CENTRE FOR ECONOMIC HISTORY
THE AUSTRALIAN NATIONAL UNIVERSITY
DISCUSSION PAPER SERIES

MORTALITY FROM THE 1944-1945 FAMINE IN JAVA, INDONESIA

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DISCUSSION PAPER 2024-01

JANUARY 2024

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Mortality from the 1944-1945 famine in Java, Indonesia

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Abstract

This paper examines the human toll of the 1944-1945 famine in Java, Indonesia's main island. It estimates birth and death rates for the Indonesian population in Java during 1941-1951. Using the net population loss method, the paper approximates a net loss of 3.4 million people during the 1942-1945 Japanese occupation period, including 1.9 million excess deaths; 0.7 million during 1944 and 1.2 million during 1945. The residual 1.5 million were missing births in 1944 and 1945, associated with the malnutrition of women of childbearing ages and the physical separation of wives from husbands recruited by Japanese authorities for forced labour.

Keywords: famine, malnutrition, Java, Indonesia, Japanese occupation

This version: 6 January 2024.

* I am grateful to Robert Cribb and Gregg Huff for their constructive comments on a previous version of this paper, and to Hans Pols for sharing rare 1940s medical publications.

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1. Introduction

Indonesia is a country that experienced several famines in its modern history, which have remained under-researched. One of these is the 1944-1945 famine during the 1942-1945 Japanese occupation of Indonesia. This famine spilled over into the subsequent years 1946-1948 when newly independent Indonesia fought a war of independence against the forces of the colonial government of the Netherlands East Indies. The war delayed the recovery of food production and impeded food imports (Van der Eng 1994).

The first estimate of the total number of victims of the Japanese occupation in Java, the main and most densely populated island of Indonesia, was 4 million, a number mentioned by both Dutch colonial and Indonesian authorities (*e.g.* Götzen 1948: 19; DoS 1951: 220-221). If true, and if all these casualties had been victims of the 1944-45 famine in Indonesia's main island of Java, the island would have lost about 8% of its 1940 population.[1] In that case, Java's human toll would have exceeded that of the widely publicised 1943-44 Bengal famine, when 2.1 million people or 3.5% of Bengal's 1941 population died of starvation (Maharatna 1996: 147).[2]

The fact that Java experienced food shortages during the 1942-1945 Japanese occupation and a famine during 1944-1945 is not in dispute. Available studies agree that there was a drought during 1944 which postponed the 1944-45 wet monsoon and therefore the subsequent main rice harvest during the first half of 1945 (Van der Eng 2024). Exacerbating the impact of the delayed harvest was the rigid system which the Japanese authorities imposed in order to seize supplies of rice for the distribution of rice to their armed forces, detention camps of prisoners of war and European civilians, and urban areas. The system relied on rice delivery quota that were imposed in a top-down manner on districts and villages. It did financially compensate farmers for the delivered rice, but paid prices well below market value, while the value of the paper money that Japanese authorities used for payments was quickly eroded by runaway inflation. In addition, bans on unauthorised inter-district shipments of food supplies effectively required rural districts to be self-sufficient in food, further exacerbated the food shortages in many districts, particularly in densely populated Central Java (Van der Eng 1998; Huff 2020: 253-269).

Historians of Indonesia dispute the validity of the estimate of 4 million victims, as section 2 explains. Estimating the magnitude and human toll of any human disaster, such as a famine is difficult, particularly in less-developed countries with imperfect or non-existing population registers. During a famine, obtaining accurate data on people suffering from malnutrition or hunger oedema and also on mortality is problematic. For most such disaster episodes, human impact estimates are generally made after the event on the basis

[1] 1940 population from Nitisastro (1970: 160-161).

[2] In absolute numbers, the 1944-45 Java famine would rank as the 3rd most disastrous famine in modern history, behind Ireland (where 12% of the population perished during the 1846-52 famine) and Bengal, but ahead of Ukraine (12%, 1932-34), Congo (6% during 1998-2007) and China (1959-61) (Dewaal 2015).

of the excess mortality method if reliable mortality data are available (Dyson and Ó Gráda 2002). The difference between actual and predicted deaths approximates the human toll of a disaster. In cases where only data on total population exist, a net population loss method is often applied, which extrapolates known population growth before a disaster event to a point in time after the event for which data on population are available, such as from a census (*e.g.* Chandra 2013). The difference between predicted and actual population approximates the net impact of the disaster event. The downside of this method is that it cannot distinguish between the effect of lower birth rates and higher mortality rates due to the event, and may for that reason overestimate actual deaths directly associated with the disaster event.

To overcome this hurdle, section 3 examines the basis for the estimate of 4 million victims, particularly the system by which births and deaths were recorded at village level in Java. Using disparate sources, section 4 estimates trends in Java's annual birth and mortality rates during the 1940s. Section 5 then applies the net population loss method to available demographic data for Indonesia during 1930-1961 in order to estimate losses of people in Java during 1942-1949. It uses the birth and death rates from section 4 to apportion the net population loss.

2. The human toll of the Japanese occupation of Java in available studies

Available studies disagree about the estimate of 4 million victims (Van der Eng 2024). This estimate was the outcome of a brief calculation made in late-1945 by agricultural economist Egbert de Vries, Professor of Economics at the nascent University of Indonesia during 1941-1942 and 1946 (Van der Eng 1991). After his release from a Japanese detention camp in Jakarta in September 1945, De Vries obtained annual data on births and deaths at residency-level in Java during 1943 and 1944, as well as monthly birth and mortality rates for Jakarta residency during 1943-1945 (Van der Eng 2024). He probably acquired them from his acquaintance, the Indonesian nationalist Prawoto Soemodilogo, who published them in the second issue of his journal *Ma'moer* in January 1946 (Soemodilogo 1946). In turn, Prawoto had most likely obtained them during his employment in 1945 at the Central Advisory Council (*Chuo Sangi-in*) of the Japanese military government. And the council must have received them from the nearby central office of the Public Health Service (*Eiseikyoku*) where the district reports with statistics on births, deaths and diseases were aggregated, as it had done before 1942.

In May 1946, De Vries published his estimates of a net population loss of 2.45 million people: 120,000 in 1943, 813,000 in 1944 and 1.5 million in 1945. He added 'It is to be feared that this unfavourable development is still having its aftermath in 1946, and that the total direct and indirect war losses in Java amount to from 3 to 4 million souls' (De Vries 1946, 1947: 19). Consequently, the estimate of 4 million victims included an unsubstantiated approximation of excess mortality in Java during 1946 as an indirect consequence of the Japanese occupation.

The estimate of 2.45 million victims during 1943-1945 has been cited by some (*e.g.* De Jong 1985: 571-572). Others have cast doubt on the validity of the underlying birth and mortality data and refrained from mentioning the aggregated death toll (*e.g.* Kurasawa 1981: 94-95, 1993: 105-106, 121; Sato 1994: 256, 2005: 131 and 373). The 1944-45 famine does not feature in other historical studies of Indonesia during the Japanese occupation. For example, the 1944-45 famine and its human toll in Java is for example not mentioned in the last two editions of the official history of Indonesia (Poesponegoro and Notosusanto 1990; Soejono *et al.* 2008). By contrast, the very sorry plight of workers mobilised by Japanese authorities (*romusha*) is part of Indonesia's historiography. These 2.6 million labourers from Java were forced by Japanese authorities to work under often abominable conditions, of whom at least 200,000 perished (Sato 2005; Huff 2020: 338-339).

3. Java's mortality and birth registration data

De Vries (1946) estimated a net loss of 2.45 million people on the basis of the 1943 and 1944 registered births and deaths in Java and an extrapolation to 1945 of mortality and birth rates in Jakarta residency to the whole of Java. His estimates therefore depend on the reliability of the vital registrations of births and deaths used in colonial Indonesia, particularly in Java, and on the degree to which the vital statistics of Jakarta residency are indicative of those in Java as a whole. This section discusses the first, section 4 the second.

