

The Price Elasticity of Hard Drugs: The Case of Opium in the Dutch East Indies, 1923–1938

Jan C. van Ours

Tinbergen Institute and Erasmus University Rotterdam

At the beginning of this century the Dutch government controlled the opium market in the Dutch East Indies—nowadays Indonesia—for several decades. This state monopoly was called the *opiumregie*. Using information gathered during the *opiumregie*, this paper estimates price elasticities of opium consumption. It appears that short-term price elasticities of opium use are about -0.7 . Long-term price elasticities are about -1.0 .

I. Introduction

Since drugs are illegal, not much is known about the price elasticity of the demand for drugs. A rare study that presents direct estimates of the price elasticity of a drug is the paper by Nisbet and Vakil (1972), in which a price elasticity of marijuana is found in the range of -1.0 to -1.5 . Drugs are assumed to be addictive goods. Therefore, indications about the price elasticity of drugs are derived from studies on similar addictive goods. Miron and Zwiebel (1991), analyzing U.S. alcohol consumption during Prohibition, find a small negative price elasticity for alcohol use. On the basis of this, they claim that the price elasticity of drug use is small. However, Becker, Grossman, and Murphy (1991), referring to price elasticities of smoking, heavy drinking, and gambling, claim that the price elasticity of drugs is not small. Obviously, studies that analyze demand characteristics of goods

I thank Eric van Lijck, who as a historian made a valuable contribution to the birth of this paper by providing many historical details. I also thank Andrew Clark, Geert Ridder, and an anonymous referee for their comments.

[*Journal of Political Economy*, 1995, vol. 103, no. 2]

© 1995 by The University of Chicago. All rights reserved. 0022-3808/95/0302-0007\$01.50

that perhaps share only the addictive nature of drugs do not seem to be very conclusive.

In the discussion about the pros and cons of the legalization of drugs, information about the size of the price elasticity of drugs can be useful. Legalization will probably lead to substantially lower prices (examples of a discussion on policy alternatives include Clague [1973], Moore [1973], White and Luksetich [1983], and Clark [1992]). A combination of a high price elasticity and low drug prices will expand drug use substantially.

This paper contributes to the scarce empirical literature on consumption of hard drugs. It presents information on the use of opium, which was collected during the so-called *opiumregie* in the Dutch East Indies (present-day Indonesia). This system operated via a state monopoly on the importation, production, and sale of opiates. Government files that were constructed during the *opiumregie* contain annual data distinguished by ethnic group and 22 regions over the period 1923–38 on opium consumption, revenues, and number of opium users.¹

The paper is organized as follows. Section II describes the characteristics of the opium users and opium use and the Dutch involvement in opium trade. Section III considers the policy goals and instruments of the *opiumregie*. Section IV analyzes drug consumption in general terms. Section V presents the results of the quantitative analysis of opium consumption in which price elasticities of opium are determined. Section VI presents conclusions.

II. Opium in the Dutch East Indies

A. Dutch Involvement in the Opium Trade

Dutch involvement in the opium trade started soon after the founding of the Dutch East Indies Company (*Verenigde Oost-Indische Compagnie*) in 1602. This company bought raw opium in Bengal (India), paid with silver, and bartered it against spices in the Indian Archipelago. According to Schama (1987), opium was also transported to the Netherlands, where it was smoked with tobacco.

Dutch opium trade in the East Indies was very profitable but quantitatively small in the early years. Dutch sales of opium were modest until 1678. For instance, from 1640 to 1652, the volume of opium

¹ The 22 regions are usually grouped into two areas: Java and Madura: western Java, central Java, eastern Java, Yogyakarta, and Surakarta; and Outer Islands: west coast of Sumatra, Tapanuli, Bengkulu, Lampung districts, Palembang, Jambi, east coast of Sumatra, Aceh, Riau and dependencies, Bangka and Belitung, western Borneo, southern and eastern Borneo, Manado, Celebes and dependencies, Bali and Lombok, Timor and dependencies, and Moluccas.

sold at the Dutch trade center Batavia (present-day Jakarta) averaged 250 kilograms a year. It increased dramatically when the Dutch gained a monopoly in trading textiles and opium in the kingdom of Mataram (central Java). In 1678, the first year of the monopoly, the Dutch traded 27,000 kilograms of opium at Batavia. The spectacular increase seems to indicate that the Dutch did not create the opium market in Java. Instead, they conquered an already existing market.

At the beginning of the nineteenth century, the Dutch influence in Java was strong enough for taxes to be imposed on the indigenous as well as the Chinese population. In 1808 the Dutch introduced a vice tax on the consumption of opium. This "opium tax farm" obliged the Chinese opium dealers to sell only crude opium delivered by the state, and they gained the exclusive right to prepare and sell opium in their territory. For this profitable right, the dealers had to pay considerable sums to the Dutch authority. During the nineteenth century, revenues from the opium tax increased, and so did opium consumption. The Dutch colonial authorities were content, but in the Netherlands there was rising discomfort with the latter development.

Around 1890 the political debate in the Netherlands on opium was at its peak. Many critics were in favor of total prohibition. However, the large-scale opium consumption had been a reality for many decades. Total prohibition would induce smuggling, which was difficult to control because of the enormous coastlines of the Indian Archipelago.

