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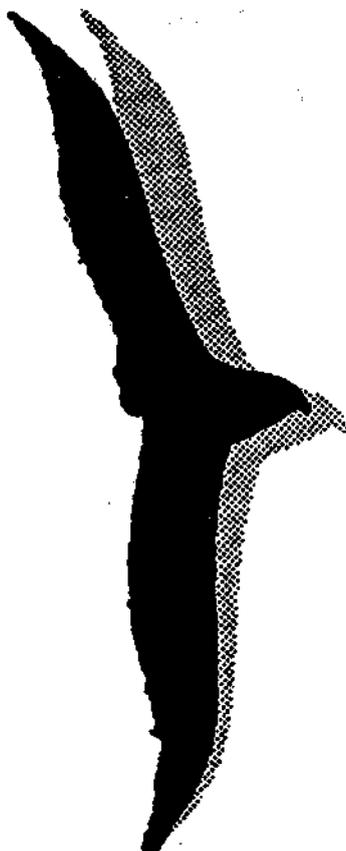
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How to control Drugs

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HOW TO CONTROL DRUGS

The lessons from the 'opiumregie'
in the Dutch East Indies (1894-1940)

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Abstract

In this article we analyze a historical example of government intervention in a drug market. 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, we estimate price elasticities of opium consumption. It appears that short term price elasticities of opium use are about -1.0. Long term elasticities are about -1.25. Our analysis indicates that opium users were quite able to adjust their consumption in response to a price change. During the opiumregie the real opium price increased substantially, leading to an impressive reduction in opium consumption.

1. Introduction

For decades many international organisations, national governments and local authorities have tried to root out drug production, drug trade and drug use by means of total prohibition and deterrence. The lack of enduring success, the heavy social costs, the distorting effects on Third World drug producing economies and the financial burden on Western countries, of this worldwide war on drugs has led to rising dissent and impatience with the prohibitive approach.

The drug problem has many faces or, as a Dutch observer in the 19th century said, it is a hydra-headed monster. But, the drug problem may be analyzed as a market problem and government policy can be analyzed in terms of market regulation. The extent of market regulation may differ. The main policy until now has been prohibition, which aims at **market repression**. At the other end of the spectrum of market regulation is **market freedom**, implying an uncontrolled legalization of drugs. A situation of market freedom is unacceptable for everyone who considers drug use to be a major social problem. Uncontrolled legalization does not seem to be a plausible policy option. The only real alternative to prohibition is controlled legalization, i.e. **market intervention**. Market intervention means that public authority, most obviously the state, excludes free enterprise from the drug market, takes control over the drug market itself, and intervenes by regulation of supply and demand.

Although market intervention allows for a combination of the positive elements of prohibition with some elements of a legal situation, it should be considered in its own right. But how? Nowadays drugs are illegal everywhere. There is no current experience with a legal market. Is it true, as the supporters of legalisation claim, that the illegal market will collapse as soon as a legal supply exists, thus ending much of the current organised crime? Or is it true, that a legal supply of drugs will stimulate the use of drugs? What will happen depends on the exact nature of the market intervention and the way in which market intervention affects the price of drugs. Legalisation will probably lead to substantially lower prices (Examples of a discussion on policy alternatives: Clague (1973), Moore (1973), White and Luksetich (1983), Clark (1992)). To a large extent, the effect of legalization will depend on the price elasticity of drug use. Not much is known about this price elasticity. A rare study which presents direct estimates of the price elasticity of a drug is Nisbet and Vakil (1972) who find a price elasticity of marihuana in the range of -1.0 to -1.5. Miron and Zwiebel (1991), analyzing US alcohol consumption during Prohibition, find a small negative price elasticity for alcohol use. Based on this, they claim that the price elasticity of drug use is small, so the increase in

drug consumption upon legalization 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. Therefore, lower drug prices could significantly expand drug use.

This article presents information from actual government intervention in a drug market. From 1894 until the end of the 1930s a system of market intervention, called the 'opiumregie', was in operation in the Dutch East Indies (present day Indonesia). The system operated via a state monopoly on the importation, production and sale of opiates.

The purpose of this article is twofold. First, we present a description of a government controlled drugs market, which seems to have been highly successful in terms of reducing the consumption of drugs. Second, we present empirical estimates of price elasticities of opium consumption. Our annual data consist of opium consumption, revenues and number of opium users, distinguished by ethnic group and 22 regions¹.

The article is set up as follows. Section 2 describes the characteristics of the opium users and opium use and the Dutch involvement in opium trade. Section 3 considers the policy goals and instruments of the opiumregie. Section 4 discusses the analysis of drug consumption in general terms. Section 5 presents the results of the quantitative analysis of opium consumption in which price elasticities of opium are determined. Section 6 concludes.

2. Opium in the Dutch East Indies

2.1 Characteristics of opium

Before we start to elaborate the characteristics of opium use and the opiumregie, we characterize opium itself; its varieties and prices, and its quality compared to opiates in the 1990s.

In the first decade of the twentieth century the opiumregie sold four

¹ The 22 regions are grouped into two main areas

Java and Madura: West-Java, Central-Java, East-Java, Yogyakarta, Surakarta.

Outer Islands: Sumatra Westcoast, Tapanuli, Bengkulu, Lampung Districts, Palembang, Jambi, Sumatra Eastcoast, Aceh, Riau and Dependencies, Bangka and Belitung, West-Borneo, South- and East-Borneo, Manado, Celebes and Dependencies, Bali and Lombok, Timor and Dependencies, Moluccas.

