The Colonization of Hong Kong: Establishing the Pearl of Britain-China Trade

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Abstract

We construct a staged development framework with multi-period discrete choices to study the colonization of Hong Kong, which facilitated the trade of several agricultural and manufactured products, including opium, between Britain and China. The model is particularly designed based on historical data and documentation collected from various sources. We show theoretically how institutions changed in response to the underlying key primitives and lead to the transition from the pre-Opium War era, to the post-Opium War era and then to the post-opium trade era, which span the period 1773-1933. Finally, we support our theoretical findings with historical evidence.

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1 Introduction

> "*Attempting to understand economic, political, and social change ... requires a fundamental recasting of the way we think. Can we develop a dynamic theory comparable in elegance to general equilibrium theory? The answer is probably not. But if we can achieve an understanding of the underlying process of change then we can develop somewhat more limited hypotheses about change that can enormously improve the usefulness of social science theory in confronting human problems*" (North 2006, p. vii).

Hong Kong, known as the "Pearl of the Orient," came on the platform of the global economy towards the last two decades of the nineteenth century, when it grew as a key entrepot for the Britain-China trade. Since then, it has become, together with Shanghai, one of the two most important economic centers that bridge the East with the West. Although Hong Kong was just one of the English-speaking colonies (see Acemoglu, Johnson and Robinson, 2001), it played a unique and distinctive role in *facilitating the Britain-China trade*. Also, in contrast with many other colonies that experienced a relative stagnation, Hong Kong was transformed into one of the four rapidly growing Asian Tigers and soon after joined the league of developed economies.

In spite of its rich economic history, the miraculous development of Hong Kong that unfolded over the past two or three centuries remains largely unexplored. This paper attempts to narrow the gap by highlighting the role played by Hong Kong, prior to World War II (WWII), as the pearl of the Britain-China trade. It was this role that helped pave Hong Kong's path of phenomenal development, making it one of the most successful countries in the world.[1]

To study this trade-induced colonization, it is most relevant to understand the historical development of Hong Kong between the years 1709, when Britain authorized the East India Company (EIC) to organize its trade with China, and 1941, when Japan occupied Hong Kong. In our paper, however, we start with 1773, when official recording of opium trade began, and end with 1933, because consistent trade data are available only until this year. We divide the chronicle of this historical time span in three distinct subperiods.

[1] Acemoglu, Johnson and Robinson (2005a) remark that, among Western European countries, Atlantic traders grew much faster and in a more sustainable manner than nontraders. In this regard, the colonization of Hong Kong was also significant in contributing to British development.

(i) The pre-Opium War era (1773-1839): with EIC essentially monopolizing the Britain-China bilateral trade throughout almost the entire subperiod and with the British government valuing both the volume of trade and the induced net silver flow, opium trade became gradually so important that eventually turned the British trade deficit into a surplus. Moreover, during this subperiod we observe an upward trend in both the quantity and the price of opium.

(ii) The post-Opium War era (1861-1917): after the Opium Wars and the colonization of Hong Kong (1840-1860), opium trade became legal.[2] The share of opium in British exports to China rose sharply over the next three decades following the last war, subsequently decreased gradually over the period 1892-1906 and finally dropped to zero a few years after the establishment of the Republic of China, which formally took place in 1912.

(iii) The post-opium trade era (1918-1933): with all parts of the opium complex being regulated, the bilateral trade between Britain and China gradually diminished; nevertheless, Hong Kong continued to play its significant role as the pearl of the Britain-Orient commerce.

We shall refer to these three subperiods as Phase I, II and III, respectively.

There is no doubt that a thorough study of the colonization process of Hong Kong is interesting. Yet, the big question is whether it is possible to develop a dynamic theory that endogenizes the institution and takes into account economic, political and social changes in this historic event. Despite North's pessimism about such an endeavor (see North 2006 and the quote before the Introduction), the political economy frameworks for endogenous institutions constructed in Acemoglu and Robinson (2000, 2001, 2008), Dewatripont and Roland (1992) and Lagerlöf (2009) have convincingly shown the feasibility of meeting this challenge (see also the survey by Acemoglu, Johnson and Robinson, 2005b). Methodologically, our paper contributes to the literature by proposing *a staged development framework with multi-period discrete choices* to endogenize institutions in a tractable manner.

To be more specific, we construct a dynamic model with the staged development of the colonization of Hong Kong captured in the aforementioned three phases. Based

[2]The colonization of Hong Kong and the legalization of opium trade were among the provisions of the Treaty of Nanking (1842), the Treaty of Tiensin (1858) and the Convention of Peking (1860) (see below).

on the economic data collected from limited sources and many historical documents, we design a model with the following key features:

(i) In addition to a composite good, we explicitly model opium production and trade.

(ii) We regard the British government and EIC as the two main organizations in action and permit the institutions to change over the three phases. The major institutions considered include the barriers that Britain faced in trading opium, the British government's subsidy rule to EIC, the declaration of wars and the decision on banning opium trade after the founding of the Republic of China.[3]

(iii) We allow the British government to value both the volume of trade with China and the resultant net silver inflow. Moreover, we take into account both the resource cost involved in the war and the moral cost associated with trading opium.

(iv) Given the addictive nature of opium, we model its demand as not too sensitive to its relative price. Also, given the observed comovement between the quantity and the relative price of opium, we allow for the presence of an opium demand shock.

(v) Finally, given the evolutionary nature of history, we solve a multi-period discrete choice problem and characterize the transition from Phase I (the pre-Opium War era), to Phase II (the post-Opium War era), and then to Phase III (the post-opium trade era).

For theoretical tractability, the declaration of wars and the decision on banning opium trade are both modeled as *discrete choices*, through which the endogenous transition from one phase to another can be fully characterized.

Our main findings concerning the colonization of Hong Kong are three-fold. First, due to high warfare and low opium trading costs initially, Phase I lasted for a long period of almost 70 years (1773-1839). Second, due to high valuation of the total volume of trade, high opium trading costs and the expectation of a continuously rising opium demand, the war was declared. This led to the transition to Phase II, during which the Hong Kong colony was established and opium trade became legal. Finally, due to a significant drop in opium demand and a rising opium trading cost, opium

[3]Following North (1994), we regard "organizations" as the players who are made up of groups of individuals with common objective and "institutions" as the rules of the game.

trade was abandoned, causing the transition to the post-opium trade era (Phase III). In the remainder of the paper, we shall elaborate on these underlying factors driving the two critical transitions by verifying them theoretically, using comparative-static analysis, and supporting the various channels with historical data and documents.

2 Historical Background

In this section, we provide a brief chronicle of the historical development of Hong Kong from 1773 to 1933. We then highlight three important observations that will guide the design of our model.

2.1 A Chronicle of the Development of Hong Kong

While there has been a long history of exchange between Britain and China, the high volume and more organized form of trade between these two giants started after the turn of the seventeenth century. Established in 1600 and merged with a new "parallel" company in 1709, EIC served as "a means of regulating international trade" (Gull 1943, p. 3).[4] The EIC era was terminated in 1833. Soon after, in 1840, there was the outbreak of the first Opium War. After fierce military and political fights that lasted for two decades, the post-treaty period began; from 1860 and onward, opium trade was fully legalized until 1917, that is, several years into the Republic of China era, which formally began on January 1, 1912.[5]

The Pre-Opium War Era: 1773-1839

The British involvement, through EIC, in the trade of opium started in Canton in 1773 and is estimated at 1000 chests per year (Gull 1943, p. 13).[6] Throughout this era, both the shipments and price of opium rose. However, while the price of opium went up only by 70 percent, the shipments of opium increased drastically by forty times. More specifically, between 1811 and 1835, the annual average number of chests of opium exported to China rose more than three times indicating that opium

[4]Both James Mill and John Stuart Mill worked for EIC and eventually both became head of the office at East India House in London.

[5]Opium imports from India (a British colony at the time) came to an end by 1917 under the agreement of the British and Chinese governments. Historians often relate this date to the year after the death of the President of the Republic of China, Shikai Yuan, in 1916.

[6]Details on all units of measurement are given in the Appendix.

trade had become relatively more significant over time (see Chart 1).[7] For example, based on the record of EIC in 1828, opium accounted for more than 55% of the total export value to China. In addition, in ten-years' time, from 1828 to 1838, the opium shipments to China rose by threefold, from 13,868 to 40,200 chests.

The Opium Wars and the Treaties: 1840-1860

The first Opium War formally began on June 9, 1840. Nevertheless, even before that day, it was well recognized by British merchants that a settlement of their own was needed to establish themselves "under the British flag, besides safe and unrestricted liberty of trade at the principal marts of the Empire" (Tuck 2000, vol. 9, p. 212). In fact, for the British the Opium War was beyond opium trade. It was for "the future mode of conducting the foreign trade in China" (Tuck 2000, vol. 9, p. 212).

The first Opium War lasted for more than two years and led to the Treaty of Nanking, which was signed on August 29, 1842. Among others, the treaty stipulated that (i) Hong Kong should become a British colony; (ii) Cohong (the Chinese counterpart of EIC) was to be abolished; (iii) five coastal cities, namely, Amoy, Canton, Foochow, Ningpo and Shanghai, were to open as Treaty Ports; and, (iv) there should be a decrease from 65% to 5% in the rates of duty on major trade items, such as silk, cotton, and woollens (but not tea); opium was not mentioned (Tuck 2000, vol. 9, p. 214).

The Treaty of Nanking changed the framework of foreign trade and gave Britain a most-favored-nation status.[8] Naturally, after the treaty, there was still a strong resentment against foreigners in Canton. As a result, the terms of the treaty were not respected and the hostility between the Chinese and the British started growing again. Eventually this led to the outbreak of the second Opium War in October 1856, which ended with the Treaty of Tientsin in 1858.[9] According to the terms of this treaty: (i) Kowloon was ceded to Britain; (ii) ten new Treaty Ports opened; and most importantly, (iii) opium trade was legalized (Nield 2010, pp. 130-132).

The two decades of the Opium Wars defined a transitional stage, which started

[7] According to Gull (1943), "Between 1811 and 1821 the annual average of chests imported ... was under 5,000." Also, "[B]etween 1828 and 1835 the annual average import was over 18,700" (p. 15).

[8] The previous system, known as the Canton System because it required that all foreign trade be conducted through the port of Canton, had been in force since 1760.

[9] The second Opium War was a joint effort of Britain and France; the French joined the British troops with the excuse that one of their missionaries was killed in Canton. Also, the Treaty of Tientsin was ratified by Emperor Hsien-Feng in the Convention of Peking in 1860.

with the prohibition of opium trade and ended with its full legalization. In the interest of this paper, we will not discuss this era in our model; instead, we will regard it simply as a transition point.

The Post-Opium War Era: 1861-1917

With the Treaty of Tientsin (1858) and the Convention of Peking (1860), opium trade was legalized; consequently, opium imported to China reached a high level both in absolute quantity and as a share of total imports (40%-50%) in the two decades following the Opium Wars. Starting in the mid-1880s, it gradually began to drop and eventually was reduced to zero a few years after the establishment of the Republic of China (see Chart 2).[10] Nevertheless, the price of opium was quite stable for most of the period, both in absolute and in relative (to rice) terms.

The Britain-China trade diminished by the end of the nineteenth century due to the fact that trade of opium declined. One of the main reasons for this decline is that the legalization of opium trade led to a rapid increase in the domestic production of opium in China. This Chinese production started in the provinces of Yunnan, Guizhou, and Sichuan, which together contributed over 60% of the total domestic production of opium. Between 1866 and 1894, the total area of plantation of opium, as a percentage of the total agricultural area, rose by more than seven times, from 0.2% to 1.5%. The table below presents the consumption and production of opium between 1879 and 1906 (the data are from Zhong (2010) and the units of measurement are piculs – see the Appendix for the definition).

Item	1879	1906
domestic production	334,300	587,300
import	82,927	54,117
consumption	417,227	641,417
self-support rate	80.12%	91.56%
import rate	19.88%	8.44%

It indicates that, over the years, imported opium was replaced by domestic production (see also the discussion in Zhong 2010, p. 148). Further evidence can be established using the customs and dues (known as likin) collected from opium. Specifically, while

[10]Because of different measurement units, the pre- and post-Opium War data series are not directly comparable. That is why we present each subperiod separately.

the likin collected from imported opium fell from more than 6.5 to less than 3.5 million taels over the period of 1888-1909, the likin from domestic opium rose from below 1 to over 1.5 million taels, thus indicating a significant shift from imported to domestically produced opium.[11]

The decline of imported opium can be attributed to two reasons: (i) the international opposition to opium trade based on moral judgement and value (see "The Moral Cost of Opium Trade," in Subsection 2.2) and (ii) the Britain's reduced incentives for promoting opium exports to China, since exporting opium was no longer necessary for ensuring British tea imports from China. Not only did British tea imports from China drop from 96% to 10% between 1866 and 1903, as tea was then produced in India and Ceylon, but also the openings of the Treaty Ports after the Opium Wars led to the increase in the consumption of western products (such as clocks, watches, matches, lamps, etc.) by the Chinese.