Instead, a new idea originated that rapidly gained political support: the opiumregie, which was meant to be a state monopoly on the importation, preparation, and distribution of smoking opium. It was supposed to achieve three policy goals: (a) reduction of criminality by crushing the power of the mighty opium dealers, ending the corruption and violence caused by opium transactions, and reducing illegal opium sale in the regions as well as international smuggling; (b) reduction of health risks by guaranteeing a product of constant quality and pureness; and (c) reduction of opium use.

In 1893 the law on the opiumregie was accepted in the Dutch parliament. The opiumregie started as an experiment on the island of Madura near the Javanese coast. The experiment proved to be a success, and in 1898 the Dutch government in The Hague (the Netherlands) decided to implement the opiumregie district by district all over Java. Implementation in Java was completed during 1903. It took until 1914 before the opiumregie was introduced in all parts of the Dutch East Indies. During the opiumregie, information was registered on various items. The information was collected on an annual basis distinguishing between regions and ethnic groups concerning quantities sold and revenues. Starting in 1923 there is also

registered information about the number of opium users. All this information was published until 1938.² Because the most detailed information pertains to the period 1923–38, I use this as the period of analysis.

Figure 1 shows the developments in total opium consumption in this period in the two main areas of the Dutch East Indies, Java and Madura and the Outer Islands. There was a substantial increase in opium consumption in the Outer Islands in the second half of the 1920s; it was less pronounced in Java and Madura. In both areas there was a sharp decline in opium consumption in the first half of the 1930s. The general development of total opium consumption in the Outer Islands in the 1920s and 1930s was very much the same as in Java and Madura.

B. Characteristics of Opium and Opium Users

In the first decade of the twentieth century, the opiumregie sold different types of opium. By the end of the 1910s the so-called *tjandoe* was the only type of opium that was sold officially in the entire Dutch East Indies. The *tjandoe* of the state had a standard quality. It contained 11–13 percent morphine. Considering the narcotic effects, today one would call pure *tjandoe* a hard drug.

Table 1 presents some information about the population of the Dutch East Indies and some characteristics of opium consumption in the year 1930. The Dutch part of the population is not mentioned in this table because the number of opium users among the 260,000 Dutch was very small.

Table 1 shows a sharp contrast between the indigenous and the Chinese part of the population. The Chinese were a minority in numbers, but on average their social and economic position was much better than that of the indigenous population. The income per head of the Chinese was about five times as much as the income per head of the indigenous population. In many respects the Chinese formed a middle class between the Dutch and the indigenous people of the Indian Archipelago. While the Dutch were mainly involved in the civil service, the army, foreign trade, and agricultural production for exports and the indigenous population was mainly involved in agriculture and fishing, the main Chinese occupation was commerce, which covered over one-third of working Chinese in the census of 1930. Nearly one-fifth were engaged in industry, mainly as small

² The data were published in the *Jaarverslagen van de dienst der opiumregie* (Yearly accounts of the opiumregie), 1915–38, and the *Koloniale verslagen* (Colonial reports), 1890–1940.

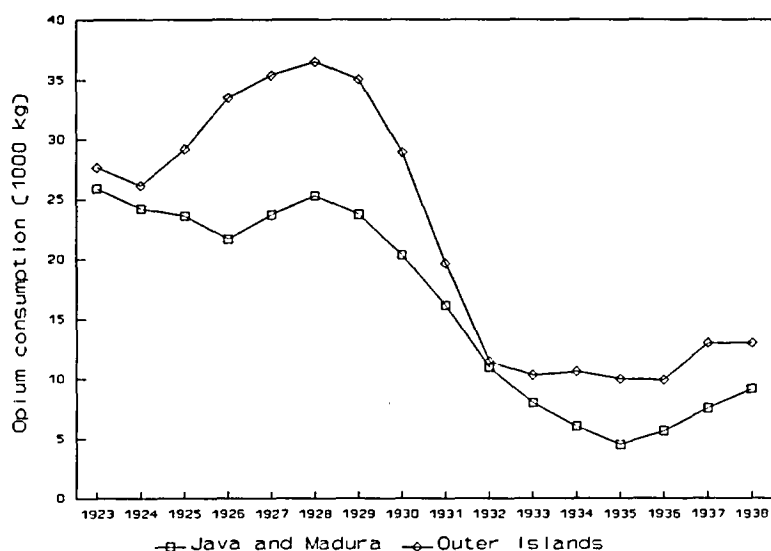


FIG. 1.—Opium consumption in Java and Madura and in the Outer Islands, 1923–38 (thousands of kg).

TABLE I

POPULATION, AVERAGE INCOME, OPIUM USERS, AND OPIUM CONSUMPTION IN THE DUTCH EAST INDIES BY REGION AND ETHNIC GROUP IN 1930

	Java and Madura	Outer Islands	Total
Population (Millions)			
Indigenous	40.9	18.2	59.1
Chinese*	.6	.6	1.2
Income per Head (Guilders)			
Indigenous	55	66	59
Chinese	310	320	315
Opium Users (Thousands)			
Indigenous	76.4	10.1	86.5
Chinese	17.9	62.8	80.7
Opium Consumption (000 kg)			
Indigenous	10.0	1.9	11.9
Chinese	10.4	27.0	37.4
Opium Consumption per User (kg)			
Indigenous	.13	.19	.14
Chinese	.58	.43	.46

* Chinese includes other Asians.