Demographers have discussed the available vital statistics of colonial Java (*e.g.* Gardiner 1981: 18-86; Gardiner and Oey 1987; Boomgaard and Gooszen 1991: 55-61; Gooszen 1999: 124-180). In essence, the colonial government decreed village-level annual registrations of population, and the numbers of deaths and births of the indigenous population of Java, starting 1874.[3] The results were published by residency in the annual colonial reports by the Ministry of Colonial Affairs in The Hague to the Dutch parliament. The publication of these data ceased after 1894 when the realisation sank in that they were underestimated. The collection of death and birth data at village level continued, but the accumulated data were no longer published.

In 1911, the nascent Public Health Service (later renamed *Dienst der Volksgezondheid*, DVG) was formally tasked with improving the collection of vital statistics to advance disease surveillance in Java (Jaarboek 1920: 90-91; Gardiner 1981: 33, 45-46). In 1912, it started with a new system involving the weekly reporting of the numbers of births and deaths at village level under the supervision of the regional health inspectors of the service who were responsible for safeguarding the accuracy of the data.

The DVG initially focused its effort on improving the registration of deaths to analyse the temporal and spatial patterns of mortality and the impact of contagious diseases in Java; essentially a crude early warning system 'to identify local mortality spikes and

[3] The 'other Asian' – largely ethnic Chinese – and 'European' populations of Java had their own civil registration systems (Septer 1935: 29-51). They were excluded from this village-based registration system. The discussion of the vital statistics relates only to the ethnic Indonesian population in Java.

epidemics' despite the acknowledged inaccuracies in the data (Van Gelderen 1937: 306). A regional health officer would investigate the disease situation in sub-regions and villages if mortality rates increased above 20‰.[4] The numbers of deaths and births were recorded at village level, collected and aggregated by the health service officials at regency (*kabupaten*) level, who mailed them for further aggregation to the residency and later the province-level health officials, who in turn passed them to the statistical office of the health service in Jakarta. From there, the district-level data were published during 1916-1940 in the annual report of the health service and later the annual statistical yearbook of colonial Indonesia published by the Central Office of Statistics (*Centraal Kantoor voor de Statistiek*, CKS).

In 1929 the DVG took an initiative to improve the quality of the vital statistics, particularly births. It trialled a new 'certificate system' in Yogyakarta in 1929, which consisted of village-level registration of the births and deaths of individuals by name, rather than village authorities reporting weekly total numbers on the basis of the village registers.[5] This system expected parents to notify the village secretary in person of births, and family members to do the same in the case of deaths. The village secretary then wrote out three certificates in the case of a birth: one for the parents, one for the village administration, and one for regional public health official in the regency office. And in case of a reported death, he issued two certificates: one for the village administration and one for regional public health official. Regional health officials accumulated these vital registrations by regency and included the totals in weekly reports which they sent up the administrative chain reaching to the DVG central office in Jakarta.

The aftermath of the 1929 economic crisis in Java prevented an immediate expansion of this new system, until it intersected with initiatives by American medical practitioner John Lee Hydrick to reduce the high rates of infant and maternal mortality through health education in Purwokerto town, the capital of Banyumas regency in Central Java (Hydrick 1936; Gardiner 1981: 49-55; Stein 2006, Neelakantan 2013: 42-43). Hydrick's required better data of infant mortality and maternal deaths from childbirth in order to tailor his efforts. The DVG introduced the new system in 1933 in Purwokerto, after which it was extended across Banyumas in 1935 and then to other regencies in Java (Tjondronegoro *et al.* 1965; Wertheim 1955: 174-176; Soedarjono 1957: 6-9).[6] The improved registration caused an increase in reported mortality and birth rates; first in Purwokerto during 1933-1937, then in Banyumas during 1936-37. Starting 1939, all 34 regencies in Central Java had new system of registering births and deaths in place (*Soerabaijasch Handelsblad*, 8 December 1938). By 1941 the system was also in use in

[4] This 20‰ threshold was not formally specified, but appears to have been used as a rule of the thumb. It was *e.g.* mentioned in Nationaal Archief (The Hague), 2.10.62, no.1383, NEFIS report 'Gebied: Zuid-Molukken. Verslag over de tweede helft van November 1946' (13 December 1946) p.2.

[5] Descriptions of the new registration system are *e.g.* Soedarjono 1957: 6; Tesch 1948: 70-71; *Soerabaijasch Nieuwsblad* (8 December 1938); *Algemeen Handelsblad voor Nederlandsch-Indië* (9 May 1939).

[6] Mochtar (1953: 32-35) provides a clear explanation of the difference between the old system and the new system of registering births and deaths with individual birth and death certificates.

eight regencies in West and Central Java (Soedarjono 1957: Appendix 4). The Japanese occupation in April 1942 impeded DVG plans to extend the system further.

In principle, the new registration system improved the quality of the vital statistics, as the increases in mortality and birth rates in Purwokerto and Banyumas indicated. However, the registration of deaths and births remained voluntary, because it was impossible to enforce any legal compulsion. That was the main reason why the registered numbers of births and deaths remained incomplete, as was well-known at the time. Expectations were that the registration system would improve over time and would become the basis of a civil registration system. In the meantime, its main purpose was to serve the purpose of contagious disease surveillance.

Also well-known was the main reason for the under-registration of births and deaths. Reflecting on his tenure as head of CKS during 1919-1928, Van Gelderen (1937: 307) mentioned:

> 'the inclination among village heads and village administrators to delay the registration of a birth. If a child dies within a few hours or days after birth, it will often be considered as neither born nor died and left out of both the birth and death records. Of course, in a country where local investigations have demonstrated high infant mortality rates during the first few days and weeks after birth, this mentality has a significant impact on the completeness of both death and birth statistics.'

These imperfect vital statistics became an issue in the 1950s, when it was still unknown what the demographic impact of the Japanese occupation and the war of independence during the 1940s had been, and therefore what Indonesia's demographic structure was. Efforts to assess Indonesia's demography focused in first instance on understanding the shortcomings of the vital registration statistics, improving their quality, and implementing the 'Purwokerto' registration system throughout the country. After Indonesia's independence, the public health service resumed work on extending vital registrations. In 1952 it became part of the new Ministry of Health. By then, the system had been introduced in most of Java, except for a few regencies in East Java (Mochtar 1953: 37). By 1956 all regencies in Java and in some parts of the other islands used this system (Soedarjono 1957: appendix 5). Nevertheless, the registered vital statistics continued to under-record deaths and births. Breman (1963: 293) summarised this shortcoming of the vital statistics:

> 'Scattered living is one of the reasons that prevents the population from registering births and deaths. We note that not only the long distances are an obstacle to registration; usually a birth is only registered after a few months if the baby remained alive. To measure the under-registration, the East Java Department of Health compared the registered births during the years 1953-1956 with the number of children vaccinated against smallpox during this period. The latter number

should be much smaller due to infant mortality and vaccine fears. In reality, the number of vaccinated children far exceeded the registered births. The registered birth rate is therefore far below the level on which we base our calculations (45‰); this is mainly due to the unreliability of the data, which varies according to place and time.'

Nitisastro (1970: 139-141) confirmed these shortcomings in the registered vital statistics during the 1950s-1960s, noting that some regencies had a good reputation for accuracy. For example, in the opinion of officials of the Ministry of Health the birth and death registrations in Wonosobo in Central Java were 'sensibly complete' (Keyfitz 1953: 645).