As a colony of the United Kingdom, Hong Kong acted as an important entrepot (Gull 1943, pp. 49-52). From 1854 to 1889, almost half of the British exports to China passed through Hong Kong. This proportion was gradually reduced but still amounted to about 1/3 during the period 1890-1913 (Gull 1943, p. 52). In addition, between 1865 and 1886, the imports of opium from Hong Kong exceeded the total combined imports of opium from all other Treaty Ports. From 1880 to 1913, the proportion of Hong Kong-China trade remained at 29%, even though the Britain-China trade, as a proportion of China's total trade, decreased from 76% to 48%. As a result, the share of Britain-China trade contributed by Hong Kong rose sharply from 38% in 1880 to over 60% in 1913 (Gull 1943, p. 56). Overall, Hong Kong served as the main center in the trade of opium between Britain and China. Nevertheless, by 1917, British opium exports from India to China had ceased, albeit the overall Chinese consumption of opium remained at a high level even in the twentieth century.

The Post-Opium Trade Era: 1918-1933

Although the use (and production) of opium resurfaced in China in this period, the trade of opium between Britain and China basically disappeared from the international arena. In the 1920-30 period, UK's exports of wool to China dropped significantly and were replaced by rice. Also, in 1929, China raised tariffs from the level of 5% that was established in the Treaty of Nanking to a range of 7.5%-22.5% (Gull 1943, p. 115).

[11]It should also be noted that the likin imposed on imported opium was twice the amount imposed on the domestically produced opium.

Throughout this era, Britain's relative role in China's international trade declined and the composition of the trade between them underwent through significant structural changes.

2.2 Three Important Observations

Based on historical documents, we would like to highlight three important observations that will be incorporated in our theoretical framework in an attempt to understand the colonization of Hong Kong as a crucial stage in the diachronic development of the Britain-China trade.

The British Objective

As documented in the preface and various chapters of Gull (1943), China was regarded by the British government as the main target for its trade in Asia. The ultimate goal of Britain was to facilitate such trade in a *laissez faire* manner. Moreover, it was emphasized that Britain and China derived mutual benefits from trade; thus, it seems that there was value put to both exports and imports (see, for example, Tuck 2000, vol. 2, Appendix G). Put differently, the motive of the British colonization was to do business: "there is little doubt that the spirit of commercial enterprise was the leading motive of the British colonial policy, and it was the British pursuit of trade in the East, which brought China and Britain into confrontation" (Bard 2000, p. 7).

To illustrate the long-run trend and characteristics of the Britain-China trade volume, we must construct the real trade series based on limited data from various sources. For the period before the nineteenth century, there are no general price level data available. Instead, we are able to compute the prices of opium and tea in various years between 1761 and 1800. Opium and tea were, respectively, the most important export and import items of Britain during this period. To obtain real trade statistics, we therefore deflate the data of total British exports and imports to and from China using the computed prices. These are exhibited in Chart 3. We can see that real imports and exports increased prominently, especially after 1785.[12] In fact, this motivated Britain to pay more attention to its commercial relations with China. For the post-Opium War period, we are able to obtain both the Sauerbeck-Statist's overall price index (Mitchell 1988) and the individual prices of tradables. Chart 4 presents the results we obtained

[12]Recall that opium trade started being officially recorded in 1773. This highlights the prominent role played by opium in the development of the Britain-China trade around this year.

using the overall price index.[13] Again, this chart points to the important fact that total real trade between Britain and China rose over time during the post-Opium War period.

With regard to the composition of the Britain-China trade in the pre-Opium War period and especially before 1800, tea and silk were the two major British import items from China; they accounted for more than 70% of the total British imports from China. On the export side, there were three major items, wool, cotton and opium; these accounted for more than 80% of the total British exports to China. An important feature is that the share of opium in exports rose sharply over time from around 11% in 1773 to over 49% in 1833, while the export share of woollen products fell drastically from 41% to 10% over the same period. In the first two decades of the post-Opium War period, tea and silk continued to be the two major British import items, accounting together for about 80% of total imports. However, this pattern changed after the turn of the twentieth century. For example, in the 1920s these two items accounted for around a quarter of the total British imports. This was mainly due to the successful policy of substituting imports from China with tea produced in India and Ceylon. Similarly, opium was still the major export item of Britain, accounting for over 40% of total exports, in the first two decades of the post-Opium War period; nevertheless, its trade was essentially eliminated after 1917.

Throughout the eighteenth century Britain suffered a large and rising trade deficit in its trade with China. This deficit was covered with silver purchased from continental Europe, as Britain had been on the gold standard since the mid-eighteenth century. Chart 5 provides more details about the British silver outflows and its net export during the pre-Opium War period. In order to stop this trade imbalance, the EIC began to smuggle opium into China in the middle of the eighteenth century. In fact, the traded volume of opium rose so drastically in the next few decades that the British trade deficit and the silver outflows were initially mitigated and eventually reversed.

To facilitate the Britain-China trade, it was recommended "to obtain a grant of a small tract of ground or detached Island, but in a more convenient situation than Canton, where our present Warehouse are at a great distance from our Ships" (Tuck 2000, vol. 2, p. 237). In 1834, Lord Napier recommended Hong Kong as the base for China trade: "if the lion's paw is to be put down on any part of the south side of

[13] Alternatively, we computed the aggregate export and import price indices as Cobb-Douglas aggregators, using the expenditure shares as weights. Then, using these price levels, we deflated the trade statistics to obtain the corresponding real measures. The results were similar to those in Chart 4.

China, let it be Hongkong" (Gull 1943, p. 20). In 1839, there were further discussions about the choice of a base for the Britain-China trade. According to J. Matheson, the cofounder of the conglomerate Jardine, Matheson & Co., "the advantage of Hongkong would be that the more the Chinese obstructed the trade of Canton, the more they would drive trade to the new English settlement. Moreover, Hongkong was admittedly one of the finest harbours in the world" (Tuck 2000, vol. 9, p. 213). Indeed, as mentioned in the previous section, these views were vindicated, since in the post-Opium War era Hong Kong became the most important entrepot of trade between Britain and China. In short, the British colonization of Hong Kong was mainly driven by its geographical advantage in the promotion of trade.[14]

The Barrier to Opium Trade

The attitude of the Chinese officials towards opium was consistent over time: they regarded it as evil and unjustified. The first Imperial edict, which prohibited the sale and the opening of opium-smoking houses, was issued in 1729 (Rowntree 1905, p.11-12). Despite that, there was growing consumption of opium, which raised the awareness and concerns, regarding its devastating effects, of the Chinese high-ranking administrators even more. In 1799, another Imperial edict prohibited the importation of the drug (Rowntree 1905, p.12-13).[15] The situation was out of control by the time of Emperor Daoguang (1821-1850). For this reason, there was a proposal for legalizing opium trade and turn it into public profit. However, such a proposal was rejected by the Emperor as he replied: "It is true, I cannot prevent the introduction of the flowing poison; gain-seeking and corrupt men will for profit and sensuality, defeat my wishes; but nothing will induce me to derive a revenue from the vice and misery of my people" (Bard 1993, p. 30).

In September of 1836, the Imperial Government of China together with the Viceroy of Canton started a campaign for the eradication of opium. According to William Jardine, an opium merchant and a cofounder of Jardine, Matheson & Co., the Canton drug market was entirely closed down by June 1837. In March 1839, Tse-hsu Lin, the recently appointed Chinese Commissioner in Canton, ordered the immediate surrender of all opium brought to China. The loss of opium because of this new Chinese anti-

[14]In a broader aspect, Acemoglu, Johnson and Robinson (2000) emphasize the interplay between geography and institutional development.

[15]An even stricter edicts followed in 1813. Also, in 1809 the Governor of Canton "ordered all incoming ships to be searched and for the captain of each ship to file bonds declaring that there was no opium in the cargo. But the British ignored the order" (Nield 2010, p. 67).

opium campaign was 20,283 chests, which was worth £2.4 million at that time (Tuck 2000, vol. 9, pp. 202-3). In response, Chief Superintendent Charles Elliot proposed to the British government to compensate the merchants for the full value of their opium loss. By then the British government was directly drawn in (Tuck 2000, vol. 9, pp. 203-4). In May 1839, the Chinese officials issued an edict that commanded all the foreigners to leave China unless they agreed to sign an opium bond "assuming full responsibility before Chinese law for all ships consigned to their charge" (Tuck 2000, vol. 9, p. 203). In June 1839, "Matheson and the other British merchants were expelled from Canton for refusing to obey the orders of the Chinese Government" (Tuck 2000, vol. 9, p. 206). After that, the diplomatic relations between Britain and China became extremely tense. As Tuck writes, "The greater the recourse to illicit trading from the receiving-ships at Lintin and along the coast, the greater the danger of the Chinese Government stopping the trade ... After Lord Napier's unsuccessful attempt to force a change, Jardine observed that the Chinese seemed more determined than ever to maintain the system ... It was now realised even in London that no change was possible without a show of force, which might lead to war" (Tuck 2000, vol. 9, pp. 196-7).

All the aforementioned documents highlight the fact that a barrier to opium trade was rising over time prior to the Opium Wars. After the Opium Wars, the anti-opium attitude of the Chinese government did not change. For example, an Imperial edict, which was issued in 1906, forbade the sale of the drug (Hanes and Sanello 2002, p. 295). Moreover, the campaign that followed planned to eliminate opium consumption in China within ten years.

The Moral Cost of Opium Trade

Although exporting opium to China helped Britain balance its trade deficit from tea imports quickly, this was done with reluctance, disgrace and sinfulness, which will be referred to as the "moral cost" of opium trade. In fact, the pressure on the British government to stop the traffic of opium on moral grounds came from two different sources: British officials and citizens and other Westerners.

Several British officials were aware of the harmful effects of opium smoking. In fact, the British government was reluctant to initiate a war for securing opium trade: "if it should be made a positive requisition ... that none of that drug (opium) should be sent by us to China, you must accede to it rather than risk any essential benefit by contending for a liberty in this respect, in which case the sale of our Opium in Bengal must be left to take its chance in an open market" (Tuck 2000, vol. 2, Appendix

G, Instructions to Lord Macartney, Sept. 8, 1792 by Henry Dundas, p. 239). Also, Charles Elliot, the Chief Superintendent at Canton from 1836 to 1841, detested opium trade: "Elliot saw it as a disgrace and a sin and the blackest stain on the British character. It has even been suggested that Elliot, under instructions to protect the opium traders - a task he resented - deliberately disobeyed his orders and demanded less from the Chinese than the Government at home had ordered him to do" (Bard 2000, p. 12).

In 1840, a bill of censure that condemned the government's military action to the opium crisis in China, which was introduced by Sir Robert Peel, the leader of the Tory opposition, was defeated in the House of Commons by a close vote of 271 to 262.[16] Later in 1857, when another bill of censure was introduced to condemn the behavior of government officials in the second Opium War, a coalition of Radical and Tories (Conservatives) won the vote with 263-247, leading to the fall of Palmerston's government (see Hanes and Sanello, 2002).

Also, after the British victory in the first Opium War and the Treaty of Nanking, Lord Shaftesbury, Anthony Ashley Cooper (1801-1885), declared, "I cannot rejoice in our successes; we had triumphed in one of the most lawless, unnecessary and unfair struggles in the records of history" (Bard 2000, p. 13). Another example of a British official who was fully aware of the devastating effects of opium is Lord Elgin, the British negotiator in the Treaty of Tientsin (1858). He had "supreme power, clear instructions, and strong backing, yet could not bring himself to tell the Chinese that the time had come when they must legalise this lucrative, but demoralising traffic" (Rowntree 1905, p. 87). Finally, "In April 1906, a private member's motion put by Liberal MP Theodore Taylor again condemned the opium trade as 'morally indefensible' and called on the new government to take measures to bring it to a speedy end" (Blue 2000, pp. 40-41).

There was an even stronger anti-opium sentiment in the British public opinion. The best summary is perhaps found in Blue (2000, pp. 37-42), who writes "If before 1895 the international balance of power allowed British authorities at home and in Asia to turn a deaf ear to protests in China, successive governments in London were steadily subjected to denunciation by the vocal anti-opium movements in Britain and the United States" (p. 37). Here we mention just a few examples of this opposition

[16]During the debate on Peel's motion, the thirty-year-old Tory MP, William Gladstone, the future Prime Minister, delivered a powerful speech against the trade of opium. Gladstone's zealousness came from personal acquaintance with the drug's harmul effects; his sister had been prescribed laudanum to help her cope with a painful illness and had become addicted to it (see Hanes and Sanello, 2002).

from other sources. An editorial in *The Times* on December 3, 1842, upon receiving the news of the Treaty of Nanking wrote that "the moment had come for Britain to extricate herself from her involvement with opium ... some moral compensation was owed to China for pillaging her towns and slaughtering her citizens in a quarrel which could never had arisen if we had not been guilty of an international crime" (Bard 2000, p. 12-13). Also, in England, after the Pharmacy Act of 1868, opium, along with other drugs, could be sold only by "pharmaceutical chemists" and not without being labeled "poison." Finally, a few years later, in November 1874, an organization, called "The Anglo-Oriental Society for the Suppression of the Opium Trade," was founded in London, having as its main purpose to make the British parliament to outlaw the deeply immoral opium trade with China. For almost forty years (1874-1916), this organization waged an unrelenting and finally successful campaign against opium traffic in China (see Brown 1973).

Opium trade was viewed as immoral by many other Westerners besides the British. Most foreign companies trading with China during the same period did not engage in opium trade. The American firms Olyphant & Co. and Nathan Dunn & Co. were two leading examples. This was due to the fact that they were Quaker disciples and their strict moral principles prevented them to participate in opium trade. In fact, the two most important anti-opium trade conferences in the early twentieth century, the 1909 International Opium Commission held in Shanghai and the 1912 International Opium Convention signed at the Hague, were outcomes of the American zeal against manufacturing and trading drugs. In sum, there was a rising anti-opium movement, based on moral grounds, against opium trade, particularly after the turn of the twentieth century and the establishment of the Republic of China. The pressure on the British government from this world-wide movement resulted in what we call "the moral cost of opium trade."