craftsmen, and the rest were distributed among gardening, agriculture, and coolie labor on Dutch-owned plantations and mines. From table 1 it appears that a relatively large share of the Chinese population used opium. The share of the Chinese in the population of opium users averaged 47 percent, whereas their share in total population was 2 percent in 1930. Furthermore, Chinese opium users used more opium than their indigenous companions: the number of Chinese opium users was about the same as the number of indigenous opium users, but the amount consumed by the Chinese was more than three times as high.³

III. Characteristics of the Opiumregie

Before I discuss the main policy instruments of the opiumregie, it should be stressed that the opiumregie operated on the principle of regional differentiation. The main reason for differentiating policy measures along regional lines was that the opium smoking habit did not occur everywhere at the same level. In some regions, such as the Islamic regions of western Java, opium smoking was not widespread. If opium smoking was almost absent, the sale of legal opium—if there was any—was stopped, and the use of opium was actually forbidden. In other regions, smoking opium was almost as common as drinking alcohol is nowadays in Western countries. This was especially the case in regions with substantial Chinese communities, or regions with large estates such as the east coast of Sumatra. The labor force on these agricultural, export-producing estates was to a large degree recruited from other parts of eastern Asia, and many of these workers displaced temporary contract workers proved to be opium smokers on arrival, or else soon afterward. By and large the Chinese population and contract workers (often overlapping categories) were subjected to less strict opium rules than the indigenous and European parts of the population of the Dutch East Indies.

The opiumregie had two main policy instruments: price regulation and a licensing and registration system.

The opiumregie followed a severe *price policy*. The price of opium

³ Opium users must have spent a large amount of their income on opium. To illustrate this, the income per head of the population is not very suitable because family size (number of earners per family) and age (number of children) are relevant too. Furthermore, it is not clear whether the average opium consumer earned an average, above-average, or below-average income. Still, one may get some idea by considering the average income per head of the working population. For the year 1930, this was 170 guilders for indigenous and 840 guilders for Chinese (Polak 1943). The average amount of money spent on opium in that year was about 100 guilders for an indigenous user and about 320 guilders for a Chinese user.

was kept high to discourage consumers. This was a risky policy, since too high a price could encourage opium smuggling and subsequently the flourishing of a local illegal drug market. I calculated the nominal opium price as the ratio of revenue and quantities sold, which is possible because opium had a standard quality. The nominal opium price was constant over long periods of time. Nevertheless, the instrument of price manipulation was rigorously used in 1920 and 1921, when the price level was raised substantially. In 1935 the price of opium was lowered, probably to discourage the use of smuggled opium and other cheaper drugs such as morphine and heroin, which had gained some popularity in these years.

Figure 2 shows the nominal opium price in Java and Madura in Dutch guilders per kilogram. The nominal opium price was stable until 1935 and then decreased substantially.

The nominal opium price in the Outer Islands was substantially lower than in Java and Madura, probably because of the difficulty of intercepting opium smugglers who supplied the Outer Islands with illegal market opium. In the period until 1935, there are fluctuations in the average price. Also, the decrease of the opium price in 1935 is not as sudden as that in Java and Madura.

The second major policy instrument was the *licensing and registration policy*. Simple registration of legal opium buyers started around 1910. The licensing policy followed a few years later. The original objective was to make the opium habit die out slowly, together with the first and final generation of licensees. To reach this goal, the sale of legal opium was limited to already active users, who now had to possess a license. New licenses were very reluctantly given, preferably only to those who could prove by a doctor's statement that they were already addicted. License conditions were severest from 1924 until 1927. During this period, legal opium was not sold to anyone except licensees throughout Java. In 1927 the system was modified. There were indications of increasing illegal opium and other drug use (especially morphine) by non-license holders. In reaction, it was made easier to obtain a license. Nevertheless, licenses remained obligatory in most regions of Java. In other regions, part of the population, mainly the Chinese, were brought under the less severe obligation of customer registration. Again, the measures that were taken differed among regions.

Not only was the licensing and registration system applied to curtail the number of opium users, it was also used to limit the amount of opium that users consumed. The quantities sold in the opium shops of the state were limited in size. Users were not permitted to buy more than once a day, and registration made this control possible.

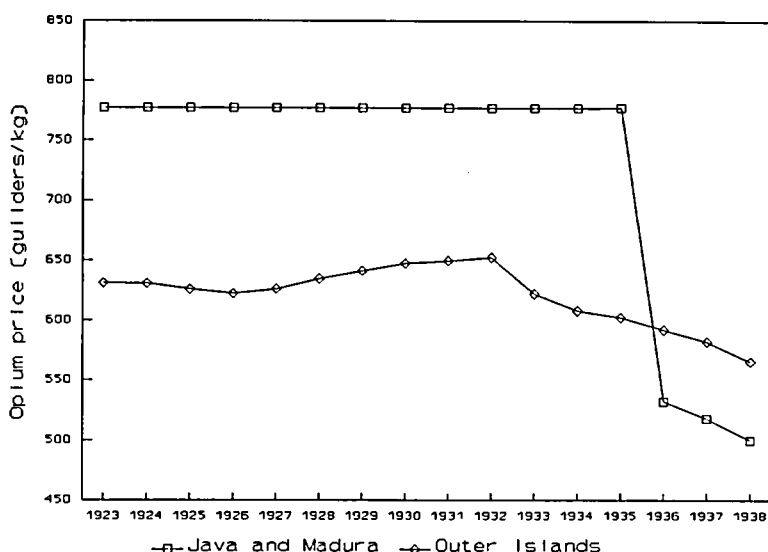


FIG. 2.—Nominal opium price in Java and Madura and in the Outer Islands, 1923-38 (Dutch guilders/kg).

