 all commodity prices dropped, but oil prices dropped faster. One reason was that Indonesia joined the international tin cartel in 1931 (Hillman 2010: 115-118). Restrictions of tin production halted the tin ore price fall.

[Figure 5 about here]

For 1946-2010, Indonesia's domestic prices in Figure 5 are expressed in US dollars, because Indonesia experienced high inflation at times, which makes it difficult to keep prices on the chart. Indonesia also had a multiple exchange rate system during 1949-1974 for the purpose of restricting imports and implicitly taxing exports. High inflation eroded the value of the Indonesian Rupiah, because official exchange rates were not adjusted accordingly. The official exchange rate that applied to exports reduced the price incentive for export producers and firms had to find ways around that. Small ventures may have engaged in smuggling operations to Malaysia and Singapore, while large companies sought to keep their foreign exchange earnings overseas. Government agencies also worked around the multiple exchange rates, because production sharing agreements in principle prevented disagreement between them and contractors about the applicable exchange rate. They also engaged in barter arrangements with Japan, exchanging bauxite for metal imports. As soon as the foreign exchange restrictions were eased in the 1970s, the US dollar equivalents of both oil and non-oil mining commodity exports rose significantly, as Figure 5 shows. They decreased during the early 1980s, stabilised by the 1990s, and increased very significantly during the commodity boom of the 2000s related to China's rapid economic development.

To the extent that export earnings depended on mining commodities, the price changes in Figure 5 impacted on Indonesia's terms of trade. During 1878-1936, Indonesia had a gold exchange standard under which the central bank kept the nominal exchange rate stable relative to the gold-based Dutch guilder. However, the advantage of nominal exchange rate stability was offset by the inability of the exchange rate to depreciate to accommodate adverse price changes of Indonesian exports in overseas markets. Higher commodity prices therefore tended to increase the general domestic price level relative to countries that did not export such commodities, and *vice versa*. At times, the higher domestic cost of living and thus labour costs made imports cheaper than domestic produce, which reduced the competitiveness of trade-exposed non-commodity sectors such as

manufacturing industry. Consequently, Indonesia's real exchange rate fluctuated to the degree that domestic prices differed from international prices. Another consequence of the exchange rate system was that instability in the real exchange rate made it difficult for entrepreneurs to plan non-commodity producing ventures. These were among the reasons why Indonesia did not see a significant development of a competitive textile industry until the 1930s, when trade protection increased the cost of imported textiles and fostered import-replacing industrialisation (Van der Eng, 2013).

This scope and stance of import-replacing industrialisation continued during the 1950s and 1960s, when Indonesia experienced even greater foreign exchange shortages to meet its current account deficits. The oil boom of the 1970s relieved such difficulties. With 45-50% of the public revenues mining-related in the 1970s and 1980s, the rapid increase of oil revenues facilitated increased public expenditure on infrastructure and development (Hill 2000:46-60). It also facilitated the pursuit of import-replacing development of rice agriculture and industrialisation to create new employment and income opportunities and avoid the worst of the 'Dutch disease' effects of the oil boom. This worked reasonably well until the early-1980s, when the prices of mining commodities decreased. In response, the government embraced policies to support export-oriented industrialisation and encourage a diversification of exports and government revenues away from dependence on oil and gas, as Figure 3 indicated (Hill 2000: 49-52, 80-84, 164-67).

6. Mining-related value adding

Already in the late-19th century, mining development encouraged public discussion about the economic opportunities and political encouragement for domestic processing of minerals before export in Indonesia. For companies, the basic reason was that the cost per unit of transporting, handling and shipping could weigh heavily on unprocessed commodities with low unit values. Thus, depending on the cost of transport, the available technologies and associated costs of processing, as well as the conditions the government imposed on concessions and CoWs, processing of minerals in Indonesia increased during the first half of the 20th century. Particularly the large tin mines and oil companies, as well as smaller ventures producing gold and silver invested in processing facilities. Nevertheless, by 1940 many opportunities for domestic processing remained, albeit that not all were then economical (Van Bemmelen 1940).

From the outset, most crude oil was refined in Indonesia for domestic consumption and export; about 60% of production during 1900-11, increasing to 90% on average during 1912-40. Most oil was initially processed into kerosene for the domestic market, but production expanded and diversified to include other derivatives, such as petrol, aviation gasoline, kerosene, diesel, lubricants, paraffin and asphalt (Lindblad 1989: 66-70). Smaller concession holders would contract with larger companies that owned processing facilities. By the late-1930s, there were 5 large and 3 smaller oil refineries with a capacity of 60 mby.

Oil refining capacity increased during the 1950s until it was around 90 mby in 1963, with the main refining facilities owned by *Shell*, *Stanvac* and *Caltex* (Redfern 2010: 165-166). The expansion of crude oil production and the increase of domestic consumption of oil derivatives therefore implied increasing exports of crude oil. By the late 1950s, 65% of crude production was processed, falling to 25-30% in the 1970s and 1980s. In due time, *Pertamina* increased its processing capacity to 150 mby in 1971 and about 300 mby today, spread over 9 refineries. Although the ageing older refineries could not operate at full capacity, the share of crude oil processed domestically rose to 50-60% during the last two decades while oil exports decreased in favour of domestic consumption.

Natural gas was not exported until the development and application in Indonesia of LNG technology. Starting in 1964, value was added at the 100,000 ton *PN Pupuk Sriwidjaja* fertiliser plant near Palembang (South Sumatra) that used gas as an input to produce urea. It expanded significantly, while other fertiliser plants were established in West Java, East Kalimantan and Aceh. Together they now produce about 3.8 million tons of ammonia and urea fertiliser, using 20% of total gas production. More importantly, Indonesia's main LNG companies *PT Arun* (Aceh) and *PT Badak* (East Kalimantan), both subsidiaries of *Pertamina*, started LNG exports in 1977 and expanded capacity over time on the basis of supply contracts with Japan to process the remainder of gas for export and domestic consumption.

