

Labor, wages, and living standards in Java, 1680–1914

PIM DE ZWART* AND JAN LUITEN VAN ZANDEN**

**International Institute of Social History, The Netherlands, pza@iisg.nl*

***Utrecht University, The Netherlands, jvz@iisg.nl*

The development of living standards in Java has long been a subject of scholarly interest. A number of scholars have suggested that between 1600 and 1900 Southeast Asian living standards declined significantly. The present article contributes to these issues by calculating long-term real wages for Java between 1680 and 1914, following Allen's subsistence basket methodology. New data on wages and prices were collected from the Dutch East India Company (VOC) archives and connected to data on the nineteenth and twentieth centuries. The resultant long-term real wage developments show a slightly different picture of Javanese living standards than that which has emerged from the literature to date.

1. Introduction

Two recent debates in economic history have stimulated the study of comparative living standards in the past. A methodology for computing internationally comparable real wages has been developed in recent years following the discussion on the Great Divergence between Europe and Asia. This methodology was pioneered by Allen (2001). The divergence debate initially stimulated real wage comparisons for 1800 between Europe on the one hand, and China, India, and Japan, on the other (Allen *et al.* 2011). The debate over the colonial origins of (under) development has furthered investigation of real wages in many former European colonies in Africa and the Americas (e.g., Allen *et al.* 2012; Arroyo Abad *et al.* 2012; Frankema and Van Waijenburg 2012). Southeast Asia is an important region in both these debates. In his book on the Great Divergence, Pomeranz (2000, pp. 39–40 and 49) suggests life expectancy and average income in parts of Southeast Asia between 1500 and the early nineteenth century were on a par with (or better than) Europe. While Acemoglu and Robinson (2012, pp. 245–73) recently pointed to Southeast Asia as a region where the Europeans (mainly the Dutch) introduced extractive institutions that led to “reversing development”.

While some studies on comparative standards of living in nineteenth and twentieth centuries Java (Van Zanden 2003) and Indonesia (Baten *et al.* 2013; Foldvari *et al.* 2013) have appeared in the past decade, consistent estimates of living standards from the seventeenth century do not exist. The lack of data for the earlier period has obviously been the major obstacle. Nevertheless, for more substantiated conclusions about the long-term development of living standards on Java, and claims of “divergence” or “reversed development”, such evidence is of vital importance.

How living standards developed in Southeast Asia in general and Java in particular is a subject of some discussion. Reid (1988, 1993) suggested that Southeast Asian living standards declined in the seventeenth century and Boomgaard (1990, pp. 44–5) found a declining trend in real wages in Java between 1600 and 1780 and suggests that this trend continued over the nineteenth

century, as the level of real wages was higher in 1800 than around 1900. Both claims are still open to debate, as they are based on limited evidence. A similar discussion relates to the effects of various Dutch colonial policies in the nineteenth century, such as implementation of the Cultivation System between 1830 and 1870 (Elson 1994; Booth 1998) and the welfare policies since the 1890s (Boomgaard 1986).

This article contributes to this discussion by presenting a great deal of new data on wages and prices on Java between 1680 and 1810, for the first time using the rich sources available in the archives of the Dutch East India Company (*Verenigde Oost-Indische Compagnie*: VOC), in combination with a variety of published sources for this period. For the period after 1810, we rely almost entirely on secondary sources, in particular the series *Changing Economy in Indonesia* (CEI) (Mansvelt 1979; Dros 1992; Korthals Altes 1994), supplemented by additional archival research to fill a few gaps in the dataset.

These data were used to estimate real wages of unskilled laborers on Java between 1680 and 1914, following Robert Allen's subsistence basket methodology (Allen 2001; Allen *et al.* 2011). This has important advantages and disadvantages. The biggest advantage is that it makes it possible to compare real wages in Java in an international comparative context, because similar calculations have been done for Western Europe, China, Japan, and India in this period. But price and wage data for Java have to be put in the same model for estimating subsistence costs and wage income used for other societies, whereas conditions are clearly different in each country, and perhaps especially on Java. For example, the Allen approach assumes 250 working days per year, whereas much wage labor on Java was seasonal, and it assumes as well that wages were the only source of income for the household involved – again, an assumption that was often violated in Javanese practice. We cannot reconstruct how many days were actually worked by wage laborers on Java during this period and thus how much money was earned per household, because the data are missing, but using the Allen framework, we can reconstruct the long-term evolution of the purchasing power of the daily wage and place it in an international perspective.

The relevance of this method depends on one's view of the organization of the labor market, but there is increasing evidence that parts of the Javanese population were at least partly dependent on wage labor. We therefore start this article with a brief overview of the literature on this subject, concluding that a “free” labor market did exist in Batavia (the main port city, current day Jakarta) and other urban centers. To maintain comparability with other studies, we employ the same arbitrary assumptions about working days, family composition, and structure of the budget, although we are aware that these do not entirely fit Javanese reality. The method does, however, tell us something about the purchasing power of wages earned, which is usually considered an important determinant of the standard of living.

As in the other contributions to the growing literature on real wages measured in this way, we focus on one of the largest cities in the region, Batavia, for the greater part of the period under study. As such, it is probably comparable to the other big cities studied in similar research, and wage labor in the eighteenth century was predominantly free in the cities. Moreover, we present wage data for the countryside as well: for *corvée* workers in the eighteenth century and for plantation laborers in the nineteenth century. However, given the coercion involved in *corvée* work, these wages are neither a good index of the relative productivity of alternative activities (in agriculture), nor a good proxy for the standard of living of the population involved, as most *corvée* work was only seasonal, and these workers also relied on other sources of income. We also present price and wage data for the seventeenth and eighteenth centuries which are entirely new and arguably the first systematic serial information about the evolution of the Javanese economy in this period. The nineteenth century has already been studied in much more

detail, and the data presented here have already been used in other publications as well, so we focus less on this aspect (Van Zanden 2003; Van Zanden and Marks 2012).

In the next section, we discuss the existence of “free” wage labor in Java before 1880. The newly collected wage data, and their problems, are discussed in Section 3. Section 4 presents the price data, sources, and limitations. Section 5 reviews some of the existing views on the development of living standards in Java before presenting our new estimates of long-run real wages. Our new estimates suggest that there was a slight improvement in real wages in the later eighteenth century, while real wages over the nineteenth and early twentieth centuries stagnated for Java as a whole, but show decline when only Batavia is taken into consideration.

2. The free labor discussion

Taking real wages as a measure of living standards has been criticized in recent years (e.g., Booth 2012). One of the problems with using wages as an indicator of living standards in Java is that most people were engaged in small peasant farming, so their standard of living would not be affected by overall changes in wages. What part of the population did depend on wages as their household income, and what part of that income came from wages? What determines the level of wages: is it the context of a free labor market responding to supply and demand or is it influenced by systems of forced labor? Urban wages may show different trends than do living standards in rural areas. In this section, we address these issues.

Four points are important here: (1) many people worked outside agriculture in Java. While the early figures are very tentative, this may have been over 10 percent in the seventeenth century (Bosma 2011). (2) This percentage increased in the eighteenth and nineteenth centuries. In 1815 non-agricultural workers amounted to around 15 percent and increased to 25–27 percent by 1880, and 27–29 percent in 1905 (Boomgaard 1989, 1992; White 1992). (3) These workers’ living standards were influenced by fluctuations in wages, because many of these workers were landless wage laborers. In 1905, 40 percent of the agricultural labor force and 36 percent in the non-farm activities were wage workers (White 1992). (4) Even landowning households’ living standards were affected by wages as many agricultural households were engaged in additional activities such as wage labor. For example, a sample of 63 “average” peasant households in Semarang in 1901 showed that 68 percent performed wage labor (Boomgaard 1992, p. 36).

What kind of labor are we talking about? In much of the (older) literature on labor in Southeast Asia there has been general agreement that free wage labor hardly existed before 1880. Boomgaard (1990) first disputed this consensus and from his work a different picture emerges. Clearly a significant part of the labor force consisted of bonded labor, in which three types can be distinguished: slavery, *corvée*, and debt bondage (Boomgaard 2003, p. 87). It seems that slavery was largely restricted to urban areas on the coast because non-noble entrepreneurs and commercially oriented rulers in ports of trade had insufficient access to *corvée* labor. Merchants from China, India, and Malaysia brought their own slaves with them, while the VOC employed slaves from India or other parts of the Indonesian archipelago. The enslavement of Javanese was prohibited (Baten *et al.* 2013, p. 107). Many of the VOC slaves were artisans who were paid a wage, and after a given amount of time had elapsed, some of them could buy their freedom. This (non-indigenous) slavery was rare in the countryside, and according to Boomgaard (2003, p. 84), only about 1.5 percent of the total population were slaves. Javanese could however be subject to debt bondage. While this was a widespread phenomenon in Southeast Asia (Reid 1988, p. 131), in the Dutch governed parts of Java, this was probably

limited, and on several occasions the Dutch tried to abolish debt peonage (Boomgaard 1989, p. 66).¹ Many in Java could however be subject to *corvée* obligations as a form of taxation.