Moreover, licensees were limited to a certain maximum monthly sale as prescribed in their licenses. For the period until 1927, there is no information on the maximum number of licenses available. Therefore, it is not clear whether or not the licensing system restricted the number of opium users. Information on the period 1927-38 shows that the number of available licenses was never exhausted. Also, the average sale per user was far below the maximum. So, even if it had some effect until 1927, since then the licensing system lost a great deal of its power as a policy instrument.

For the period of analysis there is information on the number of opium users by region and ethnic group. Figure 3 shows the total number of Chinese and indigenous opium users in Java and Madura and in the Outer Islands. Before 1926 the number of opium users in Java and Madura declined, whereas in the Outer Islands the number of Chinese users slightly increased. After 1926 the number of opium users increased in both areas, most likely because of the modification of the licensing system, which made it easier to become an opium user. In the first half of the 1930s there was a substantial decrease in the number of users. This decrease may not be attributed to government policy with respect to the licensing system since that did not change. After the mid 1930s the number of opium users was approximately constant.

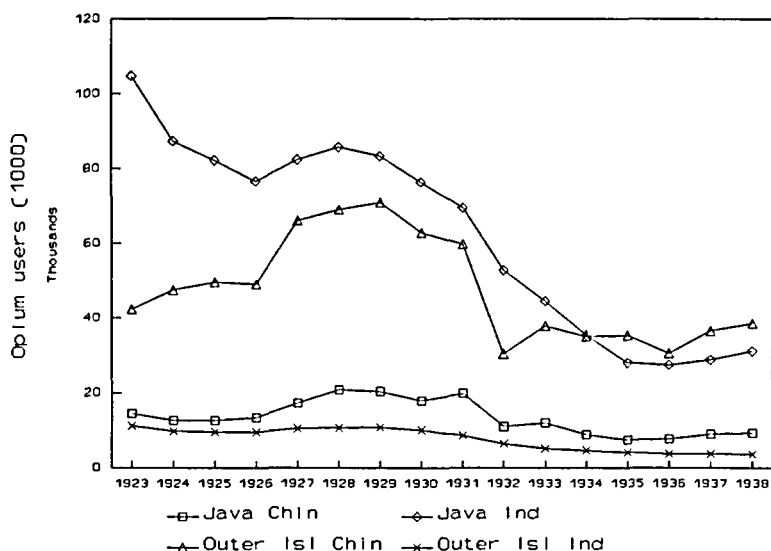


FIG. 3.—Number of Chinese and indigenous opium users in Java and Madura and in the Outer Islands, 1923-38 (thousands).

IV. Analyzing Drug Consumption

A. Preliminary Remarks

A drug is a consumer good with specific characteristics of which probably the most important is its addictive nature. A common idea is that once someone is consuming a drug he or she cannot do without it and has to go on consuming. Furthermore, low levels of consumption cannot be sustained. To hold the pleasure of consumption constant—in economic terms, to keep utility constant—one needs to increase the amounts consumed. Substitution of nonaddictive goods for drugs is not possible without reducing the overall utility derived from consumption. Drug consumers are therefore supposed to be drug addicts. In economic terms, this means that the price elasticity of drug consumption is low or even zero. Changes in the price of drugs hardly affect drug consumption.

In the discussion about the consumption of addictive goods, some distinctions are relevant (Chaloupka 1991). The first distinction refers to the tastes of consumers. Tastes may be endogenous or constant over the life cycle of the individual. If tastes are endogenous, present tastes are assumed to depend on past consumption, so utility is nonstationary. In empirical work, nonstationary utility specified as a function of current consumption may be transformed into stationary utility specified as a function of current and lagged consumption (Boyer

1983). If tastes are constant, addiction is introduced by assuming that the ability to produce the addictive commodity partly depends on past consumption. Again, this mechanism may be specified as a relationship between current and lagged consumption. So, in empirical work, there is no difference between endogenous and constant tastes.

The second distinction refers to the rationality of consumers. If current consumption depends only on past consumption, all future effects are ignored and consumers are assumed to behave myopically. However, if consumers also take future consumption into account when making decisions on current consumption, they are assumed to behave rationally. In empirical work, rational and myopic consumption can be distinguished. If there is an effect of future consumption or future price on current consumption, consumers behave rationally. If not, they behave myopically.

The economic model of rational addiction was introduced by Becker and Murphy (1988), following Stigler and Becker (1977). In the Becker-Murphy model, past, present, and future consumption are linked. There have not been many studies based on the Becker-Murphy model.

Chaloupka (1991) analyzes cigarette consumption using micro panel data from a survey of individuals. His estimates of long-run price elasticities range from -0.3 to -0.5 . He finds that they support the Becker-Murphy model in the sense that cigarette smoking appears to be addictive, and individuals do not behave myopically.

Becker et al. (1994) analyze U.S. cigarette consumption and find support for the Becker-Murphy model since one-period-ahead price or consumption has a significant effect on current consumption. Long-run price elasticities range from -0.7 to -0.8 , and short-run price elasticities are about -0.4 .