In the 1970s, Gardiner (1981: 229-248) analysed the degree of underreporting of vital statistics on the basis of surveys. He noted that the rate of underreporting was then similar to the 1920s, because by the 1970s there still was no legislation that made the registration of births and deaths compulsory. His comparison of registration and survey data indicated that deaths in infancy and early childhood tended to be more under-registered than deaths at later ages. This was not because infant deaths were hidden on purpose, but because both cultural and practical factors lowered registration rates. Parents would wait with registering births of newly born until the infant had survived the first months; in part for cultural or religious reasons (*haram*), but also for practical reasons, because after an infant died there was no reason to also register the death, thus avoiding the expense associated with traditional celebrations of a birth. Gardiner also found that local publicity and communication about the purposes and procedures of vital registration increased the registration rates, largely irrespective of socio-economic conditions and literacy, although this was contingent on the esteem and authority of the village head.

Consequently, research during the 1920s, 1950s and 1970s indicated that registered vital statistics were primarily – although not only – underestimated to the degree that they under-recorded infant mortality. As far as estimates exist, the average infant mortality rate (IMR) was very high in rural Indonesia, possibly around 250‰ around 1920, decreasing to around 200‰ in 1940, 175‰ in 1950 and 150‰ in 1960 (Van der Eng and Sohn 2019: 219). During 1952-1959, the reported average registered birth rate in Java was 30‰, and the average in regencies with good quality registration data was 34‰, both well below the 45‰ birth rate Breman (1963) presumed.

1940 was the last year for which the average birth and mortality rates of all regencies in Java were published in the annual statistical yearbooks of Indonesia. The central publication of these statistics for all regencies in Java never resumed.[7] The statistical pocketbooks of Indonesia for 1956-1966 only published the birth and death rates of selected regencies, presumably those with good quality registration data, starting in

[7] It seems the Ministry of Health semi-published quarterly and annual overviews of the vital statistics reported by regency health officials in Java, of which two issues are in the public domain (DepKes 1963, 1964). They reveal that – in addition to the underreporting in the vital registration data – by the early 1960s many of the regency reports had failed to reach the Ministry in Jakarta. See also Nitisastro (1970: 140-141).

1952. Nevertheless, the regional collection of these vital statistics continued during 1941-1951.

A reason to expect continuity in the collection of vital statistics at village and regency levels is the high degree of institutional continuity in the public health service during 1942-1945, despite two discontinuities. Firstly, the Japanese authorities abolished provinces and required residency offices to report directly to Jakarta. That is the reason why Prawoto in mid-1945 was able to acquire the residency-level vital statistics for 1943 and 1944 (see above). Secondly, although the *Eiseikyoku* received the residency health reports containing the average mortality rates, these data were not published. The *Eiseikyoku* prohibited the medical doctors it employed from discussing hunger oedema and starvation (DepKes 1978: 71-72). In 1944, the Japanese authorities in Jakarta allowed the health service to report deaths from various diseases, but not deaths associated with hunger oedema (KemPen 1953a: 401-402).

The collection of vital data at village and regency levels continued during 1945-1951, but during 1945-1949 regional officials of the public health service may have stopped reporting these data either to the residency offices or to the central public health service due to disrupted communications in Java. The government of the Republic of Indonesia retreated from Jakarta to Yogyakarta in March 1946, and the military advances of the colonial and Dutch armed forces into rural Java during 1947-1949 created an administrative vacuum at residency levels, which was not resolved until DVG officers resumed work in the areas under the control of the colonial government since July 1947 and until Indonesia's full independence in December 1949.

Only the vital statistics of Kendal regency in Central Java have been published for each year 1941-1951 (Wander 1965: 94). For the years 1941-1942 and 1946-1951, snippets of information on recorded births and deaths in some regencies sourced from the regional health services were published in local newspapers or were mentioned in unpublished reports as part of assessments of the regional health and food supply in different parts of Java. Such reports were written, because the food situation in rural Java remained precarious during 1946-1949 (Van der Eng 1994: 45-66). This was not directly caused by warfare in rural areas. The main reason was shortages of everything in rural Java, leaving few incentives for farm households to produce food surpluses beyond subsistence. And the colonial government was only able to distribute imported food supplies in selected areas outside the main cities in Java after July 1947.

The food situation was particularly precarious in Madura (*e.g. Nieuwe Courant*, 27 September and 26 November 1946) and in Central Java during 1946 and 1947. Large numbers of famished and malnourished refugees flooded from rural areas in Madura and Central Java under the administration of the Republic of Indonesia into the cities of Surabaya and Semarang that were under colonial government administration. After colonial and Dutch armed forces brought rural areas in Java under the control of the colonial government in two waves in July 1947 and December 1948, other areas of malnutrition and human suffering were uncovered, such as in Madura in August 1947

(*Nieuwe Courant*, 8 August 1947) and in Cepu in Central Java in January 1949 (*De Locomotief*, 26 and 27 January 1949). Consequently, mortality rates in rural Java may have continued to exceed 1930s levels during the late-1940s.

4. Reconstruction of the vital statistics of the 1940s

This section reconstructs the average birth and mortality rates for Java as a whole between 1940, the last year for which the colonial public health service published these data, and 1952, the first year for which the publication of equivalent data from the public health service of independent Indonesia resumed.

For 1943-1944, it is possible to use the vital statistics published by Prawoto, after correcting a few typos and incomplete data, as noted by De Vries (1946). The integrity of the data Prawoto collected is confirmed by their consistency with the 1943 rates for Semarang residency in Martoatmodjo (1944), and the 1943 and 1944 rates for Kedu and Pati residencies reported by the committee of Indonesians which investigated food supply problems in December 1944 (Sanyo Kaigi 1945; Anderson 1966: 93).

Appendix 1 lists the regional birth and mortality rates contained in newspaper reports and other sources, which are the basis for the calculation of unweighted averages d for 1941-1955. Figure 1 shows the recorded and estimated average birth and mortality rates in Java during 1935-1955. The bold continuous and dashed lines are the officially recorded average birth and mortality rates during 1935-1940, 1943-44 and 1952-1955. Slightly above the recorded averages are the unweighted average rates for the 17 regencies that during the 1950s were deemed to maintain 'good' registration practices. The light continuous and dotted lines are the unweighted average rates for various regencies and residencies for which occasional data were uncovered for 1941-1942, 1946-1949 and 1951. As explained above, all these averages are underestimated, largely to the extent that both birth and mortality rates underreported infant mortality. The light continuous and dotted lines were used to interpolate the bold lines with the Java average birth and mortality rates and the results are shown as the medium-heavy continuous and dashed lines.

[Figure 1 about here]

For 1945, only the mortality and birth rates of Jakarta residency (De Vries 1946) and Kendal regency (Wander 1965: 94) are available. De Vries (1946) used the Jakarta residency vital statistics during January-May 1945 to extrapolate the Java average for 1944 and thus estimate a birth rate of 22‰ and a mortality rate of 40‰ for Java as a whole. The average birth rate for Jakarta residency during January-May 1945 was 14‰ and the mortality rate 27‰. By contrast, the annual average birth rate for Kendal regency during the whole of 1945 was 15‰ and the mortality rate a very high 56‰.

It is likely that the food situation in Jakarta residency in 1945 was not as bad as in Kendal regency. Jakarta residency included the pre-war rice surplus areas of Karawang,

Cikampek, Bekasi and Tambun, and it was in reach of other rice surplus regencies, such as Cianjur in West Java (Van der Eng 2010). For that reason, De Vries (1946, 1947) could note for 1943-1945 'no such stories of starvation and misery reached us from the region [*i.e.* West Java, PvdE] as have come to us from Middle Java and part of East Java'. By contrast, Kendal regency was located in densely populated Central Java, where before the war the growth of food production had been delicately balanced with population growth, and where in 1944 the average mortality rate was already 38‰, compared to 27‰ in West Java and 26‰ in East Java (calculated from Soemodilogo 1946). In other words, an extrapolation of the Java average in 1944 on the basis of the Jakarta residency data led De Vries to overestimate the 1945 mortality rate.

