Opium and Empire: Some Evidence from Colonial-Era Asian Stock and Commodity Markets

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Abstract

We assess the impact of the opium trade on the economies of colonial Malaya, Netherlands Indies, and China from 1873 to 1911 using a new database of stock and commodity prices, plus measures of government revenues, commodity exports, and immigration. Stock returns for a few Malayan industries related to international trade are significantly correlated with opium price changes, as are prices for labour-intensive, Chinese-dominated export commodities such as tin and gambier. However, opium price changes explain, at most, only a small fraction of the behavior of stock and commodity prices. On balance, stock and commodity markets ascribed only secondary importance to ups and downs in the opium trade as measured by the price of the drug.

1. **Introduction**

The nature and impact of colonialism continues to be important to understanding the history, politics, and economics of Asia. The economic and political institutions and conditions that evolved under colonial rule continue to colour the workings of today's modern Asian states.

One of the most peculiar and interesting aspects of colonialism in Asia was the opium trade. Opium was already an important commodity in Asia when Europeans first visited Southeast Asian and Chinese ports. Europeans started to ship opium to the Far East to compete for the considerable profits associated with the trade and to barter for the silks, teas, and spices which originally motivated their travels to Asia. As the European presence in Asia evolved into extensive colonial possessions, the import of Turkish and Indian opium became a major economic activity. At points in the late nineteenth and early twentieth centuries, for example, opium tax revenues comprised much, if not most, of colonial government budgets in Malaya, the Netherlands Indies, and French Indochina.

The significance of the opium trade continues to be debated. Therefore, the purpose of our paper is to offer some empirical evidence on the importance of opium to colonial-era Asia. We organise our work around two alternative hypotheses. If the desire to profit from selling opium was the primary reason for colonialism in Southeast Asia and China, changes in the health of the opium trade would have a significant impact on the general economic health of the colonial economies. Therefore, our first hypothesis is that opium was a principal driving force in the colonial economies. Alternatively, the management and taxation of the opium business was merely one of many aspects of administering the Asian colonies, just as modern governments are involved in regulating and taxing tobacco, alcohol, and gambling. The opium trade would react to, rather than cause, the broader economic factors that drove the demand for opium. Therefore, our second hypothesis is that the opium trade merely reflected and followed more fundamental economic conditions. Our two competing hypotheses have a number of distinct implications that we detail below.

We base our tests on a unique database of stock and commodity prices which spans the period from 1873 to 1911 when legal, unregulated opium dealing ceased. From Singapore's principal business newspaper, *The Straits Times*, we have collected monthly market-determined prices for tin, rubber, pepper, other local commodities, and, most importantly, for opium itself. This newspaper and others also supply monthly stock prices from Malaya, Netherlands East

Indies, and European-administered areas of China. Among our sample are companies that shipped the opium, transported the largely Chinese workers who consumed it, financed the opium traders, and harvested, processed, and transported mineral and agricultural commodities produced by opium-using workers. We also collected annual data on movements of Chinese migrant workers to Southeast Asia, colonial government tax revenues, and commodity production in Malaya. Collectively, this data allow us to measure the effect of opium on many dimensions of colonial economic activity with considerable precision.

The paper is organised as follows. Section 2 briefly sketches the historical setting. Section 3 presents our testable hypotheses. Section 4 outlines the data set and empirical tests we conduct. Section 5 presents results while Section 6 is a summary and discussion of implications.

2. Historical Overview

2.1 India and Opium: Export Commodity to the East

The opium trade developed rapidly given the desire of European merchants to exchange opium for highly prized Far Eastern products. Before British domination of the opium trade, small-scale Portuguese and Dutch traders were regularly shipping opium to Macau, Canton, Java, and the spice islands.[1] With the extension of British influence in Asia, the East India Company (EIC) sought to control cultivation and sale of the drug by constructing authority and power over crucial parts of India. Starting with the Bengal Monopoly in 1773, the company gradually consolidated control and, in 1797, prohibited opium cultivation in their territories except under license. In this way, the EIC controlled opium production while leaving exportation to private traders and agency houses that purchased opium at EIC auctions in Calcutta.

To maintain high opium prices, the company continued with the steady neutralization, through treaties and combat, of rival opium-producing Native Indian states. By the time the EIC lost monopoly privileges in 1833 and the Crown claimed India, opium production had been organised into a reliable system of revenue and provided a steady trade between India and much of eastern Asia. The 1843 annexation of the Sindh, a major smuggling route, effectively sealed British control over opium cultivation and sale. Native cultivation of opium in China began in the

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[1] See Ananta C. Sahu, *Some Aspects of British Trade Policy in India* (New Delhi: Ashish Publishing House,1985), David Edward Owen, *British Opium Policy in China and India* (New Haven: Yale University Press, 1934), and Carl A. Trocki, *Opium and Empire: Chinese Society in Colonial Singapore, 1800-1910* (Ithaca, NY: Cornell University Press, 1990) for detailed descriptions of the origins of the opium trade.

late 1860s and offered strong competition to Indian opium in the 1870s and 1880s. The growing threat of local cultivation was a significant factor in negotiations with British India to slow and eventually stop the India-China opium trade. The legal flow of Indian opium to China was administratively curtailed starting in 1911 and ceased entirely in 1917.

Southeast Asia's role in the opium business increased continually with the trade between India and China. For years, the Malay archipelago had served as an important secondary market, absorbing Indian opium and supporting its price when the Chinese opium market was depressed.[2] Southeast Asia developed rapidly as an important part of the colonial economic system of independent traders and agency houses facilitating the India-China trade. Indeed, the British established the port of Singapore in 1819 specifically in the interests of these colonial enterprises. Historians have argued that, as British colonialism matured, it was shaped mostly by local and regional interests in colonial Asia, not by British officials in the metropole.[3] In 1868, the Colonial Office took control of the Straits Settlements.[4] Informal British control was placed over Perak, Selangor and Sungei Ujong after 1870, leading ultimately to British authority throughout Malaya. An underlying cause for the British expansion was turbulent local politics. Power struggles within the Malayan ruling classes and feuding between Chinese secret societies were major disturbances in the peninsula and hindered the production of tin at a time (1866-1872) when world tin prices were rising rapidly. Prominent tin capitalists reached out for assistance and were even willing to appeal to non-British powers for help in stabilizing the situation. Wary of losing their foothold in Southeast Asia, the British intervened.

2.2 Opium and Southeast Asia's Economy

Colonial Southeast Asia's export-led growth was largely funneled through the free-trade entrepôt of Singapore, which featured open, legal trading of opium at market-determined prices.[5] Opium was a part of the system of commodity production and exportation that evolved rapidly in

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[2] See Anthony Webster, "British Export Interests in Bengal and Imperial Expansion into Southeast Asia, 1780 to 1824: The Origins of the Straits Settlements", in *Development Studies and Colonial Policy*, ed. Barbara Ingham and Colin Simmons (London: Frank Cass & Co., 1987): 138-174.

[3] See, for example, Michael Adas, *High Imperialism and the New History* (Philadelphia: Temple University Press, 1993), Trocki *Opium and Empire*, Webster, *British Export Interests in Bengal*, and David K. Fieldhouse, *Economics and Empire 1830-1914* (London: Macmillan, 1984).

[4] Essentially Singapore, Malacca and Penang.