The data we use on opium are from the Jaarverslagen van de Dienst der Opiumregie ('Yearly Accounts of the Opiumregie'), 1915-1938 and the Koloniale Verslagen ('Colonial Reports'), 1890-1940.

different types of opium. One of them was crude opium, while three types were prepared forms, namely opium pills, tikee and tjandoe. Opium pills were only sold on the islands of Bangka and Belitung near Sumatra. They were mainly used by workers in the tin mines. All pills were imported from China, because the opium factory of the state was not capable of large scale manufacturing of pills conformable to Chinese tradition and users' preference. In accordance with the agreements made at the international opium conferences held at The Hague (1912-1914) the importation and subsequently the legal selling of opium pills was abandoned in 1914.

Crude opium was only sold to Indigenous lords on the islands of Bali and Lombok. Some lords still owned very old monopolies for the preparation and sale of opium to their subjects. Goesti G'de Djilantik, lord of the city of Karangasem, was the last Balinese lord who possessed such rights. He died in april 1916. After his death the Dutch authorities stopped the selling of crude opium altogether.

On Java the opiumregie sold prepared opium mixed with carved leaves of a plant called Ficus Septiva. This traditional mixture was called tikee. The habit of smoking tikee was especially widespread in the late nineteenth century among the lower class population on central Java. In those days marihuana and tobacco were also frequently added to tikee, but the Opiumregie did not produce these varieties. This mixture of psychotropic substances was considered to be a greater threat to health than pure opium. For this reason, and also because tikee was perishable, the production and selling of tikee was greatly reduced after 1914. In 1917 the last amounts of tikee were sold.

In conclusion, after September 1917 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 to 13 percent morphine. However, scientific research has shown that the narcotic effects were stronger than the percentage of morphine suggested. Today, the street level quality of illegal heroin is often not much stronger than the pure tjandoe sold by the opiumregie. So, in analyzing the consumption of opium we are analyzing the market of one of the hardest drugs.

2.2 Characteristics of opium users

Table 1 gives 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 about here* -----

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 the fivefold of that 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 craftsmen, and the rest were distributed between gardening, agriculture, and coolie labour on Dutch-owned plantations and mines. In the 1930s the number of Chinese increased in positions as teachers, dentists and doctors, in banking and as owners of industry in sugar and tobacco (Furnivall (1939)). From table 1 it appears that a relative large share of the Chinese population used opium. Furthermore, Chinese opium users used more opium than their Indigenous companions: The share of the Chinese in the population of opium users averaged 47%, whereas their share in total population was 1.2% in 1930.

2.3 Dutch involvement in the opium trade

Dutch involvement in the opium trade started soon after the founding of the Dutch East Indies Company, the 'Verenigde Oost-Indische Compagnie', in 1602. This company, commonly known as VOC, 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 1640-1652 the volume of opium sold at the Dutch trade centre 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 on Java. Instead, they conquered an already existing market.

At the beginning of the 19th 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 opium dealers, who

now became official tax farmers, to only sell crude opium delivered by the state, whereas the tax farmers gained the exclusive right to prepare and sell opium in their territory. For this profitable right, the Chinese tax farmers had to pay considerable sums to the Dutch authority. Reacting to higher financial claims by the state, the Chinese tax farmers opened up new markets in order to collect more money (Diehl(1983)). Official and unofficial opium dealers went into the interior of Java to push the opium habit amongst the Indigenous agricultural population. Revenues from the opium tax increased, and so did opium consumption. After a sharp decline around 1800 due to the Napoleonic wars, it reached 18th century levels again in 1870. 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. Looking back at this debate, there is a striking resemblance between the arguments then and the current arguments on the issue of drug legalisation. The opponents of the existing tax farm system argued that the dealers pushed the opium habit with all means, including threat and violence, and by means of organised prostitution and gambling. The greater 'opium kings' were too powerful and too rich. Drug-earned money allowed them to buy nearly everything within their territories. They caused corruption in the police force and amongst high-ranked civil servants. Whenever the state restricted the sale of opium by closing opium dens or opium shops, the tax farmers simply continued their activities secretly somewhere else. Whenever the state restricted the supply of opium to the tax farmers, they imported opium illegally from abroad. It was commonly agreed upon that the opium kings themselves were the greatest opium smugglers in the East Indies.

Many critics were in favour 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 due to the enormous coastlines of the Indian archipelago.

In stead, a new idea originated which rapidly gained political support. This idea was the opiumregie. The regie 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) Reducing health risks by guaranteeing a product of constant quality and pureness.
- c) Reducing opium use.

These arguments are very similar to those advanced today in favour of the legalisation of drugs.

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 decided to implement the opiumregie district by district all over Java. Implementation on Java was completed during 1903. It took until 1914 before the opiumregie was introduced in all parts of the Dutch East Indies.

- - - *figure 1 about here* - - -

Figure 1 shows the developments in total opium consumption on Java and Madura over the period 1903-1940. There is a substantial increase in opium consumption in the period 1910-1920, but a sharp decline in subsequent years. After a short period of increase in the late 1920s consumption declines again in the beginning of the 1930s, with a small increase in the second half of the 1930s.