Of the metallic ores, only gold and silver ore were processed in Indonesia for the domestic market. Arguably, domestic processing of tin ore came second in this respect. Most tin ore in Indonesia was long produced through alluvial mining. After washing, it contained about 70 to 75% tin. Ore was long smelted in both Bangka and Belitung, using charcoal and later coal to produce unrefined tin concentrate ingots. The Bangka smelters could refine concentrate further by removing impurities and metals such as wolframite and monazite, but their capacity was limited. The smelters on Belitung could also separate wolframite, but not refine ore. Gradually, small smelters were consolidated into bigger ventures, but the capacity to produce tin concentrate was outpaced by the production of tin ore. Thus, Indonesia exported tin ore, concentrate and a small amount of tin by the 1920s.

As the produced quantities of tin ore increased, capacity constraints in processing led to increased exports of tin ore in the 1920s. Particularly *NV Billiton* subcontracted smelting of tin ore to the large Pulau Brani smelter of the *Straits Trading Company Ltd* in Singapore. It took about 50% of ore from Belitung. From 1924, *GMB* and its two shareholders, *NV Billiton* and the government in colonial Indonesia, looked into opportunities to increase processing capacity in Indonesia for tin ore from both Bangka and Belitung. But by that stage, *NV Billiton* had mining interests in different parts of the world. Its decisions about the location of its processing facilities were guided by its interests in the Americas, Europe and Asia and by opportunities for cooperation with *Consolidated Tin Smelters Ltd* in the UK, which operated tin smelters around the world.

The outcome was that tin ore from Bangka and Belitung was largely processed together with tin ore from Malaya and Bolivia in The Netherlands, Penang, Singapore, and Texas (USA) during the 1930s-60s. The government in Indonesia benefited from this arrangement as a shareholder in *GMB*, which entitled it to dividends from the joint subsidiary company that ran the international processing facilities for *NV Billiton*. The arrangement continued after *GMB* was dissolved in 1958; effectively until in 1963 *PN Tambang Timah* started to increase its own smelting and refining capacity to produce tin concentrate and metal, with the construction of a new German-built 25,000 ton tin smelter at Mentok during 1963-67. By 1975 Indonesia was self-sufficient in tin smelting capacity and tin ore exports have been minimal since then, as Table 1 showed, until banned in 2010.

Like today, expectations about processing of bauxite into alumina and aluminium in Indonesia before export were high in the 1930s. Bauxite production started in 1935 on Bintan island by the *NV Nederlandsch-Indische Bauxiet Exploitatie Maatschappij* (*NIBEM*), a joint venture involving the government and several private companies, including *NV Billiton*. All bauxite was exported to the new plant of *Nippon Aluminium KK* in Taiwan. But the hydroelectric potential of Lake Toba in North Sumatra inspired plans in 1937 for the development a vertically integrated aluminium industry, involving several public-private ventures producing alumina and aluminium products, coordinated by *NV Billiton* (*Bataviaasch Nieuwsblad*, 24 and 25 April, 11 July, 23 December 1940). The project was expected to start in 1942, but World War II intervened. *NIBEM* resumed bauxite exports in 1947, again to Japan, and it postponed the larger project until after the construction of the Lake Toba hydroelectric plant. However, in 1954 *NV Billiton* withheld investment in the face of uncertainty about its operations and status in Indonesia (*Nieuwsblad voor Sumatra*, 15 April 1954). After nationalisation, *NIBEM* became *PN Aneka Tambang* in 1958, but interest in developing bauxite processing facilities had to wait until a promise of Soviet assistance in the early 1960s.

The Soviet plans never materialised, but two initiatives revived it in 1967. The *Aluminium Corporation of America Ltd* (*Alcoa*) sought exploration and exclusive exploitation rights for bauxite in Bintan and Kalimantan, in return for investment in an alumina plant on Bintan and an aluminium smelter near the proposed Lake Toba hydroelectric plant, plus generous tax and royalty concessions (Hunter 1968: 85-86). Spurred by this development, a consortium of Japanese companies, comprising the main customers of Indonesia's bauxite exports, rushed an alternative bid. One reason for the urgency was a Japanese interest in producing alumina in Indonesia by reducing the moisture content of bauxite and thus save transport costs to Japan. In addition, the global bauxite mining was dominated by four major European and American companies, including *Alcoa*, and the Japanese aluminium companies saw an opportunity to limit their dependence on bauxite from these four by securing bauxite supplies through *PT Aneka Tambang*. The Indonesian government was in reducing its dependence on *Alcoa* for bauxite production and processing. Hence, when the 'big four' in 1972 agreed to decrease global production by

84% through self-imposed quota, these Japanese companies, as well as the Japanese and Indonesian governments progressed a project to produce aluminium in Indonesia for shipment to Japan (Kitazawa 1990: 65). In return, the Japanese consortium secured a contract under which PT Aneka Tambang would supply them with 1 million tons of bauxite annually for 10 years (Semay 1972: 139).