[5] See, for example, Cheng U Wen, "Opium in the Straits Settlements", *Journal of Southeast Asian History* 2, 1 (1961): 52-75 and Cheng U Wen, *British Opium Policy in the Straits Settlements 1867-1910* (Kuala Lumpur: University of Malaya Press, 1960).

colonial Southeast Asia. There was virtually no cultivation within the region.[6] The British, Dutch, and French areas of influence were major consumers of opium given their substantial ethnic Chinese populations. Many scholars have asserted the pervasive social and economic effects of opium. In *A History of Straits Settlements Foreign Trade*,[7] Chiang Hai Ding has written that opium was once the most important commodity in intra-Asian trade. In 1870, for instance, he claims that opium comprised fully one-tenth of all imports and exports in the region. In *Opium to Java*, James Rush describes a colonial Java where, "in sharp contrast to the rest of Southeast Asia, the vast majority of [opium] customers were not labouring Chinese sojourners but native Javanese."[8] The resultant growth of the "opium farm"[9] system of government-licensed distributors affected the politics and economics of colonial Java. In *Opium and Empire*, Carl Trocki describes the influence of opium syndicates on life in the Straits Settlements and other British-controlled areas of Malaya. The role of opium clearly increased as the economies of the port cities and their hinterlands developed. Trocki's *Opium and Empire* identifies opium as both a critical determinant of and barometer for economic activity in Malaya: "...the health of the local economy was largely dependent upon its price. Because opium was the major exchange commodity for local Straits produce, its price affected the values of all other commodities...Its rises and falls marked periods of crisis and prosperity in the colonial entrepôt." He characterizes the guiding political events of the day as involving the economic importance of opium, its distribution, and its significance in the social control of large populations of immigrant workers.

Many scholars have highlighted the importance of opium as an input to the production of

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[6] Martin J. Murray, *The Development of Capitalism in Colonial Indochina 1870 – 1940* (Berkeley: University of California Press, 1980) notes that opium was imported into French Indochina from India or southern China. James R. Rush, *Opium to Java: Revenue Farming and Chinese Enterprise in Colonial Indonesia, 1860-1910* (Ithaca, NY: Cornell University Press, 1990) explicitly discusses the lack of opium poppy cultivation in the Dutch colony of Java. Trocki *Opium and Empire* likewise regards opium in the Straits as mainly an import from India.

[7] Chiang Hai Ding, A History of Straits Settlements Foreign Trade 1870-1915 (Singapore: National Museum, 1978).

[8] In contrast, Jan C. Van Ours, "The Price Elasticity of Hard Drugs: The Case of Opium in the Dutch East Indies, 1923-1938", *Journal of Political Economy* 103, 2 (1995): 261-279, writing about a later period in the Dutch East Indies, asserts that "[t]he share of the Chinese in the population of opium users averaged 47 per cent, whereas their share in total population was 2 per cent in 1930. Furthermore, Chinese opium users used more opium than their indigenous companions...the amount consumed by the Chinese was more than three times as high."

[9] Rush *Opium to Java* and Trocki *Opium and Empire* describe the operation of the 'opium farm' system in, respectively, Java and Singapore. The 'opium farm' consisted of monopoly rights for the preparation, distribution and sale of retail opium to certain concession areas within colonies. Control of the opium farm usually meant significant control over other avenues of trade. Successful bidders for the 'opium farm' were usually the more politically connected, wealthy, and powerful members of society. In Java and Singapore, Chinese businessmen generally controlled the farm; European bidders were rare and tended to front for rival Chinese groups.

commodities like tin, pepper, and gambier.[10] The largely Chinese workers producing these

commodities were regular consumers of opium. In *Opium and Empire*, Trocki notes that opium

was thought to have an energizing effect on miners and plantation labourers, relieving work-related

aches and allowing longer and more productive work.[11] Opium was also influential beyond the

mines and plantations. However, scholars disagree about the general economic impact of the drug.

In *Opium to Java*, Rush draws a picture of constant but low usage in the Netherlands East Indies,

where hard-core addiction was the exception and the economic impact of opium was not

substantial. In his view, opium served merely as an indicator of economic prosperity, not as a

significant causal factor. "Opium sales fluctuated with the yearly peasant and plantation

agricultural cycles and with general rises and falls in economic prosperity over the years." British

public servants overseeing the Empire's trade seemed to share this view. In contrast, Trocki in

Opium and Empire asserts that opium addiction was widespread in the Straits Settlements,

affected craftsmen and common workers in addition to immigrants, and had a significant, if not

leading, impact on all locally produced commodities. In *Government of the Pacific*

Dependencies,[12] Wilfred Hinton observed that average spending on opium seemed extremely high

in relation to daily wages. He saw a positive correlation between the physical labour intensity of

a job and the degree of opium consumption. He attributes the arduous labour of coal handlers on

the docks—"carrying coal in baskets up a gangway...dumping it into the gaping bunkers, and back

again to the beginning of the apparently endless round"— as a major reason why "six out of ten"

such labourers became regular opium consumers. Hinton also mentions the common rickshaw

operator, who, for example, "will earn $1.00 to $1.50[13] a day in good times, and will very likely

spend fifty to sixty cents of it a day on opium, for the chances are about four in ten that he will

smoke." The implication is that, if not for opium, the industriousness of workers would have been

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[10] A plant used to produce medicines, dyes, and tanning chemicals.

[11] For instance, Trocki in *Opium and Empire*, p. 67, writes that "[c]ontemporary reports tell of labourers taking a break for a pipe of opium and then resuming their work 'refreshed.' Gambier planters not only had to clear jungle and brush for their plantations, but they also had to cut wood for the fires to boil the gambier. Mining coolies faced even more demanding exertions...While not in any sense a cure, opium was a palliative that at least relieved the symptoms of these afflictions. It dulled muscular aches and pains, lowered fevers, stopped inflammations, stopped up bowels, and allowed the mind to forget, for a time, the grinding loneliness and desperation of their lives. In these circumstances, opium may well have been considered a necessity" (p. 67).

[12] Wilfred J. Hinton, *Government of Pacific Dependencies: British Malaya*, (Honolulu, HI: Institute of Pacific Relations, 1929).

[13] One Straits Settlements dollar was typically worth about one-ninth of a British pound or about half of a U.S.

much lower.

Furthermore, the economic development of the region may have slowed if not for the role opium played in financial contracts between merchant capitalists and planters. In *Opium and Empire*, Trocki claims that lending terms in the colonial period frequently included a share of the profits from worker consumption of opium. In Malaya, planters and workers often worked in remote areas, and basic necessities were usually provided by an on-site company store. Employees purchased general supplies, including liquor and opium, from the company itself. Due to this captive market, markups of up to three hundred per cent between the market price of raw opium and retail *chandu*[14] were not unknown. The degree of consumption was evidently so reliable that investors considered a share in opium income as dependable security against their investment. If, for example, the commodity market for pepper declined, the well being of investors would still be assured.

2.3 Relation of Opium to Government and Business in Colonial Southeast Asia

There are many references to the importance of opium revenues to colonial coffers. At the administrative level, the purchase tax on opium was an important, if not dominant, form of revenue for colonial governments. Chiang, Hinton, and Trocki note the dependence of the Straits Settlements government on opium-related income. In some years, opium revenue comprised over sixty per cent of Straits government revenues. For the period under study, it was a rare year when opium did not total at least forty per cent of Straits revenue. In *The Development of Capitalism in Colonial Indochina*, Murray discusses the massive income generated by the French colonial government's opium monopoly in Indochina, where the drug was priced to appeal to everyone from the "rickshaw man and errand boy" to more wealthy consumers. Even before the imposition of government monopoly in 1883, opium had become the largest source of colonial revenue. Furthermore, opium revenues in Indochina doubled between 1894 and 1907, and continued to grow until as late as the 1930s. Rush in *Opium to Java* writes of how the drug "underwrote a significant portion of Holland's colonial enterprise." He shares a stunning revelation: Of the years 1876 to 1915, "when the colonial accounts ran into deficits totaling *f* 295.3 million, the opium

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dollar during the period we study.