Before 1920 opium consumption in the Outer Islands was substantially larger than on Java and Madura. The general development of total opium consumption in the Outer Islands in the 1920s and 1930s is very much the same as on Java and Madura. On face value the opiumregie seems to have been highly successful in reaching its goal of reducing opium consumption.

3. Characteristics of the opiumregie

Before discussing the main policy instruments of the opiumregie, we stress 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, like the Islamic regions of West 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 opium smoking was almost as common as nowadays alcohol drinking in Western countries. This was especially the case in regions with substantial Chinese communities, or regions with large estates like the East Coast of Sumatra. The labour force on these agricultural, export-producing estates was to a large degree recruited from other parts of East Asia, and many of these displaced temporary contract workers proved to be opium smokers on arrival, or else soon afterwards. 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 licence and registration system.

The opiumregie followed a severe **price policy**. The price of opium was kept high to discourage consumers. This was a risky policy, as too high a price could encourage opium smuggling and subsequently the flourishing of a local illegal drug market. 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 like morphine and heroin, which had gained some popularity in these years.

- - - *figure 2 about here* - - -

Figure 2 gives the nominal Java and Madura opium price in Dutch guilders per kilogram. The nominal opium price was increased substantially in the period 1918-1920 and decreased substantially in 1935. In between these dates the opium price was constant.

The nominal opium price on the Outer Islands was substantially lower than on Java and Madura. Probably this has to do with the difficulty of intercepting opium smugglers supplying the Outer Islands with illegal market opium. The increase in opium price in the Outer Islands in the beginning of the twenties is not as abrupt. Also, the decrease of the opium price in 1935 is not as sudden as that on Java and Madura.

The second major policy instrument was the **license and registration policy**. Simple registration of legal opium buyers started around 1910. The licence 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 doctors statement that they were already addicted. License conditions were severest from 1924 until 1927. During this period there was no sale of legal opium to others than 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 between regions.

The license and registration system was not only 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 of limited size. It was not permitted to buy more than once a day, and registration made this control possible. Moreover, licensees were limited to a certain maximum monthly sale as prescribed in their licenses. For the period until 1927 we have no information on the restrictiveness of the license system. Information of the period 1927-1938 shows that the number of available licenses was never exhausted. The average sale per user was also far below the maximum. So, since 1927 the license system lost a great deal of its power as a policy instrument.

For the period 1923-1938 we have information on the number of opium users by region and ethnic group. Figure 3 shows the total number of Chinese and Indigenous opium users on Java and Madura and on the Outer Islands. Before 1926 the number of opium users on Java and Madura is declining, while on the Outer Islands the numbers of Chinese users is slightly increasing. After 1926 the number of opium users is increasing in both areas, probably due to the modification of the license system, which made it easier to become an opium user. In the first half of the 1930s there is a substantial decrease in the number of users. This decrease may not be attributed to government policy with respect to the license system, since that did not change. As will appear from section 5 the increase in the real price of opium was responsible for the decline in the number of opium users in this period. After the mid 1930s the numbers of opium users are approximately constant.

- - - figure 3 about here - - -

4. Analyzing drug consumption

The analysis of drug consumption can hardly be expected to be traditional. A drug is a consumer good with specific characteristics of which probably the most important is the addictive nature. A common idea is that once someone is consuming a drug he or she cannot do without it and has to keep on consuming. Furthermore, low levels of consumption cannot be sustained. To hold constant the 'pleasure' of consumption, in economic terms to keep constant utility, one needs increasing amounts of a drug. Substitution of drugs by non 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. For society the addictive nature of a drug has some nasty consequences. Since government policy aims at prohibition, prices of drugs are generally high. Drug consumers who cannot pay for the daily quantity they need out of their regular income are bound to find alternative ways. Drug addicts are supposed to be responsible for much criminal activity.

In the policy discussion about legalization of drugs the demand elasticity is very important. Let's start with the common assumption that the demand elasticity is low. Then, prohibition causing high drug prices will lead to criminality. Legalization causing low drug prices will have a small effect on drug consumption and will reduce drug criminality substantially, on the supply side as well as on the demand side. So, if demand elasticity is low the main effect of legalization will be the reduction of criminality.

Now, suppose the demand elasticity is high. Then, the high drug prices of prohibition will keep demand low. Low prices due to legalization will cause an increase in drugs demand. The effects on criminality are unclear. Each drug user has to pay less money to get what he or she wants, but there are many more drug users.

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 non-stationary. In empirical work non-stationary utility specified as function of current consumption may be transformed into stationary utility specified as 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 or constant tastes.

The second distinction refers to the rationality of consumers. If current consumption only depends 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, consumers are assumed to behave rationally. In empirical work rational and myopic consumption can be distinguished. If there is an effect of future consumption 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 (see Appendix

1 for more details). As far as we know, there have not been many studies based on the Becker-Murphy model. Becker, Grossman and Murphy (1990) analyze US cigarette consumption and find support for the Becker-Murphy model since one period ahead consumption has a significant effect on current consumption. Long-run price elasticities are in the range -0.7 to -0.8, while short-run price elasticities are about -0.4.

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

5. Empirical analysis of opium consumption

5.1 Explanatory variables

In the analysis of the developments in opium consumption the real opium price is an explanatory variable. We deflate the opium price using the price of rice as an indicator for consumer prices. According to Van Laanen (1989): 'by using the index of rice prices, secular price movements in the Indigenous sphere can be closely approximated'. A comparison of developments in rice price over the period 1920-1940 with an index of 'cost of living' (Creutzberg (1978)), confirms this similarity in developments.