3 The Basic Model

As mentioned in the previous section, during the second half of the eighteenth and the first half of the nineteenth century (before the Opium War), the three most important export items from Britain to China were opium, cotton and wool. The major import goods from China to Britain, on the other hand, were tea and silk. Over this period, opium rose to become the single most important trade item.[17] It is therefore essential

[17] See Section 2.2 above for the related evidence.

to separate opium from all other goods in the model-economy constructed below. It should also be noted that the trade between Britain and China was essentially monopolized by EIC until 1833 when the "free trade" regime emerged. To ease the analysis, we shall group EIC and private traders together as a producer-trader entity. Moreover, we shall consider a central-planner problem: given production and trading technologies as well as the asset accumulation equation faced by the representative producer-trader, the British government, who cares about the total volume of trade and the net silver inflow resulting from its bilateral trade relations with China, seeks to optimize.[18]

Let Y^o denote the output of opium and Y^c the output of a composite consumption good comprising all other goods in the economy; this composite good is taken to be the numeraire and the relative price of opium is denoted by p. Further, denote the exports from Britain (including British India) to China and the imports from China to Britain as X_t and M_t, respectively. The total volume of trade (T_t) is then:

$$T_t = X_t + M_t. \tag{1}$$

During the pre-Opium War period, Britain incurred regularly a sizable deficit in its trade with China, which was covered with silver. In fact, the British government often injected bullion to subsidize severe silver outflows suffered by EIC.[19] This trade subsidy to the representative producer-trader is denoted by S_t and takes the form of injection of bullion. The British government's net silver inflow from trading with China (R_t) equals its trade surplus net of its subsidy to the EIC:

$$R_t = X_t - M_t - Z^T S_t, \tag{2}$$

where Z^T is an indicator of trade deficit that takes on the value one if a deficit occurs and zero otherwise; accordingly, a subsidy is provided only when a trade deficit occurs. We specify the trade subsidy in terms of the following two possible rules:

$$S_t = \begin{cases} \bar{S}_t & \text{under a fixed subsidy rule (FSR)} \\ s\left(M_t - X_t\right) & \text{under a proportional subsidy rule (PSR).} \end{cases} \tag{3}$$

In the main text, we restrict our attention only to the FSR and relegate the analysis under the PSR to the Appendix, where we show that our main findings remain qualitatively unchanged.

[18] See Section 2.2 under "The British Objective."

[19] See Chart 5 for related evidence.

The production cost of each output is given by a standard quadratic function: $q_i \left(Y_t^i\right)^2/2$, where $i = c, o$. In addition, fund (F) and labor (L) are required for trading and marketing each product. We denote the fund requirements per unit of opium and per unit of the composite good by α^o and α^c, respectively, where $\alpha^o > \alpha^c$; that is, in line with historical documentation, we assume that opium trade requires relatively more fund for networking and marketing due to the presence of legal barriers.[20] On the other hand, purely for convenience, we assume that the labor unit requirements for the two goods are the same and we denote them by β. Thus, $F_t^i = \alpha^i Y_t^i$ and $L_t^i = \beta Y_t^i$, $i = c, o$. Total fund and labor demands are then given by $F_t = F_t^c + F_t^o$ and $L_t = L_t^c + L_t^o$, respectively.

Let A_t denote the total assets accumulated by the representative producer-trader and r_t and w_t denote, respectively, the real interest rate and the real wage rate. Then, the evolution of A_t is governed by,

$$A_{t+1} = (1 + r_t) A_t + (X_t - M_t) + Z^T S_t - w_t L_t - F_t - \frac{q^c}{2} (Y_t^c)^2 - \frac{q^o}{2} (Y_t^o)^2 , \qquad (4)$$

that is, the sources of asset accumulation include gross interest, trade surplus and government trade subsidy, net of production, trading, networking and marketing costs.

Let Z^o be an indicator of opium production that takes on the value one if opium is produced and zero otherwise. Since opium is a "bad" to the Chinese civilians, its import is officially banned by the Chinese government (even though the ban may not be fully effective). Thus, there must be legal barriers associated with opium trade and the outbreak of an opium war can effectively lower such barriers. We capture this unit cost of barriers in opium trade using the term $(1 - Z^w)\,\delta$, where Z^w takes on the value one if a war has occurred in the past and zero otherwise; moreover,

$$\delta = \begin{cases} \bar{\delta} & \text{before the Opium Wars when there existed trade barriers} \\ 0 & \text{after the Opium Wars when there existed free trade.} \end{cases}$$

That is, had a war never been initiated ($Z^w = 0$), the cost barrier per unit of opium would be $\bar{\delta} > 0$; after a war has occurred ($Z^w = 1$), this unit-cost barrier takes the value of zero. Since we will divide the time interval between the end of the Opium Wars and the end of our analysis into two periods (the post-Opium War period and

[20] In the 1830s, opium was the largest British export item to China (see Section 2.2 for supporting evidence). As Nield (2000) wrote, "Opium had by now overtaken cotton as the most valuable import to China, and was therefore well worth the *considerable investment being made in its shipment and distribution*" (p.70; italics added).

the post-opium trade period), it is necessary to employ both the indicator function Z^w and the measure of the size of such legal barriers δ (to be discussed in the next section). Britain's exports to China then can be written as

$$X_t = Y_t^c + Z^o p_t Y_t^o \left[1 - \left(1 - Z^w\right) \delta\right] = Y_t^c + \psi(p_t) Y_t^o, \tag{5}$$

where $\psi(p_t) \equiv \left[1 - \left(1 - Z^w\right) \delta\right] Z^o p_t$ represents the effective relative price of opium.

Based on the historical documents (see Section 2.2 under "The British Objective"), the period-by-period objective of the British government is specified as: $(1-\zeta)\left[U(R_t) + \theta H\left(T_t\right)\right]$, where both U and H are concave functions with positive but diminishing marginal utilities, $\theta > 0$ and $\zeta \in (0,1)$. The interpretation of the flow utility is as follows. First, the British government gets utility directly from having net silver inflows, as captured by the term $U(R_t)$. Second, as emphasized in internal correspondence and documents, other things equal, the British government prefers a larger trade volume and this is indicated by $H\left(T_t\right)$. The parameter θ measures the weight that the government puts on the volume of trade relative to that of silver inflows. Third, since opium is an addictive with detrimental socioeconomic consequences, its production and trade are considered immoral (see Section 2.2 under "The Moral Cost of Opium Trade"). We use ζ to measure the unit moral cost of selling opium, at which rate the overall flow utility is discounted. It is obvious that, with greater self-awareness upon establishing national identity and dignity in China, the unit moral cost associated with exporting opium to China rises.[21] For simplicity, we normalize the unit moral cost of trading opium to zero for the period before the establishment of the Republic of China (when all opium imports from British India ceased) and denote with $\bar{\zeta}$ the differential unit moral cost during the Republic of China period. We thus have the following specification:

$$\zeta = \begin{cases} \bar{\zeta} & \text{during the Republic of China regime} \\ 0 & \text{before the Republic of China regime.} \end{cases}$$

We can now write the Bellman equation associated with the value function of the British government as:

$$V\left(A_t\right) = \max\left\{(1-\zeta)\left[U(R_t) + \theta H\left(T_t\right)\right]\right\} + \frac{1}{1+\rho} V\left(A_{t+1}\right), \tag{6}$$

[21] Under pressure from the international community "in 1913 Britain signed the Hague anti-opium treaty, committing itself to the eventual elimination of the worldwide opium trade. The Hague treaties tied Great Britain to a new vision of cooperative internationalism" (Baumler 2007, p. 82).

subject to (4), where ρ is the time discount rate of the British government. Substituting (2), (1), (5) and the associated production/trading costs of opium into (4) and (6), we can then write the central planner's optimization problem as:

$$V(A_t) = \max\{(1\text{-}\zeta)\left[U\left(Y_t^c + \psi(p_t)Y_t^o - M_t - Z^T S_t\right) + \theta H\left(Y_t^c + \psi(p_t)Y_t^o + M_t\right)\right]\} + \frac{V(A_{t+1})}{1+\rho},$$

$$s.t.\ A_{t+1} = (1+r_t)A_t + Z^T S_t - M_t + (1\text{-}\alpha^c\text{-}\beta w_t)Y_t^c + [\psi(p_t)\text{-}\alpha^o\text{-}\beta w_t]Y_t^o - \frac{q^c(Y_t^c)^2 + q^o(Y_t^o)^2}{2},$$

and $M_t \geq 0$, $S_t \geq 0$, $Y_t^c \geq 0$, $Y_t^o \geq 0$, where the optimization is performed with respect to M_t, S_t, Y_t^c, Y_t^o.

We note that viewing Britain's behavior as the outcome of the central planner's optimization problem specified above is realistic given the documented cooperative relation between the British government, on the one hand, and EIC/private traders, on the other (see Section 2 above). For brevity, we present all first-order and the Benveniste-Scheinkman conditions in the Appendix.

To close the model, we let $D^o(p, \kappa)$ be the Chinese demand for British opium, where κ is an autonomous component that stands for an increase in the opium demand function. The introduction of κ facilitates the capture of the observed positive comovement between opium price and quantity (see Section 2.1, under "The Pre-Opium War Era: 1773-1839"). Let also $D^M(\bar{I})$ be the British demand for import goods from China, where $\bar{I}$ is the exogenously given income of the British. We follow common practice and assume that $\partial D^o(p)/\partial p < 0$ and $\partial D^M(\bar{I})/\partial \bar{I} > 0$, that is, the demand for opium slopes downward (with price) and the British demand for importables rises with British income. Equilibrium in the market of each of the two goods requires equating the demand with the corresponding supply:

$$D^o(p_t) = Y_t^o, \tag{7}$$

$$D^M(\bar{I}_t) = M_t. \tag{8}$$

4 Equilibrium Analysis

We focus on the addictive nature of opium and assume:

Assumption 1: $\varepsilon_p^o < 1$.

That is, the demand for opium is not very sensitive to changes in its relative price.

Following the historical background delineated in Section 2.1, we shall divide the whole period of pre-WWII Britain-China trade into three phases (see Figure 1 for the time line):

(i) Phase I (the pre-Opium War era): $Z^T = 1$, $Z^w = 0$, $Z^o = 1$, $\zeta = 0$, $\delta = \bar{\delta} > 0$.

(ii) Phase II (the post-Opium War era): $Z^T = 0$, $Z^w = 1$, $Z^o = 1$, $\zeta = 0$, $\delta = 0$.

(iii) Phase III (the post-opium trade era): $Z^T = 0$, $Z^w = 1$, $Z^o = 0$, $\zeta = \bar{\zeta} > 0$, $\delta = 0$.

Phase I captures the pre-Opium War era of 1773-1839. Specifically, during this phase, opium trade was undertaken ($Z^o = 1$) either with local resistance or in an illegal environment, thereby implying higher trading barriers ($\delta = \bar{\delta} > 0$). In this phase, Britain had a deficit in its trade with China ($Z^T = 1$), which required injections of silver bullion. Phase II captures the post-Opium War era of 1861-1917. In Phase II, the British trade balance with China was reversed ($Z^T = 0$). Moreover, the Opium Wars ($Z^w = 1$) forced the legal trade of opium ($Z^o = 1$ with $\delta = 0$). Finally, Phase III captures the post-opium trade era of 1918-1933. In Phase III, the British trade surplus with China continued ($Z^T = 0$). At the same time, during the Republic of China regime, a period when trading addictive goods incurred a higher moral cost ($\zeta = \bar{\zeta} > 0$), opium trade ceased ($Z^o = 0$). The assignment of values to Z^T is suggested by Charts 3 and 4, and to Z^o by Charts 1 and 2.

Next, we provide a characterization of the stationary equilibrium for each of the three phases.

4.1 Phase I: The Pre-Opium War Era

Substituting the parameter values that describe this phase ($Z^T = 1$, $Z^w = 0$, $Z^o = 1$, $\zeta = 0$, $\delta = \bar{\delta} > 0$) into the stationary version of the first-order and market-equilibrium conditions under FSR, we can obtain two critical relations concerning the outputs of the composite good and opium:

$$\alpha^c + \beta w + q^c Y^c = 4, \tag{9}$$

$$\alpha^o + \beta w + q^o D^o(p) = 4\psi\left(p\right), \tag{10}$$

(recall that $\psi(p) \equiv [1 - (1 - Z^w)\,\delta]\, Z^o p$). The first expression pins down the output of the composite good right away; notice that it does not depend on the opium price p.