[14] In *Opium to Java*, Rush describes *chandu* as purified raw opium mixed with taste enhancers and adulterants. The product came in a variety of sizes, depending on the locale. In the Straits Settlements, for instance, *chandu* was sold by the *tahil* (about 1.3 ounces), *chi* (one-tenth of a *tahil*), or *hoon* (one-tenth of a *chi*). In Indochina opium was sold in tins of five, ten, twenty-five, fifty, or one hundred grams.

revenues amounted to *f* 703.3 million, in the absence of which, the total deficit would have been *f* 998.6 million.[15] Thus opium reduced the potential deficit by 70 per cent."[16] In the European colonies of Asia, opium seemed to be a powerful economic and social force that shaped the growth and control of the European colonial empires.

For the economy as a whole, however, the picture is not as clear. While opium was certainly important for Chinese businesses, which were almost always the operators of opium and related 'farms,' its effect on European or more export-oriented businesses remains undetermined. Chiang describes their role as 'complementary' to the more locally based Chinese companies, and concludes that there was a general lack of competition between European and Chinese businesses. In *Planters and Speculators*,[17] James Jackson also notes the lack of success encountered by Europeans in their bids for entry into the world of commodity production and opium farming. The end result was that certain sectors, notably gambier and pepper planting, were ceded to Chinese firms, while other sectors, like shipping and plantation finance, were controlled by Westerners.[18] Nevertheless, these and other historians assume that opium's influence can be generalized to the whole economy, to European and Chinese firms alike, and to firms in various import and export industries. However, ethnic specialization could imply that opium was not so influential. Rather, it may well be that its effect was strong in certain local sectors, but insignificant in others. Therefore, the interests of certain business sectors may have overlapped with those of the government, while those of other sectors did not.

Our data begin after the separation of the Straits Settlements from control by the Colonial Office in India in 1867. The state in the Straits Settlements began to govern as a separate colonial body, with its own interests in preserving colonial revenue and carrying out governmental functions. Thus, Singapore may have originated from the needs of agency houses and traders, but the interests of her independent colonial government did not necessarily remain coincident.

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[15] *f* refers to Dutch guilders.

[16] Rush quotes from F. W. Diehl, "The Opium-tax Farms in Java, 1813-1914: The Quest for Maximisation of Government Revenue and Chinese Tax Farmers' Profits", presented at Conference on Indonesian Economic History in the Dutch Colonial Period, Australian National University (1983).

[17] James C. Jackson, *Planters and Speculators: Chinese and European Agricultural Enterprise in Malaya*, 1786-1921 (Kuala Lumpur: University of Malaya Press, 1968).

[18] Rush *Opium to Java* mentions instances of partnership between Chinese and Europeans. A few such partnerships sprang up after 1870 concerning commercial land leasing and development. In addition, some Chinese plantations hired European managers. These examples appear to centre on personal relationships between an individual European and a Chinese family.

2.4 Principal Export Commodities

In this subsection, we briefly describe several of the export commodities that are an important part of our tests. We stress which commodities were most important and profitable during the period we study, were especially labour intensive, and were dominated by Chinese labour or management.

Tin was the most important commodity in east-west trade during most of our period of study.[19] Although China was once a major consumer of Southeast Asian tin, by the early nineteenth century demand from North America and Western Europe dominated tin markets.[20] By 1883, the tin output of the Malay peninsula led the world, and by 1885-1896 represented five-sixths of the world's tin output.[21] At first, tin was mostly a labour-intensive industry. Because many tin deposits initially lay relatively shallow in the ground, technological demands were low. This situation complemented the labour-intensive, low-tech mining techniques of the Chinese. However, the industry shifted from Chinese dominance to European control early in the twentieth century. More capital-intensive European dredging methods predominated as tin miners were forced to dig deeper for ore. Yet even after the ascendance of European tin producers, Jackson in *Planters and Speculators* notes that the labour force remained largely Chinese.

Rubber became relevant to Southeast Asian trade at the turn of the century. Driven by the rise of the automobile industry and especially its boom in the United States, world demand for rubber increased exponentially and the plantations of Southeast Asia quickly became dominated by rubber. European and Chinese planters alike abandoned other crops for the newly lucrative rubber tree. Economic motives to cultivate rubber were further strengthened by positive regulatory actions in the region: in 1897, for instance, the FMS introduced special land rents for rubber, asking only ten cents per acre for the first ten years of cultivation and only fifty cents per acre afterwards.[22] By 1908, Malaya had become "the premier planting territory [for rubber] in Southeast Asia".[23] Rubber gradually superceded tin as the dominant trade commodity. One

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[19] See Wong Lin Ken, *The Malayan Tin Industry to 1914*, (Tuscon: University of Arizona Press, 1965), Chiang *A History of Straits Settlements Foreign Trade*, Jackson *Planters and Speculators*, and Trocki *Opium and Empire*.
[20] Mary F. Somers Heidhues, *Bangka Tin and Mentok Pepper: Chinese Settlement on an Indonesian Island* (Singapore: Institute of Southeast Asian Studies, 1992).
[21] Chiang *A History of Straits Settlements Foreign Trade.*
[22] Jackson *Planters and Speculators*.
[23] Voon Phin Keong, *Western Rubber Planting Enterprise in Southeast Asia 1876-1921* (Kuala Lumpur: Penerbit Universiti Malaya, 1976).

distinctive feature of the rubber industry was its labour force, largely immigrant Indian labourers. The expansion of the rubber industry meant a like increase in Indian immigration to the region. In *Government of Pacific Dependencies*, Hinton notes that, in 1901, the Indian population in the Federated Malay States was only about 58,000. By 1927, that number had increased to 400,000. Unlike immigrant Chinese labourers, Indian workers were not known for opium consumption.

Gambier[24] increased then declined in importance during the period under study. Jackson (1968) observes that the 1880s and 1890s were a period of rapidly escalating demand for gambier from Britain and North America, the main destinations for this product. Chinese planters largely controlled the gambier industry. Europeans did not succeed in gambier because they could not compete against the Chinese, who not only paid lower wages but also made significant side profits from the sale of opium and food to their employees.[25] However, gambier was not usually a profitable plant; its price was seldom high enough to justify its cultivation alone.[26] Rather, gambier was often planted in close association with pepper. Gambier cultivation was a labour-intensive endeavor, requiring almost continuous collection of the gambier foliage, clearing of jungle and bush, and plenty of available cut wood for the fires in which to boil the commodity.[27] This proved to be greatly complementary to the highly seasonal nature of pepper production. Gambier was a way to ensure constant employment throughout the year for the labour force.[28] Chinese gambier workers, like those in other highly labour-intensive industries, were prone to regular use of opium. Jackson in "Chinese Agricultural Pioneering" writes that, in some years, gambier production would have incurred substantial losses if not for revenue from opium consumption. He notes that gambier exports declined by over forty per cent between 1890 and 1910. Furthermore, Trocki in *Opium and Empire* suggests that the link between gambier and the opium trade weakened after 1870. By the end of World War I, the gambier industry had ceased to be a significant part of Southeast Asian commodity trade.

Pepper was a staple item of the East-West trade. As noted above, it was often associated with gambier by Chinese planters. The fate of the pepper industry largely mirrored that of gambier. Between 1912 and 1917, gambier and pepper exports fell by sixty per cent (Jackson

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[24] A derivative of the leaves of the gambier plant used for dyeing, tanning, and medicines.
[25] See Chiang *A History of Straits Settlements Foreign Trade* and Trocki *Opium and Empire*.
[26] James C. Jackson, "Chinese Agricultural Pioneering in Singapore and Johore 1800-1917", *Journal of the Malaysian Branch Royal Asiatic Society* 38, 1 (1965): 77-105 and Trocki *Opium and Empire*.
[27] Trocki *Opium and Empire*.