- - - *figure 4 about here* - - -

Figure 4 shows the development of the real opium price. The real opium price did not change very much over the period 1903-1930. Apparently, the sharp rise in the nominal opium price in the period 1918-1920 was somewhat damped by a sharp rise in the costs of living in the same period, so that the real opium price did not change that much. After 1930, the real price increases substantially due to a substantial decrease in the consumer prices (deflation). According to Maddison (1989): '... the fall in general price level in Indonesia was extreme even by the standards of the time...' So, the real opium price increased in the 1930s because of deflation. Again, the general patterns of the real price fluctuations on Java and Madura and the Outer Islands are quite similar.

When analyzing developments in the legal opium market in the Dutch East Indies we have to deal with the possible interaction between the illegal

and legal opium market. We have some information of the size of the illegal market for opium, using the amount of illegal opium intercepted by the authorities as proxy. Table 2 gives some information on these amounts.

- - - *table 2 about here* - - -

The amounts fluctuate over time, but there is no obvious increase or decrease. Table 2 shows that legal opium consumption on Java and Madura in the period 1905-09 was 29.200 kg/year, while in the period 1935-38 this was on average 6.700 kg/year. The amount of captured illegal opium was on average 314 and 300 kg. The enormous decrease of 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. Nevertheless, we will investigate the influence of the size of the illegal market, as proxied by the amount of captured illegal opium.

Another possible determinant of opium consumption is the licence and registration policy, which we discussed in section 3. 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 we introduce a dummy variable which has a value of 0 until 1927 and a value of 1 in the period 1927-38.

5.2 Total opium consumption

We started the analysis by using the Becker-Murphy model. As shown in Appendix 1 the estimation results are quite unsatisfactory. Therefore, we put the question aside whether opium consumers behave myopic or rational. We concentrate on estimating price elasticities. We continue using loglinear equations, in which price elasticities are specified directly. The use of lagged opium consumption as an explanatory variable, allows us to distinguish between short term and long term effects. If there is such a distinction this indicates that opium is an addictive good.

First, we investigate the developments in total opium consumption. Since we have no annual information of the size of the regional population, we use total regional consumption. To account for regional differences in the size

of the population or other non-observed regional differences, we use regional specific intercepts (fixed effects):

$$\ln(Y_{j,t}) = \tau_{0,j} + \tau_1 \ln(Y_{j,t-1}) + \tau_2 \ln(\text{pr}_{j,t}) + \tau_3 \ln(\Pi_t) + \tau_4 d_{2738,t} \quad [1]$$

in which: Y = total opium consumption in kilogram
 pr = real opium price
 Π = amount of captured illegal opium
 j = region, 1-22
 d_{2738} = dummy variable, until 1927=0, 1927-38=1

In stead of estimating [1] directly we take first differences, thus eliminating the fixed effects:

$$\Delta \ln(Y_{j,t}) = \tau_1 \Delta \ln(Y_{j,t-1}) + \tau_2 \Delta \ln(\text{pr}_{j,t}) + \tau_3 \Delta \ln(\Pi_t) + \tau_4 \Delta d_{2738,t} \quad [2]$$

We started the analysis using information of the period 1923-1938. As indicated in section 2, in this period opium had a standard quality. For this period, opium consumption can be distinguished by ethnic group: Chinese and Indigenous. Estimation results of [2] for both ethnic groups are presented in table 3. For all estimates it appears that the coefficients of the price and lagged consumption variables are significant, which means that we may distinguish short term and long term price effects. The coefficients of the dummy variable are significant in all estimates. The change in the license policy in 1927 stimulated total drug consumption with about 18%. The effect of the illegal market is significant but small.

The introduction of time specific dummy variables influences the estimated coefficients hardly. These variables account for all time specific effects and not just for the change in license policy. So, they also capture the effect of changes in for example the average yearly income. Introducing time specific dummy variables does significantly improve the estimation results. The coefficients of the lagged consumption variable and the price variable change somewhat: the short-run price elasticity increases somewhat, while the influence of lagged consumption is reduced.

Comparing the separate estimation results with a combined one, it appears that there is no significant difference between Chinese and Indigenous (F-test value: 1.45). So, Chinese and Indigenous consumers have the same response to changes in the real opium price. This is striking because there are substantial differences between the ethnic groups in terms of consumption and income per head. The short term price elasticity in the pooled estimate is -1.01, the long term price elasticity -1.27.

- - - table 3 about here - - -

We also have information on opium consumption of the period 1905-1938. This information is less detailed, we cannot make a distinction by ethnic group or distinguish captured illegal opium by region. The time period over which we have information differs by region, since the opiumregie started in different years. As indicated before, in 1904 the opiumregie was introduced in all the regions in Java and Madura, while it took until 1914 until the opiumregie was introduced in all regions of the Outer Islands. For the 5 regions on Java and Madura we have 165 observations, for the 17 regions on the Outer Islands we have 486 observations.