I concentrate on estimating price elasticities using log-linear equations, in which price elasticities are specified directly.⁴ Furthermore, the lagged dependent variable is introduced as a right-hand-side variable, which allows a distinction between short-term and long-term effects.

B. Explanatory Variables

Both the developments of the quantity of opium consumed and the number of consumers are analyzed. As usual in demand analysis, the influence of real opium price and real income is investigated.

⁴ A linear equation is not suitable for the analysis since at the regional level over the period of analysis there are big differences in consumption. Applying a linear equation would imply very big fluctuations in price and income elasticities.

Furthermore, the effects of the size of the illegal opium market and the licensing and registration policy are taken into account.

To get data on the real opium price, the nominal price is deflated using a cost-of-living index (Polak 1943).

Figure 4 shows the development of the real opium price. The real opium price did not change very much over the period 1923–30. After 1930, the real price increased substantially because of a substantial decrease in consumer prices. According to Maddison (1989), “the fall in general price level in Indonesia was extreme even by the standards of the time” (p. 23). So the real opium price increased in the 1930s because of deflation. In the second half of the 1930s, the real opium price decreased very much because of the decrease in the nominal price. The general patterns of the real price fluctuations in Java and Madura and the Outer Islands are quite similar.

A second determinant of opium consumption is real income. There is no information for this by region, so I used information distinguished by two areas: Java (and Madura) and the Outer Islands (Polak 1943). Figure 5 shows that the developments in both areas were very similar. Apart from some fluctuations, there was a steady increase in real income. By 1938, real income was 40 percent higher than in 1923.

When analyzing developments in the legal opium market, one has to deal with the possible influence of the illegal opium market. The amount of illegal opium intercepted by the authorities is an indicator of the size of the illegal market. Table 2 presents some information on these amounts. The amounts fluctuated over time, but there was no obvious increase or decrease. Table 2 shows that legal opium consumption in Java and Madura in the period 1920–24 was 33,000 kilograms per year, whereas in the period 1935–38 it was, on average, 6,700 kilograms per year. The amount of captured illegal opium was, on average, 190 and 300 kilograms. The enormous decrease in the consumption of legal opium does not seem to have been compensated to a large extent by illegal consumption. Furthermore, the amount of captured illegal opium in the period 1925–29 was about twice as high as in the period 1930–34, when the real opium price was substantially higher. So there seems to be no strong relationship between the real price of opium and the size of the black market, nor does there seem to be a strong relationship between the size of the legal and the size of the illegal market. There is also a high correlation in the amounts captured in both regions. This indicates that the amounts captured are by no means random, but reflect real fluctuations in the size of the illegal market. Therefore, I investigate the influence of the size of the illegal market, as proxied by the amount of captured illegal opium.

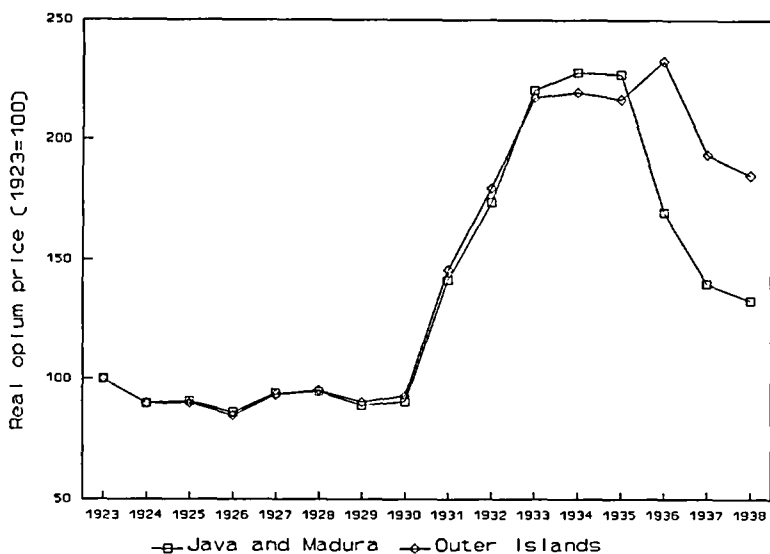


FIG. 4.—Real opium prices in Java and Madura and in the Outer Islands, 1923-38 (1923 = 100).

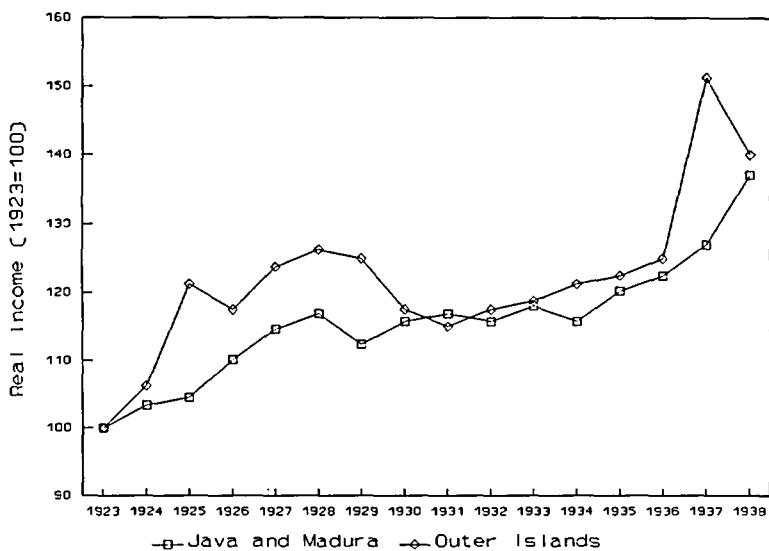


FIG. 5.—Real income in Java and Madura and in the Outer Islands, 1923-38 (1923 = 100).