1968). In *A History of Straits Settlements Foreign Trade*, Chiang writes that, as of 1890, pepper had already become a fairly unimportant portion of Straits trade. Like gambier, most of the planting land dedicated to pepper was switched over to rubber in the beginning of the twentieth century. Our main interest in pepper lies in its largely Chinese labour force, and the possible price effect of opium through them.

Copra, the dried kernel of coconuts, came into prominence as an export article around 1870. The popularity of coconut oil and nut oils in margarine ensured the future of this industry, providing steady if unspectacular returns.[29] In addition, around the turn of the century, government policy in both the Straits Settlements and the Federated Malay States required the inter-planting of 'permanent' crops, specifically coconut and rubber, for all land grants for gambier and pepper cultivation.[30] It was felt that the introduction of 'permanent' crops would help sustain the fertility of the land, and perhaps shift producer interest from the more-destructive, short-term cultivation of pepper, gambier and tapioca towards longer-term investments. This policy was targeted mainly at Chinese planters, who were the main gambier and pepper producers. It proved fortuitous, as rubber and copra became more lucrative and product markets expanded. For our period, the copra workforce was likely mostly Chinese. As time progressed, this probably changed to include great numbers of Indian labourers on European-owned plantations.

Tapioca[31] was the last of the great plantation crops in Malaya prior to the rubber boom of the early twentieth century. Its heyday was in the second half of the nineteenth century. Chinese planters and workers dominated this industry. Tapioca cultivation proved quite destructive, exhausting the land much faster than other crops, like pepper or gambier.[32] Official opinion began to turn against the cultivation of tapioca in the 1890s. Officials first tried to regulate tapioca cultivation in order to allow maximum land regeneration. Eventually, tapioca land grants also required the simultaneous cultivation of permanent crops, like rubber or coconuts. The decline of the tapioca industry was quickened in the early 1900s by a drastic fall in prices.

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[28] Jackson "Chinese Agricultural Pioneering".

[29] R.L German, *Handbook to British Malaya 1927* (London: Malay States Information Agency, 1927).

[30] Jackson *Planters and Speculators*.

[31] Tapioca pearl and flake were required for flour in the preparation of foodstuffs and various industrial uses. See James C. Jackson, "Tapioca: The Plantation Crop Which Preceded Rubber in Malaya", *Malaysia in History* 10, 2 (1967): 13-24.

[32] In *Planters and Speculators*, Jackson mentions that tapioca lands were generally abandoned within five years, with a general concession usually exhausted within twenty-five years. By contrast, gambier and pepper lands usually could be cultivated regularly for fifteen to twenty-five.

3. Testable Hypotheses

Given our understanding of the opium trade and the viewpoints expressed by several prominent writers, we state two alternative hypotheses about the importance of the opium trade to the colonial economies. Each hypothesis leads to distinct predictions about the associations between opium price movements and a variety of indicators of stock market performance, commodity prices and production, and movements of Chinese workers in and out of the region.

Our first hypothesis is inspired by Carl Trocki's *Opium and Empire*.[33] It characterizes the central role of opium in the colonial Asian economies:

H1: Changes in the price of opium had a direct impact on the profitability of colonial Asian businesses, the amount of revenue collected by colonial governments, and the general level of prosperity in the colonies.

If demand for opium was inelastic,[34] increased opium prices would imply a higher total opium revenue from which shippers, merchants, and financiers associated with the trade would have benefited. Prices for shares in these companies would be positively correlated with opium prices. Colonial government revenues would be positively correlated with opium prices.

H1 also implies that higher opium prices could have an adverse impact on the cost of production in labour-intensive industries. A higher cost of living (the price of opium) increases the wage demands of mining and agricultural workers (or decreases the supply of immigrant workers from China), and raises the cost of producing commodities. Higher production costs raise price, lower quantity produced, and decrease corporate profits. Therefore, prices for shares of companies that produce and process commodities should be negatively correlated with opium prices, as should the output of those commodities. Prices of commodities should be positively correlated with opium prices. Movements of immigrant workers into export commodity businesses would be negatively correlated with opium prices. Under H1, opium should have no impact on

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[33] Note, however, that Trocki describes the size, volatility, and impact of the opium trade as largest during periods prior to the start of our data set in 1873.
[34] This is a strong assumption. See van Ours "The Price Elasticity of Hard Drugs" for some supportive statistical evidence. On the other hand, there is also conflicting historical and anecdotal evidence suggesting that the quantity of opium consumed was quite sensitive to the price of the drug.

rubber-related indicators, since the rubber workforce consisted mainly of immigrant Indians.[35] To the extent that wage demands and other costs adjust only gradually to the increased cost of opium, opium prices may lead prices for export commodities.

Our alternative hypothesis is inspired by James Rush's *Opium to Java*. It suggests that the health of the opium trade was derived from, or indicative of, more fundamental economic conditions:

> **H2**: Changes in the price of opium were caused by shifts in demand driven by more fundamental economic factors.

When commodity exports and other aspects of the colonial economy were booming, wages were high and the demands of immigrant labourers and others for opium increased. The price of opium was positively correlated with good economic times in colonial Asia's principal industries, just as the demand for discretionary or luxury products rise with prosperity in any economy. Share prices of all enterprises rise during an economic upswing and, thus, are positively correlated with the price of opium. Prices of export commodities are the source of much of any such upswing. Therefore, prices and outputs of tin, pepper, and other commodities are positively correlated with opium prices. Government revenue and movements of immigrant workers into the region are positively correlated with opium prices. To the extent that demand for opium lags the economic cycle, the price of opium may lag share prices for export commodities. The rubber industry would have contributed to the general prosperity driving demand for opium and, in contrast to what is predicted by H1, all indicators from the rubber industry should be positively correlated with the price of opium.

Table 1 summarizes the hypothesized effects on various aspects of the colonial economy.

[Insert Table 1 about here]

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[35] Rubber data proved difficult to gather. Rubber company share prices are only observable during the last half dozen years of our sample period.   Rubber price data was impossible to collect consistently as rubber auctions occurred only irregularly in Singapore and Penang during our sample period.

Some of the predictions differ markedly under H1 versus H2. When combined with our empirical results, these differences may allow us to distinguish between the two hypotheses.

4. Data and Methodology

Our sample spans the period from December 1872 to June 1911. Prior to 1872, stock and commodity prices appeared in *The Straits Times* and other newspapers only sporadically. After June 1911, regional governments regulated the supply of opium and did not allow its price to fluctuate freely.

4.1 Opium prices

We collected end-of-month prices in Straits dollars per "export"[36] opium chest (containing forty raw opium balls each weighing about 1.5 kilograms) from *The Straits Times*. Our price quotes represent the most regularly reported Benares opium.

The Singapore export opium price is particularly important for several reasons. Its regularity as a data source and its free-market nature make it possibly the best available indicator of opium demand, relatively free of local idiosyncrasies, for the Asian region.[37] "The forces that generally determined the opium price were outside of Southeast Asia," Trocki writes in *Opium and Empire*. "As the centre of the trade in Southeast Asia, however, Singapore became the transmitter of global economic forces." Therefore, export opium prices from Singapore are a relatively undistorted measure of global demand and supply. They had substantial impact on more controlled markets. Rush in *Opium to Java* and Van Ours in "The Price Elasticity of Hard Drugs", for instance, credit the free trade in Singapore for driving down governmentally negotiated 'opium farm' prices in Java.[38] By some estimates, the amount of smuggled opium substantially overwhelmed that of legal opium. One author[39] thought smuggled opium accounted for up to sixty per cent of the available opium in Java. Therefore, the free market opium price from Singapore is

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[36] Sales of opium within Singapore were controlled by the licensed opium "farmer" or later by the colonial government itself.