Alcoa scuppered the project by declining to commit to a project that included the construction of the hydroelectric plant, arguing that this would make it unprofitable. However, the project had been conceived with the involvement of *Alcoa* as an alumina producer outside Bintan. When it started in 1976, it was without *Alcoa*'s participation and without a guaranteed supply of sufficient domestic alumina, but with lavish Japanese government support. Twelve Japanese investors pooled their interests in the *Nippon Asahan Aluminium Co Ltd (NAA)*, which was party to a joint venture with the Indonesian government, *PT Indonesia Asahan Aluminium (Inalum)*. It produced aluminium under a 30-year contract and with 83% funding in the form of low-interest Japanese loans as foreign aid (Kitazawa 1990: 67). The whole project involved construction of the upstream hydroelectric plant along the Asahan river and a downstream bauxite smelter. Starting in 1982, the *Inalum* plant smelted some local alumina, but it had to import most from Japan and Australia. Even when *Inalum* eventually produced some 250,000 tonnes of aluminium ingots annually, most bauxite produced in Indonesia continued to be exported and was not processed domestically. This situation continued until 2013, when *NAA* handed its share in *Inalum* to the Indonesian government upon completing its contract.

In nickel mining, two 'Article 5' companies – *NV Mijnbouw Maatschappij Celebes* (a subsidiary of *NV Billiton*) in Soroako and *NV Mijnbouw Maatschappij Toli Toli* (associated with the private *NV Oost Borneo Maatschappij*) – started nickel ore production in Southeast Sulawesi in 1939. They exported ores containing ferronickel and nickel matte to Germany and Japan for further processing, although by 1941 both had plans to invest in ore processing. Due to war and unsafety, exports of nickel ore from both concessions did not resume until 1959 and processing plans were not revived until the late-1970s. Based on a 1967 CoW with the Indonesian government, *PT Inco*, a subsidiary of *International Nickel Inc (Inco)* of Canada, together with *Sumitomo Metal Mining Co.* of Japan, started a large mine at Soroako in 1978. It had its own processing plant for nickel matte, with a capacity of 35,000 ton/year. Also in 1978, *PT Aneka Tambang* started to mine for nickel ore near Halmahera (Maluku) and in South Sulawesi, soon becoming the biggest nickel ore producer. It maintains a small processing plant in Pomalaa (Southeast Sulawesi) with a capacity of just 4,800 tons of ferronickel. Together, both companies processed around 25% of Indonesia's nickel ore by 2010.

Copper ore production did not increase significantly until the *Freeport Minerals Inc* venture in West Papua became operational in 1972. While most initial exports were ore for processing by the parent company in North America, the company participated in a joint venture with initially *Metallgesellschaft AG* (Germany) and later two companies from the

Mitsubishi group as well as *Nippon Mining & Metals Co Ltd* (Japan), to build and operate a copper smelting facility in Gresik (East Java). Starting in 1996, *PT Smelting Gresik* produced copper for export with a 200,000 ton/year capacity. However, the expansion of ore production was so fast that this capacity was insufficient. By 2010, the Gresik smelter processed about 30% of ore production.

Manganese and iron ores were long mined in several places in Indonesia for export, but both did not increase to significant proportions until the 2000s. Manganese ore was not processed, because the quantities were too small to justify investment in processing facilities, and was shipped overseas, mainly to Japan. Iron ore was processed for domestic use on a very small scale until the 1970s. The poor quality of the ore and the unavailability of coking coal long prevented the production of pig iron. Ambitions to establish a steel industry to utilise local deposits of iron ore did not come to fruition until in the 1960s, when an offer of Russian aid yielded a project that eventually led to the establishment of *PT Krakatau Steel* in Cilegon (West Java) in 1970, which was then 60% owned by *Pertamina*. Despite the availability of small deposits of low-grade iron ore in Indonesia, *Krakatau Steel* relied on scrap metal and imports of high-grade iron ore, while Indonesia's low-grade iron ore was exported, largely to Japan. *Krakatau Steel's* processing capacity increased over time, but it continued to depend on imports of iron ore from Brazil and Chile, while *PT Aneka Tambang* exported most of Indonesia's low-grade iron sands.

Indonesian ventures also processed phosphate into fertiliser, as well as raw materials for the chemical industry (e.g. sulphur, copper-iodine and other salts), and raw materials for the ceramic and construction industries (such as clays, kaoline, quartz sand, marble, feldspar, sandstone, trass). Most of this produce was destined for domestic markets. However, their contribution to mining-related value adding remained relatively small.

7. Conclusion

By quantifying mining production in Indonesia, this paper has shown that the mining sector was a relatively small part of Indonesia's economy until the 1970s, despite the development of some large mining ventures, including the spawning of two large multinational companies *Shell* and *NV Billiton*. The quantification has also shown that despite the diverse range of products, mining was long dominated by tin and oil production until diversification into the production of particularly gas, coal, copper and nickel ore since the 1970s. Apart from the development on some very large mining ventures controlled by Indonesia's large SOEs, the process engaged growing numbers of foreign enterprises as contractors and involved smaller privately-owned domestic companies, often as joint-venture partners.

The paper also demonstrated that from the outset in the early 19th century the central government in Indonesia sought to maximise its share in the resource rents that mining ventures generated. While before 1850 the government believed that it could run mining ventures itself, it concluded that the investment capital and technology that private

companies could muster were indispensable. Despite growing private sector involvement, the government regularly changed the conditions under which private mining firms were operating in Indonesia in order to maximise the government share in the resource rent.

The general principles were established with the 1852, 1872 and 1899 legislation, but specific applications depended on the case and were subject to negotiations between the Mining Service and companies. The conditions under which private firms operated were adjusted when market conditions changed and shifted balance in resource rents to private firms. Where commercial opportunities were limited, as in coal, the government operated ventures itself. Other ventures were operated by private companies as contractors. Most oil for domestic use was processed locally for export and domestic use. Most Bangka tin was processed locally, but not tin from Belitung. New products manganese, bauxite and nickel ore were processed overseas, as produced quantities were insufficient. Nevertheless, there were plans to step up domestic processing in 1941.