In addition to these forms of compulsory labor, there was also a group of free laborers. From early on, Chinese migrants were an important source of free labor. Around 1670 the term *coolie* first appears in the sources, associated with (indigenous) unskilled wage laborers (Boomgaard 1990). While some coolies could also be coerced, many were free wage laborers. In addition to the coolies, which resembled a permanent proletariat, there were also *bujang*, who were temporary or seasonal workers. 1750 *bujang* were found as free wage laborers on the sugar estates in the environs of Batavia (Boomgaard 1990).

From the research by Nagtegaal (1988), it becomes clear that the VOC employed free coolies and *bujang* as well as *corvée* laborers. The Company mainly used *corvée* laborers for large, irregularly organized operations such as dredging canals or unloading large ships. These workers almost always received some food, but also received monetary compensation even though it was part of their *corvée* service. Free wage laborers often worked as domestic servants or craftsmen. There was also labor migration in the early eighteenth century as inhabitants of Banyumas (in south-central Java) went to the northern coast during the dry season to work as caulkers, while people came to Batavia from across the entire island to work in the sugar mills, or, from the 1720s onward, on the coffee plantations in the Priangan. In Semarang men came to the *alun-alun* (central square) every morning to hire themselves out as day laborers (Nagtegaal 1988, pp. 194–6).

The free labor market grew over the eighteenth century (Boomgaard 1990, 2009) as a result of population growth between 1750 and 1850, which possibly led to an increase in the absolute number of wage dependent workers. Feenstra (2014) and Van Zanden (2007) found an increase in the number of small coins (*duiten*) per capita over this same period, which may be related to the rise of wage labor (Lucassen 2007; Feenstra 2014). Finding sufficient workers remained problematic at the end of eighteenth century, and the number of both *corvée* laborers and free wage laborers increased over the seventeenth and eighteenth centuries (Nagtegaal 1988, p. 196; Boomgaard 2009, p. 62). Several *plakkaten* (edicts) were issued to raise the number of laborers by issuing requests for the supply of *corvée* laborers to work in construction, sugar mills, or dredge canals between 1750 and 1811. Furthermore, between 1765 and 1811 there were at least² sixty-five edicts in the *Plakaatboeken* (books containing all edicts issued by the VOC government in Batavia) concerned with setting wage levels of various laborers, while at least thirteen of these were specifically issued to increase the level of wages.³ For example, an edict raising the wages of coolies working in the Chinese hospital in Batavia on 5 January 1807 stated that the salary had to be raised to five *rix-dollars* per month, as no one could be found to work for only three *rix-dollars* (Van der Chijs 1885–1900, vol. 14, p. 369).⁴ An edict issued a couple of weeks later raised the wages of Chinese blacksmiths from forty *stuivers* to one *rix-dollar* per day, because that was what they could earn on the free market (Van der Chijs 1885–1900, vol. 14, p. 371).

¹ Hoadly (1983) suggests that in the Cheribon–Priangan region less than 5 percent of the total population around 1700 was in debt-peonage, while in the Batang regency in the early nineteenth century this was less than 1 percent (Boomgaard, 1989, p. 66).

² At least, because the index seems to be incomplete. We found some of these edicts by scanning through the total volume of all edicts. Considering the magnitude of the entire collection of edicts we cannot be sure that we have not missed a few.

³ See Appendix, Supplementary material for these edicts.

⁴ A *rix-dollar* or *rijksdaalder* was a coin worth forty-eight *stuivers*, equal to 2.40 guilders.

Thus, over the seventeenth and eighteenth centuries, unfree and free labor existed side by side in Java. This situation continued into the nineteenth century, when government policy toward labor markets (and related product markets) had a significant impact on labor relations. Between 1816 and 1830, policy took a liberal course, but a combination of developments (declining prices on the world markets, and social unrest erupting into the Java War in 1825) made it unsuccessful. One analyst, the future Governor General Van den Bosch, advanced the classic argument that land was abundant and agricultural productivity so high that peasants were not induced to offer themselves on the labor market for competitive wages (Van den Bosch 1829, p. 304). He proposed a system of forced cultivation of cash crops (to finance the colonial administration and create a tradable surplus), which was introduced after 1830, and became known as the Cultivation System. To some extent free wage labor may have been “crowded out” by the strong growth of *corvée* labor, on which the system was based. Dros (1992, p. 15) summarized the evidence: “Although free wage-labor was in a difficult position from 1830 onward, it did not disappear entirely and even staged a cautious comeback in the 1840s”. The Cultivation System was initially very successful in increasing production and exports of cash crops such as coffee and sugar, but was also inherently inefficient, and encountered problems during the 1840s. Then followed a gradual turn toward more market-oriented policies, inaugurated by a set of experiments in which the efficiency of free labor was compared with that of *corvée* labor, which demonstrated the inefficiency of the latter. The Cultivation System did however create an increased demand for labor, which partially resulted in relatively high wages and acceleration of population growth (Van Zanden and Marks 2012, pp. 46–56).

A growing population meant, however, that Java gradually moved from a situation with a relatively abundant supply of land (at the beginning of the century) to one in which land was becoming increasingly scarce. This change may have been behind the decline of nominal wages and other signs that pointed toward “declining welfare” of the indigenous population (a major theme in the colonial literature of the 1890s and 1900s). Free wage labor became available on a larger scale, and in particular, the plantation sector profited from this change of events. Colonial policy adapted (to some extent): following major debates about the exploitation of the colony by the Dutch state, the “Ethical Policy” was introduced in 1901, with the official aim to raise the prosperity of the indigenous population.

Hence, the group of free wage laborers was a small (yet growing) part of the total population. Although the amount of forced labor may continuously have exceeded that of free labor until the 1890s, the latter group was by no means absent. Wages of this group may be meaningfully compared with their counterparts in other parts of the world. The compensation for *corvée* laborers in the eighteenth century may be less informative about their actual standard of living, yet they may be indicative of the trends. It is important to keep in mind that wages were not the main income for most of the population,⁵ but, as many households had some kind of relationship with the labor market, we would argue that wages still contain important information about trends in living standards in Java.

3. Wage data and trends

We have assembled wages on the seventeenth and eighteenth centuries from a variety of sources. In addition to those reported in the secondary literature mentioned above, wages were taken

⁵ Much as in the other real wage studies.

from De Haan (1910–12) as well as published sources (Hooyman 1779; Van der Chijs 1885–1900; De Jonge 1862–88; Heeres *et al.* 1887–1931). Furthermore, indications of wages were provided in original documents of the VOC archives stating the expenses incurred in the construction and renovation of various buildings in Java. The wages found in the sources were reported for various time periods (day, week, month, and year) and in different coins. These were all converted into guilders per day.⁶ By far the most wage observations (over two-thirds of the total) were noted per day, many other wages were paid per month, while only a few wages were paid on an annual or weekly basis. To use all these observations in a single database, they were converted to daily rates, assuming 21 days per month, thereby following Allen *et al.* (2011) to allow international comparisons.⁷

The dataset thus constructed contains observations for different types of workers from various places across Java (see Appendix, Supplementary material). This includes wages from different towns and regions across Java, for Chinese as well as Javanese laborers, for free and coerced work, and a variety of occupations (see Appendix, Supplementary material for detailed information). These are all presumed to be male wages as it is never mentioned otherwise. To predict a continuous trend of wages over time from the scattered observations, we use a regression analysis in which dummy variables are included for differences in ethnicity (Javanese or Chinese) and free, *corvée*, or slave labor. The regressions also include a time trend (called Trend) equal to the year minus 1750.⁸ In all regressions the time trend is significant and increasing, indicating slight wage inflation over time. Trend2 is the square of the trend and is also significant, which leads to a U-shaped curve in the predicted wage trend.⁹ Table 1 reports the results.