Apart from the dummy variable representing the license policy we also introduce a dummy variable for the period 1918-38 representing the change in the quality of opium which was introduced in the period 1917-1918. The estimation results are shown in table 4. Again we find very similar results as before. The coefficients of price, lagged consumption and the dummy variable for the change in license policy are all significant. For both Java and the Outer Islands we find a short-run price elasticity of about -0.6. The coefficient of the lagged consumption variable is of the same size for both regions. The estimation results for both parts of the Dutch East Indies are very similar. The third line of table 3 presents the estimate in which all regions are combined. The change in opium quality in 1917-18 appears to have had a negative effect on opium consumption, which is logical since due to this change low concentrates of opium were banned. To get the same amount of opium a smaller quantity was needed. Finally, we introduced time specific dummy variables. This improves overall estimation results, indicating that more time-specific effects than the change in opium quality and the license policy affected the opium consumption. It also appears that there is no significant difference between regions (F-test value: 1.38) or between the time periods 1905-1922 and 1923-1938 (F-test value: 0.16).

- - - table 4 about here - - -

3.3 Number of users

For the period 1923-1938 we have information on the number of opium users. We estimated a similar loglinear equation as [2] specifying the number of opium consumers (G) as a function of the lagged number of opium consumers, the current real opium price, the illegal market and the licence policy dummy. The estimation results are shown in table 5. For both Chinese

and Indigenous we find significant short term price elasticities of users in the range of -0.4 to -0.5. The coefficient of the lagged endogenous variable is not significant, indicating that there is no difference between short-run and long-run effects of price changes. There seems to be no effect of the size of the illegal market on the number of opium consumers. The estimation results also reveal government influence by the license system on the number of opium users. It appears that the change of policy in 1927 had a positive effect on the number of opium users, which increased with 17-22% in that year. This means that the increase in the number of opium consumers due to the change in license policy is of the same size as the increase in total opium consumption, which implies that the new consumers had on average the same consumption per head as the existing ones.

The introduction of time specific dummy variables does improve the estimation results, but does not influence the estimated coefficients. Again, if we compare the separate estimation results with a combined one, it appears that there is no significant difference between Chinese and Indigenous (F-test value: 1.46).

The (short term) price elasticity of the number of opium users in the pooled estimate is -0.47. The estimated price elasticity of the number of opium consumers is about half the price elasticity of total opium consumption. This indicates that a price change influences both the number of opium consumers and the consumption per opium consumer in about the same way.

- - - *table 5 about here* - - -

6. Conclusions

In this article we have analyzed a case of actual government intervention in a drugs market. 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 we estimated price elasticities of the demand for opium. We use information of different groups of consumers and different time periods. The estimation results are very similar: short-term elasticities of opium consumption range are about -1.0, long-term elasticities about -1.25. There is no big difference between short-term and long-term price effects. Apparently, opium was not very addictive. The effect of price changes on opium consumption consists of two parts: the effect on the number of opium consumers and the effect on the average consumption per consumer. Our analysis reveals that the price elasticity of the number of opium

consumers is about -0.5. So, both effects are of the same size.

From our analysis it also appears that the license policy influenced the number of opium users. The change of policy in 1927, when it became easier to obtain a license had an autonomous positive effect on the number of opium users and thus on total opium consumption.

All in all the opiumregie, which led to a substantial increase in real opium prices, caused an impressive reduction in the consumption of opium. The system of market intervention succeeded in achieving its major policy goals: first the control over the drug market and then the reduction of drug consumption. It is not clear to what extent the price policy was coincidental. The major increases in real opium price were not due to an increase in nominal opium price - which was controlled by the government - but due to large decreases in the general price level.

What do we learn from the Dutch experiments of the opium regie? Nowadays, the notion is common that most drug users are addicts. Therefore, it is widely presumed that drug users are unable to change their consumption level and will adjust their financial position to their consumption level by means of crime, if necessary. Our analysis contradicts this common notion, since it indicates that opium users were quite able to adjust their consumption to price changes. This seems to point out that under the opiumregie the incentives for drug related crime were not very strong. This view is supported by the opinions of most contemporary observers of the opiumregie. Many of them did not even mention drug-related crime as a problem. Instead, it was emphasized more than once that crime was much more related to alcohol abuse (notably acts of violence).

The estimated price elasticities of opium are not small. We think the same applies to drug consumption nowadays. Low prices will stimulate drug demand both by increasing the drug use per user and by increasing the number of users. However, we have 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 we should consider the effects of a change from prohibition to market intervention instead of a change from market freedom to market intervention. Nevertheless, today market intervention may be a good policy to consider when it comes to drugs. Market intervention may succeed where prohibition seems to fail and uncontrolled legalization is too risky.

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$$Y_t = \beta_0 + \beta_1 \cdot Y_{t-1} + \beta_2 \cdot Y_{t+1} + \beta_3 \cdot P_t \quad [A5]$$

in which: $\beta_2/\beta_1 = 1/(1+r)$

In this equation current consumption is related to current prices, lagged consumption and future consumption. Equation [A5] encompasses several types of consumer behaviour:

- If $\beta_1 = \beta_2 = 0$, then there is no addiction
- If $\beta_2 = 0$ and $0 < \beta_1 < 1$, then there is addiction of myopic consumers.
- If $0 < \beta_1 < 1$ and $0 < \beta_2 < 1$, then there is rational addiction. If β_2 is substantially smaller than β_1 , then the discount rate is large.

A1.2 Empirical analysis

Becker, Grossman and Murphy (1990) analyze US cigarette consumption, using annual data (31 years) distinguished by state (50). They estimate equation [A5] with real (= deflated) cigarette prices, adding state and time-specific dummy variables. Our data enable us to perform a similar analysis.