The second equation together with the opium market-equilibrium condition (7) yields a fixed-point mapping in the (relative) price of opium, p:

$$p = \Pi(p) \equiv \frac{1}{4\left(1-\bar{\delta}\right)}\left[\alpha^o + \beta w + q^o D^o(p)\right], \tag{11}$$

where $\Pi(0) > 0$ and $d\Pi/dp < 0$. We thus have:

Lemma 1: (Equilibrium Price in Phase I) *Under Assumption 1, there exists a unique relative price of opium p^* that solves $\Pi(p^*) = 0$ in stationary equilibrium.*

Proof: All proofs are relegated to the Appendix. ■

Utilizing (11), we can obtain the comparative static effects on the relative price of opium p^*:

Lemma 2: (Characterization of the Equilibrium Price in Phase I) *Under Assumption 1, the relative price of opium in stationary equilibrium is increasing in the effective barrier $\left(\bar{\delta}\right)$, the wage cost of opium trade (w)* and *the production cost of opium (q^o).*

Intuitively, the relative price of opium goes up to reflect the increased costs resulting from the tightening of the banning restriction $\left(\bar{\delta}\right)$ or from the higher values of w and q^o. Focusing on the effect of barriers, an increase in $\bar{\delta}$ shifts up the downward-sloping fixed-point mapping $\Pi(p)$, thereby leading to a higher fixed point of the relative price of opium.

To complete the analysis in this phase, we solve for the stationary equilibrium values of trade subsidy and of the producer-trader's assets using:

$$A = \frac{1}{r}\left[D^M(\bar{I}) - \bar{S} + 3Y^c + 3\psi(p)D^o(p) - \frac{q^c}{2}(Y^c)^2 - \frac{q^o}{2}D^o(p)^2\right], \tag{12}$$

$$U'\left[Y^c + \psi(p)D^o(p) - D^M(\bar{I}) - \bar{S}\right] = \theta H'\left[Y^c + \psi(p)D^o(p) + M\right]/2, \tag{13}$$

where the notation " $'$ " denotes total derivative. Note that equation (13) yields: $S(p) = \bar{S}$. Next, we define $\sigma_U \equiv -RU''/U'$ as the elasticity of marginal utility of net silver inflow and $\sigma_H \equiv -TH''/H'$ as the elasticity of marginal utility of total trade. We then impose:

Assumption 2: $\frac{R}{T}\frac{\sigma_H}{\sigma_U} > 1$.

Under Assumption 2, the curvature of the H function is sufficiently high compared with that of U. We can then obtain:

Lemma 3: (Characterization of Equilibrium Trade Subsidy and Producer-Trader's Assets in Phase I) *Under Assumptions 1 and 2, the trade subsidy in stationary equilibrium is negatively related to the relative price of opium, whereas the producer-trader's assets in stationary equilibrium are positively related to the opium price.*

The intuition is straightforward. If the demand for opium is price inelastic (Assumption 1) and the curvature condition of the flow utility is met (Assumption 2), then an increase in p will raise the British net silver inflow. Hence, the subsidy for offsetting the trade deficit can be reduced.[22] The effects of a change in opium price on producer-trader's assets involve both a cost effect and a silver inflow effect, where the latter depends on the price elasticity of the opium demand. First, when the price of opium goes up, the quantity demanded is reduced and hence more assets can be accumulated due to cost saving. Moreover, if opium demand is inelastic (Assumption 1), then the net silver inflow from exporting opium increases so that asset accumulation is even higher.

4.2 Phase II: The Post-Opium War Era

Given the terms that describe this phase ($Z^T = 0$, $Z^w = 1$, $Z^o = 1$, $\zeta = 0$, $\delta = 0$, implying $\psi(p) = p$ and $S = 0$), we can manipulate the first-order and market-equilibrium conditions in stationary equilibrium to obtain:

$$\frac{\alpha^o + \beta w + q^o Y^o}{p} - 1 = \Omega(p, Y^c, \kappa) \equiv \frac{U' + \theta H'}{-U' + \theta H'}, \tag{14}$$

$$p = \frac{\alpha^o + \beta w + q^o Y^o}{\alpha^c + \beta w + q^c Y^c}. \tag{15}$$

Using (14), we can write Y^c as a function of p and further apply (15) to derive a fixed-point mapping in p:

$$Y^c = Y^c(p) \tag{16}$$

$$p = \frac{\alpha^o + \beta w + q^o D^o(p)}{\alpha^c + \beta w + q^c Y^c(p)} \equiv \Psi(p) \tag{17}$$

[22]The prediction of Lemma 3 seems to be consistent with the existing empirical evidence. For instance, in the pre-Opium War era (1773-1833), the correlation coefficient between the average opium price and the British silver outflows (net exports to China) is -0.783 (0.777). It may be recalled that the trade subsidy is supposed to take the form of bullion injection (silver flows) and is inversely related to net exports.

Concerning now the composite good output schedule given by (16), Figure 2 gives the graphical representation of $Y^c(p)$ in relation to the opium price. Under the realistic assumption of opium demand being inelastic (Assumption 1), Y^c is decreasing in p so that the supply curve of Y^c is downward sloping in the relative price of opium. Furthermore, producer-trader's assets in stationary equilibrium are given by:

$$A = \frac{1}{r}\left\{ D^M(\bar{I}) + (1-\alpha^c-\beta w)\, Y^c + (p-\alpha^o-\beta w)\, D^o(p) - \frac{q^c}{2}\,(Y^c)^2 - \frac{q^o}{2}[D^o(p)]^2 \right\}. \tag{18}$$

Define the price elasticity of the composite good supply as $\eta_p^c = -(p/Y^c)(\partial Y^c/\partial p)$. The following condition then imposes unity as an upper bound on this supply elasticity:

Assumption 3: $\eta_p^c \leq 1$.

We then obtain:

Lemma 4: (Equilibrium Price and Output of Opium in Phase II) *Under Assumptions 1 and 3, there exists a unique relative price of opium p^* that solves $\Psi(p^*) = 0$ in stationary equilibrium. Moreover, the supply of the composite good is decreasing in the relative price of opium and increasing in the opium trading cost α^o, whereas the equilibrium opium price rises with the opium trading cost.*

The intuition of Lemma 4 can be understood with the help of Figure 2. A rising trading cost of opium in this period lead to an upward shift of both the opium (Y^o) and the composite-good (Y^c) supply curves. Hence, a new equilibrium resulted with a higher opium price and a larger quantity of the composite good.[23]

There are two possible cases in steady state, depending on the slope of the fixed-point mapping. The first case is $\Psi_p < 0$, where we have a downward sloping curve $\Psi(p)$. The second case is $1 > \Psi_p > 0$, which yields an upward sloping curve $\Psi(p)$, but with a slope less than unity. Both cases give us a unique p^*.

4.3 Phase III: The Post-Opium Trade Era

We finally turn to the derivation of the key stationary equilibrium equations in Phase III, when $Z^T = 0$, $Z^w = 1$, $Z^o = 0$, $\delta = 0$, $\zeta = \bar{\zeta} > 0$ and hence with the opium supply and trade completely banned $Y^o = 0$ (and with the relative price p eliminated

[23] As a matter of fact, the correlation coefficient between the opium price and the output of the composite good for the period of 1867-1917 is 0.56, which supports our findings.

throughout):

$$Y^c = \Phi(Y^c, w) \equiv \frac{1}{q^c}\left(\frac{2\theta H'}{\theta H' - U'} - \alpha^c - \beta w\right), \tag{19}$$

$$A = \frac{1}{r}\left[D^M(\bar{I}) + (1 - \alpha^c - \beta w)\, Y^c - \frac{q^c}{2}\,(Y^c)^2\right]. \tag{20}$$

Consider the following regularity condition,

Assumption 4: $\Phi(0, w) > 0$ and $\partial\Phi/\partial Y^c < 1$.

We can then establish:

Lemma 5: (Equilibrium-Composite-Good Output in Phase III) *Under Assumptions 1 and 4, there exists a unique composite-good output Y^{c^*} that solves $Y^{c^*} = \Phi(Y^{c^*}, w)$ and is decreasing in the cost of labor w.*

Since the fixed-point mapping $\Phi(Y^c, w)$ is upward sloping but flatter than the 45° line, in response to a higher wage and hence a higher trading cost, the output of the composite good must fall.

5 Phase Transitions

We can express the value function (6) in stationary equilibrium as:

$$V(\delta, \zeta) = \frac{1+\rho}{\rho}(1 - \zeta)\left[U(R) + \theta H(T)\right],$$

where both R and T on the RHS take on their optimized values. In each phase, this value function becomes:

$$V_I\left(\bar{\delta}, 0\right) = \frac{1+\rho}{\rho}\left\{U\left[Y^c + (1-\bar{\delta})pY^o - M - S\right] + \theta H\left[Y^c + (1-\bar{\delta})pY^o + M\right]\right\}, \tag{21}$$

$$V_{II}\left(0, \bar{\zeta}\right) = \frac{1+\rho}{\rho}\left(1 - \bar{\zeta}\right)\left[U\left(Y^c + pY^o - M\right) + \theta H\left(Y^c + pY^o + M\right)\right], \tag{22}$$

$$V_{III}(0, 0) = \frac{1+\rho}{\rho}\left[U\left(Y^c - M\right) + \theta H\left(Y^c + M\right)\right]. \tag{23}$$

¿From the information on the historical background (see Section 2.1), we know that the effective barrier on opium trade imposed by the Chinese government varied during the first phase. In particular, it has been recognized that in the early stages of Phase I, the effective barrier on opium trade was very low, as the Chinese officials were bribed so that they did not take any banning action in local communities. Toward the end of Phase I, however, the Ching Dynasty government decided to take serious

action by appointing Commissioner Lin to eradicate opium trade. This led to a sharp increase in the effective barrier. After the Opium Wars, opium trade was legalized and the effective barrier was removed.

Let G denote the British war expenses. We define the net welfare change from moving from Phase i to Phase j as ${}_i\Delta_j$, $i = I, II$ and $j = II, III$. Then, we have:

$$\begin{aligned} {}_I\Delta_{II}\left(\bar{\delta}\right) &= V_{II}\left(0,0\right) - G - V_I\left(\bar{\delta},0\right) \\ {}_{II}\Delta_{III}\left(\bar{\zeta}\right) &= V_{III}\left(0,0\right) - V_{II}\left(0,\bar{\zeta}\right). \end{aligned}$$

We now formulate multi-period discrete choices in our staged development framework to endogenize institutions. Specifically, for any given pair of differentials in opium trade barriers and moral costs, $\left(\bar{\delta},\bar{\zeta}\right)$, we fully characterize how changes in economic primitives may cause an endogenous regime switch in institutions, captured by the transition from one phase to another. Based on the existing historical data and documents, the primitives that we analyze include government objectives (especially the preference parameter θ) and warfare expenses (G), as well as the opium trading cost (α^o) and demand shocks (κ).

5.1 From Phase I to II: The Colonization of Hong Kong

The transition from Phase I to Phase II can be accounted for by the existence of a (unique) critical level of trade barriers, denoted as δ_c, such that ${}_I\Delta_{II}\left(\delta_c\right) = 0$. To show this, we must examine the effects of the trade barriers $\bar{\delta}$ on the welfare gain from moving from Phase I to Phase II. Consider,

Assumption 5: $G < V_{II}\left(0,0\right) - V_I\left(1,0\right)$.

The interpretation of Assumption 5 is that the gain from moving from no trade to free trade in opium is larger than the cost of wars. We can then plot the ${}_I\Delta_{II}\left(\delta\right)$ schedule in Figure 3, which is upward sloping with ${}_I\Delta_{II}\left(0\right) < 0 < {}_I\Delta_{II}\left(1\right)$. The first inequality comes from the fact that $V_I\left(0,0\right) = V_{II}\left(0,0\right)$ and the second follows Assumption 5. We therefore obtain:

Proposition 1: *Under Assumptions 1-5, there exists a unique critical level of trade-barriers δ_c such that, for any $\bar{\delta} \in (\delta_c, 1)$, a war is instigated and Phase II emerges.*

The intuition is clear. When the effective barrier is absent, there is no need to start a war. When the effective barrier is at its maximum, so that all opium trade is banned, the war is unavoidable. Thus, it is to the benefit of Britain to initiate an opium

war as long as the effective trade barrier on opium is above the threshold level δ_c. In particular, a decrease in the threshold δ_c, which is caused by a change in the primitives G, θ, α^o, or κ, is more likely to induce an institutional change and to lead eventually to the colonization of Hong Kong and the legalization of opium trade.

5.2 From Phase II to III: The Abandonment of Opium Trade

The transition from Phase II to Phase III can be accounted for by the existence of a critical level of moral cost denoted as ζ_c and defined by equation ${}_{II}\Delta_{III}(\zeta_c) = 0$. To show this, we analyze the effects of the differential moral cost $\bar{\zeta}$ on the welfare gain from moving from Phase II to Phase III. Figure 4 depicts the ${}_{II}\Delta_{III}(\zeta)$ schedule, which is increasing in ζ with ${}_{II}\Delta_{III}(0) < 0 <_{II} \Delta_{III}(1)$. The first inequality comes from the intuition that opium trade is preferred in the absence of moral cost and the second is due to the fact that $V_{II}(0,1) = 0$. This leads to:

Proposition 2: *Under Assumptions 1-4, there exists a unique critical level of moral cost ζ_c such that, for any $\bar{\zeta} \in (\zeta_c, 1)$, all opium trade ceases and Phase III emerges.*

Intuitively, when the moral cost is absent, there is no incentive for moving into Phase III, because it is strictly dominated by Phase II. When the moral cost is at its maximum, opium trade is not conducted, since it does not yield any utility; thus, Phase III is the only choice. Hence, as long as the moral cost exceeds the critical value ζ_c, it is to Britain's benefit to move into Phase III and abandon opium trade. Summarizing, a decrease in the threshold ζ_c, caused by a change in the primitives θ, α^o, or κ, is likely to induce an institutional change that will result in the abandonment of opium trade.