The example created for the wages of *corvée* laborers was highly significant and unfavorable, suggesting that *corvée* laborers earned less than half that of free workers around 1750. The example for slave “wages” was almost always insignificant suggesting that hiring slaves was roughly as costly for the VOC as employing free wage workers.¹⁰ There are few observations for slaves and, as it is unclear what part of the money paid for slaves went into the pockets of the slave owner and what part the slave could keep himself, we are unable to say anything about their standard of living. The premium for skilled labor is significant: over 130 percent, which is significantly above that paid for skilled labor in Europe and China, though on a par with India (Broadberry and Gupta 2006; Van Zanden 2009). Finally, in our examples, we see that Chinese laborers earned much more than indigenous workers, which according to the *Plakaatboeken* is due to their higher productivity.¹¹

Considering the price inflation after 1800 (see the next section), as well as the cluster of data between 1800 and 1820, regression 2 excludes those years. As the coefficients do not change dramatically this suggests that the rise in wages is not only caused by the post-1800 inflation. Regressions 3 and 4 test whether the wages of skilled and *corvée* laborers follow similar trends as free unskilled laborers. We see that the square of trend becomes insignificant in

⁶ See Appendix, Supplementary material.

⁷ Even though a few notations in the sources suggest that a month of work in Java consisted of between 26 and 30 days (Van der Chijs, 1885–1900, vol. 12, p. 198; vol. 14, pp. 566–8, 699).

⁸ Similar procedures were applied in Allen (2007) and Allen *et al.* (2011). See the Appendix, Supplementary material for further details. In the period before 1750, Trend has a negative value, allowing the U-shaped curve in the predicted wage trends.

⁹ We also included the trend cubed in the regressions, but this always proved statistically insignificant.

¹⁰ Only sixteen observations for slaves; these are the non-Javanese artisan slaves, rather than those in debt-bondage.

¹¹ Van der Chijs (1885–1900, pp. 545–7): “[...] as it has been demonstrated that the Chinese are more capable of the work than the indigenous workers” (authors’ translation).

Table 1. *Regression analysis of Javanese wages, 1630–1820^a*

	Regression 1	Regression 2	Regression 3	Regression 4
Constant	0.287*** (10.71)	0.269*** (10.33)	0.599*** (19.54)	0.160*** (9.84)
Trend	0.001*** (3.54)	0.002*** (2.48)	0.002** (2.55)	0.001*** (3.88)
Trend 2	0.00003*** (3.76)	0.00004*** (3.42)	0.00003*** (3.20)	0.000 (0.97)
Corvée	−0.187*** (−7.35)	−0.151*** (−5.68)		
Slave	−0.050 (−0.77)	−0.019 (−0.45)	−0.027 (−0.21)	
Skilled	0.336*** (11.86)	0.337*** (12.50)		
Chinese	0.733*** (11.43)	0.691*** (8.74)	0.787*** (7.94)	
R ²	0.48	0.48	0.30	0.18
F	101.35***	106.47***	21.04***	7.56***
N	581	357	304	62

Source: See text.

Note: Robust standard errors. *T*-ratios are in parentheses.

^aThe regressions exclude the data on European wages paid in Java. Fourteen outliers of wages over two guilders per day were also excluded from the regression. Regression 2 excludes data after 1800, regression 3 excludes data for unskilled laborers, and regression 4 excludes data for free laborers and slaves.

***, **, * denote significance at the 1, 5, and 10 per cent levels, respectively.

regression 4; whereas the wages of free workers (both skilled and unskilled) increased more rapidly toward the end of the eighteenth and beginning of the nineteenth century, wages of corvée laborers followed a linear trend. These regression have so far included wages from different places in Java, however, there were some differences between wages in different areas. Unfortunately, many observations lack explicit mention of the regional origin of the observation, and the observations are too unevenly spread across time.¹² However, it should be kept in mind that we may have understated the wage rate in Batavia, which seems to have been generally somewhat higher than elsewhere.¹³

While the wage data presented here are far from ideal, the results seem plausible. Both Boomgaard (1990) and Reid (1988, 1993) have suggested declining wages over the seventeenth and early eighteenth centuries. They did not show data on wages for the later eighteenth century, but the evidence retrieved for this article strongly suggests an increase in nominal wages in the second half of the eighteenth century. This fits with the evidence of high labor demand from the previous section.

Wages for the period 1825–1914 were mainly taken from Dros (1992). The term “coolie” is most frequently used for the workers mentioned in these sources, which suggests that this

¹² Those observations explicitly stating that they refer to Batavia are concentrated toward the end of the period (almost half the observations are for the period after 1800).

¹³ Interpolating between observations for only unskilled coolies in Batavia leads to roughly similar wage series as those estimated here (see the Appendix, Supplementary material). We have preferred to use the thus estimated average unskilled wage trend for calculating real wages in the next section.

probably relates to more or less free wage labor.¹⁴ For the period 1855–1915, we calculated the wage of a coolie on the plantations of Java on the basis of the minimum wages in the twenty-one residencies (all, except Batavia) for which wage data were available; the Batavia series was based on the same source, and after 1903 on wages of coolies at tram and railway companies in that city.¹⁵ Additional wage data were collected for the first half of the nineteenth century,¹⁶ which confirmed the wage estimates derived from the CEI; Dros (1992, p. 36, table 1) shows that wages of coolies at about 1820 were 13 cents, except for Batavia where it was at about double that level. For the period 1833–49 the number of data points was very limited, so we decided not to present estimates for these years. By 1860 wages of coolies had risen to almost 25 cents, and in Batavia to 42 cents, a rise that was possibly related to the growing demand for labor created by the Cultivation System and by the gradual liberalization that began in the 1850s. Nominal wages began to fall after the “sugar-crisis” of 1883, when the price level also went down sharply (see the next section). The nineteenth century data suggest that until the 1880s rural wages continued to be significantly lower than those prevailing in Batavia, yet following roughly similar trends (figure 1). In the final decades of the nineteenth century, as the free labor market grew rapidly, the wage gap between coolies in or near Batavia and similar plantation workers elsewhere on the island narrowed substantially.

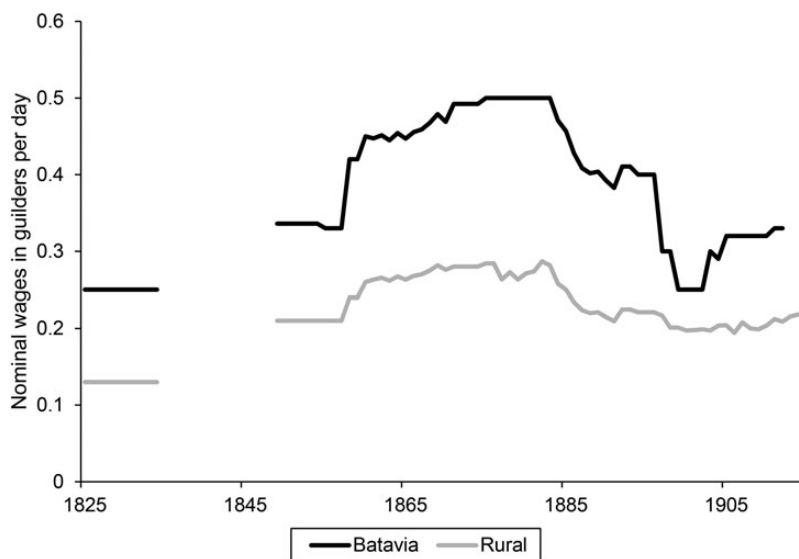


Figure 1. *Wages in Java, 1825–1915.*

Source: *See text.*

¹⁴ We thus assume that these are more or less similar workers to the coolies in the seventeenth and eighteenth centuries which were also often free wage laborers as discussed in Section 2.

¹⁵ Unweighted averages of the minimum wages given in the sources, in particular table 5.4 (covering 1875–1915), table 5.1 (1861–66), and tables 4.1 and 4.2 (1855–70); missing observations were interpolated as were wages for Batavia between 1882 and 1893.

¹⁶ Sources: Dutch National Archives (NA), The Hague: *Collectie Baud*, no. 892 (estimates of wage level in 1830 and 1853); Ministry of Colonies, Government budgets Netherlands Indies 1819–26, no. 2972–88, with large numbers of wage estimates in various parts of Java; also De Klerck (1905, pp. 190, 634); An. (1866, pp. 250–3).