The years between independence and the new 1960 Mining Law were unsettled and few foreign companies were willing to invest, except three foreign oil companies. The 1960 law created more certainty, but allowed foreign mining companies to operate under different conditions. The CoW institution was a continuation of past practice, and proved an acceptable compromise to government and foreign companies in the context of Indonesia's 1945 Constitution. The production sharing institution was a pragmatic response to Indonesia's foreign exchange shortages and controls, as well as the interests that the Indonesian military had developed in the oil industry. Nevertheless, it took until after the new Mining Law, the new Foreign Investment Law and the regime change in 1967 before Indonesia made a new start with the rapid expansion of mining operations; first in the oil sector and later a more diverse range of mining operations. Both institutions maximised the government share in resource rents, particularly in the wake of the 1973 oil boom.

The oil boom of the 1970s and the subsequent diversification of mining production facilitated a drastic expansion of public spending to spur economic development. Import-replacing agricultural and industrial development shielded the Indonesian economy from the worst 'Dutch disease' consequences in the 1970s and early 1980s. And when the terms of trade effect subsided, the revenues from mining exports supported a more broad-based development strategy.

The expansion of mineral production generally exceeded the growth of processing capacity, particularly in oil. Large foreign companies were often reluctant to invest in processing facilities in Indonesia, as they had their own processing facilities overseas. Based on the involvement of foreign firms as contractors, Indonesian SOEs took up processing mining commodities for growing domestic markets as well as exports. With the exception of tin and LNG, the capacity to process all minerals before exports remained insufficient in the face of sustained growth in the output. The reluctance among foreign first to invest in such facilities increased when administrative decentralisation took hold in Indonesia after 1999 and during the lead-up to the new 2009 Mining Law. Consequently,

key minerals like bauxite, and copper and nickel ore, as well as minor minerals like manganese and iron ore continued to be exported unprocessed, which in turn fed the prohibition on unprocessed mineral exports starting in 2014

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Appendix: Statistical sources and estimation of value added

The following sources were used to construct long-term time series of production and average wholesale prices of crude oil, natural gas, coal, tin and tin ore, copper ore, nickel ore, manganese ore, bauxite, diamonds, gold and silver, platinum, doré, iron ore, rock asphalt/bitumen, sulphur, rock phosphate, limestone, clay, silica, iodine and wolframite.

- *Buku Statistik Pertambangan dan Energi* (1972-1980), continued as *Statistik Pertambangan Indonesia* (1981-1984), *Statistik Pertambangan Non Minyak dan Gas Bumi di Indonesia* (1985-1996) and *Statistik Pertambangan Minyak dan Gas Bumi Indonesia* (1985-1996).
- *Buku Tahunan Pertambangan Indonesia* (1970-1988), continued as *Buku Tahunan Pertambangan dan Energi Indonesia* (1989-2002).
- *Handbook of Energy & Economic Statistics of Indonesia* (2007-2012).
- *Indonesia Mineral and Coal Statistics* (2011-2012).
- *Jaarboek van het Mijnwezen in Nederlandsch-Indië* (1872-1939).
- *Koloniaal Verslag* and appendices (1870-1949).
- Schmitz, C.J. (1979) *World Non-Ferrous Metal Production and Prices, 1700-1976*. London: Frank Cass.
- Segers, W.A.I.M. (1985) *Changing Economy in Indonesia, Volume 8: Manufacturing Industry 1870-1942*. Amsterdam: Royal Tropical Institute.
- *Statistik* (1956), continued as *Statistik Indonesia: Statistical Pocketbook of Indonesia* (1957-1974) and *Statistik Indonesia: Statistical Yearbook* (1975-2010).
- *Statistisch Jaaroverzicht voor Nederlandsch-Indië* (1924-1929), continued as *Indisch Verslag* (1930-1940).
- *United States Geological Survey Minerals Yearbook* (1963-2013).

Where production data were missing export data were used, and where domestic prices were missing unit prices from Indonesia's foreign trade statistics were used. The latter were converted from US\$ into Rupiah for 1968-1974 with the official exchange rates and for 1975-2010 the average market exchange rate. Foreign trade data from: *Statistiek van den Handel, de Scheepvaart en de In- en Uitvoerregten van Java en Madoera / op de Bezittingen Buiten Java en Madoera* (1870-73); continued as *Statistiek van den Handel, de Scheepvaart en de In- en Uitvoerregten van Nederlandsch-Indië* (1874-1923); *Jaaroverzicht van de In- en Uitvoer van Nederlandsch-Indië* (1924-40); *Meerjarige Overzichten van den In- en Uitvoer van Indonesië 1936/1941-1946/1949* (1950); *Ichtisar Tahunan Impor dan Ekspor Indonesia* (1947-51); *Statistik Perdagangan Impor dan Ekspor Indonesia* (1952-53); *Impor dan Ekspor menurut Djenis Barang* (1954-62), *Impor menurut Jenis Barang* (1963-2010) and *Ekspor menurut Jenis Barang* (1963-2010).

To estimate Gross Value Added (GVA) in current and 2000 constant prices, production, prices and input-output ratios were multiplied. Input-output ratios for 1971-2010 are interpolated on the basis of Indonesia's Input-Output Tables for 1971, 1975, 1980, 1985, 1990, 1995, 2000 and 2005. It was assumed that the 1971 input-output ratios are applicable to all years during 1870-1970:

- IDE (1977) *Input-Output Table Indonesia, 1971*. Tokyo: Institute of Developing Economies.
- BPS (1975-2005) *Tabel Input-Output Indonesia*. Jakarta: Biro/Badan Pusat Statistik.