6 Comparative Statics

In the comparative-static exercises performed below, we consider the following categories of shocks on the critical levels of the transitional parameters δ_c and ζ_c: (i) a shock in the cost of warfare (a change in G); (ii) two structural shocks: a preference shock (a change in θ) and a cost shock to opium supply (a change in α^o); and (iii) an autonomous opium demand shock (an increase in κ). To evaluate the changes in δ_c and ζ_c resulting from these shocks, we totally differentiate ${}_{I}\Delta_{II}(\delta_c) = 0$ and ${}_{II}\Delta_{III}(\zeta_c) = 0$, respectively.

6.1 A Shock in the Cost of Warfare

Since the transition from Phase II to III does not involve G, the effect of a change in G falls only on the critical level of effective barrier δ_c. We can establish:

Proposition 3: *Under Assumptions 1-3, an increase in the warfare cost delays the transition from Phase I to Phase II.*

Graphically, a change in the military spending G shifts down the ${}_I\Delta_{II}(\delta)$ locus by the same magnitude as depicted in Figure 3. Thus, an increase in G raises the critical level of δ, i.e., for a given value of $\bar{\delta}$, as war becomes more costly, it is less likely for it to occur; hence, δ_c goes up.

6.2 Changes in Structural Parameters

We consider two types of structural shocks, one to preferences and another to opium trade cost.

6.2.1 A Preference Shock

We analyze the effects of a preference shock in favor of the volume of trade, i.e., an increase in θ. We assume that the total volume of trade rises in the Republic of China regime, which is consistent with the data (compare the total volume of trade before and after 1917 in Chart 4); that is,

Assumption 6: $T_{III} > T_{II}$.

We then obtain:

Proposition 4: *Under Assumptions 1-6, a preference shift toward the volume of trade speeds up the transition from Phase I to Phase II as well as from Phase II to Phase III.*

In Figure 3, we illustrate the effect of a rise in θ, which rotates the ${}_I\Delta_{II}(\delta)$ locus counterclockwise. Thus, δ_c decreases. As we put more weight on the volume of trade in the preference function, the critical trade barrier is more likely to decrease. Consequently, for any given $\bar{\delta}$, we are more likely to enter Phase II. In Figure 4, we depict the effect of a rise in θ, which shifts the ${}_{II}\Delta_{III}(\zeta)$ locus up; thus, ζ_c decreases. As we put more weight on the volume of trade in the preference function (an increase in θ), less emphasis is put on opium trade due to its declining share in total trade. This is also in accord with the actual experience. For instance, opium share was more than

40% in total British exports to China in the mid nineteenth century, but declined to less than 10% in the beginning of the twentieth century. As a result, for any given level of the moral cost $\bar{\zeta}$, we are more likely to enter Phase III of no opium trade.

6.2.2 A Cost Shock to Opium Supply

We consider a cost shock to opium supply by taking an increase in α^o to represent a deterioration of the business environment within which opium is traded. We assume that the direct price effect is stronger than the cross-market spillover effect via consumption substitution; that is,

Assumption 7: $\frac{\partial Y^c}{\partial \alpha^o} + \left(\frac{\partial Y^c}{\partial p_{II}} + D^o + p_{II} \frac{\partial D^o}{\partial p_{II}} \right) \frac{dp_{II}}{d\alpha^o} < 0.$

We can now establish:

Proposition 5: *Under Assumptions 1-5 and 7, a rise in the cost of opium supply delays the transition from Phase I to Phase II, but speeds up the transition from Phase II to Phase III.*

The intuition goes as follows. As the business environment within which opium is traded deteriorates (α^o increases), there is no reason for the British government to put additional effort (as mirrored by a war) into expanding opium trade. So the likelihood of starting an opium war diminishes, which is reflected in an increase in δ_c. Similarly, ζ_c falls when the production cost of Y^o increases. As α^o goes up, the opium trading environment deteriorates, and hence the cost of stopping opium trade is lower. Thus, for any given level of the moral cost $\bar{\zeta}$, we are more likely to enter Phase III of no opium trade.

6.3 An Autonomous Opium Demand Shock

Finally, we analyze the effects of an autonomous demand shock to opium trade, which in terms of our model is captured by an increase in κ. Consider,

Proposition 6: *Under Assumptions 1-3, an autonomous increase in opium demand speeds up the transition from Phase I to Phase II, but delays the transition from Phase II to Phase III.*

The intuition is readily understood. If opium demand increases, then it is worth putting more effort (e.g., initiating a war) to expand opium trade; hence, for any given $\bar{\delta}$, we are more likely to enter Phase II of the legal opium trade period . On the other

hand, if the demand for British opium drops, as a result of the sharp increase in the domestic opium supply, there is less incentive to maintain opium trade. Hence, for any given level of the moral cost $\bar{\zeta}$, we are more likely to enter Phase III of no opium trade.

7 Toward Understanding the Colonization of Hong Kong

Before proceeding further in the analysis, we tabulate our comparative-statics results.

Comparative	Critical Value		Transition	
Statics	δ_c	ζ_c	I to II	II to III
$G \uparrow$	$+$	n.a.	slower	n.a.
$\theta \uparrow$	$-$	$-$	faster	faster
$\alpha^o \uparrow$	$+$	$-$	slower	faster
$\kappa \uparrow$	$-$	$+$	faster	slower

Note: n.a. stands for non-applicable.

Using the comparative statics above, we would like to investigate the "alternative" history as suggested in the following quote by Bard (2000, p. 13):

> "*The facts of history cannot be altered. Is there then any profit in speculating what might have happened if certain events had or had not taken place? Perhaps, if there are lessons to be learned from such speculations for, after all, events of today will become history tomorrow, next year, or a century later.*"

More specifically, we are now ready to introduce the following three hypotheses, which suggest how the course of history might have been altered:

[Hypothesis 1] Due to high warfare and low opium trading costs, Phase I lasted for a long period of 70 years (1773-1842).

[Hypothesis 2] Due to high valuation of the total volume of trade, high opium trading costs and the expectation of continuously rising opium demand, the Opium Wars were declared and the Hong Kong colony emerged, leading to a transition to Phase II.

[**Hypothesis 3**] Due to a significant drop in opium demand and a rising opium trading cost, opium trade was abandoned, leading to a transition to Phase III.

These hypotheses are readily corroborated by our model, which is built to capture the historical environment and some important observations of the particular era before and after the Opium Wars. Of course, due to data limitation, it is impossible to formulate econometric tests of our hypotheses. Nonetheless, the existing historical data and documents support the proposed underlying factors driving the two transitions based on our theoretical model. They also indicate how opium trade "had determined the course of history of that period and region, and how easily that course might have been altered, preventing the conflict, and possibly subsequent imperialist policy of western nations in China" (Bard, 2000, p. 14).

Next we present a selected sample of the existing evidence, found either in the data or in historical documents, which provides support to our hypotheses. More specifically, according to our hypotheses, there are seven cases where the shocks that we consider played a pivotal role. These cases are tabulated below and are labeled D-1 to D-7.

Supporting Evidence	Hypothesis 1	Hypothesis 2	Hypothesis 3
G	high (D-1)	n.a.	n.a.
θ	n.a.	high (D-3)	n.a.
α^o	low (D-2)	high (D-4)	high (D-6)
κ	n.a.	high (D-5)	low (D-7)

(D-1) This case refers to the role played by the cost of conducting a war (G). Morse (1910) described the mission of William John Napier, the first Chief Superintendent of trade at Canton, as follows: "The chief superintendent was instructed that every effort was to be made to conform to all Chinese regulations and to consider all Chinese prejudices, and at the same time was forbidden to call in the aid of the armed forces of the Crown" (p. 121). We take this quote to indicate that Britain had no intention of initiating a war against China because warfare was high. Britain would prefer to maintain the status quo (Phase I).

(D-2) Although the Chinese government banned opium trade right from the beginning, this did not lead to a prohibitively high trading cost of opium. The reason

is that the banning acts were never seriously implemented by local Chinese officials, who were bribed by British merchants. This is reflected in the rising opium shipments shown in Chart 1.

(D-3) As documented in Charts 3 and 4, the total real Britain-China trade was rising over time during both the pre- and post-Opium War periods. This expansion of trade was one of Britain's important objectives. As Pritchard has pointed out, the basis of British-Chinese relations was "the commercial intercourse" (Pritchard 1970, Preface). Moreover, according to the instructions given to Lord Macartney by the Secretary of State for War Henry Dundas in 1792, in order to facilitate trade with China, the British government had been looking for "a more convenient situation than Canton, where our present Warehouse are at a great distance from our Ships" (Tuck 2000, vol. 2, p. 237). Naturally, the benefit from such a settlement increased with the volume of trade.

(D-4) As depicted in Chart 5, opium trade reversed the British silver outflows. Thus, opium trade had been a very important component of Britain-China trade. However, the growing consumption of opium raised the awareness and concerns regarding its devastating effects of the Chinese high-ranking administrators. In 1839, Commissioner Tse-hsu Lin ordered the immediate surrender of all opium brought to China. This raised the opium trading cost to a historically high level. Consequently, "It was now realised even in London that no change was possible without a show of force, which might lead to war" (Tuck 2000, vol. 9, pp. 196-7).

(D-5) The expectation of a continuously rising opium demand, captured by the positive demand shock (increase in κ), is supported by the positive comovement between opium quantity and price during Phase I. Using the data on opium price and shipments in the period 1773-1838, we computed the correlation coefficient to be 0.12, which verifies our claim.

(D-6) The cost of trading opium rose drastically following the success of the 1906 imperial edict that banned opium. As Blue (2000) pointed out, the success "reflected the intensification in China over the previous decade of aversion to the drug. The aversion was part of the rise in nationalist sentiment at the turn of the century, stimulated by such factors as the 1895 defeat at the hands of Japan, the subsequent new imperialist incursions by other powers, and the humiliation delivered by the anti-Boxer expeditionary forces in 1900" (p.40). "The edict also

reflected new concepts of citizenship ... creating a new category of people who would be left out of the modern concept of citizenship" (Baumler 2007, p. 56). Eventually, in 1911, Britain agreed to stop all opium exports from India into China within seven years.

(D-7) In the post-Opium War period, the rapid increase in the domestic production of opium in China led to a significant decline in the demand for imported opium. In terms of our model, this negative shock on imported opium demand seen in the data can be understood as an increase in the supply of opium. In other words, an increase in domestic supply is equivalent to a decrease in import demand; thus, there should be a negative comovement between opium quantity and price during Phase II. Indeed, the correlation coefficient between opium price and quantity in the period 1867-1917 is -0.82, which is consistent with our analysis.

In sum, while high warfare (D-1) and low opium trading costs (D-2) were the primary factors preventing initially the breakout of the Opium Wars, in the end the wars and the consequential colonization of Hong Kong were mainly driven by the British government's high valuation of the total volume trade with China (D-3), the rising opium trading cost (D-4) and the anticipated increase in China's demand for opium (D-5). Also, as a result of the anticipated increase in the opium trading cost (D-6) and the sharp drop in opium demand under the Republic of China regime (D-7), opium trade was abandoned and a period of more conventional trade with China began.

8 Concluding Remarks

We have constructed a staged development framework with multi-period discrete choices to study the trade-induced colonization of Hong Kong and the history of opium trade between Britain and China. The framework has enabled us to characterize each of the three phases involved, namely, the pre-Opium War era, the post-Opium War era and the post-opium trade era. We have also illustrated theoretically how the transition between two phases emerged in response to some key underlying factors. For the first transition, these factors included the British government's high valuation of the total volume of trade with China, the warfare cost, the cost of trading opium and the expectation of a rising opium demand. For the second transition, the key factors were a decrease in China's import demand for opium and the British government's moral cost of opium trade. Thus, we are able to explain why Britain instigated the Opium

Wars and colonized Hong Kong in mid-nineteenth century (first transition) as well as why it abandoned opium trade a few years after the turn of the twentieth century (second transition). Finally, we have put together historical data and documentation that provide support to our theoretical results.

While our model is specifically designed to capture the historical observations of the Britain-China trade during the period 1773-1933 and the colonization of Hong Kong, the general methodology and framework can be readily modified to study the establishment of other colonies, such as Korea, Macau and Taiwan, where trade also played a significant role. For example, over the long period of 442 years (1557-1999), Macau was under Portuguese occupation and served as an important center for Portuguese trade with China and Japan. During the sixteenth century and from 1848 to early 1870s, it was also a trafficking point for skilled slaves from Southern China to Portugal or South American ports.

Moreover, following the assassination of the Korean Empress Myeongseong by Japanese agents in 1895 and the Russo-Japanese War of 1904-1905, Korea came under Japanese rule with the Japan-Korea Annexation Treaty. This occupation lasted from 1910 to 1945. It formally ended with Japan's defeat in WWII. While imperialistic expansion to Northeast and Central Asia was one of the primary factors leading to this colonization, its role for trade with China, Russia and, through this, Europe was also important.

Similarly to the colonization of Korea, Taiwan was ceded to Japan from 1895 to 1945 with the Treaty of Shimonoseki, which ended the First Sino-Japanese War in 1894. The primary reason for the establishment of this colony was again Japan's imperialistic expansion, only this time to Southeast and South Asia. Yet, potential trade with Southern China and Southeast Asia played a non-negligible role.