[37] As Trocki notes, the local Singapore retail market itself had little impact on the larger trade in opium; he estimates that only 20 per cent of Indian production was landed at Singapore. Much of this was transshipped to other points like Java or further east to Hong Kong.

[38] The Dutch colonial government bought opium either directly from the Calcutta auctions or indirectly through traders. Java's opium farmers would then buy their rations from warehouses in Batavia, Semarang, and Surabaya (Rush *Opium to Java*). However, these farmers were forced to buy and sell at inflated prices, which reflected both official Dutch policy to limit opium consumption and Dutch reliance on opium revenues. A price advantage, therefore, could accrue to successful smugglers.

[39] Rush *Opium to Java* attributes this calculation to Christian Casten, a Batavia official responsible for opium affairs.

applicable even to colonies where the price was nominally much higher. Historically, gyrations in the free-market price directly affected nominal government farm prices. Finally, opium price data are neither reliably or systematically available from Chinese sources.

4.2 Export commodity prices

The Straits Times is also the source of matching end-of-month commodity prices. We selected commodities that were produced (and often processed) locally for export: tin, gambier, tapioca, sago, black pepper, copra, and Liberian coffee.

4.3 Share prices for publicly listed companies

History suggests that Chinese firms were particularly vulnerable to opium price fluctuations. Many scholars note that Chinese firms facilitated much of Southeast Asian commerce.[40] However, it was rare for a Chinese firm to list on a stock market during the colonial era. While comparative analysis between European and Chinese firms is, therefore, not possible, our sample includes a broad cross-section of European-owned colonial companies directly or indirectly related to several facets of the opium trade.

End-of-month stock prices were collected from principal colonial or metropolitan newspapers. British Malaya stock prices were obtained from the *Straits Times* which was known as *Singapore Daily Times* prior to 1882. Hong Kong stock prices were obtained from the *China Mail* and *China Overland Mail* (prior to 1881), the *Hong Kong Telegraph* (1881 to 1904), and the *South China Morning Post* (1904 on). Netherlands Indies stock prices were obtained from *Nieuwe Amsterdamsche Courant* (through November 1884) and *Die Indische Mercuur* thereafter. Shanghai stock prices were obtained from the *North China Herald* and *North China Daily News*. Stock prices are either closing transactions or bid-offer midpoints from organised or over-the-counter markets. The firms selected are quoted regularly, have relatively large capitalization, and represent leading industries. While only a handful of companies are collected from each market, they are typically the largest firms which represent much of the total market capitalization and, in many cases, explicitly owned partial stakes in many other listed firms. Information on dividends, ex dividend dates, and shares outstanding was published only irregularly and, therefore, was not collected.[41] Table 2 summarizes the stock price data. It also indicates how the individual

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[40] See Trocki *Opium and Empire*, Chiang *A History of Straits Settlements Foreign Trade*, and Jackson *Planters and Speculators*.

[41] Since our study focuses on estimating correlations and other higher moments of price changes, the absence of

[Insert Table 2 about here]

company stock prices have been classified into industries.

4.4 Other data

End-of-month exchange rates for each country or territory, and the price of silver in London,[42] were also collected from the same newspapers or, in the case of silver, from *The Times* of London. Exchange rates are closing or midpoint quotes supplied to the newspapers by leading banks. We need exchange rates to translate all prices into a common currency, the British pound.

As a measure of global trends in asset values and general economic conditions, we also collected monthly returns on British and U.S. stock indexes. For Britain, we use a spliced series of The London and Cambridge Economic Service *The British Economy Key Statistics* (through 1921) and *Banker's Monthly* (from 1922) indexes.[43] For the U.S., we combine the series constructed by G. William Schwert[44] through 1925 with the value-weighted index computed by the Centre for Research in Securities Prices (CRSP) at the University of Chicago. We translate the U.S. index returns to pounds and construct an equally weighted index of British and U.S. index returns to serve as our global stock index return series. We use the global index returns to attempt to control for "other factors" in our statistical analysis. If, for example, we are trying to explain ups and downs in the price of a tin mining stock with opium prices, the global index returns can be included in the test to control for "general" factors and thereby focus more precisely on the specific impact of opium.

Finally, we obtained annual data on several non-price series published in colonial government publications and other summaries. These include the annual government revenues of the Straits Settlements and other Malayan states, number of Chinese immigrants and emigrants for the Straits Settlements, and the output of export commodities. These data were drawn from the

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dividends is not likely to induce significant bias in our results. This would not be the case if we were studying long-term cumulative stock returns, the fit of asset pricing models, or other issues related to total equity return performance.

[42] Hong Kong and China were on the silver standard during our period of study and the exchange values of their currencies were determined by the price of silver in London.

[43] Supplied by Professor Tim Opler, Ohio State University.

[44] G. William Schwert, 1990, "Indexes of U.S. Stock Prices from 1802 to 1987", *Journal of Business* 63, 3 (1990): 399-426.

Straits Settlements Annual Departmental Reports and other government documents.

4.5 Methodology

Our testable hypotheses imply significant relationships between the variables we have collected data on. We assume a simple linear relationship and, therefore, use regression analysis to assess the significance of the relationship between two variables, X_t and Y_t,

$$\ln\{Y_t/ Y_{t-1}\} = \alpha + \beta \ln\{X_t/ X_{t-1}\} + \varepsilon_t.$$

The function $\ln\{\cdot\}$ takes the log of consecutive monthly values of Y and X respectively. This expresses changes in those variables as a growth rate that typically has good statistical properties. The error terms, ε_t, define the precision of the slope coefficient, β, and, therefore, indicate the statistical significance of the estimated relationship. The estimated sign and significance of the slope coefficient, β, tells us whether or not there is a linear relationship between the two variables. The estimated β also indicates the scale of the association between the two variables. For example, a β of .8 suggests that a one per cent change in X is associated with a .8 per cent change in Y. The regression also yields an "r-squared" statistic, a measure of the degree of explanatory power of the regression. For example, an "r-squared" of .5 indicates that the behavior of X over time can explain fifty per cent of the behavior of Y.

Note that both Y and X are measured as changes over the same time period, from "t-1" to "t". Therefore, no causality is implied by which variable goes on the "right" side versus the "left" side of the regression.[45] The estimated equations can help us distinguish between the causality stories of H1 and H2 only when interpreted with the predictions in Table 1.

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[45] We will conduct one test in which a "previous" value, $\ln\{X_{t-2}/X_{t-1}\}$, appears on the right side and a "contemporaneous" value, $\ln\{Y_{t-2}/Y_{t-1}\}$, appears on the left side. This specification does imply causality from X to Y across time.

For one test, we also estimate the "rank correlation" between two variables. The rank correlation measures the extent to which the highest value of X tends to occur at the same time as the highest value of Y, the lowest value of X tends to occur at the same time as the lowest value of Y, and so on. This is an alternative measure of whether or not two variables appear related to each other. It can be effective for some cases (such as our annual data on commodity output, government revenues, and immigration) where the quantity and quality of data is poor, or we are not confident about the nature of the statistical distribution of the errors, ε_t, which relate the two variables.

5. Results

Prior to discussing our results, we present an overview of the driving factor behind this study, the monthly price of opium at Singapore. Figure 1 plots the end-of-month price of Benares opium in Straits dollars per chest. During most of the period we study, the price

[Insert Figure 1 about here]

fluctuated between 400 and 1200 dollars per chest. There is an upward trend in prices and, as restriction of Indian opium exports loomed, the price in Singapore skyrocketed.