TABLE 2
LEGAL CONSUMPTION OF OPIUM AND CAPTURED ILLEGAL OPIUM

	Captured Illegal Opium (kg/Year)	Legal Opium (000 kg/Year)	Captured Illegal Opium (% of Legal)
Java and Madura			
1920-24	190	33.0	.6
1925-29	600	23.6	2.5
1930-34	358	12.4	2.9
1935-38	300	6.7	4.5
Outer Islands			
1920-24	194	38.0	.5
1925-29	620	33.9	1.8
1930-34	306	16.5	1.9
1935-38	235	11.5	2.0

Another possible determinant of opium consumption is the licensing and registration policy, which was discussed in Section III. This policy was very strict in the period 1924-26. In subsequent years, it was easier to obtain a license, and the number of actual licenses was always smaller than the maximum number set by the government. To investigate the effect of this policy, I introduce a dummy variable that has a value of zero until 1927 and a value of one in the period 1927-38.

V. Empirical Analysis of Opium Consumption

A. Total Opium Consumption

First, the developments in total opium consumption are investigated. Since I have no annual information on the size of the regional population, total regional opium consumption is used as the dependent variable. To allow for autonomous changes in opium consumption, a trend is included. To account for regional differences in the size of the population or other nonobserved regional differences, region-specific intercepts are introduced:

$$\ln(C_{j,t}) = \beta_{0,j} + \beta_1 \ln(C_{j,t-1}) + \beta_2 \ln(Pr_{j,t}) + \beta_3 \ln(Y_{k,t}) + \beta_4 \ln(B_{j,t}) + \beta_5 d_{2738,t} + \beta_6 \tau + \epsilon_{j,t}, \quad (1)$$

where C denotes total opium consumption in kilograms, Pr the real opium price, Y real income, B the amount of captured illegal opium, d_{2738} a dummy variable that has a value of zero until 1927 and a

value of one starting from 1927, and τ is an index for calendar time. Furthermore, j (1, . . . , 22) is a subscript for region, k (1, 2) a subscript for area, t a subscript for time, and $\epsilon_{j,t}$ is the disturbance term. To account for endogeneity of the lagged dependent variable, equation (1) is estimated using two-stage least squares, with lagged real opium price plus the other explanatory variables as instruments. For the period 1923–38, opium consumption can be distinguished for two ethnic groups: Chinese and indigenous. Estimation results of equation (1) for both ethnic groups are presented in table 3.

Most of the coefficients are different from zero at conventional levels of significance. To investigate the robustness of the estimation results, equation (1) is reformulated in terms of first differences, thus eliminating the region-specific intercepts:

$$\begin{aligned} \Delta \ln(C_{j,t}) = & \beta_1 \Delta \ln(C_{j,t-1}) + \beta_2 \Delta \ln(Pr_{j,t}) + \beta_3 \Delta \ln(Y_{k,t}) \\ & + \beta_4 \Delta \ln(B_{j,t}) + \beta_5 \Delta d_{2738,t} + \beta_6 + \Delta \epsilon_{j,t}. \end{aligned} \quad (2)$$

The estimation results of (2) are shown in table 4. From a comparison of the estimates in tables 3 and 4, it is clear that for Chinese almost all and for indigenous all coefficients are about the same. Furthermore, the t -values of the coefficients in both tables are about the same. So neither the value of the coefficients nor the accuracy of the estimates is influenced by the specification of the equation. For Chinese, there are two exceptions to this. The values of the trend and the income elasticity differ. In equation (1) the income elasticity is larger and the trend more negative than in equation (2). Obviously, in equation (1) there is some interference of income and trend, which is plausible considering the trendlike development of income as shown in figure 5. Therefore, I prefer the estimates of equation (2) presented in table 4.

For all estimates, it appears that the coefficient of the lagged consumption variable differs significantly from zero, which means that there is a difference between short-term and long-term effects. It also implies that opium is addictive. But since the coefficient of the lagged dependent variable is small, the degree of addiction is not very large. Furthermore, price and income effects and the coefficients of the dummy variable differ significantly from zero in both estimates. The change in the licensing policy in 1927 stimulated total drug consumption by about 10–15 percent. The effect of the illegal market is significant but small. The time trend appears to be insignificant for Chinese but significantly negative for indigenous. The next section discusses the reason for this.