Lacking annual information of the size of the regional population, we use 1930 data to calculate regional opium consumption per head. Opium prices are deflated by using the rice price as an indicator of the general price level of consumer prices. To investigate the effects of the change in the license system in 1927 we added a dummy variable with a value of 0 in the period until 1927 and a value of 1 in the period 1927-1938. To account for regional differences we use regional specific intercepts (fixed effects):

$$y_{ij,t} = \beta_{0,ij} + \beta_{1,i} y_{ij,t-1} + \beta_{2,i} y_{ij,t+1} + \beta_{3,i} pr_{j,t} + \beta_{4,i} il_t + \beta_{5,i} d_{2738,t} \quad [A6]$$

- in which:
- y = opium consumption in kilograms per head
 - pr = real opium price
 - il = captured amount of illegal opium per head
 - i = ethnic group, Indigenous or Chinese
 - j = region, 1-22
 - d_{2738} = dummy variable, 1924-26=0, 1927-38=1

In the estimates we used one period lagged and one period ahead price as instruments for lagged and future opium consumption. By taking first differences the regional fixed effects are excluded:

$$\Delta y_{ij,t} = \beta_{1,i} \Delta y_{ij,t-1} + \beta_{2,i} \Delta y_{ij,t+1} + \beta_{3,i} \Delta pr_{j,t} + \beta_{4,i} \Delta il_t + \beta_{5,i} \Delta d_{2738,t} \quad [A7]$$

The estimation results of [A7] are shown in table A1.

Table A1 Estimation results regional opium consumption per head distinguish by ethnic group: 1924-1937 ^{a)}

	$\Delta y(-1)$	$\Delta y(+1)$	Δpr	Δil	Δd_{2738}
Indigenous	0.41 (2.1)	0.64 (4.6)	-0.20 (1.2)	-0.00 (0.4)	0.06 (0.1)
Chinese	0.15 (0.8)	0.54 (4.8)	-1.07 (3.3)	-0.01 (4.1)	1.31 (1.3)
Indigenous ^{b)}	1.29 (2.0)	-0.01 (0.0)	-0.87 (1.6)	-0.00 (0.4)	
Chinese ^{b)}	0.94 (3.2)	-0.04 (0.0)	-0.92 (1.5)	-0.02 (2.5)	

^{a)} Two stage least squares using $\Delta pr(-1)$ and $\Delta pr(+1)$ as instruments for $\Delta y(-1)$ and $\Delta y(+1)$; ; absolute t-values in parentheses

^{b)} Estimate includes time specific dummy variables

From these estimation results it is difficult to draw firm conclusions. The coefficients of the dummy variable representing the licensing policy are not significantly different from zero. Those of the illegal market are significantly negative for Chinese. The sign of the coefficient of the price variable is correct. The coefficients of the one period ahead variable is larger than that of the lagged variable.

In our second estimates we added time-specific dummy variables, excluding the license policy variable. The estimation results show that this especially influences the coefficients of lagged and future consumption. The coefficients of the lagged consumption variable are now very high, those of future consumption very small. All in all we conclude that our data are not quite capable of making a distinction between rational and myopic addiction.

Table 1 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 (mln)			
Indigenous	40.9	18.2	59.1
Chinese	0.6	0.6	1.2
Income per head (gld)^{a)}			
Indigenous	55	66	59
Chinese	310	320	310
Opium users (1000)			
Indigenous	76.4	10.1	86.5
Chinese	17.9	62.8	80.7
Opium consumption (1000 kg)^{b)}			
Indigenous	10.0	1.9	11.9
Chinese	10.4	27.0	37.4
Opium consumption (kg/user)			
Indigenous	0.13	0.19	0.14
Chinese	0.58	0.43	0.46

^{a)} gld = Dutch guilders; Chinese include other Asiatics

^{b)} kg = kilograms

Table 2 Legal consumption of opium and captured illegal opium

Java and Madura	Captured illegal opium (kg/year)	Legal opium (1000 kg/year)	Captured illegal (% of legal)
1905-09	314	29.2	1.1
1910-14	192	33.0	0.6
1915-19	188	36.8	0.5
1920-24	190	33.0	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			
1915-19	101	54.6	0.2
1920-24	194	38.0	0.5
1925-29	620	33.9	1.8
1930-34	306	16.5	1.9
1935-38	235	11.5	2.0

Table 3 Estimation results regional opium consumption by ethnic group; 1924-1938

	$\Delta \ln(Y_{t-1})$	$\Delta \ln(pr_t)$	$\Delta \ln(\Pi_t)$	$\Delta d_{2738,t}$	R^2
Chinese	0.24 (5.2)	-0.79 (10.6)	-0.03 (3.2)	0.20 (4.6)	0.429
Indigenous	0.15 (3.7)	-0.87 (10.9)	-0.02 (1.7)	0.14 (2.9)	0.361
Chinese ^{b)}	0.23 (4.1)	-0.81 (3.5)	-0.03 (2.8)	-	0.503
Indigenous ^{b)}	0.13 (2.9)	-1.01 (4.7)	-0.01 (1.7)	-	0.422
Total ^{b)}	0.19 (5.5)	-1.01 (5.8)	-0.02 (2.6)		0.460

^{a)} Intercept included in the regressions; absolute t-values in parentheses; R^2 corrected for degrees of freedom

^{b)} Time-specific dummy variables included

Table 4 Estimation results regional opium consumption; various time periods during 1905-1938^{a)}