4. Price data and trends

To calculate real wages, it is necessary to know the prices for a number of products. The price data in this study were taken from a variety of VOC archival sources. For the period up to 1800, the most important sources were the General Journals of the [Bookkeeper General in Batavia](#).¹⁷ In these general journals, the trade in the entire VOC charter area was recorded. Fifty-five volumes from the eighteenth century have been preserved which recorded for a financial year the products, quantities, and values that were shipped between the Dutch Republic and the charter area, and among the colonies and trading posts in Asia. Additional data were gathered from expense bills which contained prices of provisions bought by ships in Batavia for the return trip to Europe.¹⁸ Finally, we collected data from the *rendementen* (lists of purchases and sales of various products, hereafter: Purchase and Sale lists). For the period 1747–87 these lists contained data on rice and some other basic commodities.

A potential problem with prices taken from the VOC administration is that they are mainly wholesale prices paid by a large trading organization wielding considerable political power. The current study is not the first to encounter such problems, and many previous studies have had to rely to a greater or lesser extent on wholesale prices paid by large institutions ([Allen 2001](#)). The issue is usually resolved with consistent mark-ups based on a number of observations for retail prices. However, in this case, the VOC could obtain shipments of rice and other products as forced deliveries at payments below the market price. After the 1740s, the Company consolidated its power over Java's northeast coast (the main supplier of rice to Batavia). It may have been that the VOC was able to procure greater quantities of rice at lower cost ([Jacobs 2006](#), p. 244), and that as a consequence there was a divergence between VOC purchasing and market prices.

Fortunately, the Purchase and Sale lists for Batavia for the period 1747–87 contain data on these prices, while those for the years between 1769 and 1787 even show the costs of transport, storage, personnel and a risk premium. Figure 2 shows these prices alongside the prices of rice found in the other VOC documents. Interestingly, if costs are taken into account, the VOC was often losing money on the sale of rice in Batavia. This suggests that the VOC was primarily interested in feeding its workers in Batavia, while profits were to be made from the sale of, e.g., coffee ([Van Niel 2005](#), p. 123). Figure 3 shows that the prices from the other VOC sources are similar to the sales prices from the Purchase and Sale lists rather than the purchase prices. Therefore, mark-ups on the rice prices are not used to obtain the prices from the period before 1747, as this would unfairly depress real wages. While the VOC was unable to control the rice market completely, the evidence from the Purchase and Sale lists did suggest minor mark-ups on salt, sugar, and textiles (see Appendix, Supplementary material).

Figure 3 confirms the same pattern of rice prices in other towns across Java's northeast coast over the eighteenth century. While Van Niel notes that the price of rice increased over the eighteenth century (2005, pp. 127–8), our newly collected VOC data suggest otherwise.¹⁹ How do these trends relate to what we know about supply and demand?

First the demand side: there seems to be general agreement that the population of Java was growing during the latter half of the eighteenth century, even though estimates of the total

¹⁷ Available via <http://bgb.huylgens.knaw.nl/>.

¹⁸ In the *Scheepssoldijboeken* (Ships-pay-ledgers) and various expense bills scattered through the VOC archives. See Appendix, Supplementary material.

¹⁹ In fact, his own data ([Van Niel 2005](#), appendix 13) do not point to an increase in prices either.

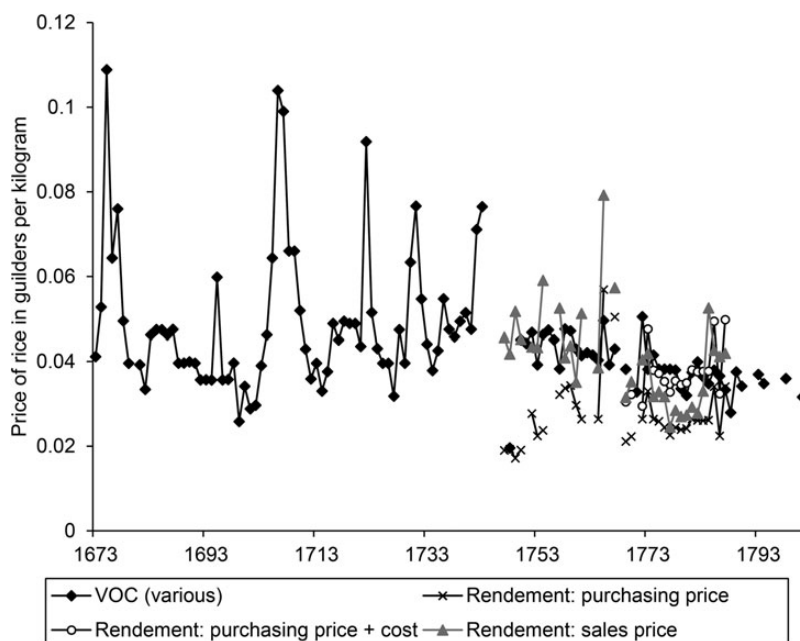


Figure 2. *Comparison of purchasing and sales prices of rice in Batavia.*

Source: See text and Appendix, Supplementary material. (The VOC purchasing price series is based on data from expense bills, Bookkeeper-General and Ships-Pay-Ledgers. Extrapolations from rice prices in Tegal (Nagtegaal, 1988) from 1673–77; 1681–83; 1686; 1704–5; 1716–17; 1719–20; 1732–39).

population size and the extent of the population increase vary greatly. Recent estimates suggest a growth rate of 1 percent annually or more (Feenstra 2014). This increased population densities that were already among the highest in Southeast Asia (generally characterized by low population densities) (Reid 1992). This must have led to a growing demand for rice (and other products), especially since the number of people outside the subsistence sector increased (as suggested above). Why did prices not increase?

Did per capita production increase? The peaks in prices in the late seventeenth and early eighteenth century can easily be explained, as they coincide with periods of warfare (Nagtegaal 1988, pp. 176–7). After 1755 the long period of peace would have allowed for the expansion of agricultural production (Ricklefs 2008, p. 121), allowing for lower and more stable prices. Maddison (1989) finds an increased per capita export production between 1700 and 1780. That this did not occur at the expense of reduced food production is suggested by figure 4, which shows that the total value of goods (in guilders, at VOC purchasing prices) and total amounts of rice shipped from Semarang (on Java's northeast coast) to Batavia increased over the eighteenth century (also when accounting for population growth).

This serves only as indirect evidence of increased production, as VOC trade from Semarang to Batavia was not the only trade, while increased exports might have been at the expense of local consumption. It could be argued that increases in VOC trade were at the expense of the trade generated by Javanese and Chinese merchants (as suggested by Reid 1993). This seems to have been the case in the first half of the eighteenth century (Nagtegaal 1988). But the role of

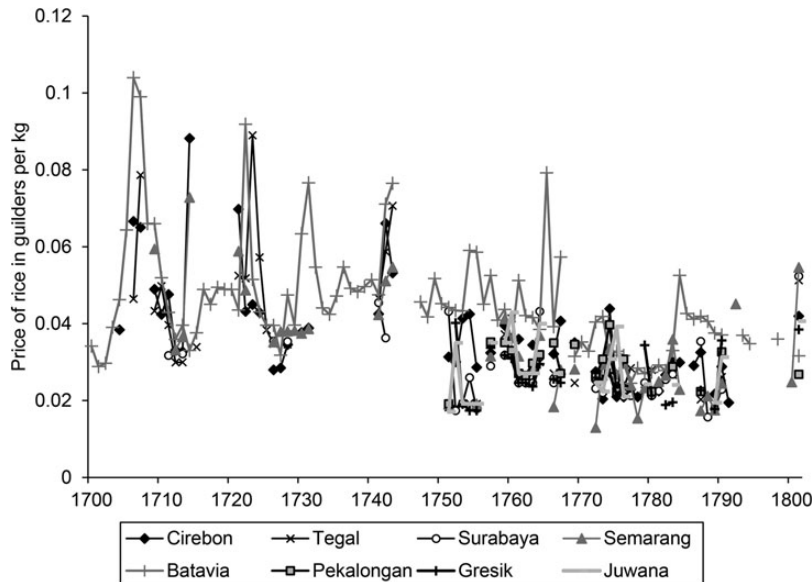


Figure 3. Prices of rice in various towns on Java's coast (prices were sometimes given per last, koyan, or Dutch pond. These were all converted to guilders per kg to allow comparison, see Appendix, Supplementary material).

Source: Batavia: see figure 3; other cities: *Bookkeeper-General*.