Table 1: Economic Role and Composition of Mining in Indonesia, 1971-2010

	1971	1980	1990	2000	2010
<i>A. Mining in the economy</i>					
Mining GVA as % of GDP	7.3	25.7	12.5	12.7	11.1
Mining exports as % of exports	22.9	72.2	27.4	15.0	24.5
Mining as % of total employment	0.2	0.7	1.0	0.9	1.2
<i>B. Sectors as % of total mining GVA</i>					
Crude petroleum, natural gas	84.6	94.9	81.7	69.7	42.1
Coal	0.0	0.0	1.9	8.9	21.8
Copper ore	-	0.4	2.7	5.6	11.4
Gold and silver ore	-	0.0	0.6	4.7	5.6
Tin ore	4.4	1.7	0.7	1.0	1.4
Nickel ore	1.3	0.2	2.0	2.5	0.5
Bauxite	0.7	0.1	0.1	0.0	0.5
Other metallic ores*	0.2	0.0	0.1	0.1	0.6
Non-metallic mining and quarrying**	8.7	2.6	10.2	7.5	16.0
Total mining sector	100.0	100.0	100.0	100.0	100.0
<i>C. Exports as % of gross output</i>					
Crude petroleum, natural gas	62.2	84.4	50.9	38.8	39.0
Coal	0.0	37.6	47.4	56.9	70.0
Copper ore	-	104.0 [#]	96.7	94.2	62.2
Gold and silver ore	-	0.0	0.1	0.0	0.0
Tin ore	53.1	14.1	1.1	0.0	0.3
Nickel ore	94.0	56.9	80.3	59.9	84.0
Bauxite	100.0	89.5	67.5	76.4	90.9
Other metallic ores*	59.4	21.9	19.2	2.3	40.2
(Sub-total metallic ores)	(64.1)	(36.1)	(67.6)	(49.8)	(42.0)
Non-metallic mining and quarrying**	0.0	0.6	2.6	4.6	2.7
Total mining sector	56.5	80.7	46.6	39.6	41.6

*mainly iron and manganese ores. **includes copper, gold and silver in 1971.

[#]number exceeding 100 implies exports of stockpile.

Notes: Calculated from data in current market prices; excludes GVA in related manufacturing (e.g. oil refining, LNG production, basic metals manufacturing etc).

Source: Calculated from IDE (1977) and BPS (1975-2005), see the Appendix; the data from the 2010 I-O Table are provisional; the 2010 share in employment is from Indonesia's National Labour Force Survey (Sakernas).

Table 2: Active Exploration Permits and Mining Concessions in Indonesia, 1890-1938

	Exploration permits	Mining sites				Total
		Con-cessions	Article 5a	CoWs	Public-Private JVs	
1890	109	19	-	-	-	19
1895	268	31	-	-	-	31
1900	2,758	89	-	-	-	89
1905	2,122	153	-	-	-	153
1910	741	177	-	-	-	177
1915	66	146	-	-	-	146
1920	191	220	-	-	-	220
1925	619	259	-	12	2	273
1930	1,267	271	20	10	4	305
1935	1,754	273	57	10	4	344
1938	1,412	274	64	5	4	347

Notes: Article 5a, see main text; CoW = contract of work, JV = joint venture.

Source: Calculated from *Jaarboek van het Mijnwezen in Nederlandsch-Indië* (1872-1939).

Table 3: Non-Oil and Gas Mining Sites and Employment, 1968-1970

Product	Sites of formal companies		Sites of informal ventures		Total	
	Number	Employment	Number	Employment	Number	Employment
Tin ore	7	20,013	1	0	8	20,013
Quicklime	31	6,198	38	1,880	69	8,078
Diamonds	3	200	2	7,500	5	7,700
Coal	10	7,358	3	60	13	7,418
Gold and silver	7	1,384	49	5,058	56	6,442
Manganese ore	3	1,104	0	0	3	1,104
Bauxite	1	1,052	0	0	1	1,052
Sulfur	5	810	1	0	6	810
Marble	2	502	0	0	2	502
Quartz sand	7	340	0	0	7	340
Asbestos	5	288	0	0	5	288
Kaolinite clay	16	263	1	0	17	263
Feldspar	1	93	0	0	1	93
Other products	21	585	3	82	24	667
Total	119	40,190	98	14,580	217	54,770

Notes: The survey excluded Sulawesi, Maluku and Papua. The sites of informal small ventures (*usaha rakyat*) may comprise more than one venture. Informal employment is incomplete due to missing data.

Source: Calculated from Departemen Pertambangan (1971).

Table 4: Outstanding Contracts of Work and Mining Permits, 2000

	CoWs	Coal CoWs		Mining Permits
		Foreign	Domestic	
Issued during 1967-2000	235	16	103	597
Concluded before 2000	132	0	0	0
Expired before 2000	17	0	0	0
Remaining in 2000, for:				
Surveying	20	0	0	21
Exploration	39	0	7	293
Feasibility study	6	0	18	0
Construction	6	0	15	0
Production	15	16	64	283
Total	86	16	103	597