	$\Delta \ln(Y_{t-1})$	$\Delta \ln(pr_t)$	$\Delta d_{2738,t}$	$\Delta d_{1838,t}$	R^2
Java and Madura	0.34 (5.7)	-0.59 (9.5)	0.19 (3.2)	-0.17 (2.8)	0.485
Outer Islands	0.23 (5.9)	-0.55 (10.2)	0.21 (4.3)	-0.11 (2.2)	0.287
Total	0.25 (7.5)	-0.55 (13.0)	0.20 (5.1)	-0.12 (3.0)	0.321
Total ^{b)}	0.16 (4.1)	-0.82 (7.1)	-	-	0.436

^{a)} Java and Madura: 5 regions, 165 observations; Outer Islands: 17 regions, 486 observations; intercept included in the regressions; absolute t-values in parentheses; R^2 corrected for degrees of freedom

^{b)} Time-specific dummy variables included

Table 5 Estimation results regional number of opium users by ethnic group; 1924-1938^{a)}

	$\Delta \ln(G_{t-1})$	$\Delta \ln(pr_t)$	$\Delta \ln(\Pi_t)$	$\Delta d_{2738,t}$	R^2
Chinese	0.01 (0.2)	-0.48 (6.2)	-0.02 (1.7)	0.22 (4.8)	0.164
Indigenous	0.06 (1.6)	-0.39 (5.5)	0.01 (1.1)	0.17 (4.0)	0.129
Chinese ^{b)}	-0.08 (1.4)	-0.37 (1.5)	-0.01 (0.9)	-	0.259
Indigenous ^{b)}	0.03 (0.7)	-0.55 (2.3)	0.02 (2.1)	-	0.192
Chinese ^{b)}	-	-0.43 (1.7)	-	-	0.258
Indigenous ^{b)}	-	-0.51 (2.1)	-	-	0.184
Total ^{b)}	-	-0.47 (2.7)	-	-	0.231

^{a)} Intercept included in the regressions; absolute t-values in parentheses; R^2 corrected for degrees of freedom

^{b)} Time-specific dummy variables included

Figure 1 Opium consumption on Java and Madura and on the Outer Islands; 1905-1938 (1000 kg)

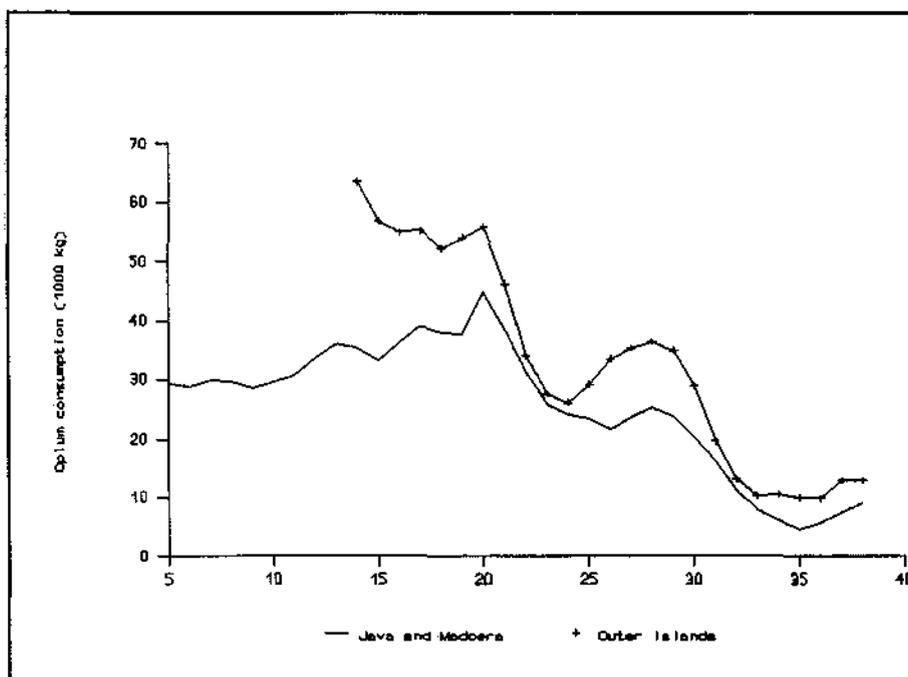


Figure 2 Nominal opium price on Java and Madura and on the Outer Islands; 1905-1938 (Dutch guilders/kg)