The development experiences of these colonies are also of particular interest. Although Macau is just a short distance from Hong Kong and was also a colony of a Western European country, its development has been drastically different from that of Hong Kong. Among others, Macau lacked significantly in terms of growth compared to Hong Kong. On the contrary, Korea and Taiwan, who were both under an entirely different Imperial Japanese rule, have grown rapidly during the post-WWII period and joined Hong Kong in the group of the newly industrialized Asian Tigers. Despite such noticeably disparate development patterns, to the best of our knowledge, there is no systematic study of these colonial episodes. We regard this as a potentially fruitful avenue for future work.

References

[1] Acemoglu, Daron, Simon Johnson, and James A. Robinson (2000) "Reversal of Fortune: Geography and Institutions in the Making of the Modern World Income Distribution," *Quarterly Journal of Economics*, 117, 1231-1294.

[2] Acemoglu, Daron, Simon Johnson and James A. Robinson (2001), "The Colonial Origins of Comparative Development," *American Economic Review*, 91, 1369-1401.

[3] Acemoglu, Daron, Simon Johnson and James A. Robinson (2005a), "The Rise of Europe: Atlantic Trade, Institutional Change, and Economic Growth," *American Economic Review*, 95, 546-579.

[4] Acemoglu, Daron, Simon Johnson, and James A. Robinson (2005b) "Institutions as a Fundamental Cause of Development," in Philippe Aghion and Steven Durlauf (eds.), *Handbook of Economic Growth*, Elsevier, Amsterdam, The Netherlands, 386-347.

[5] Acemoglu, Daron, and James A. Robinson (2000) "Why Did the West Extend the Franchise? Democracy, Inequality, and Growth in Historical Perspective," *Quarterly Journal of Economics*, 115, 1167-1199.

[6] Acemoglu, Daron, and James A. Robinson (2001) "A Theory of Political Transitions," *American Economic Review*, 91, 938-963.

[7] Acemoglu, Daron, and James A. Robinson (2008), "Persistence of Power, Elites, and Institutions," *American Economic Review*, 98, 267-293.

[8] Bard, Solomon (1993), *Traders of Hong Kong: Some Foreign Merchant Houses, 1841-1899*, Urban Council, Hong Kong.

[9] Bard, Solomon (2000), "Tea and Opium," *Journal of the Royal Asiatic Society, Hong Kong Branch*, 40, 1-19.

[10] Baumler, Alan (2007), *The Chinese and Opium under the Republic: Worse than Floods and Wild Beasts*, State University of New York Press, Albany, NY, USA.

[11] Blue, Gregory (2000), "Opium For China: The British Connection," in *Opium Regimes*, ed. by Timothy Brook and Bob Tadashi Wakabayashi, University of California Press, Berkeley and Los Angeles, CA, USA.

[12] Brown, J. B. (1973), "Politics of the Poppy: The Society for the Suppression of the Opium Trade, 1874-1916," *Journal of Contemporary History*, 8, 97-111

[13] Dewatripont, Mathias and Gerard Roland (1992), "Economic Reform and Dynamic Political Constraints," *Review of Economic Studies*, 59, 703-30.

[14] Gull, Edward Manico (1943), *British Economic Interests in the Far East,* Oxford University Press, London, UK.

[15] Hanes, W. Travis III and Frank Sanello (2002), *Opium Wars*, Sourcebooks Inc., Naperville, Illinois, USA.

[16] Hsiao, Liang-Lin (1974), *China's Foreign Trade Statistics, 1864-1949,* Harvard University Asia Center.

[17] Lagerlöf, Nils-Petter (2009), "Slavery and Other Property Rights," *Review of Economic Studies*, 76, 319-342.

[18] Mitchell, B.R. (1988), *British Historical Statistics*, Cambridge University Press.

[19] Morse, Hosea Ballou (1910), *The International Relations of the Chinese Empire,* vol.1, Longmans, London, U.K.

[20] Nield, Robert (2010), *The China Coast: Trade and the First Treaty Ports*, Joint Publishing (H.K.) Co., Ltd, Hong Kong.

[21] North, Douglass C. (1994), "Economic Performance Through Time: The Limits to Knowledge," *American Economic Review*, 84, 359-368.

[22] North, Douglass C. (2006), *Understanding the Process of Economic Change*, Princeton University Press, Princeton, USA.

[23] Pritchard, E.H. (1970), *Anglo-Chinese Relations During the Seventeenth and Eighteenth Centuries*, Octagon Books, New York, U.S.

[24] Rowntree, Joshua (1905), *The Imperial Drug Trade*, Methuen and Co, London, U.K.

[25] Tuck, Patrick J.N. (2000), *Britain and the China Trade, 1635-1842,* Routledge, New York, U.S.

[26] Zhong, Wei-Min (2010), *Tea and Opium: China in the Process of Economic Globalization in the Nineteenth Century*, SDX Joint Publishing Company, Beijing, China (in Chinese).

Appendix

(For Online Publication)

In this Appendix, we summarize data sources, currency exchange rates and weight measurements. We also provide the mathematical details of the results established in the main text. Finally, we present the results under an alternative subsidy rule, namely the case of the proportional subsidy rule (PSR), where $S_t = s\,(M_t - X_t)$.

A. Summary of the Data

There are various sources, including scattered data, in Hsiao (1974) and Tuck (2000). To put together a meaningful statistical analysis, we have used proper conversions of currency and weight measurements. There were three major currencies used: the tael, the British pound and the Spanish dollar. These were converted in the following manner: (i) the basic unit of Chinese currency is the tael (tls), known as "Yuan Pao" (silver sycee), which was worth 1.208 oz. of pure silver; and, (ii) 1 tael = £1/3 or \$1.388 (Spanish dollar). Also, there were several weight measurements with the following conversion rates: (i) the chest was used as the basis for measuring opium weight; one chest of opium contained around 135 pounds of the substance; (ii) tael was also used as a weight measurement unit in China with 1 tael = $1\frac{1}{3}$ oz., 16 taels = 1 catty (Chinese kg) or $1\frac{1}{3}$ lbs; and, (iii) other weight measurement units include, 1 picul = $133\frac{1}{3}$ lbs, 1 long ton = 16.8 piculs, and 1 short ton = 15 piculs.

B. Optimization under FSR

Under fixed subsidy rule (FSR), the first-order conditions with respect to M, $\bar{S}$, Y^c and Y^o are:

$$(1-\zeta)\left(-U' + \theta H'\right) - \frac{1}{1+\rho} V'_{+1} \leq 0,\ M \geq 0, \tag{B1}$$

$$\begin{cases} -(1-\zeta)\,U' + \frac{1}{1+\rho} V'_{+1} \leq 0,\ \bar{S} \geq 0, & \text{if } Z^T = 1 \\ \bar{S} = 0, & \text{if } Z^T = 0 \end{cases} \tag{B2}$$

$$(1-\zeta)\left(U' + \theta H'\right) + \frac{V'_{+1}}{1+\rho}\left(1 - \alpha^c - \beta w - q^c Y^c\right) \leq 0,\ Y^c \geq 0, \tag{B3}$$

$$(1-\zeta)\left(U' + \theta H'\right)\psi\,(p) + \frac{V'_{+1}}{1+\rho}\left[\psi\,(p) - \alpha^o - \beta w - q^o Y^o\right] \leq 0,\ Y^o \geq 0, \tag{B4}$$

with complementary slackness, where the subscript "+1" indicates the variable in the next-period. While the last two conditions regarding the levels of outputs are standard (they equate the marginal benefit of production with the respective marginal cost), the first two deserve further comments. Concerning (B1), high imports, on the one hand, lower the British net silver inflow and reduce the representative producer-trader's asset accumulation, but, on the other, raise the total volume of trade. Imports are optimized when the marginal cost and marginal benefit are equalized. In the case

where a trade deficit occurs, (B2) indicates that the optimal level of the government subsidy to the representative producer-trader is to equalize the losses from the current net silver outflow to the gains from the higher assets accumulated in the future. Also, the Benveniste-Scheinkman equation is:

$$V' = \frac{1+r}{1+\rho} V'_{+1}. \tag{B5}$$

C. Proofs of Lemmas and Propositions

Proof of Lemma 1: Substituting the restrictions associated with Phase I into the first-order conditions (B1)-(B4) and focusing on the interior solution, we have that in stationary equilibrium:

$$-U' + \theta H' - \frac{1}{1+\rho} V' = 0, \tag{C1}$$

$$-U' + \frac{1}{1+\rho} V' = 0, \tag{C2}$$

$$U' + \theta H' + \frac{V'}{1+\rho} \left[1 - \alpha^c - \beta w - q^c Y^c\right] = 0, \tag{C3}$$

$$\left(U' + \theta H'\right) \psi(p) + \frac{V'}{1+\rho} \left[\psi(p) - \alpha^o - \beta w - q^o Y^o\right] = 0. \tag{C4}$$

Evaluating the Benveniste-Scheinkman equation (B5) in a stationary equilibrium yields $r = \rho$, whereas the asset evolution equation implies:

$$rA - M + \bar{S} + (1 - \alpha^c - \beta w) Y^c + [\psi(p) - \alpha^o - \beta w] Y^o - \frac{q^c}{2} (Y^c)^2 - \frac{q^o}{2} (Y^o)^2 = 0. \tag{C5}$$

Combining (C1) and (C2), we have:

$$U' = \frac{1}{1+\rho} V' = \frac{\theta H'}{2}. \tag{C6}$$

Then (C3) and (C6) together yield (9). Also, (C4) and (C6) together give

$$\alpha^o + \beta w + q^o Y^o = 4\psi(p). \tag{C7}$$

Combining (7) and (C7), we obtain (10), which can be manipulated to get (11). Finally, it is straightforward to obtain the following properties of $\Pi(p)$: $\Pi(0) = \frac{1}{4\left(1-\bar{\delta}\right)} \left[\alpha^o + \beta w + q^o D^o(0)\right] > 0$ and $\frac{d\Pi}{dp} = \frac{q^o}{4\left(1-\bar{\delta}\right)} \frac{\partial D^o(p)}{\partial p} < 0$. ■

Proof of Lemma 2: Straightforward differentiation yields

$$\frac{dp^*}{d\bar{\delta}} = \frac{\partial \Pi / \partial \bar{\delta}}{1 - \partial \Pi / \partial p} = \frac{p^*}{1-\bar{\delta}} \frac{1}{1 + \left(\frac{q^o D^o}{\alpha^o + \beta w + q^o D^o}\right) \varepsilon_p^o} > 0, \tag{C8}$$

where ε_p^o is the price elasticity of opium demand. The other comparative statics follow in a similar manner. ■

Proof of Lemma 3: Equation (C6) can be manipulated to yield (13). Substituting (7), (8), (9), and (C7) into (C5), we get (12). Straightforward differentiation implies:

$$S'(p) = \left(1 - \frac{R}{T}\frac{\sigma_H}{\sigma_U}\right)\left(1 + \frac{p}{D^o}\frac{\partial D^o}{\partial p}\right)(1-\delta)\,D^o = \left(1 - \frac{R}{T}\frac{\sigma_H}{\sigma_U}\right)\left(1-\varepsilon_p^o\right)(1-\delta)\,D^o, \tag{C9}$$

$$r\frac{dA}{dp} = -q^o\frac{\partial D^o}{\partial p} + \left(2 + \frac{R}{T}\frac{\sigma_H}{\sigma_U}\right)\left(1-\varepsilon_p^o\right)(1-\delta)\,D^o. \tag{C10}$$

¿From (C9), it is clear that under Assumption 1, $1-\varepsilon_p^o > 0$ and under Assumption 2, $1 - \frac{R}{T}\frac{\sigma_H}{\sigma_U} < 0$. Hence, $S'(p) < 0$. The result regarding the producer-trader's assets follows from $\frac{\partial D^o}{\partial p} < 0$ and Assumption 1, which imply, respectively, that both the first and the second term in (C10) are positive. ■

Proof of Lemma 4: Substituting the restrictions associated with Phase II into the first-order conditions and focusing on an interior stationary equilibrium, we obtain:

$$-U' + \theta H' - \frac{1}{1+\rho}V' = 0, \tag{C11}$$

$$U' + \theta H' + \frac{V'}{1+\rho}\left(1 - \alpha^c - \beta w - q^c Y^c\right) = 0, \tag{C12}$$

$$\left(U' + \theta H'\right)p + \frac{V'}{1+\rho}\left(p - \alpha^o - \beta w - q^o Y^o\right) = 0, \tag{C13}$$

$$rA - M + \left(1 - \alpha^c - \beta w\right)Y^c + \left[p - \alpha^o - \beta w\right]Y^o - \frac{q^c}{2}\left(Y^c\right)^2 - \frac{q^o}{2}\left(Y^o\right)^2 = 0. \tag{C14}$$

Also, the Benveniste-Sheinkman equation yields $r = \rho$. From (C11), we have:

$$-U' + \theta H' = \frac{1}{1+\rho}V'. \tag{C15}$$

Then (C13) together with (C15) yield (14), while (C12) together with (C13) give (15). Substituting (7) and (8) into (C14), we get (18). Also, under Assumptions 1 and 2, straightforward differentiation of $\Omega(p, Y^c, \kappa)$ yields the following:

$$\Omega_p = \frac{\partial \Omega}{\partial p} = \frac{2\theta H' U''}{\left(-U' + \theta H'\right)^2}\left(1 - \frac{R}{T}\frac{\sigma_H}{\sigma_U}\right)\left(1-\varepsilon_p^o\right)D^o > 0,$$

$$\Omega_Y = \frac{\partial \Omega}{\partial Y^c} = \frac{2\theta H' U''}{\left(-U' + \theta H'\right)^2}\left(1 - \frac{R}{T}\frac{\sigma_H}{\sigma_U}\right) > 0,$$

$$\Omega_\kappa = \frac{\partial \Omega}{\partial \kappa} = \frac{2\theta H' U''}{\left(-U' + \theta H'\right)^2}\left(1 - \frac{R}{T}\frac{\sigma_H}{\sigma_U}\right)p\frac{\partial D^o}{\partial \kappa} > 0.$$