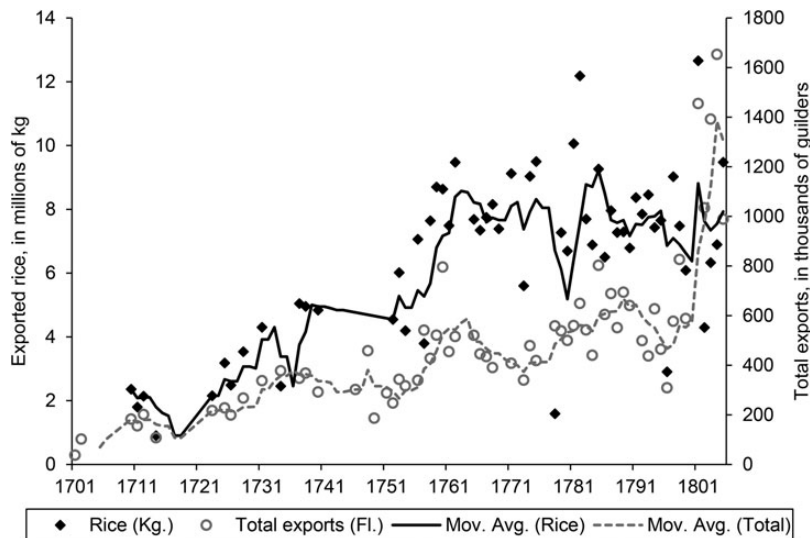


Figure 4. Trade from Semarang to Batavia, five-year-moving averages.

Source: 1701–40: [Nagtegaal \(1988\)](#); 1741–1805: [Van Niel \(2005\)](#).

Javanese merchants remained substantial up until the later eighteenth century, although in importance they were clearly surpassed by the VOC and the Chinese ([Knaap 1999](#)). While the VOC may have dominated long-distance trade, Javanese traders specialized in local

connections. In recent work, [Knaap \(2015\)](#) estimates that in the port of Semarang (the VOC capital on Java's northeast coast) VOC trade represented only 6 percent of the total trade in the 1770s.

We would therefore argue that VOC purchasing prices and market prices follow similar trends in the long run. This also corroborates Van Niel's observation that "the private rice market, however, came increasingly to operate outside Company control and was mainly in the hands of wealthy Chinese and Europeans" (2005, p. 128). Rice prices declined in the later eighteenth century, as the absence of war increased stability, which had a positive impact on agricultural production and trade.

For the period 1800–11, we had to rely on prices from the *Plakaatboeken*,²⁰ which contained edicts on the prices for the sale of rice from the Company depots in the *bazaar* in Batavia. One issue with these prices is that they were influenced by seasonal fluctuations. Prices were relatively high in February during the rainy season, but were much lower in April and May (dry season).²¹ Yet, besides the fact that these prices could differ per month, another difficulty is that in this period silver, copper and paper moneys were circulating with changing exchange rates. There are no consistent data on these rates, and it is not always stated explicitly which sort of money is meant. Therefore we focused on prices that explicitly stated copper or silver values, as paper money devaluated the most. Considering these issues, the year to year fluctuations in this period may not be entirely reliable. Yet we are convinced of the relatively high prices in this period. Not only did British ships block the port of Batavia, which led to shortages of food, there were also bad harvests from 1795 to 1803 ([Boomgaard 2002](#)). This restricted supply would undoubtedly have driven prices up.

For the period after 1820, we can again rely on the CEI series ([Mansvelt 1979](#); [Korthals Altes 1994](#)).²² In addition, we collected the two-weekly price data of rice from the *Bataviasche Courant* (from 1823 onward), and for the 1820s we collected price data from archival sources.²³

Prices were collected for the products in a consumption basket reflecting the "barebones" cost of subsistence. Following [Allen et al. \(2011\)](#), the basket contains 1940 kcal per day, mainly from rice, sufficient protein, as well as some clothing and fuel (table 2). While 1940 kcal may be high considering the relatively short stature of Indonesians ([Baten et al. 2013](#); [Foldvari et al. 2013](#)), as well the nutritional surveys conducted since the 1920s which often indicated lower per capita consumption ([Van der Eng 2000](#), pp. 609–11), this assumption is necessary for comparisons with other studies employing the same method, as noted in Section 1. Rice was the main staple and the dominant source of calories in Java ([Reid 1988](#), p. 28; [Nagtegaal 1988](#), p. 35; [Boomgaard 1989](#), pp. 222–8). While [Nagtegaal \(1988, p. 35\)](#) also notes the consumption of maize (*jagung*), it was not traded and thus does not occur in the VOC sources. While other crops like sweet potatoes and cassava increased as important elements of the food supply in

²⁰ [Van der Chijs \(1885–1900, vol. 14: pp. 16, 67, 129, 225–9, 300; vol. 15: pp. 552, 571–2, 781–2; vol. 16: pp. 58, 463–5\)](#).

²¹ See [Van Zanden \(2009\)](#) and [Van Zanden and Marks \(2012\)](#) for seasonal patterns in rice prices.

²² All price series were estimated as part of the reconstruction of the national accounts of Java for the period 1815–1939, explained in [Van Zanden \(2002\)](#); main series from [Korthals Altes \(1994\)](#): prices of (imported) textiles (calicoes): table 1A; coconut oil and firewood: table 2A; and sugar: table 3A.

²³ The rice price data from the *Bataviasche Courant* are discussed and analyzed in [Van Zanden \(2004\)](#); the archival sources are as follows: [NA, Collectie Baud](#), no. 192, 251; ARSIP, Colonial Office, no. 2195 (prices Semarang 1820–39); [Van Zanden and Marks \(2012\)](#) already published estimates of real wages using the Allen-methodology, but included meat in the basket; this was however the price of meat imported from the Netherlands, not consumed by the indigenous population. In this new series, we replaced meat by fish, which was much cheaper. Due to the lower caloric values of fish *vis-à-vis* meat, the amount is doubled to 6 kg per year, instead of the 3 kg of meat in other baskets.

Table 2. *Subsistence basket of goods Java*

	Unit	Quantity per person per year	Nutrients per kg		Nutrients per day	
			Calories	Grams of protein	Calories	Grams of protein
Rice	kg	168	3,620	75	1,666	35
Beans	kg	25	3,383	213	232	15
Fish	kg	6	1,301	192	21	3
Sugar	kg	2	3,750	0	21	0
Salt	kg	3	—	—	—	—
Lamp oil	litre	2.6	—	—	—	—
Cotton	m ²	3	—	—	—	—
Fuel	MBTU	3	—	—	—	—
Total	—	—	—	—	1,940	53

MBTU, million British thermal units, are a measure of heat energy and employed in comparative real wage studies (see, e.g., [Allen, 2001](#), [Allen et al., 2011](#)).

the nineteenth and twentieth centuries, rice remained by the dominant crop until the early twentieth century.²⁴ Estimates for this later period, however, usually imply a lower per capita consumption of about 100 kg ([Boomgaard 1989](#), [Van der Eng 1996, 2000](#)). Rice was supplemented with cassava or maize, both cheaper substitutes for the necessary calories. Our figures may therefore overestimate the cost of subsistence and underestimate real wages, but the absence of price data for these products for most of the period makes it impossible to correct for this. Furthermore, the butter or olive oil (that are included in the baskets for Europe and China) were replaced with some additional sugar and beans owing to the lack of data. Following [Reid \(1988, p. 31\)](#), we assume that sugar was also consumed,²⁵ while beans (*kacang*) too seem to have been widely produced (and thus consumed) for additional protein ([Nagtegaal 1988, p. 35](#); [Van der Eng 2000](#)). Finally, the soap in the other baskets was replaced by salt, which fits both the notes by early modern observers about the great importance of salt as an article of everyday consumption in Southeast Asia ([Reid 1988, pp. 28–9](#); [Carey 2007, pp. 44–5](#)), and studies on nineteenth-century living standards ([Van Zanden 2003](#)).

Figure 5 shows the price of the same barebones basket over time. In the early period we find the peaks caused by wars and a slight decline over the later eighteenth century. Prices rose during the blockade and poor harvests of the early nineteenth century, but then declined until the beginning of the Cultivation System, when prices began to increase again, perhaps due to an increased money supply or because land and labor to produce food crops were increasingly used for cash crops. The inflationary trend of the middle decades of the nineteenth century ended abruptly in the early 1880s, and the sugar crisis of 1883 was followed by a large fall in the price level of almost 50 percent, followed by a moderate increase in prices in the years before the Great War.

²⁴ Declining from 78 percent of the total gross food production in 1815 to 59 percent in 1900 ([Boomgaard and Van Zanden, 1990, p. 132](#)).

²⁵ Sugar cane was native to the area and widely cultivated and while Javanese themselves may have consumed *arenga* (sugar palm), in the absence of *arenga* prices sugar cane serves as a proxy.