To test the degree to which the mortality and birth rates in Jakarta residency and Kendal regency may have been representative for the other regencies in Java, Table 1 shows the numbers of other regencies with which the Jakarta and Kendal rates are correlated during 1930-1941. The mortality and birth rates in Kendal are positively correlated with a greater share of other regencies in Java than Jakarta residency: respectively 39 *vs.* 36%, and 36 *vs.* 23%. In the case of regencies in Central Java, Kendal is representative to a higher degree than for Java as a whole, respectively 50 and 44%, particularly for several regencies in Kendal's vicinity, such as Brebes, Semarang, Demak, Japara, Rembang and Blora. Consequently, it is likely that Kendal's plight of high mortality rates in 1945 was shared by other regencies in Central Java, which makes Kendal a more representative case for extrapolation of 1944 to 1945 than Jakarta.

[Table 1 about here]

An extrapolation of Java as a whole on the basis of only Kendal would result in a 1945 mortality rate of 37‰, due to the fact that the mortality rate in Kendal was already a high 47‰ in 1944, while the Java average was 31‰ that year. An extrapolation on the basis of only Jakarta residency resulted in 40‰ for 1945, due to the fact that the mortality rate in Jakarta was 22‰ in 1944. While the demographic consequences of the food situation in Kendal during 1945 may have been representative of much of Central Java, that may not have been the case for much of East and West Java. For that reason, 1945 is extrapolated for Central Java on the basis of Kendal regency, while 1945 is extrapolated for West and East Java on the basis of an unweighted average of Kendal regency and Jakarta residency. The 1945 results shown in Figure 1 are a mortality rate of 37.5‰ and a birth rate of 15.8‰ for Java as a whole, lower than those estimated by De Vries (1946).

Figure 1 reveals that Java's population underwent significant demographic shocks in terms of both mortality and births during the 1940s, not just during the 1944-1945 famine, but also during 1946-1949. The average mortality rate increased after 1943 in relation to the famine that spread during 1944 and reached its zenith in 1945. The mortality rate did not recover to its 1943 level until 1949, most likely due to continued food shortages in several parts of rural Java.

The mortality rate continued to decrease after 1949 to levels well below the 1930s. A possible explanation is that the most vulnerable older Javanese had perished during 1944-1948 in relatively greater numbers than during the years before 1944, so that fewer remaining older Javanese would pass away of old age during the early 1950s. Another explanation is that the public health service resumed the work that Hydrick had started in Banyumas regency to reduce IMR and maternal mortality through health education. This led to the initiative to establish mother and child health centres (*Balai Kesejahteraan Ibu dan Anak*), first in Bandung city in 1951, where they had an immediate effect of lowering infant, child and maternal deaths (*De Vrije Pers*, 19 March 1952; Soesmojo 1958; Neelakantan 2017: 67-92). This low-cost initiative spread quickly in Java and contributed to a decrease in the average mortality rate.

Figure 1 also shows that the average birth rate decreased significantly after 1943, and did not recover to the 1943 level until 1952, three years later than the birth rate. This significant decrease of the birth rate is broadly confirmed by Hull and Hull (1977). They surveyed Maguwoharjo village in Yogyakarta during 1972-73 and found that women in the low-income category aged 40-44 and 45-49 (*i.e.* aged 10-14 and 15-19 in 1942-43) had fewer babies than those aged 35-39 and 50-54, and that the survival rate of their children was lower than the children of generations of women before and after.

It remains conjecture, but the decreasing birth rate during 1943-1945 can be explained as the result of two factors. Firstly, the Japanese authorities mobilised 2.6 million labourers from Java during 1942-1945 to work on various projects in Java and outside Java (Huff 2020: 338-339). Most were young adult males, who were forced to work away from home. To the degree that they were married, their physical separation from their wives affected the ability of women to conceive. Secondly, increasing malnutrition during 1944-1945 must have reduced the fecundity of women of child-bearing ages. This has been observed in studies of other famines and of malnourished women (*e.g.* Stein and Susser 1975; Zhao and Reimondos 2012; Padilla *et al.* 2017). The low birth rate during 1946-1951 may be explained by continued malnutrition in rural Java during 1946-1951, and the degree to which married men in Java were combatants in the 1945-1949 war of independence and separated from their wives.

Much of the increase of the mortality rates during 1944 and 1945 is likely to have taken the form of increasing IMR, because infants were the first to suffer the consequences of increasing malnutrition as it exacerbated their susceptibility to contagious diseases. However, to the degree that increased infant mortality remained unrecorded for reasons discussed in section 3, births remained unrecorded as well, which therefore reduced the recorded birth rates. With the spread of the mother and child centres after 1951, the decrease in recorded infant deaths also implied an increase in recorded births as more young parents saw their newborn survive beyond infancy and decided to register the births.

The decrease in the birth rate during 1944-1945 and its slow recovery until 1952 is consistent with observations in the 1950s and the results of the 1961 population census. For example, German demographer Kurt Horstmann travelled in Indonesia in the early

1950s as a demographic advisor to Indonesia's National Planning Bureau (*Biro Perancang Negara*). He noted:

> 'Everywhere in Indonesia where up to now I have had an opportunity to interview the village heads and other persons I was told that during the time of the occupation and the revolution fights the living conditions, especially food supply, had so deteriorated that the number of children born had decreased and, besides, the infant and toddler mortality had been very high. Furthermore, many couples had been separated for a long time.' (Horstmann 1956: 209.)

In addition, the age distribution of Indonesia's population in the 1961 census indicates that a large number of 10-24 year olds, born during 1937-1951, were missing (BPS 1963: 2). Kozo Ueda, a Japanese demographer working at Indonesia's Central Bureau of Statistics (*Biro Pusat Statistik*), took a closer look on the basis of the unpublished 1961 population census results for Java and confirmed that the relative number of the missing generation was higher in Java's rural areas than in urban areas (Ueda 1965: 6). Ueda also compared the 1961 census results with the 1963-64 population survey in Java, to be more specific about the reasons. He found that it was especially those born during 1940-1949 that were missing, particularly in rural areas. This suggests that the worsening conditions during the 1940s increased the mortality of infants and children and raised the infant and child mortality rates during those years.

5. Estimating the missing millions of the 1940s

The method used by De Vries (1946) to estimate the number of Indonesian victims of the 1942-1945 Japanese occupation in Java resembles the net population loss estimation method, which has been used to approximate the impact of other demographic shocks in Indonesia (*e.g.* Chandra 2013). The downside of this methodology is that it is based on net population growth and can therefore only establish net excess mortality, *i.e.* the degree to which the net loss of people is a consequence of negative net population growth. By itself, the methodology cannot differentiate between the loss of people due to a decreasing birth rate or to an increasing mortality rate, unless estimates of both vital statistics are available.

This section will first discuss the estimates of net population loss that are implicit in studies that estimated the size of the population of Java during the 1940s and 1950s. It will then use the reconstructed birth and mortality rates in Figure 1 to apportion the net loss of people to reduced births and increased deaths in Java during 1942-1945. The section will also discuss the consequences of the fact that available birth and mortality rates were underreported in Java due to the incomplete recording of infant mortality.

Section 3 mentioned that the size and composition of Indonesia's population remained unclear during the 1950s due to the underestimation of Indonesia's recorded vital statistics. This uncertainty lasted until the 1961 population census. However, the increasing

underestimation of Indonesia's recorded vital statistics impeded extrapolation of the 1961 census results into the 1960s and also retropolation back to 1950. Nevertheless, demographers estimated net population growth during the 1940s-1950s in order to approximate Indonesia's population in the 1950s and 1960s. Van der Eng (2002: 495-503) used these available estimates of net population growth as a guide to apportion net population growth to the population across residencies in Java and provinces in the outer islands in order to interpolate the population census years 1930 and 1961. Figure 2 shows the results of this exercise for Java, which allows the identification of a net population loss during 1942-1945 of 2.4 million people, also shown in Table 2.