Substituting (7) and $\Omega(p, Y^c, \kappa)$ into (14), we obtain (16), where $\frac{dY^c}{dp} = -\frac{\Gamma+\Omega_p}{\Omega_Y} < 0$, $\frac{dY^c}{d\kappa} = \frac{1}{\Omega_Y}\left(\frac{q^o}{p}\frac{\partial D^o}{\partial \kappa} - \Omega_\kappa\right)$, $\frac{dY^c}{d\alpha^o} = \frac{1}{p\Omega_Y} > 0$, and $\Gamma \equiv \left[\alpha^o + \beta w + \left(1+\varepsilon_p^o\right) q^o D^o\right]/p^2 > 0$. Next, substituting (7) and (16) into (15), we get (17), where

$$\begin{aligned}
\Psi_p &= \frac{\partial \Psi}{\partial p} = -\left(\frac{q^o D^o}{\alpha^o + \beta w + q^o D^o}\right)\varepsilon_p^o + \left(\frac{q^c Y^c}{\alpha^c + \beta w + q^c Y^c}\right)\eta_p^c, \\
1 - \Psi_p &= 1 + \left(\frac{q^o D^o}{\alpha^o + \beta w + q^o D^o}\right)\varepsilon_p^o - \left(\frac{q^c Y^c}{\alpha^c + \beta w + q^c Y^c}\right)\eta_p^c.
\end{aligned}$$

Then, under Assumptions 1 and 3, we have two alternative cases: either $\Psi_p < 0$ or $1 > \Psi_p > 0$. In either case, a unique fixed point in p is ensured. Finally, totally differentiating (17), we obtain:

$$\frac{dp^*}{d\alpha^o} = \frac{1}{1-\Psi_p}\frac{1}{\alpha^c + \beta w + q^c Y^c(p)}\left(1 - \frac{q^c}{\Omega_Y}\right).$$

Combining (7), (14), (15) and (17), we have: $\frac{dY^c}{dp} = \frac{\Omega_p}{q^c - \Omega_Y}$. Since $\frac{dY^c}{dp} < 0$ under Assumption 1, we conclude that $q^c < \Omega_Y$, which in turn yields $dp^*/d\alpha^o > 0$. ■

Proof of Lemma 5: Substituting the restrictions associated with Phase III into the first-order conditions and focusing on an interior stationary equilibrium, we obtain:

$$\left(1 - \bar{\zeta}\right)\left(-U' + \theta H'\right) - \frac{1}{1+\rho}V' = 0, \tag{C16}$$

$$\left(1 - \bar{\zeta}\right)\left(U' + \theta H'\right) + \frac{V'}{1+\rho}\left(1 - \alpha^c - \beta w - q^c Y^c\right) = 0, \tag{C17}$$

and (20). Also, the Benveniste-Sheinkman equation yields $r = \rho$. From (C16), we have

$$\left(1 - \bar{\zeta}\right)\left(-U' + \theta H'\right) = \frac{1}{1+\rho}V'. \tag{C18}$$

Substituting (C18) in (C17) yields (19). Then direct differentiation of $\Phi(Y^c, w)$ yields the following partial derivatives:

$$\begin{aligned}
\Phi_Y &= \frac{\partial \Phi}{\partial Y^c} = \frac{2\theta H' U''}{q^c\left(\theta H' - U'\right)^2}\left(1 - \frac{R}{T}\frac{\sigma_H}{\sigma_U}\right) > 0, \\
\Phi_w &= \frac{\partial \Phi}{\partial w} = -\frac{\beta}{q^c} < 0.
\end{aligned}$$

Since a rise in the wage cost should reduce production (other things equal), we can conclude from (19):

$$\frac{\partial Y^c}{\partial w} = \frac{\Phi_w}{1 - \Phi_Y} < 0 \Longrightarrow 1 - \Phi_Y > 0,$$

So $\Phi(Y^c, w)$ has a positive slope in Y^c that is less than unity. This together with the other half of Assumption 4, namely that $\Phi(0, w) > 0$, ensures the existence of a unique fixed point. ■

Proof of Proposition 1: It is clear that,

$$_I\Delta_{II}(0) = V_{II}(0,0) - G - V_I(0,0) = -G$$

Also, if the war expenses G are not too high, so that Assumption 5 is met, then

$$_I\Delta_{II}(1) = V_{II}(0,0) - G - V_I(1,0) > 0$$

since $V_{II}(0,0) - V_I(1,0) > 0$. In addition, we can derive:

$$\begin{aligned}\frac{d_I\Delta_{II}\left(\bar{\delta}\right)}{d\bar{\delta}} &= -\frac{dV_I\left(\bar{\delta},0\right)}{d\bar{\delta}} \\ &= \frac{1+\rho}{\rho}U'D^o\left(2+\frac{R}{T}\frac{\sigma_H}{\sigma_U}\right)\frac{p\varepsilon_p^o\left(\alpha^o+\beta w+2q^oD^o\right)}{\alpha^o+\beta w+\left(1+\varepsilon_p^o\right)q^oD^o} > 0.\end{aligned}$$

Thus, the $_I\Delta_{II}\left(\bar{\delta}\right)$ schedule is monotone (positively sloped) with $_I\Delta_{II}(0) < 0 < {}_I\Delta_{II}(1)$. By the Mean Value Theorem, there exists a unique critical value $\delta_c \in (0,1)$ such that $_I\Delta_{II}(\delta_c) = 0$. ■

Proof of Proposition 2: It is easily seen that

$$\begin{aligned}{}_{II}\Delta_{III}(0) &= V_{III}(0,0) - V_{II}(0,0) < 0 \\ {}_{II}\Delta_{III}(1) &= V_{III}(0,0) - V_{II}(0,1) = V_{III}(0,0) > 0.\end{aligned}$$

Moreover, we have:

$$\frac{d_{II}\Delta_{III}\left(\bar{\zeta}\right)}{d\bar{\zeta}} = -\frac{dV_{II}\left(0,\bar{\zeta}\right)}{d\bar{\zeta}} = \frac{1+\rho}{\rho}(U+\theta H) > 0.$$

Straightforward application of the Mean Value Theorem proves the existence of a unique critical value $\zeta_c \in (0,1)$ such that $_I\Delta_{II}(\zeta_c) = 0$.

Proof of Proposition 3: Recall the definition of the critical transitional parameter δ_c:

$$\begin{aligned}{}_I\Delta_{II}(\delta_c) &= V_{II}(0,0) - G - V_I(\delta_c,0) \\ &= \frac{1+\rho}{\rho}\left[U\left(R_{II}\right)+\theta H\left(T_{II}\right)\right] - G - \frac{1+\rho}{\rho}\left[U\left(R_I\right)+\theta H\left(T_I\right)\right] \\ &= \frac{1+\rho}{\rho}\left[U\left(Y^c+p_{II}Y^o-M\right)+\theta H\left(Y^c+p_{II}Y^o+M\right)\right] - G \qquad \text{(C19)} \\ &\quad -\frac{1+\rho}{\rho}\left\{U\left[Y^c+(1-\delta_c)p_IY^o-M-S\right]+\theta H\left[Y^c+(1-\delta_c)p_IY^o+M\right]\right\} \\ &= 0.\end{aligned}$$

In response to a change in G, the endogenous variables Y^c, p and S remain all unchanged. Hence, it follows from (C19) that

$$\frac{d_I\Delta_{II}(\delta_c)}{dG} = \frac{\partial_I\Delta_{II}(\delta_c)}{\partial G} = -1,$$

which proves the proposition. ■

Proof of Proposition 4: Totally differentiating (C19) yields,

$$\begin{aligned}\frac{d\delta_c}{d\theta} &= -\frac{\partial_I \Delta_{II}(\delta_c)/\partial\theta}{\partial_I \Delta_{II}(\delta_c)/\partial\bar{\delta}} \\ &= -\frac{H(T_{II}) - H(T_I) + U'(R_I) S_\theta}{U'(R_I) p_I D^o \varepsilon_p^o \left(2 + \frac{R}{T}\frac{\sigma_H}{\sigma_U}\right) \frac{\alpha^o + \beta w + 2q^o D^o}{\alpha^o + \beta w + \left(1+\varepsilon_p^o\right) q^o D^o}} < 0,\end{aligned}$$

where $S_\theta = -H'(T_I)/2U''(R_I) > 0$ and $H(T_{II}) - H(T_I) > 0$ due to the fact that Phase II is the free-trade regime after the Opium Wars and hence the trade volume is expected to increase.

Next, recall the definition of the critical transitional parameter ζ_c:

$$\begin{aligned}{}_{II}\Delta_{III}(\zeta_c) &= V_{III}(0,0) - V_{II}(0,\zeta_c) \\ &= \frac{1+\rho}{\rho}\left[U(R_{III}) + \theta H(T_{III})\right] - \frac{1+\rho}{\rho}(1-\zeta_c)\left[U(R_{II}) + \theta H(T_{II})\right] \\ &= \frac{1+\rho}{\rho}\left[U(Y^c - M) + \theta H(Y^c + M)\right] \qquad \text{(C20)} \\ &\quad -\frac{1+\rho}{\rho}(1-\zeta_c)\left[U(Y^c + p_{II}Y^o - M) + \theta H(Y^c + p_{II}Y^o + M)\right] \\ &= 0.\end{aligned}$$

Totally differentiating (C20) gives,

$$\begin{aligned}\frac{d\zeta_c}{d\theta} &= -\frac{\partial_{II}\Delta_{III}(\zeta_c)/\partial\theta}{\partial_{II}\Delta_{III}(\zeta_c)/\partial\bar{\zeta}} \\ &= -\frac{H(T_{III}) - (1-\zeta_c) H(T_{II})}{U(R_{II}) + \theta H(T_{II})} < 0,\end{aligned}$$

where the numerator is positive because, under Assumption 6, $T_{III} > T_{II}$. ■

Proof of Proposition 5: Totally differentiating (C19), taking into account the first-order conditions in each phase, we find:

$$\frac{d\delta_c}{d\alpha^o} = -\frac{\partial_I \Delta_{II}(\delta_c)/\partial\alpha^o}{\partial_I \Delta_{II}(\delta_c)/\partial\bar{\delta}} - \frac{\partial_I \Delta_{II}(\delta_c)/\partial\alpha^o}{\frac{1+\rho}{\rho} U'(R_I) p_I D^o \varepsilon_p^o \left(2 + \frac{R}{T}\frac{\sigma_H}{\sigma_U}\right) \frac{\alpha^o + \beta w + 2q^o D^o}{\alpha^o + \beta w + \left(1+\varepsilon_p^o\right) q^o D^o}},$$

so that

$$\text{sign}\left(\frac{d\delta_c}{d\alpha^o}\right) = -\ \text{sign}\left(\frac{\partial_I \Delta_{II}(\delta_c)}{\partial\alpha^o}\right). \qquad \text{(C21)}$$

The expression of $\partial_I \Delta_{II}(\delta_c)/\partial\alpha^o$ can be written as:

$$\begin{aligned}\frac{\rho}{1+\rho}\frac{\partial_I \Delta_{II}(\delta_c)}{\partial\alpha^o} &= \left[U'(R_{II})+\theta H'(T_{II})\right]\left[\frac{\partial Y^c}{\partial\alpha^o}+\left(\frac{\partial Y^c}{\partial p_{II}}+D^o+p_{II}\frac{\partial D^o}{\partial p_{II}}\right)\frac{dp_{II}}{d\alpha^o}\right] \\ &\quad \text{-}(1\text{-}\delta_c)\left[U'(R_I)+\theta H'(T_I)\right]\left(D^o+p_I\frac{\partial D^o}{\partial p_I}\right)\frac{dp_I}{d\alpha^o}+U'(R_I)S_p\frac{dp_I}{d\alpha^o} \\ &= \left[U'(R_{II})+\theta H'(T_{II})\right]\left[\frac{\partial Y^c}{\partial\alpha^o}+\left(\frac{\partial Y^c}{\partial p_{II}}+D^o+p_{II}\frac{\partial D^o}{\partial p_{II}}\right)\frac{dp_{II}}{d\alpha^o}\right] \\ &\quad \text{-}U'(R_I)(1-\delta_c)D^o(1-\varepsilon_p^o)\left(2+\frac{R}{T}\frac{\sigma_H}{\sigma_U}\right)\frac{dp_I}{d\alpha^o}.\end{aligned}$$

If the direct price effect of the supply shock to opium demand dominates the spillover effects on Y^c, so that Assumption 7 holds, then $\frac{\partial_I \Delta_{II}(\delta_c)}{\partial\alpha^o}<0$ and, from (C21), $\frac{d\delta_c}{d\alpha^o}>0$.