5.1 Opium prices and stock returns

Table 3 presents regressions of stock portfolio price changes on opium price changes and

[Insert Table 3 about here]

the return on our global stock index. There is one regression estimate for each of the industry portfolios described by Table 2, plus one regression for an equally weighted average of all stock returns from each of our four economies, British Malaya, Hong Kong, Netherlands Indies, and Shanghai.

The table indicates only a few portfolios that exhibit a significant association with changes in the price of opium. British Malaya Banking and Insurance portfolio increases .65 per cent for every one per cent increase in the price of opium. As Table 2 indicates, this portfolio consists entirely of a single firm, Straits Insurance. During this period, local insurance companies were

primarily concerned with shipping insurance. Therefore, the result suggests that the demand for shipping insurance and, implicitly, the amount of shipping activity were positively correlated with movements in the price of opium. This is consistent with either H1 or H2. The R^2 coefficient indicates that the combined impact of opium and the global stock index explain about five per cent of the movements in the portfolio's value. British Malaya Ports also shows a statistically significant positive association with opium, although it is smaller and explains less than one per cent of the overall movements in stock returns for the portfolio. Again, this is evidence of higher profits from the shipping business at times of high opium prices, and is consistent with either H1 or H2.

The Food portfolios for British Malaya and Hong Kong show positive associations with opium price changes, although they are only marginally statistically significant. These portfolios consist of retailers such as Cold Storage and Dairy Farm. Therefore, these results are consistent with either H1 or H2: high opium prices boost the spending power of colonial elites who benefit from the trade (H1) or are associated with generally good economic times during which retail sales are high and profitable (H2). The index of all British Malayan stock returns (towards the bottom of Table 3) exhibits a very strongly significant positive regression relationship with opium price changes. A one per cent increase in the opium price is associated with a .17 per cent increase in Malayan stock prices generally, and opium explains about two per cent of all movements in those stock prices. This confirms that opium had a small but significant impact on the Malayan economy as measured through its stock market.

No reaction on the part of labour-intensive British Malayan Mining rejects both H1 and H2: there is no evidence that opium was a "cost of production" in these industries (H1) or that prosperity in these industries spurred demand for opium (H2). No reaction for British Malayan Rubber is consistent with H1 and rejects H2. To the extent that Malaya as a whole may be thought of as an export commodity economy, the positive association between the index of all Malayan stocks and the price of opium reported in the previous paragraph could be thought of as supportive of H2. There are no reactions for stocks from the other colonies and territories.

5.2 Opium prices and export commodity prices

Table 4 presents regressions of commodity price changes on opium price changes and the

[Insert Table 4 about here]

return on our global stock index. There is one regression estimate for each of the commodities in the sample. Rubber is excluded as it was not traded regularly except at the end of our sample period. All of the commodities exhibit some relationship with the price of opium. About eight per cent of the variation in the price of tin can be explained by opium, with a one per cent increase in the price of opium associated with a .18 per cent increase in the price of tin. The importance of the general health of the world economy to the tin market is evident in the large slope coefficient on our world stock index return series. Prices for labour intensive gambier and copra also show a very significant association with opium prices, as indicated by the statistics in the table. Black pepper, tapioca, sago, and Liberian coffee also show significant or marginally significant associations with the price of opium.

Like the stock price results, these regressions confirm the small but significant impact of opium on the export-commodity sector of the Southeast Asian colonial economies, particularly for Malaya. It is especially significant that strong results are observed for tin and gambier since they are known to be labour-intensive and Chinese-dominated. However, the commodity results do not allow us to distinguish between H1 and H2. It may be the case that the positive associations between opium prices and commodity prices represent the higher cost of labour implied by higher opium prices (H1). The results are also consistent with a general business cycle effect in which commodity prices rise and fall with global demand, and opium prices reflect these trends like other consumer prices in an export-dependent economy (H2).

5.3 Commodity exports, government revenues, and migration

Table 5 presents regressions of changes in annual government revenues, Chinese immigration, and commodity exports of the Straits Settlements on changes in the price of opium.

[Insert Table 5 about here]

Because the number of observations of data is low and the statistical properties of the series are not clear, we also present rank correlations that relate both levels and changes of these variables. The data series span different time periods due to the varying availability of these series, but all series extend to the end of our sample period, June 1911.

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Government revenues and expenses show no correlation with ups and downs in the price of opium. While this could indicate that opium was an extremely steady source of government revenue, it may also reflect changes in retail prices and license fees that helped smooth the opium revenue against fluctuations in the wholesale price of opium. The immigration numbers show no correlations with the opium price, but it may be the case that the number of data points is too small to support statistical inference. Some negative slope coefficients for commodity exports (tin, pepper) are supportive of H1. However, the non-parametric rank correlations reported in the right-hand column of the table indicate that the results on tin and gambier are not robust, which is unsurprising given the small number of observations for those series. The apparent negative correlation between rubber exports and opium price changes would reject both H1 and H2, but the number of observations of data available for analysis is too tiny to be taken seriously.

5.4 Leads and lags of opium versus other commodity prices.

Table 6 presents regression evidence on the extent to which export commodity prices followed (H1) or led (H2) opium prices. For each commodity in the sample, price changes on

[Insert Table 6 about here]

regressed on leading, lagging, and contemporaneous opium price changes. The slope coefficients on the contemporaneous opium price change are mostly significant, and mirror the results reported in Table 4. However, there is very little evidence of any leading or lagging relationship between the commodity prices and the opium price. Three cells indicate significant or marginally significant leads or lags, but they are not strong, consistent in sign, or numerous. Therefore, these tests do not allow us to distinguish between H1 and H2.

6. Summary and Conclusions

We have used monthly prices from stock and commodity markets, along with other related annual data, to assess the importance of the opium trade to colonial Asian economies during the period from 1873 to the restriction of Indian opium exports to China in 1911. Opium prices explain a small but significant fraction of the stock price movements in selected trade-related industries. Most export commodity prices are also correlated with opium prices, particularly those for labour-intensive, Chinese-dominated products like tin and gambier. However, only a small fraction of the movements in the prices of these commodities can be explained by opium.

There is no reliable evidence that opium price changes affected changes in annual government revenues, immigration, or quantities of commodities exported. Except for the evidence on rubber share prices, there is little evidence to support hypothesis H1 that proposes opium as a leading economic factor in these economies. It seems more likely that opium was a significant but small indicator of broader economic trends, perhaps consistent with a weak version of H2.

We recognize that several limitations constrain our ability to draw strong conclusions about opium's impact on the colonial economies. First, we cannot gauge how large and important the stock and commodity markets were, and how responsive prices were to economic developments and, in particular, to changes in the state of the opium business. If these markets were small in size or dominated by short-term speculators, they may not reflect fundamental information very precisely. Second, it is simplistic to assume that changes in the price of opium are sufficient to characterize the state of the opium business or the particular impact of opium on business costs and government revenues. A more complete array of information including retail prices, quantities imported and sold, and estimated prices and quantities sold in the black market might give us more definitive results. In particular, we do not know the quantity of opium purchased by "farmers" and government monopolies, the number of smokers, or the importance of "recycled" opium obtained from ashes or pipe scrapings. Third, more information on consumer prices, wages, and other everyday economic indicators could be used to study another facet of the impact of the opium trade. Fourth, we have included no information on monetary conditions and currency regime changes that may have had an influence on the opium trade or on the colonial economies generally.[46] Furthermore, the lack of data from prior to 1873 excludes the period when opium price fluctuations, links between commodity production and opium, and direct European participation in the opium trade were thought to be strongest. Finally, the lack of data on the rubber trade prevents us studying the rubber industry more extensively to distinguish between H1 and H2.