[Figure 2 about here]

Figure 2 also shows the result of using the estimated annual net population growth rates in Figure 1 to extrapolate the recorded, but underestimated population, which yields a comparable net population loss of 2.5 million people. And Table 2 shows the results of applying the net population loss method to other estimates of net population growth, particularly by Indonesian demographer and economist Widjojo Nitisatro and by Indonesian physicist Herman Johannes. Except for De Vries (1946), the estimates of net population loss are implicit. The method is sensitive to assumptions about the population growth rate that would have applied if there had not been a demographic shock.[8] The different estimates of the rate of population growth during the 1930s and their extrapolation 1945 are therefore a reason for the different results in Table 2.

[Table 2 about here]

The net population loss estimate based on De Vries (1946) in Table 2 is slightly lower than the 2.45 million quoted above, because De Vries rounded up his result.[9] The table shows that his result is comparable to those implicit in Keyfitz and Nitisastro (1954), Johannes *et al.* (1960), Van der Eng (2002) and also this paper's estimate based on the reconstructed (but underestimated) 1941-1945 birth and mortality rates and the recorded (but also underestimated) population data.

Table 2 shows that the birth and mortality rates implicit in De Vries (1946) reveal that the number of deaths exceeded normal levels during 1943-1945 by 1.5 million. Based on similar data, this study finds excess deaths of 1.3 million during 1942-1945, of which 0.5 million during 1944 and 0.8 million during 1945. This is slightly lower than De Vries

[8] This sensitivity is for example obvious in Chandra (2013), which estimates the net population loss due to the 1918 Spanish flu pandemic in Java. His estimate of 3.5 million victims is based on an estimate of population growth of 1.75% per year that he assumes would have applied during 1918-1920 if the pandemic had not taken place. This population growth estimate exceeds the best estimates of demographers of Indonesia of 1.0 to 1.1% per year (Boomgaard and Gooszen 1991: 61). Using a lower population growth and the registered birth and mortality rates for these years yields a still formidable, but significantly lower estimate of 1 million flu victims (Van der Eng 2023).

[9] The correction of typos and incorrect column totals in De Vries (1946) did not affect the estimate.

(1946) due to the lower estimated mortality rate in 1945. Both estimates are lower than the 4 million mentioned publicly around 1950, because the latter includes missing births during 1942-1946 and an estimate of excess deaths in 1946. Including those, this paper's estimate for 1942-1946 is 3.3 million (based on the extrapolation of recorded population in Figure 3 and the mortality rate in Figure 1).

Section 3 concluded that both the recorded mortality and birth rates were underestimated, largely to the extent that infant mortality was incompletely registered. This led Nitisastro (1970: 139-144) to denounce the recorded vital data in his estimation of the age-composition of Java's population 1930-1960. Gardiner (1981: 54) compared recorded births and deaths with the implicit estimates in 5-yearly intervals of birth and mortality rates and the age composition of Java's population in Nitisastro (1970: 158 and 161) during the 1930s and 1950s. He concluded that for the 1930s official registrations in Java were underestimated by around 40%.

Nitisastro (1970: 158) used the hindsight of 1961 population census results to estimate birth and mortality rates back to 1930 as 5-year averages. These data were not available to De Vries (1946), Keyfitz and Nitisastro (1954) and Johannes *et al.* (1960) whose implicit estimates of net population loss are shown in Table 2. Nitisatro (1970) retropolated the age structure in 1961 in Java on the basis of an assumed life expectation at birth of 27.5. That allowed him to estimate births and birth rates and on the basis of net population growth estimates also mortality rates. However, the 1961 census results were 5-year averages no annual data, therefore Nitisastro's estimates of birth and mortality rates were five year averages, not annual estimates that can be used to apportion implicit net annual population loss to the 1942-1945 years. For that purpose, Figure 3 shows an extrapolation of Nitisastro's 5-year averages on the basis of the annual birth and mortality rates in Figure 1, in order to correct the latter for underestimation. Using these corrected birth and mortality rates to extrapolate the Nitisastro (1970) 1940 population estimate yields the estimate of a net population loss of 3.4 million during 1942-1945 shown in Table 2, consisting of 1.9 million excess deaths and a residual of 1.5 million missing births.[10]

[Figure 3 about here]

The net population loss method can in principle be applied to the years 1946-1949 when the food situation in Java remained precarious. Figure 1 indicates that birth rates started to recover after 1946, but that net population growth remained negative during 1946-1948. However, a major problem with the estimates for these years is that their basis is much more limited compared to 1941-1942 (see Appendix 1) and 1943-1944. Altogether, there are just 18 mortality and 14 birth rate observations for 1946-1949, of

[10] Note that Nitisastro (1970) assumed the same net population growth during 1930s and 1950s of 1.7% per year, which meant that his 1940s estimate of net population growth during the 1940s had to be quite low in order to bridge the 1930 and 1961 population censuses. Van der Eng (2002) uses a more conventional annual growth of 1.45% during the 1930s and 1.9% during 1950s, leaving a higher annual average growth rate during the 1940s.

which respectively 9 and 6 in the cities of Jakarta, Semarang, Surabaya and Yogyakarta. The first three are not representative for most of Java for two reasons. Firstly, during 1946-1948 they experienced inflows of malnourished refugees from rural Java, many of whom did not recover (Van der Eng 2002: 489-492; Huff and Huff 2015: 528). Secondly, the urbanisation rate in the whole of Java remained low in the 1940s, despite the increase in the urban population in the late-1940s. For those reasons, the 1946 and 1947 mortality and birth rates for these cities were not used to estimate the unweighted averages in Figure 1 (see Appendix 1).

With a limited number of observations of birth and mortality rates in rural Java during 1946-1949, estimates of the net population loss during these years are more speculative than for 1942-1945. Nevertheless, Table 3 shows the excess mortality during the years of constrained food supplies and war of independence, 1946-1949. Based on the reconstructed (but underestimated) 1946-1949 birth and mortality rates and the recorded (but also underestimated) population data, net population loss during 1946-1949 was 2.52 million, or which 0.70 million excess deaths and 1.82 million missing births. Correction for underestimation, as explained above, leaves a net population loss of 1.27 million, consisting of 1.63 million excess deaths and a residual of -0.35 million missing births.[11] The difference between both estimates underlines the method's sensitivity to assumptions about the population growth rate that would have applied in the absence of a demographic shock.

6. Conclusion

This paper identified the origin of the estimate of 4 million victims during the Japanese occupation. This estimate is an issue of controversy in Indonesia's historiography, as section 2 summarised. It is also an issue in Indonesia's demographic history, as its lasting impact of Indonesia's demographic structure has never been analysed. The paper established that estimate of 4 million was too high, as it included an unsubstantiated estimate of the indirect occupation victims during 1946. However, sections 3 and 4 established that the estimate of 2.45 million victims during 1942-1945 was valid as it was based on the system by which births and deaths were recorded at village level in Java, albeit under-recorded largely as a consequence of the underestimation of infant mortality rates.

Using disparate sources, section 4 approximated the average birth and mortality rates during the 1940s. To correct for the under-recording of infant mortality, section 5 made indirect use of the age distribution results of the 1961 population census, particularly the estimated 5-year average birth and mortality rates, which it apportioned to individual years on the basis of approximated birth and mortality rates. It concluded that the net loss of population during 1942-1945 was 3.4 million, of which 1.9 million excess deaths: 0.7

[11] The excess deaths would include the Indonesians who died in combat in Java during the 1945-1949 war of independence. Throughout Indonesia, around 100,000 Indonesian combatants died (NIOD 2022). The negative number of missing births underlines that the 1946-1949 data limitations affect the estimates.

during 1944 and 1.2 million during 1945, altogether 3.8% of Java's 1940 population. The residual 1.5 million were missing births, related to the decreased birth rate in 1944 and 1945 associated with the malnutrition of women of childbearing ages and the physical separation of wives from husbands who were recruited by Japanese authorities for forced labour.