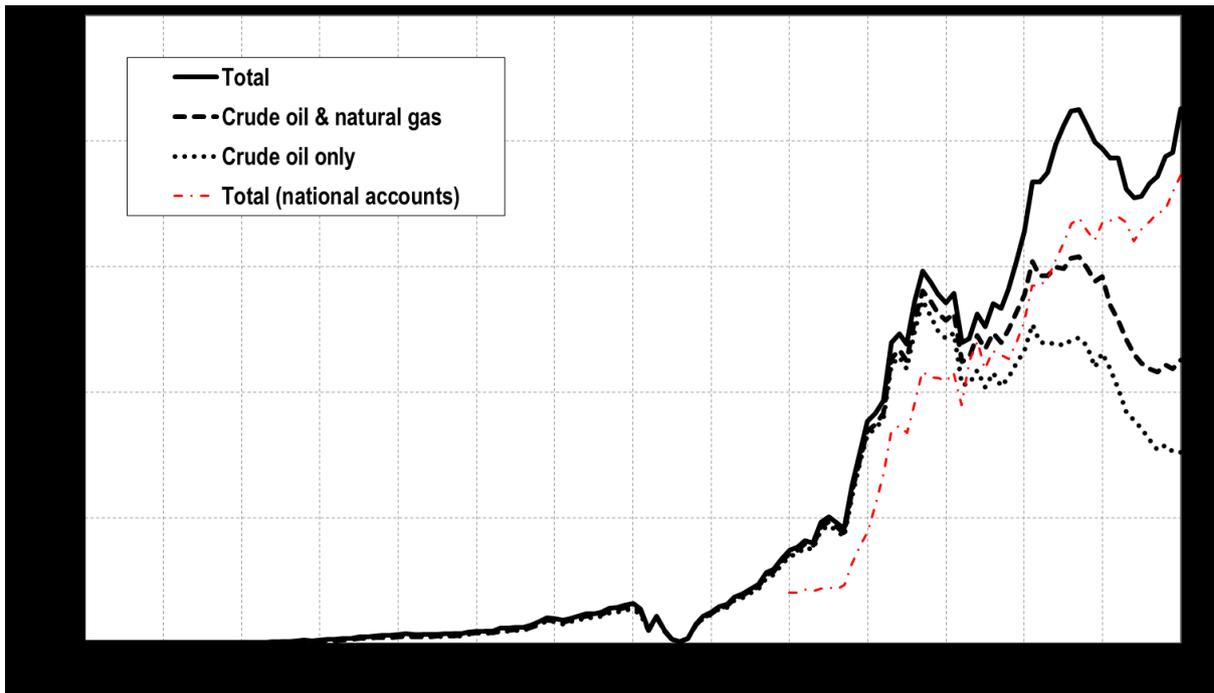
Source: DESDM (2001).

Table 5: Number of Mining Licenses, December 2012

	Exploration	Production	Total
Metallic minerals	2,607	1,729	4,336
Non-metallic minerals	175	435	610
Quarrying	109	1,785	1,894
Coal	2,492	1,341	3,833
Total	5,383	5,290	10,673

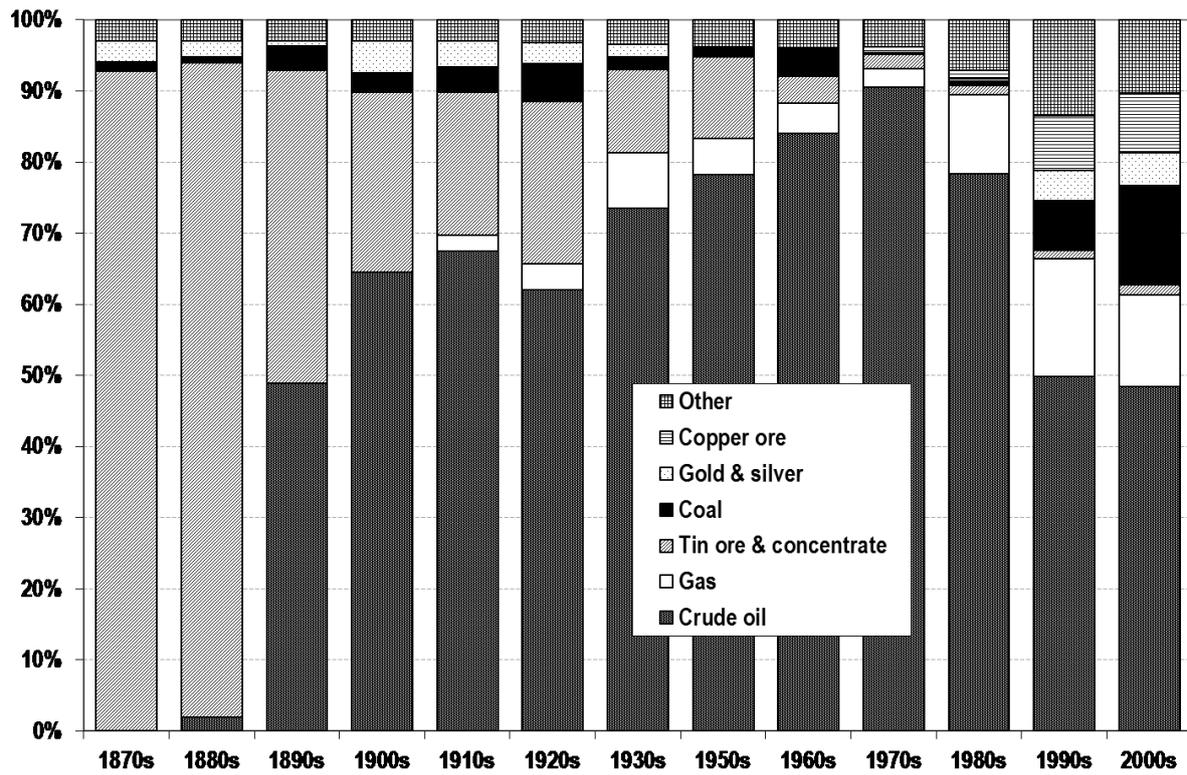
Source: Calculated from MEMR (2013) 65-71.