To investigate the sensitivity of the first-difference estimation results with respect to the price elasticities, other variables were subse-

TABLE 3
ESTIMATION RESULTS EQUATION (1): REGIONAL OPIUM CONSUMPTION AND NUMBER OF OPIUM USERS DISTINGUISHED BY ETHNIC GROUP, 1924-38

CONSUMPTION						
	τ	$\ln(G_{t-1})$	$\ln(P_t)$	$\ln(Y_t)$	$\ln(B_t)$	R^2
Chinese	-.043 (3.6)	.35 (3.2)	-.58 (6.1)	1.17 (3.8)	-.04 (2.8)	.97
Indigenous	-.058 (3.7)	.37 (3.4)	-.71 (6.4)	.89 (2.7)	-.00 (.1)	.99
USERS						
	τ	$\ln(G_{t-1})$	$\ln(P_t)$	$\ln(Y_t)$	$\ln(B_t)$	R^2
Chinese	-.049 (3.3)	.45 (3.3)	-.32 (4.5)	.09 (.3)	.02 (1.2)	.99
Indigenous	-.032 (3.4)	.34 (2.7)	-.34 (4.4)	.39 (1.3)	-.02 (1.1)	.98

NOTE.—Absolute t -values are in parentheses; R^2 is corrected for degrees of freedom. Equations with lagged dependent variables are estimated using two-stage least squares, with $\ln(P_{t-1})$ plus the other exogenous variables as instruments for $\ln(G_{t-1})$ and $\ln(B_{t-1})$. All equations contain region-specific dummy variables.

TABLE 4

ESTIMATION RESULTS EQUATION (2): REGIONAL OPIUM CONSUMPTION AND NUMBER OF OPIUM USERS DISTINGUISHED BY ETHNIC GROUP, 1924-38

CONSUMPTION

	Constant	$\Delta \ln(C_{t-1})$	$\Delta \ln(P_{t1})$	$\Delta \ln(Y_t)$	$\Delta \ln(B_t)$	$\Delta d_{2738,t}$	R^2
Chinese	-.017 (1.4) .001 (1) -.019 (1.6)	.32 (2.7) .25 (2.3)	-.69 (6.7) -.81 (8.5) -.91 (12.2)	.82 (3.9)	-.03 (3.3)	.16 (3.4) .20 (4.4) .25 (5.6)	.46 .41 .34
Indigenous	-.053 (2.9) -.041 (2.2) -.088 (5.8)	.38 (2.9) .29 (2.5)	-.70 (5.9) -.83 (8.0) -.93 (9.7)	.91 (3.7)	-.02 (1.4)	.09 (1.7) .13 (2.6) .17 (3.0)	.34 .33 .23

USERS

	Constant	$\Delta \ln(G_{t-1})$	$\Delta \ln(P_{t1})$	$\Delta \ln(Y_t)$	$\Delta \ln(B_t)$	$\Delta d_{2738,t}$	R^2
Chinese	-.019 (1.3) -.010 (.7) -.021 (1.7)	.26 (1.5) .33 (1.8)	-.42 (4.0) -.43 (4.3) -.50 (6.5)	.35 (1.2)	-.02 (1.6)	.20 (3.7) .21 (4.0) .23 (5.0)	.11 .07 .16
Indigenous	-.053 (2.5) -.047 (2.1) -.098 (6.2)	.33 (1.7) .40 (2.0)	-.35 (3.9) -.35 (4.0) -.37 (3.7)	.22 (.9)	.02 (1.5)	.15 (3.1) .16 (3.3) .19 (3.2)	.07 .03 .06

NOTE.—Absolute t -values are in parentheses; R^2 is corrected for degrees of freedom. Equations with lagged dependent variables are estimated using two-stage least squares, with $\Delta \ln(P_{t-1})$ plus the other exogenous variables as instruments for $\Delta \ln(C_{t-1})$ and $\Delta \ln(G_{t-1})$; equations without a lagged dependent variable are estimated using ordinary least squares.

quently omitted. Omitting real income and the size of the illegal market does not change the estimated price coefficient very much. Finally, the lagged dependent variable is also omitted. Then the equation contains only a constant and a price variable and was estimated using ordinary least squares. This too does not have a big impact on the estimated price elasticity. So the estimation results are quite robust.

From the results in table 4, it appears that the short-term price elasticity in the pooled estimate is -0.7 and the long-term price elasticity about -1.0 . The short-term income elasticity appears to be about 0.8 and the long-term income elasticity about 1.3 .

The problem with the interpretation of the price elasticities is that it is not clear to what extent they measure a real reduction in opium consumption. Of course, it is also possible that consumers substituted illegal consumption for legal consumption or substituted other types of drugs for opium. However, the estimated direct effect of illegal opium is small. Furthermore, the increase in illegal opium captured is not very large, so even if the opium captured reflects only a small amount of the total illegal market, the increase in illegal opium was not sufficient to counter the decline in legal opium consumed. Finally, from the literature there are no indications that other drugs were consumed in large quantities. Therefore, the estimated price elasticities reflect to a large extent the relation between opium price and total opium consumed. Since there is an effect of lagged consumption, I conclude that in the case of opium there is myopic addiction.⁵

B. Number of Users

For the period 1923–38, there is also information on the number of opium users. Equations similar to (1) and (2) were estimated speci-

⁵ The possibility of rational addiction is also investigated. In models of rational addiction, future variables have an effect on current consumption. As in Becker et al. (1994), I introduced the one-period-ahead real opium price as an explanatory variable in eq. (2). For both Chinese and indigenous, the coefficients of the future price variable had the right negative sign, but the t -values were low (1.2). Furthermore, in additional estimates, the one-period-ahead dependent variable was introduced using future opium price as an additional instrument. The coefficients of future consumption also had the correct sign and low t -values (1.2). Finally, again as in Becker et al., I restricted the coefficient of future consumption to be equal to the coefficient of lagged consumption multiplied by 0.90. Then the coefficient of lagged consumption dropped to about 0.25, with t -values ranging from 2.0 to 2.5. My conclusion from this is that when it comes to opium there is no strong evidence for rational addiction. It is possible that this has to do with the characteristics of the time period in the sense that a different model specification is needed for testing rational addiction when capital markets were not developed and opium users could not easily smooth their income over time. For the moment I leave this for future research.

fying the number of opium consumers (G) as a function of the lagged number of opium consumers, current real opium price, real income, amount of captured illegal opium, the licensing policy dummy, and a time trend. The estimation results are also shown in tables 3 and 4. Again, from a comparison of coefficients and t -values, it appears that most results are about the same.