The net loss estimate seems similar to the 4 million victims mentioned publicly around 1950, but is different, because it excludes the net loss of people in the aftermath of the Japanese occupation period in 1946. The estimate of excess deaths is similar to De Vries (1946), but is different, because the latter did not account for the underestimation of birth and mortality rates and included missing births.

Further research may analyse the demographic and physical consequences of the 1944-1945 famine in Indonesia. Studies of famines in other countries have identified the personal tragedy of families whose children died or who were unable to raise the children that were not born during these years. Such studies also identified the adverse physical and mental health effects on famine survivors, as well as the transgenerational and epigenetic effects due to in-utero genetic changes on the second and third generations of survivors of other famines. Examples of such studies relate to the famines in Ireland 1845-52 (Walsh 2016), The Netherlands 1944-45 (Veenendaal *et al.* 2013), North Vietnam in 1945 (Guven *et al.* 2021) and China 1959-61 (Xie and Zhu 2022). Such health effects may therefore still affect Indonesians born in Java during the 1940s, and possibly also their descendants.

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Table 1: Correlation Coefficients of Mortality and Birth Rates across Regencies in Java, 1930-1940

		Regencies in	r > 0.6	Share
a. Mortality rates				
Kendal regency	1930-1940	Java	30 of 77	39%
		Central Java	16 of 32	50%
Jakarta residency	1930-1940	Java	27 of 75	36%
b. Birth rates				
Kendal regency	1932-1940	Java	28 of 77	36%
		Central Java	14 of 32	44%
Jakarta residency	1932-1940	Java	17 of 75	23%

Notes: In the case of Kendal, Pearson's correlation coefficient (r) calculated for all regencies in Java, excluding Kendal. In the case of Jakarta residency, r calculated for all regencies in Java excluding the regencies in Jakarta residency: Jakarta (*i.e.* Batavia), Jatinegara (*i.e.* Meester Cornelis) and Krawang. Population denominators in 1933-1941 estimated by extrapolating 1932 registered population with 1932-1941 annual balance of registered births less registered deaths.
Source: Indisch Verslag (1931-1941).

Table 2: Estimates of the Net Loss of Population in Java during 1942-1945

Source	1930s annual rate of net population growth extrapolated to 1945	Net loss of population	of which due to: higher than normal deaths	of which due to: missing births
		(× 1,000)		
De Vries (1946), 1943-1945 net loss	1.12% (1939)	2,430	1,539	891
Keyfitz and Nitisastro (1954: 57)	1.50%	2,336	-	-
Johannes *et al.* (1960)	1.50%	2,349	-	-
Van der Eng (2002: 198-203)	1.45%	2,420	-	-
This paper, Figure 1 mortality rates	0.96%[a]	2,521	1,351[b]	1,170[c]
Nitisastro (1970: 158) extrapolated[d]	1.70%[e]	3,464	1,939[b]	1,525[c]

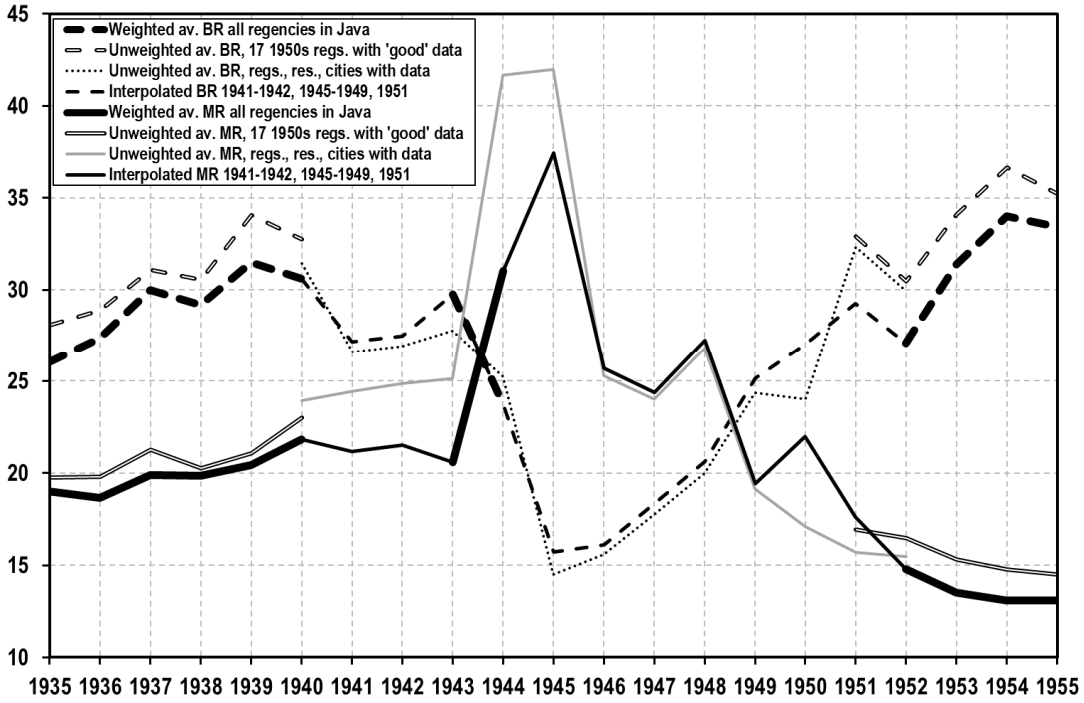
a. 1936-1940 5-year average growth of registered population, estimated by extrapolating 1932 registered population with annual registered births and deaths during 1933-1940.
b. Deviation of mortality rates during 1942-1945 from 1936-1940 average mortality rate.
c. Residual.
d. See main text and Figure 3 for the extrapolation of 5-yearly averages.
e. 1935-1940 growth rate.

Table 3: Estimates of the Net Loss of Population in Java during 1946-1949

Source	1930s annual rate of net population growth extrapolated to 1949	Net loss of popu-lation	of which due to	
			higher than normal deaths	missing births
		(× 1,000)		
Keyfitz and Nitisastro (1954: 57)	1.50%	805	-	-
Johannes *et al.* (1960)	1.50%	3,106	-	-
Van der Eng (2002: 198-203)	1.45%	1,204	-	-
This paper, Figure 1 mortality rates	0.96%[a]	2,526	706[b]	1,820[c]
Nitisastro (1970: 158) extrapolated[d]	1.70%[e]	1,275	1,633[b]	-358[c]