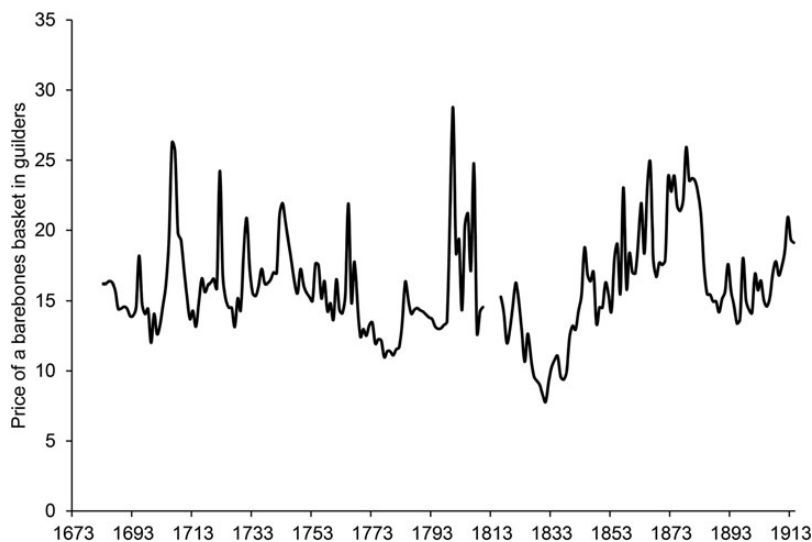


Figure 5. *Prices in Batavia, 1680–1914.*

Source: *See text.*

5. Long-term real wages

Several scholars on early modern Southeast Asia have claimed that living standards declined between 1600 and 1800. Reid provides evidence on the relative wealth of Southeast Asia from various accounts of early European travelers for the period around 1600. This evidence suggests that the “lives [of Southeast Asians] were no more squalid, their health no more wretched and their physical stature no worse than those of eighteenth century Europeans” (Reid 1992, pp. 503–4). Trade was an important source of this wealth and the size of the maritime cities and their fleets compared favorably with Europe at that time. Over the course of the seventeenth and eighteenth centuries, economic fortunes declined, and the Dutch intrusion in Southeast Asia’s trading system and changing climatic conditions led to the impoverishment of Southeast Asians (Reid 1993, pp. 301–2). Nagtegaal (1988, p. 197), however, notes that while the thesis of the underdevelopment of Java over the seventeenth and eighteenth centuries is not implausible, the opposite could also have been the case: increasing global trade could have led to more effective use of land and labor.

Regarding the nineteenth and twentieth centuries there has also been considerable debate about the development of living standards, especially in the period 1890–1910, when the debate on the “declining welfare” of the indigenous population resulted in the introduction of a set of welfare policies aimed at redressing the situation. Before this period, concerns about the standard of living of the Javanese were limited to a few radicals and progressive civil servants. Yet, some scholars have claimed that living standards declined almost continually after 1800 (Carey 1979). Recently, Baten *et al.* (2013) have shown that adult male height for the 1870s birth cohorts declined *vis-à-vis* those of the 1850s and 1860s, and recovery in height was slow thereafter. They point out natural disasters and a disease environment as possible reasons for the poor living standards in this period.

Is this picture confirmed by the development of real wages? Following Allen *et al.* (2011), the prices shown in figure 6 were multiplied by 3.15 to allow for the cost of maintaining a wife and two

children (each consuming $\frac{1}{2}$ basket) as well as rent (adding 5 percent for each basket). Dividing the wages from Section 3 by this annual family budget results in subsistence ratios, which reflect something akin to the contemporary World Bank Poverty Line of US\$ 1.25 per day (Allen *et al.* 2012). While the same procedure is followed to allow international comparisons, it should be noted that this procedure may overestimate prosperity as Javanese households in the nineteenth and early twentieth centuries consisted of an average of about 4.5 people (Boomgaard 1989; Leigh and Van der Eng 2010).

Figure 6 shows that real wages of free unskilled laborers (in Batavia) were stable or declined between 1680 and 1740. This confirms Reid and Boomgaard's claims of declining real wages in the seventeenth and eighteenth centuries. Rural corvée laborers received lower compensation, reaching level 1 only in the second half of the eighteenth century. However, these laborers probably received food and shelter during their periods of service, which did not encompass the entire year. Throughout the later eighteenth century, however, the real wages of both free and unfree workers in Java increased. Those of urban workers in Batavia increased from somewhat above subsistence level to over twice subsistence between the 1770s and 1790. At the same time, the compensation for corvée services also increased over the eighteenth century. These findings fit with evidence of expanded irrigation, agricultural production, handicraft production, monetization, increased farmers' prosperity, and population growth (Carey 1986, pp. 89–91; Ricklefs 1986, p. 30; Jacobs 2006, p. 241; Feenstra 2014) and the observations of various colonial officials of increased production and consumption (Carey 1986, p. 91; 2007, p. 35; Van Niel 2005, p. 131).

For most of the nineteenth century, the trend in both Batavia and rural wages is flat. While real wages of urban laborers move between 1.5 and 2, those of rural workers are consistently around subsistence level. The difference between urban and rural only changed toward the end of the century, when real wages in the capital city suddenly move much closer to the level found on the rest of the island. At the same time, real wages in the countryside also show a declining trend,

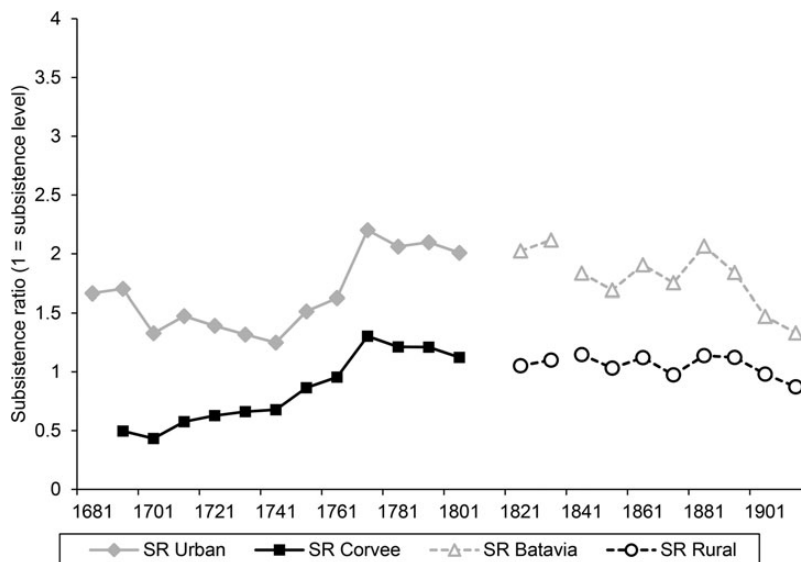


Figure 6. Subsistence ratios in Java, 1680–1914, 10-year-averages.
Source: See text.

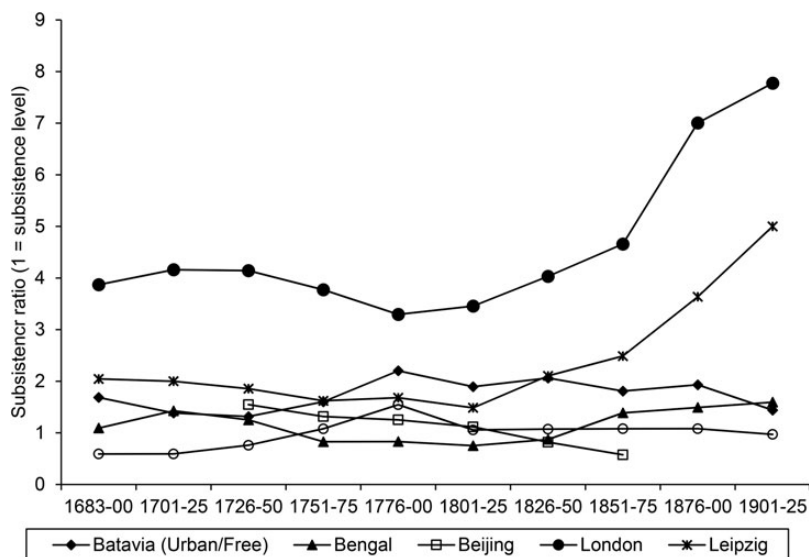


Figure 7. *Subsistence ratios in Europe and Asia, 1680–1925.*

Source: *Batavia*: See text; *London, Leipzig, Beijing, and Bengal*: [Allen et al. \(2011\)](#).

which is the more remarkable as this happens in a period of deflation. Normally, nominal wages are inflexible downward, as a result of which real wages tend to increase in periods of falling prices. Since declining real wages occurred in a period of deflation, it shows that the concerns about the “declining welfare” of the population were well-founded.