It appears that for both Chinese and indigenous, price elasticities of users range from -0.3 to -0.4 . The coefficients of the lagged endogenous variables do not differ significantly from zero. The same holds for the effect of real income and the size of the illegal market variable. The estimation results also reveal government influence by the licensing system on the number of opium users. It appears that the change in policy in 1927 had a positive effect on the number of opium users, which increased by 15–20 percent in that year. This means that the increase in the number of opium consumers due to the change in licensing policy is somewhat larger than the increase in total opium consumption, which implies that, on average, new consumers had a somewhat smaller consumption than current ones.

The size of the negative trend in the number of indigenous users is similar to the size of the trend for total consumption. Therefore, the significant autonomous decline in opium consumption of indigenous is due to a decrease in the number of users and not in the quantity per user.

Income does not appear to have a significant effect on the number of users. So income does determine how much a user consumes but not whether an individual becomes a user. This is further evidence that opium is not very addictive.

VI. Conclusions

This paper presents an empirical analysis of a market for hard drugs. By the so-called opiumregie, the Dutch government controlled the opium market in the Dutch East Indies—nowadays Indonesia—for several decades in the beginning of this century. Using information gathered during the opiumregie, I estimated price elasticities of the demand for opium for different groups of consumers. The estimation results are very similar: short-term price elasticities of opium consumption are about -0.7 and long-term price elasticities about -1.0 . There is no big difference between short-term and long-term price effects. Apparently, opium was not very addictive. The estimated income elasticities are large too. The short-term income elasticity of opium is about 0.8 and the long-term about 1.3.

The main conclusion of this paper is that the estimated price elasticities of the demand for opium are not small. If the same applies

to drug consumption nowadays, legalization-induced low prices will stimulate drug demand by increasing both the number of users and the quantity per user. However, one has to be careful in drawing firm conclusions. The government intervention in the Dutch East Indies followed a period of market freedom. The situation in the 1990s is one of prohibition. This implies that one has to consider the effects of a change from prohibition to market intervention instead of a change from market freedom to market intervention.

References

- Becker, Gary S.; Grossman, Michael; and Murphy, Kevin M. "Rational Addiction and the Effect of Price on Consumption." *A.E.R. Papers and Proc.* 81 (May 1991): 237–41.
- . "An Empirical Analysis of Cigarette Addiction." *A.E.R.* 84 (June 1994): 396–418.
- Becker, Gary S., and Murphy, Kevin M. "A Theory of Rational Addiction." *J.P.E.* 96 (August 1988): 675–700.
- Boyer, Marcel. "Rational Demand and Expenditures Patterns under Habit Formation." *J. Econ. Theory* 31 (October 1983): 27–53.
- Chaloupka, Frank. "Rational Addictive Behavior and Cigarette Smoking." *J.P.E.* 99 (August 1991): 722–42.
- Clague, Christopher. "Legal Strategies for Dealing with Heroin Addiction." *A.E.R. Papers and Proc.* 63 (May 1973): 263–69.
- Clark, Andrew. "The Economics of Drug Legalization." Discussion paper. Essex: Univ. Essex, 1992.
- Maddison, Angus. "Dutch Income in and from Indonesia, 1700–1938." In *Economic Growth in Indonesia, 1820–1940*, edited by Angus Maddison and Gé Prince. Dordrecht: Foris, 1989.
- Miron, Jeffrey A., and Zwiebel, Jeffrey. "Alcohol Consumption during Prohibition." *A.E.R. Papers and Proc.* 81 (May 1991): 242–47.
- Moore, Mark H. "Policies to Achieve Discrimination on the Effective Price of Heroin." *A.E.R. Papers and Proc.* 63 (May 1973): 270–77.
- Nisbet, Charles T., and Vakil, Firouz. "Some Estimates of Price and Expenditure Elasticities of Demand for Marijuana among U.C.L.A. Students." *Rev. Econ. and Statis.* 54 (November 1972): 473–75.
- Polak, J. J. *The National Income of the Netherlands Indies, 1921–1939*. New York: Netherlands and Netherlands Indies Council, Inst. Pacific Relations, 1943.
- Schama, Simon. *The Embarrassment of Riches: An Interpretation of Dutch Culture in the Golden Age*. New York: Knopf, 1987.
- Stigler, George J., and Becker, Gary S. "De Gustibus Non Est Disputandum." *A.E.R.* 67 (March 1977): 76–90.
- White, Michael D., and Luksetich, William A. "Heroin: Price Elasticity and Enforcement Strategies." *Econ. Inquiry* 21 (October 1983): 557–64.

Copyright of Journal of Political Economy is the property of University of Chicago Press and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.