In spite of these potential shortcomings, we believe our results are interesting and offer new evidence on the importance of the opium trade to the colonial Asian economies. We also

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[46] See Warren Bailey and Kirida Bhaopichitr, "How Important was Silver? Some Evidence on Exchange Rate Fluctuations and Stock Returns in Colonial-Era Asia" (unpublished Cornell University working paper, 2000) and references therein.

hope our work encourages others to address historical and political questions with financial market data.

Table 1: Predicted Associations between Opium Prices and Indicators of Colonial Economic Activity

This table briefly outlines the predicted associations between opium prices and other economic indicators under our hypotheses.

	Correlation with opium price given inelastic opium demand and:	
	H1: Opium is a central causal factor	**H2:** Opium reflects basic economic conditions
Share prices of banks, shippers, and others directly involved in opium trade	Positive: they benefit from higher opium prices.	Positive: profits rise with good economic times.
Share prices of producers/processors of export commodities with Chinese workforce	Negative: higher opium price increases wage demands.	Positive: high profits from export commodities are the primary source of economic growth.
Prices of export commodities with Chinese workforce	Positive: production costs go up so prices rise.	Positive: high export commodity demand is the source of economic growth.
Output of export commodities which use primarily Chinese workforce	Negative: higher price reduces quantity sold.	Positive: again, high output is associated with high demand.
Share prices of rubber plantations and output of rubber	None: Indian workers were not known to use opium.	Positive: same effect as export industries with Chinese workforce.
Colonial government revenue	Positive	Positive
Chinese immigration	Negative: higher wage demands reduce demand for labour.	Positive: high demand for exports raises labour demand.
Opium leads or lags	Opium leads if wage demands increase only gradually in response to opium price increase.	Opium lags if increased consumer demand for opium only gradually responds to economic prosperity.

Table 2. Overview of the Sample of Equities

End-of-month stock prices were collected from colonial or metropolitan newspapers. The firms selected are quoted regularly, have relatively large capitalization, and represent leading industries. Except where noted, each company has monthly data from January 1873 to June 1911, the last month before exports of opium from British India were regulated by international agreement. The table does not indicate the frequency of missing observations due to market closures, corporate reorganization, infrequent trading, or missing newspapers.

Industry	British Malaya	Netherlands Indies	Hong Kong	Shanghai
Agricultural Groups		Nederlandsche Handel, N. I. Handelsbank, Koloniale Bank		
Banking and Insurance	Straits Insurance (1884-1902)	Javasche Bank, N. I. Escompto (1895 on)	Hong Kong and Shanghai Bank	
Commercial and Industrial	Singapore Dispensary (1893 on)			EWO Cotton (1895 on)
Food (processing and retailing)	Cold Storage (1904 on), Fraser and Neave (1898 on)		Dairy Farm (1899 on)	
Mining and Smelters	Tongkah Harbour Tin Dredging (1909 on), Malay Peninsula Prospecting (1887-1898), Jelebu Mining (1889-1904), Pahang (1889 on), Tronoh (1901-1933), Eastern Smelting (1908 on), Straits Trading (1894 on)			
Ports (ship building, engineering, docks, wharves, and warehouses)	Tanjong Pagar Dock (ends 1907), New Harbour Dock (1876-1899) Howarth Erskine (1901 on), Riley Hargreeves (1899 on), Maynard (1884 on)		Hong Kong and Whampoa Dock, H. K. and Kowloon Wharf and Godown (1887 on)	Shanghai Dock
Real Estate	Tanjong Pagar Land (1884-1893)		Hong Kong Land (1894 on)	Shanghai Land (1889 on)
Rubber Plantations	Bukit Rajah (1905 on), Pataling (1905 on), Selangor (1905 on), Highlands and Lowlands (1906 on)			
Transport (Ship lines and Railways)	Straits Steamship (1891 on), Singapore Steamship (ends 1886)	Koninklijke Paketvart (1889 on), Java China Japan Line (1902 on), N. I. Spoorweg , Deli Spoorweg (1888 on)		
Utilities			China Light and Power (1901 on), Hong Kong Electric (1894 on), Hong Kong and China Gas (1899 on)	Shanghai Gas, Shanghai Telephone (1900 on), Shanghai Water (1881 on)

Table 3. Regressions of Industry Portfolio Price Changes on Opium Price Changes

Monthly industry portfolio price changes are regressed on opium price changes, global stock index returns and a constant. See Table 2 for descriptions of the component securities. Time period is ordinarily January 1873 to June 1911 but missing observations may reduce this. T-statistics in parentheses beneath each coefficient estimate are adjusted for serial correlation and heteroskedasticity. See Whitney K. Newey, and Kenneth D. West, A Simple, Positive Semi-Definite, Heteroskedasticity and Autocorrelation Consistent Covariance Matrix, *Econometrica* 55, 3 (1987): 703-08, and Halbert White, "A Heteroscedasticity-Consistent Covariance Matrix Estimate and A Direct Test for Heteroscedasticity", *Econometrica* 48, 4 (1980): 817-38. ** (*) indicates statistical significance for opium at the 5 per cent (10 per cent) level.

Portfolio Series	Region	Number of observations	Constant	Slope coefficient on opium price change	Slope coefficient on global stock index return	Adjusted R^2
Agricultural Groups	Netherlands Indies	449	0.00149 (0.80)	0.02946 (0.83)	0.33911 (4.95)	0.035
Banking and Insurance	British Malaya	225	-0.01948 (-1.98)	0.65620 ** (2.15)	0.51612 (1.37)	0.051
	Netherlands Indies	391	0.00043 (0.36)	0.00530 (0.23)	-0.05675 (-1.19)	-0.002
	Hong Kong	450	0.00114 (0.40)	-0.00149 (-0.03)	0.07364 (0.78)	-0.004
Commercial Industrial	British Malaya	212	-0.00229 (-0.46)	0.07831 (0.97)	0.40723 (1.66)	0.010
	Shanghai	190	0.00650 (0.74)	0.00216 (0.02)	-0.35184 (-1.05)	-0.005
Food	British Malaya	160	0.00923 (1.73)	0.13839 * (1.78)	-0.18729 (-1.18)	0.007
	Hong Kong	145	0.01398 (1.90)	0.14775 * (1.78)	0.15220 (0.37)	0.001
Mining	British Malaya	288	0.00715 (0.52)	0.24326 (1.54)	-0.12853 (-0.32)	-0.003
Ports	British Malaya	450	0.00040 (0.19)	0.08342 ** (2.07)	-0.07131 (-0.90)	0.006
	Hong Kong	450	-0.00042 (-0.14)	0.03298 (0.56)	-0.06201 (-0.60)	-0.004
	Shanghai	451	-0.00128 (-0.45)	0.00306 (0.05)	-0.12472 (-1.07)	-0.002

Real Estate	British Malaya	103	-0.00270 (-0.14)	0.37499 (0.93)	0.35543 (0.54)	-0.013
	Hong Kong	267	-0.00398 (-1.19)	0.05418 (1.30)	-0.03323 (-0.23)	-0.003
	Shanghai	269	0.00456 (0.99)	-0.03097 (-0.56)	-0.02708 (-0.13)	-0.007
Rubber Plantations	British Malaya	73	0.02416 (1.90)	0.06640 (0.32)	-0.18613 (-0.53)	-0.024
Transport	British Malaya	377	-0.00090 (-0.31)	0.05400 (0.94)	-0.15256 (-1.34)	0.001
	Netherlands Indies	446	0.00354 (2.87)	0.02612 (1.19)	0.06685 (1.31)	0.003
Utilities	Hong Kong	266	-0.00204 (-0.34)	0.06543 (0.84)	-0.01708 (-0.06)	-0.006
	Shanghai	443	0.00341 (1.57)	-0.02816 (-0.70)	-0.15289 (-1.67)	0.003
Equal Weight Index of All Sample Stocks	British Malaya	450	0.00055 (0.22)	0.17302 ** (3.61)	-0.02849 (-0.33)	0.023
	Hong Kong	450	0.00033 (0.13)	0.03870 (0.93)	0.00601 (0.07)	-0.003
	Netherlands Indies	449	0.00219 (1.79)	0.02457 (1.21)	0.16094 (3.72)	0.019
	Shanghai	451	0.00327 (1.63)	-0.02029 (-0.58)	-0.12144 (-1.52)	0.001