Finally, if we compare real wages in urban Java/Batavia with those in other Asian and European cities, it is clear that living standards in Batavia measured in this way compare favorably with those in other Asian and European cities, especially in the period 1750–1825 (figure 7). In the course of the eighteenth century, real wages of free coolies in urban Java/Batavia even surpassed those in Leipzig. This perhaps supports claims of, e.g., Pomeranz that average incomes were relatively high in various parts of Asia even in the late eighteenth century. Labor scarcity and declining prices pushed up real wage levels for free coolies in Batavia close to those prevalent in London. But whereas European real wages increased in the nineteenth century, real wages in Batavia stagnated, resulting in the well-known Great Divergence.

6. Conclusion

Employing a variety of sources, this article has established estimates of the development of real wages in Java between 1680 and 1914. Until the 1740s, real wages for urban free laborers declined or remained constant at best, while those of corvée laborers stagnated. Although this study may capture the standard of living of only a proportion of the total population, the decline in urban wages can be interpreted as a confirmation of the thesis of declining living standards in Java by Reid, Boomgaard, and others. However, as nominal wages increased in the later eighteenth century, while prices declined in the sustained period of peace and stability, living standards may have improved from 1740 and 1790. Thus, after the crisis of the seventeenth century and the wars of the early eighteenth century, some of the evidence for the late eighteenth

century suggests that there was an increase in consumption and living standards that coincided with possible increases in production and trade, increases in monetary exchange, and population growth. High urban real wages remained a feature of the Javanese economy until the final decade of the nineteenth century, when, during a period of crisis in the colonial economy, there was a strong decline in wages in Batavia.

Until the 1890s, there was no systematic decline in living standards, as has been suggested by much of the literature: not in the eighteenth century, nor during the Cultivation System (1830–70), when growing labor scarcity led to the increase of nominal wages and stabilization of real wages. Real wages for rural laborers were below or not much above subsistence level for most of the period studied, which puts Java on a par with other parts of Asia and the European “periphery” rather than with north-western Europe, where levels of between three and four times subsistence were reached in the seventeenth and eighteenth centuries (Allen *et al.* 2011). Between 1775 and 1815, however, free coolies in Batavia may have enjoyed a standard of living higher than that in most parts of Europe.

Fluctuations in real wages differ somewhat from those in heights, which demonstrates that real wages (as well as heights) represent “only” one dimension of well-being. Both heights and wages are able to capture changes in living standards of only parts of the population and thus suffer from biases toward the people studied. Only when taken together, as well as with other indicators, can a complete picture of living standards emerge.

One of the reasons for this difference may be the fact that Java had an “underdeveloped” labor market, in which coercion played a relatively large role, especially in the countryside. Consequently, there was a substantial difference in wages between town and countryside. In the period before 1850, there were clearly two labor markets: free wage labor (roughly speaking) in Batavia, which was remunerated relatively well, and which coexisted with bonded labor in the countryside (that received a wage about 50 percent of that earned by the urban coolies). After 1850 the supply of free wage labor in the countryside increased, and government policy also gradually switched to using these workers as the main source of labor recruitment. By the second half of the nineteenth century, labor in the countryside was no longer coerced, and the wage gap between urban Batavia and the countryside narrowed.

The findings in this article provide some support to claims about the relatively high standard of living in Southeast Asia as put forward in the work of, e.g., Pomeranz. In addition, the lack of a consistent declining trend may throw some doubt on Acemoglu and Robinson’s suggestion of “reversing development” in Indonesia. Yet patterns could vary in different places across Indonesia and among different social groups. While Batavia flourished as a result of its prominent place in the VOC trading network, the neighboring city of Banten clearly suffered decline from being the main commercial center in the fifteenth and sixteenth centuries to one of the poorer parts of Java nowadays. Furthermore, while free coolies may have benefitted from the greater demand for labor, others may have suffered from increased labor coercion (both under the VOC and then the Cultivation System).

Acknowledgements

We like to thank Jean-Pascal Bassino, Lex Heerma van Voss, Elise van Nederveen Meerkerk, Sevket Pamuk and the participants of the real wages workshop at the International Institute of Social History in Amsterdam and those of the 7th EuroSEAS conference in Lisbon, as well as the anonymous referees for their comments and suggestions on earlier versions of this paper. We thank Judith Schooneveld-Oosterling and Gerrit Knaap for early access to the VOC Bookkeeper-General database. Naturally, all remaining errors are ours.

Supplementary material

Supplementary material is available at *EREH* online.

References

- ACEMOGLU, A. and ROBINSON, J. (2012). *Why Nations Fail? The Origins of Power, Prosperity and Poverty*. New York: Crown.
- ALLEN, R.C. (2001). The Great Divergence in European wages and prices from the Middle Ages to the First World War. *Explorations in Economic History* **38**, pp. 411–47.
- ALLEN, R.C. (2007). India in the Great Divergence. In T.J. HATTON, K.H. O'ROURKE and A.M. TAYLOR (eds), *The New Comparative Economic History. Essays in Honor of J. G. Williamson*. Cambridge, MA: MIT Press, pp. 9–32.
- ALLEN, R.C., BASSINO, J.-P., MA, D., MOLL-MURATA, C. and VAN ZANDEN, J.L. (2011). Wages, prices, and living standards in China, 1738–1925: in comparison with Europe, Japan, and India. *Economic History Review* **64**, pp. 8–38.
- ALLEN, R.C., MURPHY, T. and SCHNEIDER, E. (2012). The colonial origins of the divergence in the Americas: a labour market approach. *Journal of Economic History* **72**, pp. 863–94.
- AN. (1866). Bijdragen tot de kennis van het landelijk stelsel op Java, *Tijdschrift Nederlandsch Indië* **4**, pp. 221–62.
- ARROYO ABAD, L., DAVIES, E. and VAN ZANDEN, J.L. (2012). Between conquest and independence: real wages and demographic change in Spanish America, 1530–1820. *Explorations in Economic History* **49**, pp. 149–66.
- BATEN, J., STEGL, M. and VAN DER ENG, P. (2013). The biological standard of living and body height in colonial and post-colonial Indonesia, 1770–2000. *Journal of Bioeconomics* **15**, pp. 103–22.
- BOOMGAARD, P. (1986). The welfare services in Indonesia, 1900–1942. *Itinerario* **10**, pp. 57–83.
- BOOMGAARD, P. (1989). *Children of the Colonial State. Population Growth and Economic Development in Java 1795–1880*. Amsterdam: Free University Press.
- BOOMGAARD, P. (1990). Why work for wages? Free labour in Java, 1600–1900. *Economic and Social History in the Netherlands* **2**, pp. 37–57.
- BOOMGAARD, P. (1992). The non-agricultural side of an agricultural economy, Java, 1500–1900. In P. ALEXANDER, P. BOOMGAARD and B. WHITE (eds.), *In the Shadow of Agriculture. Non-Farming Activities in the Javanese Economy, Past and Present*. Amsterdam: Royal Tropical Institute.
- BOOMGAARD, P. (2002). From subsistence crises to business cycle depressions, Indonesia 1800–1940. *Itinerario* **26**, pp. 35–51.
- BOOMGAARD, P. (2003). Human capital, slavery and low rates of economic and population growth in Indonesia, 1600–1910. *Slavery and Abolition* **24**, pp. 83–96.
- BOOMGAARD, P. (2009). Labour, land, and capital markets in early modern Southeast Asia from the fifteenth to the nineteenth century. *Continuity and Change* **24**, pp. 55–78.
- BOOMGAARD, P. and VAN ZANDEN, J.L. (1990). *Changing Economy in Indonesia. Vol. 10. Food Crops and Arable Lands, Java 1815–1942*. Amsterdam: Royal Tropical Institute.
- BOOTH, A. (1998). *The Indonesian Economy in the Nineteenth and Twentieth Centuries: A History of Missed Opportunities*. Basingstoke: Macmillan.
- BOOTH, A. (2012). Measuring living standards in different colonial systems: some evidence from South East Asia, 1900–1942. *Modern Asian Studies* **46**, pp. 1145–81.
- BOSMA, U. (2011). Labour relations in Java 1650, 1800, 1900. *Global Collaboratory on Labour Relations*: <https://collab.iisg.nl/web/labourrelations/java>.
- BROADBERRY, S. and GUPTA, B. (2006). The early modern Great Divergence: wages, prices and economic development in Europe and Asia, 1500–1800. *Economic History Review* **59**, pp. 2–31.
- CAREY, P. (1979). Aspects of Javanese history in the nineteenth century. In H. AVELING (ed.), *The Development of Indonesian Society: From the Coming of Islam to the Present Day*. St. Lucia: University of Queensland Press.