Figure 1: Gross Value Added in Mining, 1870-2010 (billion 2000 Rupiah)



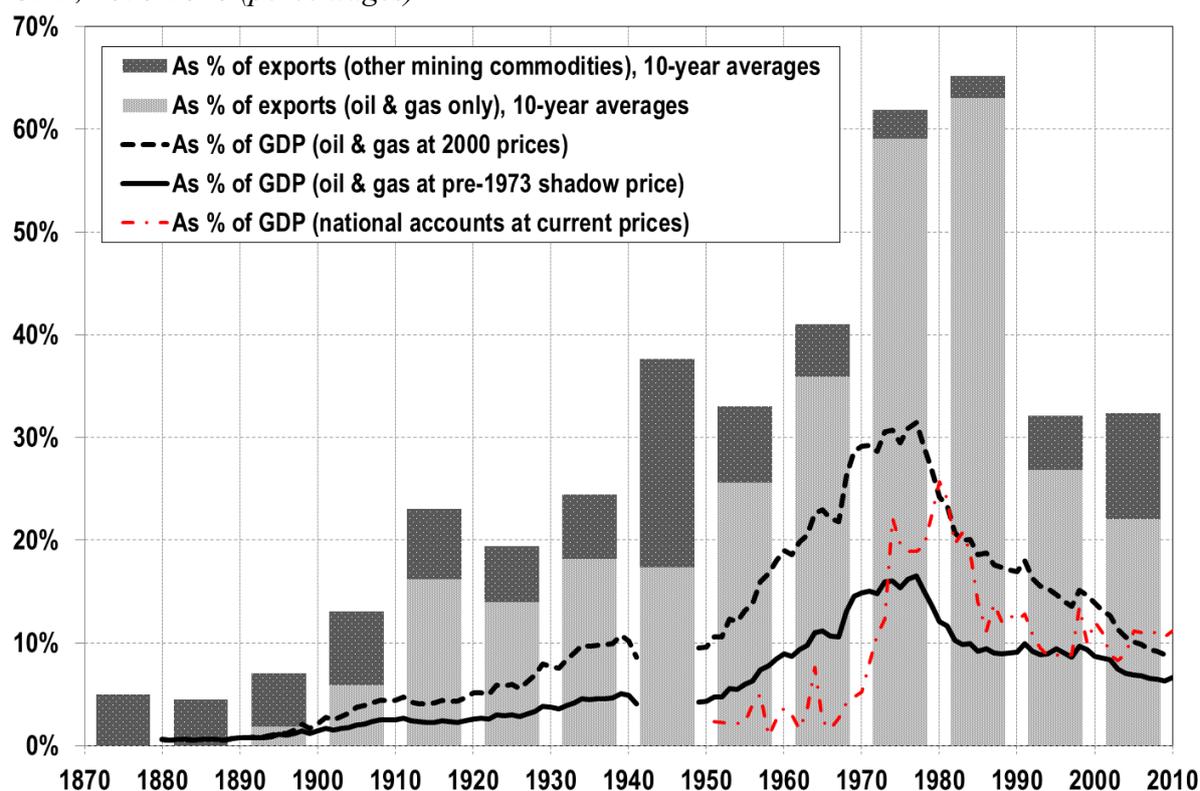
Sources: Calculated from a wide range of sources comprising data on production and prices of mining commodities produced in Indonesia, as well as input-out ratios, see the Appendix.

Figure 2: Cumulative Shares of Key Commodities in Gross Value Added in Mining, 1870-2010 (ten-year averages, current prices)



Sources: See Figure 1.

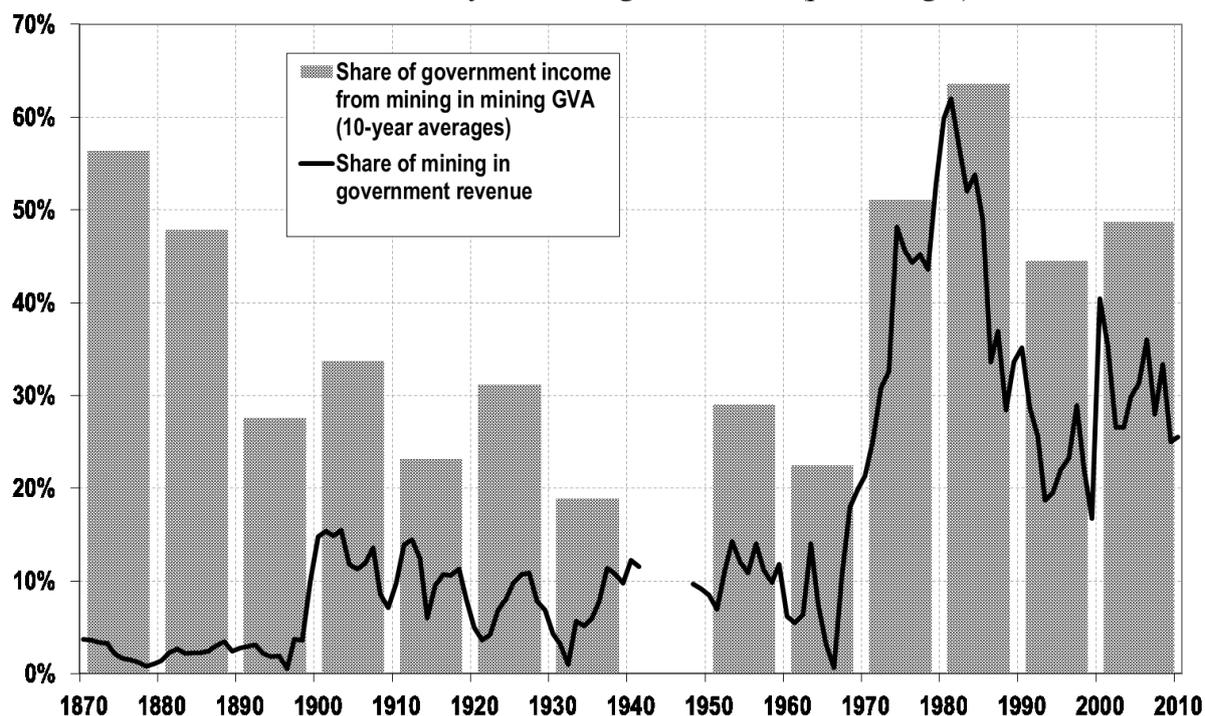
Figure 3: Shares of Mining Commodities in Exports and of Mining Gross Value Added in GDP, 1870-2010 (percentages)



Notes: No data 1942-45 for foreign trade and 1942-48 for GDP. Van der Eng (2010) only contains GDP estimates in 2000 prices, not current prices. Nominal oil and gas prices in Indonesia rose by a factor of 465 from 1973 to 2010, while nominal prices of all other goods and services combined rose by a factor of 180. The share of oil and gas GVA in GDP in 2000 prices is therefore also estimated with just 40% of GVA in oil and gas as a proxy for the contribution of oil and gas to total GVA at an assumed pre-1973 shadow price.