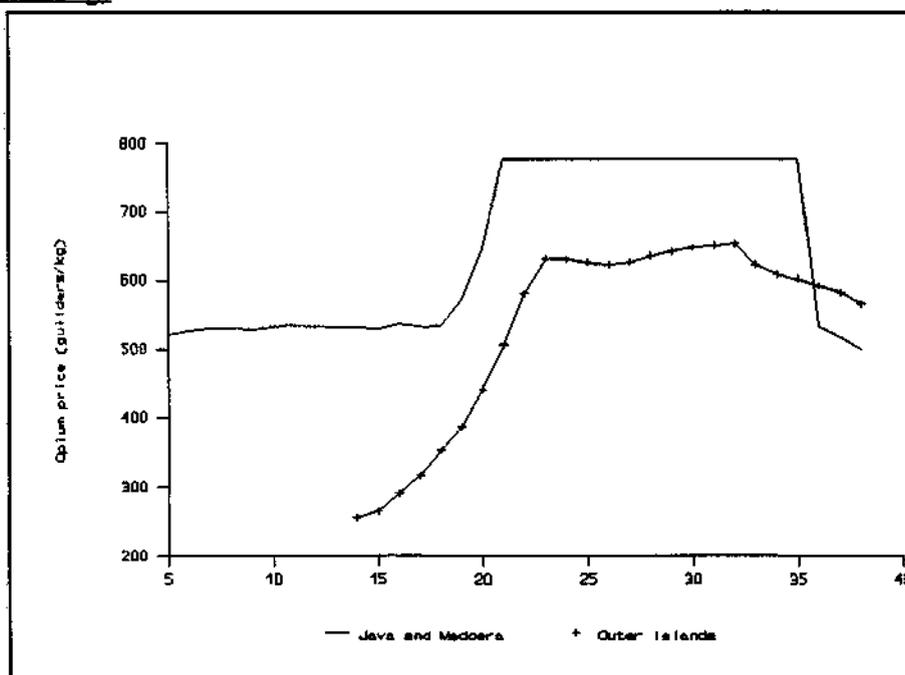


Figure 3 Number of Chinese and Indigenous opium users on Java and Madura and on the Outer Islands; 1923-1938 (1000)

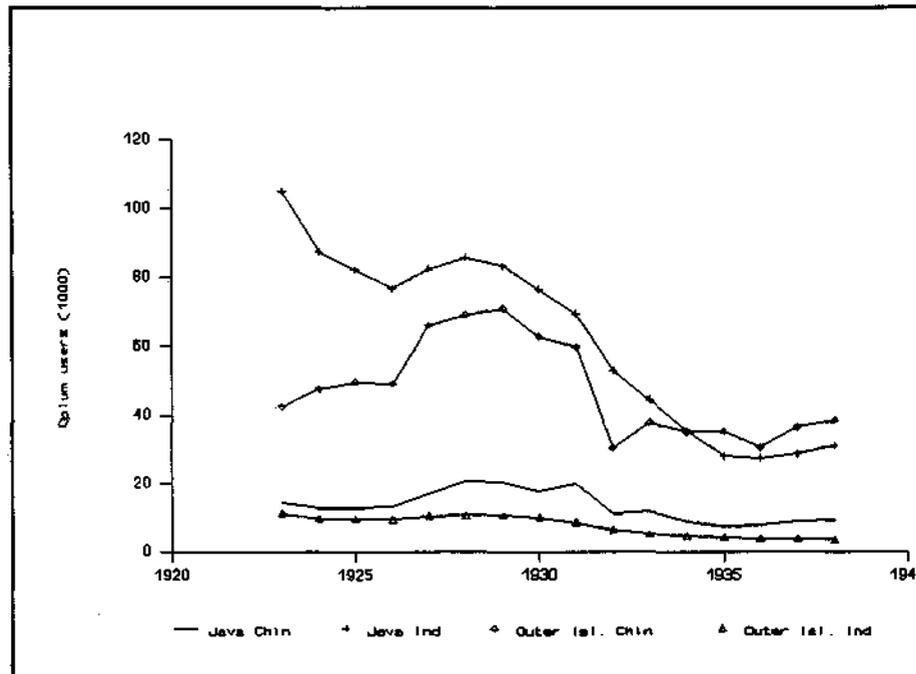
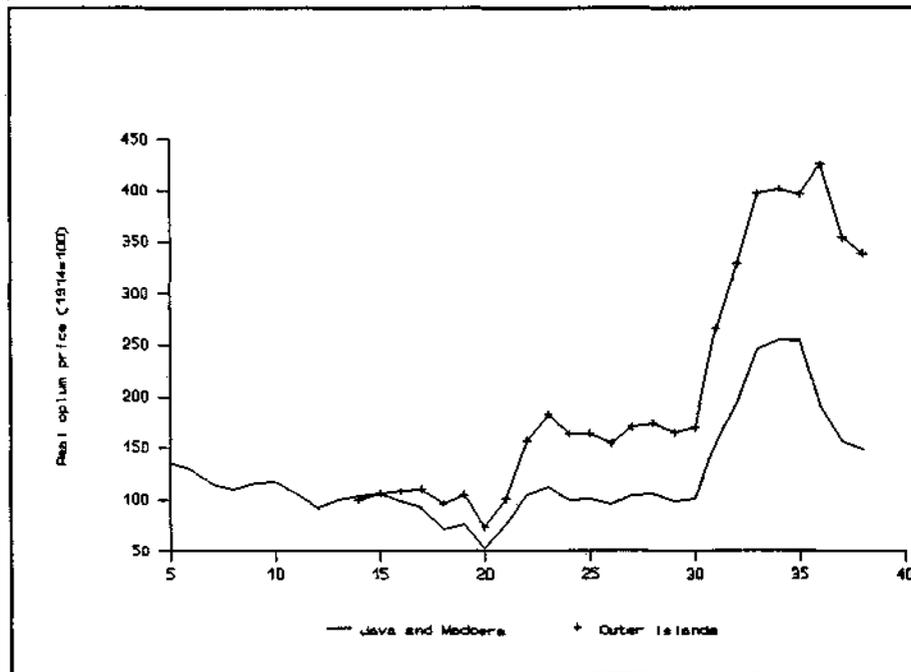


Figure 4 Real opium prices on Java and Madura and on the Outer Islands; 1905-1938 (1913=100)



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