- CAREY, P. (1986). Waiting for the 'Just King': the Agrarian World of South-Central Java from Giyanti (1755) to the Java War (1825–30). *Modern Asian Studies* 20, pp. 59–137.
- CAREY, P. (2007). *The Power of Prophecy. Prince Dipanagara and the End of an Old Order in Java, 1785–1855*. Leiden: KITLV.
- DE JONGE, J.K. (1862–1888). *De opkomst van het Nederlandsch gezag in Oost-Indie (1595–1811)*. The Hague: M. Nijhoff.
- DROS, N. (1992). Changing Economy in Indonesia 13. Wages, 1820–1940. Amsterdam: Royal Tropical Institute.
- ELSON, R.E. (1994). *Village Java under the Cultivation System*. Sydney: Allen & Unwin.
- FEENSTRA, A. (2014). Dutch Coins for Asian growth. VOC-duiten to assess Java's deep monetisation and economic growth, 1724–1800. *Tijdschrift Voor Sociale en Economische Geschiedenis* 11, pp. 153–7.
- FOLDVARI, P., VAN LEEUWEN, B., MARKS, D. and GALL, J. (2013). Indonesian regional welfare development, 1900–1990: new anthropometric evidence. *Economics & Human Biology* 11, pp. 78–89.
- FRANKEMA, E. and VAN WAIJENBURG, M. (2012). Structural impediments to African growth? New evidence from real wages in British Africa, 1880–1965. *Journal of Economic History* 72, pp. 895–926.
- DE HAAN, F. (1910–12). *Priangan: De Preanger-Regentschappen onder het Nederlandsch bestuur tot 1811*. Batavia: Bataviaasch Genootschap van Kunsten en Wetenschappen.
- HEERES, J.E., COLENBRANDER, H.T. and VAN DER CHIJS, J.A. (eds.) (1887–1931). *Dagh-register gehouden int Casteel Batavia van't passerende daer ter plaetse als over geheel Nederlands-Indië*. The Hague: M. Nijhoff.
- HOADLY, M. (1983). Slavery, bondage and dependency in pre-colonial Java: the Cirebon–Priangan Region, 1700. In A. REID (ed.), *Slavery, Bondage and Dependency in Southeast Asia*. New York: St. Martin's Press, pp. 90–117.
- HOOYMAN, J. (1779). Verhandelungen over den tegenwoordigen staat van den landbouw in de Ommelanden van Batavia. *Verhandelungen van het Bataviaasch Genootschap van Kunsten en Wetenschappen* 1, pp. 173–262.
- JACOBS, E.M. (2006). *Merchant in Asia. The Trade of the Dutch East India Company during the Eighteenth Century*. Leiden: CNWS.
- DE KLERCK, E.S. (1905). *De Java-oorlog van 1825–1830*. Batavia: Landsdrukkerij.
- KNAAP, G. (1999). Shipping and trade in Java, c. 1775; a quantitative analysis. *Modern Asian Studies* 33, pp. 405–20.
- KNAAP, G. (2015). Semarang. A colonial provincial capital and port city in Java, circa 1775. In U. BOSMA and T. WEBSTER (eds), *Commodities, Ports and Asian Maritime Trade, c. 1750–1950*. Basingstoke: Palgrave Macmillan.
- KORTHALS ALTES, W.L. (1994). *Changing Economy in Indonesia 15. Prices (non-rice) 1814–1940*. Amsterdam: Royal Tropical Institute.
- LEIGH, A. and VAN DER ENG, P. (2010). Top incomes in Indonesia, 1920–2004. In A. B. ATKINSON and T. PIKETTY (eds), *Top Incomes: A Global Perspective*. Oxford: Oxford University Press, pp. 171–219.
- LUCASSEN, J. (2007). Introduction: wages and currency, 500 BCE–2000 CE. In J. LUCASSEN (ed.), *Wages and Currency. Global Comparisons from Antiquity to the Twentieth Century*. Bern: Peter Lang, pp. 9–58.
- MADDISON, A. (1989). Dutch income in and from Indonesia 1700–1938. *Modern Asian Studies* 23, pp. 645–70.
- MANSVELT, W.M.F. (1979). *Changing Economy in Indonesia 4. Rice Prices*. Amsterdam: Royal Tropical Institute.
- NAGTEGAAL, L.W. (1988). *Rijden op een Hollandse tijger: de noordkust van Java en de VOC 1680–1743*. PhD thesis, Utrecht University.
- National Archives. Archives of the Bookkeeper General Batavia (BGB): inv. no. 1.04.18.02. General journals: ref. nos. 10751–809.
- National Archives. Archives of the Dutch East India Company (VOC): inv. no. 1.04.02.
- National Archives. Collectie Baud: inv. no. 892.
- National Archives. Ministry of Colonies, Government budgets Netherlands Indies 1819–1826, inv. nos. 2972–88.
- POMERANZ, K. (2000). *The Great Divergence. China, Europe, and the Making of the Modern World Economy*. Princeton and Oxford: Princeton University Press.

- REID, A. (1988). *Southeast Asia in the Age of Commerce 1450–1680. Vol. 1. The Lands Below the Winds*. New Haven and London: Yale University Press.
- REID, A. (1992). *Economic and Social Change, c. 1400–1800. Cambridge History of Southeast Asia, Vol. 1. From Early Times to c. 1800*. Cambridge: Cambridge University Press, pp. 460–507.
- REID, A. (1993). *Southeast Asia in the Age of Commerce 1450–1680. Vol. 2. Expansion and Crisis*. New Haven and London: Yale University Press.
- RICKLEFS, M.C. (1986). Some statistical evidence on Javanese social, economic and demographic history in the later seventeenth and eighteenth centuries. *Modern Asian Studies* **20**, pp. 1–32.
- RICKLEFS, M.C. (2008). *A History of Modern Indonesia Since c. 1200*. Stanford, CA: Stanford University Press.
- VAN DEN BOSCH, J. (1829). Advies van den Luitenant-Generaal van den Bosch over het stelsel van kolonisatie. In D.C. STEIJN Parve (ed.), *Het koloniaal monopoliestelsel getoetst aan geschiedenis en staathuishoudkunde*. Zaltbommel: Joh. Noman en Zoon, pp. 294–328.
- VAN DER CHIJS, J.A. (ed.) (1885–1900). *Nederlandsch-Indisch Plakkaatboek 1602–1811*, 16 vols. Batavia: Landsdrukkerij.
- VAN DER ENG, P. (1996). *Agricultural Growth in Indonesia: Productivity Change and Policy Impact since 1880*. London: MacMillan.
- VAN DER ENG, P. (2000). Food for growth: trends in Indonesia's food supply, 1880–1995. *Journal of Interdisciplinary History* **30**, pp. 591–616.
- VAN NIEL, R. (2005). *Java's Northeast Coast 1740–1840: A Study in Colonial Encroachment and Dominance*. Leiden: CNWS.
- VAN ZANDEN, J.L. (2003). Rich and poor before the industrial revolution, a comparison between Java and the Netherlands at the beginning of the nineteenth century. *Explorations in Economic History* **40**, pp. 1–23.
- VAN ZANDEN, J.L. (2004). On the efficiency of markets for agricultural products: rice prices and capital markets in Java, 1823–1853. *Journal of Economic History* **64**, pp. 1028–55.
- VAN ZANDEN, J.L. (2007). Linking two debates: money supply, wage labour, and economic development in Java in the nineteenth century. In J. LUCASSEN (ed.), *Wages and Currency. Global Comparisons from Antiquity to the Twentieth Century*. Bern: Peter Lang, pp. 169–92.
- VAN ZANDEN, J.L. (2009). The skill premium and the 'Great Divergence'. *European Review of Economic History* **13**, pp. 121–53.
- VAN ZANDEN, J.L. and MARKS, D. (2012). *An Economic History of Indonesia, 1800–2010*. London: Routledge.
- WHITE, B. (1992). Economic diversification and agrarian change in rural Java, 1900–1990. In P. ALEXANDER, P. BOOMGAARD and B. WHITE (eds), *In the Shadow of Agriculture. Non-Farming Activities in the Javanese Economy, Past and Present*. Amsterdam: Royal Tropical Institute.