Sources: Calculated from Indonesia's foreign trade statistics 1870-2010, see the Appendix; Indonesia's national accounts in current prices 1951-2010; GVA in Mining in 2000 prices, see Figure 1; GDP in 2000 prices 1880-2010 Van der Eng (2010), replacing the old estimates of total GVA in mining with the ones in Figure 1.

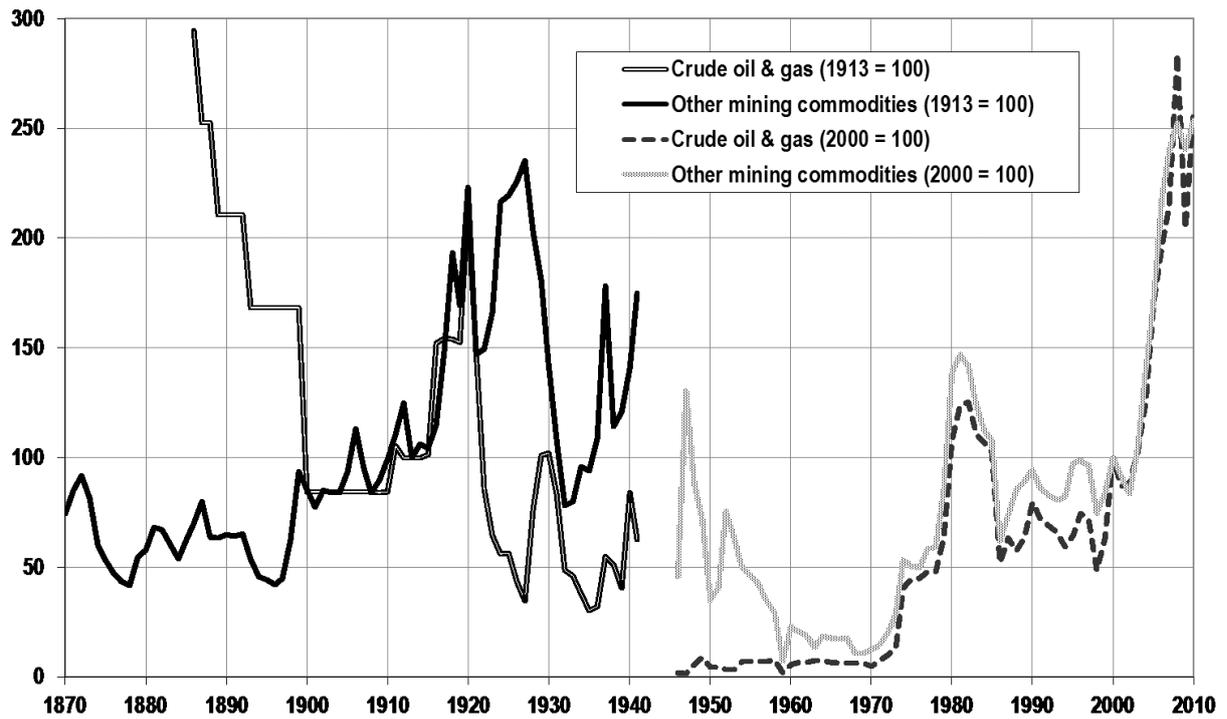
Figure 4: Share of Tax and Non-Tax Income from Mining in Total Central Government Revenue and in Gross Value Added from Mining, 1870-2010 (percentages)



Notes: No data for 1942-47. 1870-1940 comprises net government income from tin, coal, gold and silver mining, revenues from mining concessions, dividends from NIAM and GMB joint ventures, oil industry crisis levy in the 1930s, mining export duties and mining company tax (both estimated from totals in proportion to the share of mining in exports), and excludes income from the salt monopoly; 1948-2010 comprises 1948-66 mining company tax and 1948-2010 mining-related export duties (both estimated from totals in proportion to the share of mining in exports), 1952-59 net transfers from all SOEs, 1960-72 net transfers from SOEs *Permina* and *Pertamina*, 1967-89 oil company tax, 1990-2010 non-tax revenue from mining, 1994-2010 net profit transfers by SOEs (mining SOEs were predominant), 1999-2010 income tax from oil and gas firms.

Sources: Mining GVA in current prices, see the Appendix; government income 1870-1940 calculated from Encyclopedia (Vol.1: 750-758; Vol.7: 154-163), Mulder (1938), and budget papers included in *Bijlagen bij de Handelingen van de Staten Generaal* (1870-1940) and *Bijlagen bij de Handelingen van de Volksraad* (1918-1942); 1948-2010 from *Nota Keuangan Negara* (1948-1959), *Statistik Keuangan* (1960-89), *Statistik Ekonomi dan Keuangan Indonesia* (1990-2010).

Figure 5: Implicit Price Indices of GVA in Mining, 1870-2010 (1913 and 2000 = 100)



Note: For 1946-1974 'deflated' with the official US\$ official export exchange rate, and for 1975-2010 with the market US\$ exchange rate.

Sources: See the Appendix.