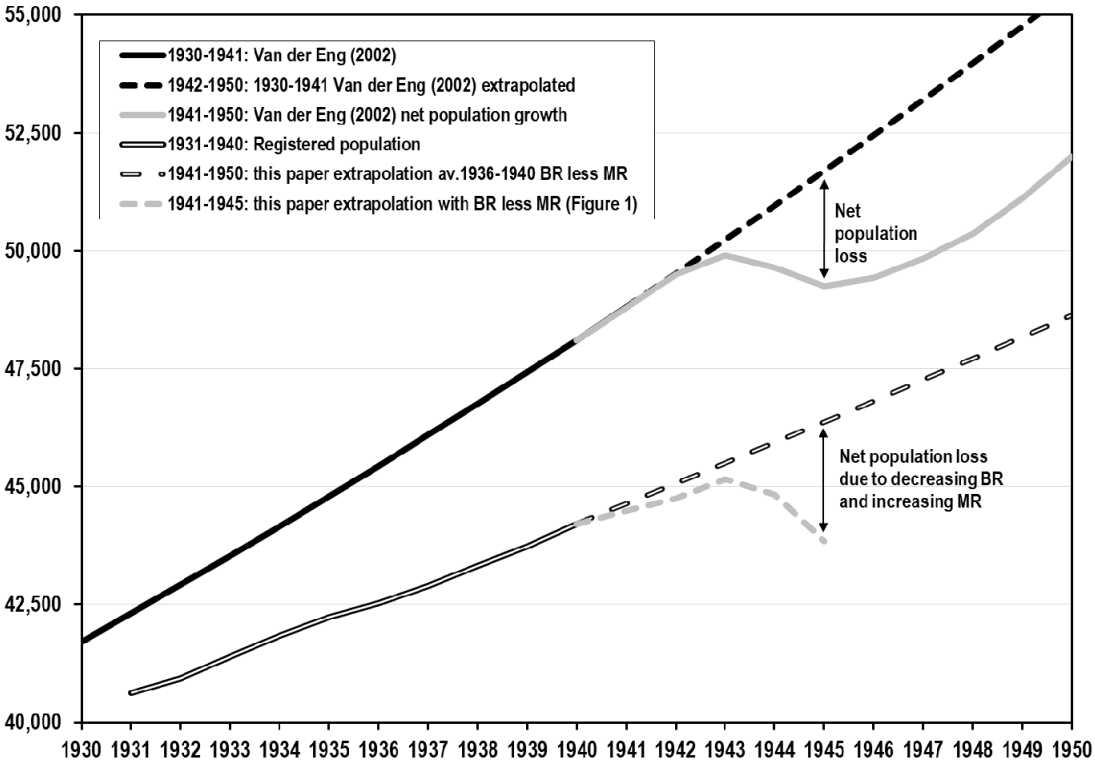
a. 1936-1940 5-year average growth of registered population, estimated by extrapolating 1932 registered population with annual registered births and deaths during 1933-1940.
b. Deviation of mortality rates during 1946-1949 from 1936-1940 average mortality rate.
c. Residual.
d. See main text and Figure 3 for the extrapolation of 5-yearly averages.
e. 1935-1940 growth rate

Figure 1: Average Birth and Mortality Rates in Java, 1935-1955 (‰)



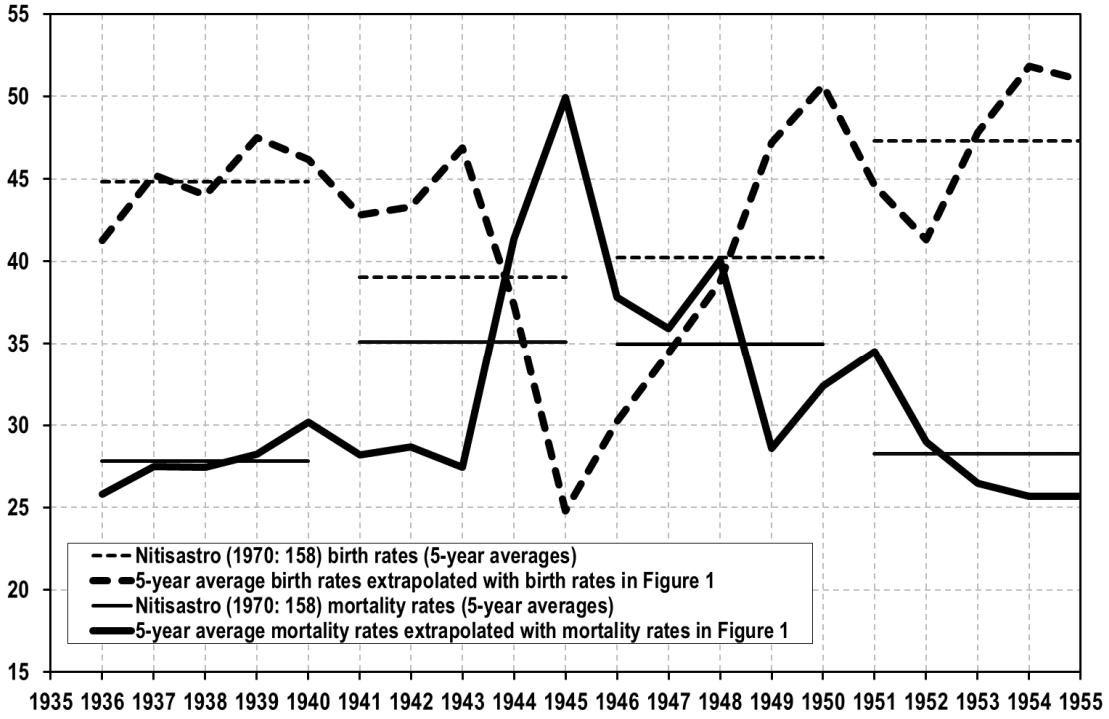
Notes: BR is birth rate, MR is mortality rate; regs. = regencies, res. = residencies; for 1935-1940, total population estimated on the basis of 1932 registered population at the start of the year, increased annually with 1932-1939 recorded net population growth; data refer to the Indonesian population in Java only.
Sources: Weighted averages 1935-1940 *Indisch Verslag* (1936-1941); 1943-1944 Soemodilogo (1946, corrected for typos and partial 1944 data); 1950 *De Java Bode* (13 December 1954); 1952-1955 Breman (1963: 290 and 292); unweighted averages 1941-1942 and 1946-1955, Appendix 1.

Figure 2: Estimates of Net Population Loss in Java, 1942-1945 (1,000 people)



Note: Data refer to the Indonesian population in Java only.
Sources: Van der Eng (2002: 498); Figure 1 and 1931-1940 vital statistics in *Indisch Verslag* (1931-1941).

Figure 3: Average Birth and Mortality Rates in Java Corrected for Under-Recording, 1936-1955 (‰)



Note: Refers to the Indonesian population in Java only. Nitisastro's 5-yearly average birth and mortality rates is extrapolated for each five-year period on the basis of the estimated annual birth and mortality rates in Figure 1.
Sources: Nitisastro (1970: 158) and Figure 1.