Table 4. Regressions of Commodity Price Changes on Opium Price Changes

Monthly commodity price changes are regressed on opium price changes, global stock index returns, and a constant. Time period is ordinarily January 1873 to June 1911 but missing observations may reduce this. T-statistics reported in parentheses beneath each coefficient estimate are adjusted for serial correlation and heteroskedasticity. See Whitney K. Newey, and Kenneth D. West, A Simple, Positive Semi-Definite, Heteroskedasticity and Autocorrelation Consistent Covariance Matrix, *Econometrica* 55, 3 (1987): 703-08, and Halbert White, "A Heteroscedasticity-Consistent Covariance Matrix Estimate and A Direct Test for Heteroscedasticity", *Econometrica* 48, 4 (1980): 817-38. ** (*) indicates statistical significance for opium at the 5 per cent (10 per cent) level.

Commodity	Number of observations	Constant	Slope coefficient on opium price change	Slope coefficient on global stock index return	Adjusted R^2
Tin	451	-0.00180 (-0.72)	0.18126 ** (3.65)	0.55897 (4.38)	0.082
Gambier	450	-0.00100 (-0.37)	0.12247 ** (2.34)	0.19065 (1.82)	0.014
Black Pepper	442	-0.00309 (-0.99)	0.13132 * (1.83)	0.36143 (2.65)	0.024
Tapioca	380	-0.00148 (-0.39)	0.15599 * (1.78)	0.14569 (0.94)	0.009
Sago	448	-0.00231 (-0.79)	0.18900 ** (3.02)	0.22277 (1.54)	0.020
Liberian Coffee	257	-0.00233 (-0.52)	0.20521 ** (2.03)	-0.07134 (-0.38)	0.025
Copra	317	.001185 (0.36)	0.24645 ** (4.40)	-.23834 (-1.69)	0.060

Table 5. Regressions of Annual Changes in Straits Settlements Commodity Exports, Colonial Government Revenues, and Agricultural Worker Immigration on Annual Opium Price Changes

Log-differences of these annual economic indicators are regressed on opium price changes and a constant. The number of observations indicates differing amounts of data available, but all series extend to June 1911, only the starting points differ. T-statistics reported in parentheses beneath each coefficient estimate are adjusted for serial correlation and heteroskedasticity. See Whitney K. Newey, and Kenneth D. West, A Simple, Positive Semi-Definite, Heteroskedasticity and Autocorrelation Consistent Covariance Matrix, *Econometrica* 55, 3 (1987): 703-08, and Halbert White, "A Heteroscedasticity-Consistent Covariance Matrix Estimate and A Direct Test for Heteroscedasticity", *Econometrica* 48, 4 (1980): 817-38. ** (*) indicate statistical significance for opium at the 5 per cent (10 per cent) level.

Series	Regression				Rank correlation (p-value)
	Number of observations	Constant	Slope coefficient on opium price change	Adjusted R^2	
Government opium revenue	42	0.0494 (1.756)	-0.1351 (-0.632)	-0.011	.074 (.642)
Government total revenues	42	0.0481 (3.164)	0.0134 (0.199)	-0.024	.053 (.741)
Government total expenditures	42	0.0446 (2.654)	-0.0863 (-0.791)	-0.007	-.039 (.805)
Chinese immigration, total	14	-0.0751 (-1.183)	0.2483 (1.278)	-0.008	.066 (.823)
Female Chinese immigration	14	-0.0357 (-0.647)	0.1499 (0.906)	-0.047	-.073 (.805)
Male Chinese immigration	14	-0.0778 (-1.239)	0.2523 (1.275)	-0.010	.035 (.905)
Opium imports	16	-0.0828 (-1.03)	0.421 ** (2.294)	-0.021	.331 (.210)
Tin exports	16	0.0289 (3.257)	-0.114 ** (-3.822)	0.266	-.375 (.152)
Pepper exports	16	0.0323 (1.189)	-0.16 (-1.082)	-0.001	-.275 (.302)
Gambier exports	16	-0.0458 (-4.198)	-0.0648 * (-1.943)	-0.002	-.361 (.170)
Rubber exports	9	0.695 (8.759)	-0.703 ** (-2.728)	0.404	-.912 (<.001)

Table 6. Lead-Lag Associations between Monthly Changes in Opium Prices and Changes in Export Commodity Prices

This table reports estimates of regressions of commodity price relatives on leads and lags of opium price relatives. Time period is ordinarily January 1873 to June 1911 but missing observations may reduce this. T-statistics reported in parentheses beneath each coefficient estimate are adjusted for serial correlation and heteroskedasticity. See Whitney K. Newey, and Kenneth D. West, A Simple, Positive Semi-Definite, Heteroskedasticity and Autocorrelation Consistent Covariance Matrix, *Econometrica* 55, 3 (1987): 703-08, and Halbert White, "A Heteroscedasticity-Consistent Covariance Matrix Estimate and A Direct Test for Heteroscedasticity", *Econometrica* 48, 4 (1980): 817-38. ** (*) indicates statistical significance for opium at the 5 per cent (10 per cent) level.

Commodity	Number of observations	Constant	Slope coefficient on opium price change:							Adjusted R^2
			Lead 3	Lead 2	Lead1	Contemporaneous	Lag1	Lag2	Lag3	
Tin	438	-0.0003	0.047	-0.004	0.017	0.187 **	0.035	-0.011	0.019	0.020
		(-0.124)	(0.997)	(-0.067)	(0.371)	(3.40)	(0.648)	(-0.211)	(0.382)	
Gambier	438	-.001	0.026	-0.016	0.067	0.108 *	-0.032	-0.065	0.032	0.010
		(-0.259)	(0.529)	(-0.357)	(1.44)	(1.95)	(-0.662)	(-1.43)	(0.678)	
Black Pepper	429	-0.002	0.057	0.080	0.077	0.132 *	-0.067	-0.11	-0.018	0.016
		(-0.765)	(0.97)	(1.39)	(1.08)	(1.80)	(-1.07)	(-1.66)	(-0.27)	
Tapioca	373	-0.001	-0.044	-0.023	-0.09	0.133	0.18 *	-0.115	0.09	0.020
		(-0.242)	(-0.64)	(0.29)	(-1.25)	(1.51)	(2.36)	(-1.46)	(1.30)	
Sago	436	-0.001	0.04	0.006	0.112 *	0.179 **	0.043	0.003	-0.101 *	0.017
		(-0.453)	(0.61)	(0.10)	(1.66)	(2.63)	(0.66)	(0.05)	(-1.71)	
Liberian Coffee	254	-0.003	0.038	-0.09	-0.0003	0.193 **	-0.010	0.02	0.144	0.029
		(-0.69)	(0.45)	(-1.08)	(-0.004)	(2.10)	(-0.12)	(0.196)	(1.61)	
Copra	314	-0.0001	0.062	0.007	0.006	0.233 **	-0.03	-0.094	-0.03	0.050
		(-0.04)	(1.14)	(0.13)	(0.11)	(3.90)	(-0.52)	(-1.60)	(-0.62)	

Figure 1. End-of-month price of Benares opium in Singapore, Straits dollars per chest