Appendix 1: Sources of Recorded Mortality and Birth Rates in Java, 1941-1955

a. 1941-1950

Year	Region	*		MR	BR	Sources	Notes
1941	Blora	reg	C.Java	26.0	30.5	*Indische Courant* (18 October 1941)	Q2, 3 average
1941	Demak	reg	C.Java	34.0	30.0	Martoatmodjo (1944) 50-52	Annual average
1941	Grobogan	reg	C.Java	31.5	26.0	Martoatmodjo (1944) 50-52	Annual average
1941	Kendal	reg	C.Java	26.6	33.0	Martoatmodjo (1944) 50-52; Wander (1965) 94	Annual average
1941	Semarang	city	C.Java	26.0	19.0	Martoatmodjo (1944) 50-52	Annual average.
1941	Semarang-Salatiga	reg	C.Java	27.5	28.0	Martoatmodjo (1944) 50-52	Annual average.
1941	Banyuwangi	reg	E.Java	20.0	25.3	*Soerabaijasch Handelsblad* (15 August and 11 November 1941)	Q1, 2, 3 average
1941	Bojonegoro	res	E.Java	30.0		*Indische Courant* (10 July 1941)	Q1
1941	Bondowoso	reg	E.Java	17.3		*Soerabaijasch Handelsblad* (11 November 1941)	Q2, 3 average
1941	Jember	reg	E.Java	19.2		*Soerabaijasch Handelsblad* (15 August and 11 November 1941)	Q1, 2, 3 average
1941	Madura	res	E.Java	23.2		*Indische Courant* (10 July 1941)	Q1
1941	Malang	reg	E.Java	19.0		*Soerabaijasch Handelsblad* (30 March 1942)	Q4
1941	Panarukan	reg	E.Java	16.6		*Soerabaijasch Handelsblad* (11 November 1941)	Q2, 3 average
1941	Pasuruan	reg	E.Java	28.5		*Indische Courant* (10 July 1941)	Q1
1941	Sidoarjo	reg	E.Java	26.4		*Indische Courant* (1 November 1941)	Q1, 2 average
1942	Demak	reg	C.Java	25.9	30.9	Martoatmodjo (1944) 50-52	Annual average
1942	Grobogan	reg	C.Java	24.1	27.9	Martoatmodjo (1944) 50-52	Annual average
1942	Kendal	reg	C.Java	25.6	29.4	Martoatmodjo (1944) 50-52; Wander (1965) 94	Annual average
1942	Semarang	city	C.Java	26.2	19.1	Martoatmodjo (1944) 50-52	Annual average
1942	Semarang-Salatiga	reg	C.Java	26.2	27.2	Martoatmodjo (1944) 50-52	Annual average
1942	Jakarta	city	W.Java	21.2		KemPen (1953a) 401-402	Annual average
1943	Demak	reg	C.Java	26.0	31.4	Martoatmodjo (1944) 50-52	Annual average
1943	Grobogan	reg	C.Java	23.1	30.5	Martoatmodjo (1944) 50-52	Annual average
1943	Kendal	reg	C.Java	25.0	31.9	Martoatmodjo (1944) 50-52; Wander (1965) 94	Annual average
1943	Kudus	reg	C.Java	22.0		Anderson (1966) 93	Q4
1943	Pati	res	C.Java	23.0	22.0	Anderson (1966) 93	Q4
1943	Semarang	city	C.Java	35.6	20.1	Martoatmodjo (1944) 50-52	Annual average
1943	Semarang-Salatiga	reg	C.Java	27.8	25.7	Martoatmodjo (1944) 50-52	Annual average
1943	Jakarta	res	W.Java	18.7	32.8	De Vries (1946)	Jan.-Dec. average
1944	Kedu	res	C.Java	34.2	29.9	Anderson (1966) 93	Q1, 2, 3 average
1944	Kendal	reg	C.Java	47.0	23.0	Wander (1965) 94	Annual average
1944	Kudus	reg	C.Java	45.0		Anderson (1966) 93	Q2
1944	Pati	res	C.Java	38.0	25.4	Anderson (1966) 93	Q2
1944	Purworejo	reg	C.Java	42.7	23.8	Anderson (1966) 93	Q3
1944	Wonosobo	reg	C.Java	53.7	29.1	Anderson (1966) 93	Q3
1944	Jakarta	res	W.Java	21.8	20.3	De Vries (1946)	Jan.-Dec. average
1944	Jakarta	city	W.Java	51.1		KemPen (1953a) 401-402	Annual average
1945	Kendal	reg	C.Java	56.0	15.0	Wander (1965) 94	Annual average
1945	Jakarta	res	W.Java	28.0	14.0	De Vries (1946)	Jan.-May average
1946	Kendal	reg	C.Java	35.0	16.0	Wander (1965) 94	Annual average
1946	Semarang	city	C.Java	85.0	12.0	*De Locomotief* (17 March 1950)	July, *MR not used*
1946	Madiun	res	E.Java	14.3	18.8	Nationaal Archief 2.22.21 item 13-0601 *Antara* (April 1948) p.34	Annual average
1946	Madura	reg	E.Java	75.0		*Nieuwe Courant* (27 September 1946)	'in some villages', *MR not used*
1946	Surabaya	city	E.Java	59.3		Nationaal Archief, 2.10.14, No.676, p.3	Dec., *MR not used*
1946	Jakarta	city	W.Java	26.6		KemPen (1953a) 404	Annual average
1947	Kendal	reg	C.Java	32.0	17.0	Wander (1965) 94	Annual average
1947	Semarang	city	C.Java	40.0	17.0	*De Locomotief* (17 March 1950)	July, *MR not used*
1947	Madiun	res	E.Java	16.0	24.1	Nationaal Archief 2.22.21 item 13-0601 *Antara* (April 1948) p.34	Annual average

1947	Surabaya	city	E.Java	63.4	13.0	Nationaal Archief, 2.10.14, No.676, p.3	Jan.-Nov. average, *MR not used*
1948	Kendal	reg	C.Java	25.0	18.0	Wander (1965) 94	Annual average
1948	Semarang	city	C.Java	25.0	22.0	*De Locomotief* (17 March 1950)	March
1948	Surabaya	city	E.Java	30.4		*De Nieuwe Courant* (20 January 1949)	Nov.-Dec. average
1949	Kendal	reg	C.Java	23.0	27.0	Wander (1965) 94	Annual average
1949	Semarang-Salatiga	reg	C.Java	16.0	33.0	*De Locomotief* (17 June 1949)	May
1949	Surabaya	res	E.Java	15.2	16.1	KemPen (1953b) 608	Annual average
1949	Surabaya	city	E.Java	21.1	28.6	*De Vrije Pers* (28 July and 10 October 1949); *De Nieuwe Courant* (13 August, 11 October and 15 November 1949)	Jan.-Oct. average
1949	Yogyakarta	city	C.Java	16.0	17.0	*Suara Merdeka* (16 August 1952)	Annual average
1950	Kendal	reg	C.Java	21.0	31.0	Wander (1965) 94	Annual average
1950	Semarang	city	C.Java	22.0	27.0	*De Locomotief* (11 September 1953)	Annual average
1950	Besuki	res	E.Java	13.3	22.6	KemPen (1953b) 608	Annual average
1950	Bojonegoro	res	E.Java	17.5	22.5	KemPen (1953b) 608	Annual average
1950	Kediri	res	E.Java	14.4	26.8	KemPen (1953b) 608	Annual average
1950	Madiun	res	E.Java	12.5	29.0	KemPen (1953b) 608	Annual average
1950	Madura	res	E.Java	16.0	21.3	KemPen (1953b) 608	Annual average
1950	Malang	res	E.Java	20.5	28.1	KemPen (1953b) 608	Annual average
1950	Surabaya	res	E.Java	15.0	19.9	KemPen (1953b) 608	Annual average
1950	Surabaya	city	E.Java	27.2		*De Nieuwe Courant* (20 September 1950)	July-Aug. average
1950	Bandung	reg	W.Java	11.7	17.8	*De Vrije Pers* (19 March 1952)	Annual average
1950	Jakarta	city	W.Java	13.9	18.2	KemPen (1953a) 412	Annual average

* reg = regency or *kabupaten*, res = residency, city is generally part of the regency and residency data, except when listed separately.
Notes: MR is mortality rate, BR is birth rate. MR Madura 1946 not used in Figure 1 because it is unclear how representative this estimate was for the famine experienced in Madura residency. MR Semarang city 1946 and MR Surabaya city 1946-1947 not used because both cities experienced a large inflow of famished refugees fleeing the famine during the lean season from surrounding rural areas under the control of the Republic of Indonesia.

b. 1951-1955

1951 West Java province: *Java-Bode* (22 February 1952);
1951 Jakarta: KemPen (1953a) 412;
1951 Bandung: Indonesische documentatie dienst van ANP-Aneta, no.12 (28 March 1952);
1951-1952 Central Java all regencies: Mochtar (1953);
1951-1952 East Java all residencies: KemPen (1953b) 609-610;
1952 West Java province: Breman (1963) 290 and 292, Jakarta included;
1952-1955 Java total, weighted averages: Breman (1963) 290 and 292.
1952-1955 regencies of Bandung, Kuningan, Bogor, Pekalongan, Banyumas, Magelang, Purworejo, Kudus, Kendal, Klaten, Bantul, Mojokerto, Ngawi, Blitar, Malang: *Statistik Indonesia 1956*, 20 and *Statistical Pocketbook of Indonesia 1957*, 13;
1952 Wonosobo regency: Keyfitz (1953) 645;
1953-1954 Purbolinggo and Wonosobo regencies: Mochtar *et al.* (1956) 109.