Similarly, differentiating (C20) yields:

$$\begin{aligned}\frac{d\zeta_c}{d\alpha^o} &= -\frac{\partial_{II}\Delta_{III}(\zeta_c)/\partial\alpha^o}{\partial_{II}\Delta_{III}(\zeta_c)/\partial\bar{\zeta}} \\ &= \frac{(1-\zeta_c)\left[U'(R_{II})+\theta H'(T_{II})\right]\left[\frac{\partial Y^c}{\partial\alpha^o}+\left(\frac{\partial Y^c}{\partial p_{II}}+D^o+p_{II}\frac{\partial D^o}{\partial p_{II}}\right)\frac{dp_{II}}{d\alpha^o}\right]}{U(R_{II})+\theta H(T_{II})},\end{aligned}$$

which is negative under Assumption 7. ■

Proof of Proposition 6: Totally differentiating (C19), we get:

$$\begin{aligned}\frac{d\delta_c}{d\kappa} &= -\frac{\partial_I\Delta_{II}(\delta_c)/\partial\kappa}{\partial_I\Delta_{II}(\delta_c)/\partial\bar{\delta}} \\ &= -\frac{\left[U'(R_{II})+\theta H'(T_{II})\right]\Lambda_{II}}{\frac{1+\rho}{\rho}U'(R_I)p_I D^o\varepsilon_p^o\left(2+\frac{R}{T}\frac{\sigma_H}{\sigma_U}\right)\frac{\alpha^o+\beta w+2q^oD^o}{\alpha^o+\beta w+\left(1+\varepsilon_p^o\right)q^oD^o}}<0,\end{aligned}$$

where $\Lambda_{II}\equiv\frac{q^o}{p_{II}\Omega_Y}\frac{\partial D^o}{\partial\kappa}-\frac{\Gamma}{\Omega_Y}\frac{dp_{II}}{d\kappa}>0$.

Similarly, total differentiating (C20) implies:

$$\begin{aligned}\frac{d\zeta_c}{d\kappa} &= -\frac{\partial_{II}\Delta_{III}(\zeta_c)/\partial\kappa}{\partial_{II}\Delta_{III}(\zeta_c)/\partial\bar{\zeta}} \\ &= \frac{(1-\zeta_c)\left[U'(R_{II})+\theta H'(T_{II})\right]\Lambda_{II}}{U(R_{II})+\theta H(T_{II})}>0,\end{aligned}$$

which completes the proof. ■

D. The Case of PSR

Under PSR, $S_t=s(M_t-X_t)$. The first-order conditions with respect to M, s, Y^c, Y^o are:

$$(1-\zeta)\left[-(1+s)U'+\theta H'\right]-\frac{1-s}{1+\rho}V'_{+1}\le 0,\ M\ge 0, \tag{D1}$$

$$\begin{cases} (M-X)\left[-(1-\zeta)U' + \frac{1}{1+\rho}V'_{+1}\right] \leq 0,\ s \geq 0, & \text{if } Z^T = 1 \\ s = 0, & \text{if } Z^T = 0 \end{cases} \tag{D2}$$

$$(1-\zeta)\left[(1+s)U' + \theta H'\right] + \frac{V'_{+1}}{1+\rho}\left(1 - s - \alpha^c - \beta w - q^c Y^c\right) \leq 0, Y^c \geq 0, \tag{D3}$$

$$(1-\zeta)\left[(1+s)U' + \theta H'\right]\psi(p) + \frac{V'_{+1}}{1+\rho}\left[(1-s)\psi(p) - \alpha^o - \beta w - q^o Y^o\right] \leq 0,\ Y^o \geq 0, \tag{D4}$$

with complementary slackness. The Benveniste-Scheinkman equation is the same as the one in the FSR case (see equation (B5)). Substituting the restrictions that describe this phase ($Z^T = 1$, $Z^w = 0$, $Z^o = 1$, $\delta = \bar{\delta}$, $\zeta = 0$,) into (D1)-(D4) we have

$$-(1+s)U' + \theta H' - \frac{1-s}{1+\rho}V'_{+1} = 0, \tag{D5}$$

$$-U' + \frac{1}{1+\rho}V'_{+1} = 0, \tag{D6}$$

$$(1+s)U' + \theta H' + \frac{V'_{+1}}{1+\rho}\left[1 - s - \alpha^c - \beta w - q^c Y^c\right] = 0, \tag{D7}$$

$$\left[(1+s)U' + \theta H'\right]\psi(p) + \frac{V'_{+1}}{1+\rho}\left[(1-s)\psi(p) - \alpha^o - \beta w - q^o Y^o\right] = 0, \tag{D8}$$

Also, the asset accumulation equation is:

$$\begin{aligned} A_{+1} \;=\; & (1+r)A - (1-s)M + (1 - s - \alpha^c - \beta w)Y^c + \\ & \left[(1-s)\psi(p) - \alpha^o - \beta w\right]Y^o - \frac{q^c}{2}(Y^c)^2 - \frac{q^o}{2}(Y^o)^2. \end{aligned} \tag{D9}$$

Combining (D5) and (D6), we have:

$$U' = \frac{1}{1+\rho}V'_{+1} = \frac{\theta H'}{2}. \tag{D10}$$

Then (D7) together with (D10) yield,

$$\alpha^c + \beta w + q^c Y^c = 4. \tag{D11}$$

Also, (D8) and (D10) give,

$$\alpha^o + \beta w + q^o Y^o = 4\psi(p). \tag{D12}$$

In steady state, we have $A_{+1} = A$. Substituting (7), (8), (9) and (C7) into (D9), we get:

$$rA - (1-s)D^M(\bar{I}) - (3+s)Y^c - (3+s)\psi(p)D^o(p) + \frac{q^c}{2}(Y^c)^2 + \frac{q^o}{2}D^o(p)^2 = 0. \tag{D13}$$

Notice that (C6)-(C7) are identical to (D10)-(D12), so our equilibrium analysis for p^*, Y^c and s is the same as the one under the FSR. Thus, proposition 1 is valid under both FSR and PSR.

Next, we write (D10) as:

$$U'\left\{(1+s)\left[Y^c+\psi(p)D^o(p)-D^M(\bar{I})\right]\right\}=\theta H'\left[Y^c+\psi(p)D^o(p)+M\right]/2,$$

which yields $s=s(p)$. Direct differentiation shows that

$$s'(p)=\frac{1+s-\frac{R}{T}\frac{\sigma_H}{\sigma_U}}{M-X}\left(1-\varepsilon_p^o\right)\left(1-\bar{\delta}\right)D^o. \tag{D14}$$

Consider Assumption 2′, which is analogous to but stronger than Assumption 2.

Assumption 2′: $\frac{R}{T}\frac{\sigma_H}{\sigma_U}-s>1$.

Then we can establish the results of Lemma 3, namely that under Assumptions 1 and 2′, the trade subsidy in stationary equilibrium is negatively related to the relative price of opium, whereas the producer-trader's assets in stationary equilibrium are positively related to the opium price. The former result follows directly from equation (D14). To obtain the latter, differentiate (D13) to obtain exactly the same expression as in the case of FSR, namely equation (C10).

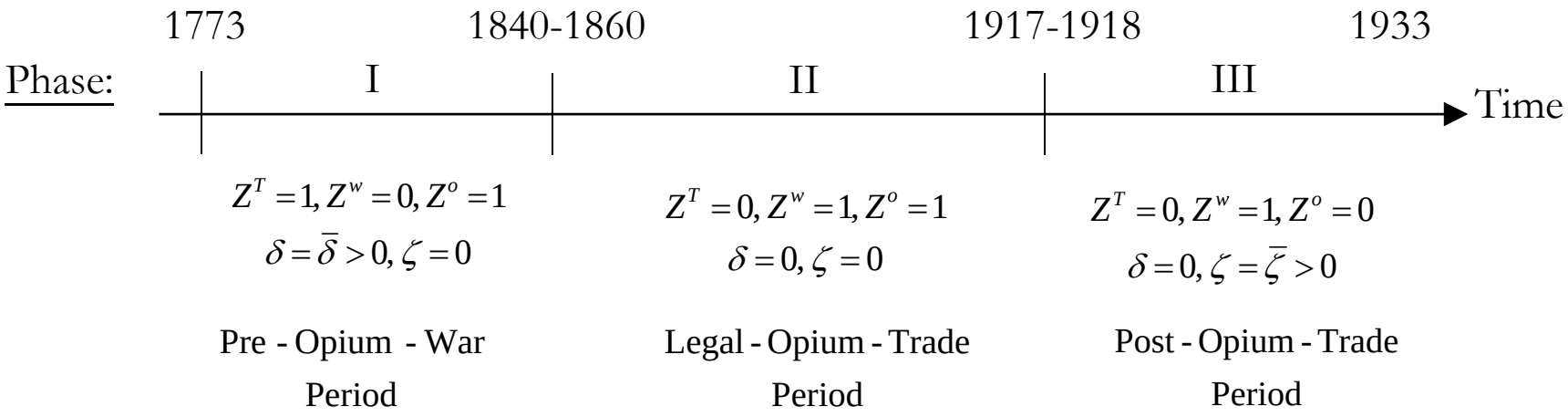

Figure 1: The Time Line

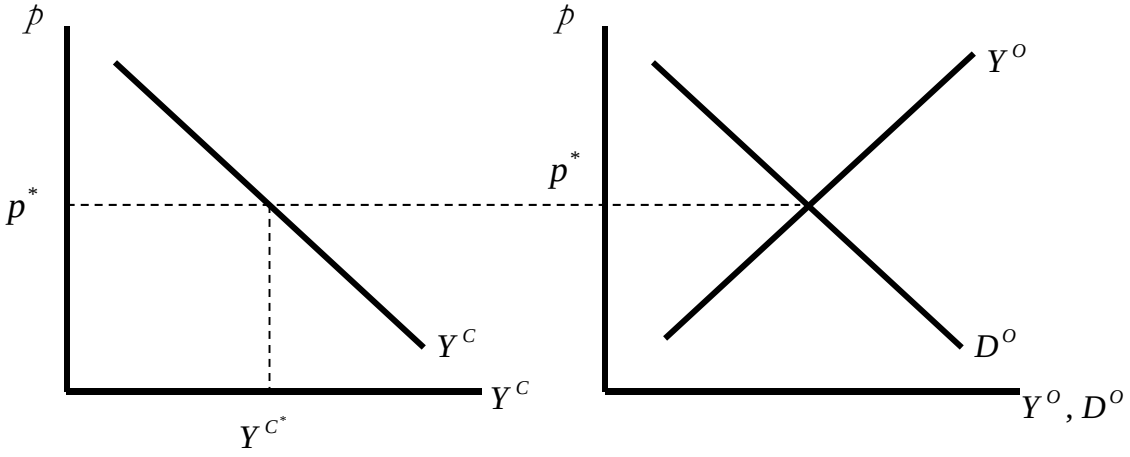

Figure 2: Goods Market Equilibrium in Phase II

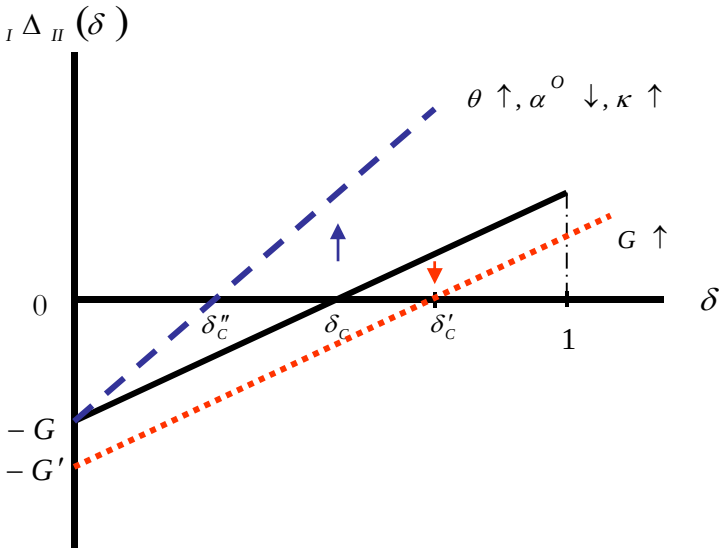

Figure 3: Comparative Statics on the Transition from Phase I to II

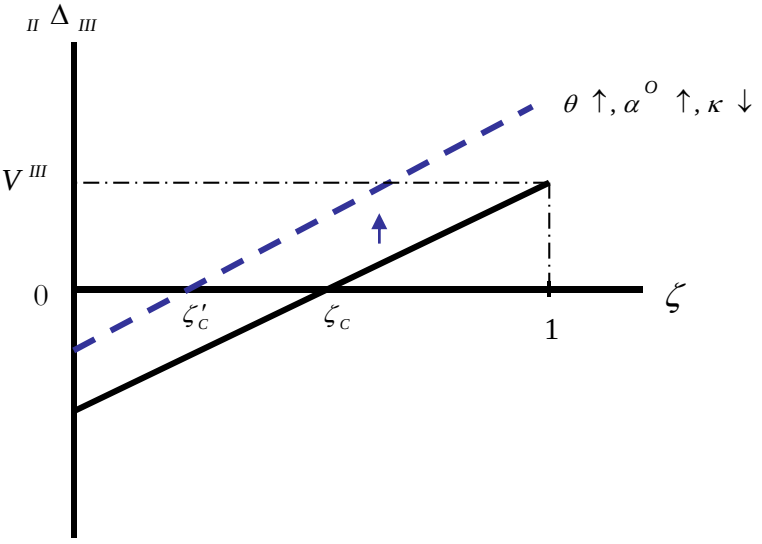

Figure 4: Comparative Statics on the Transition from Phase II to III

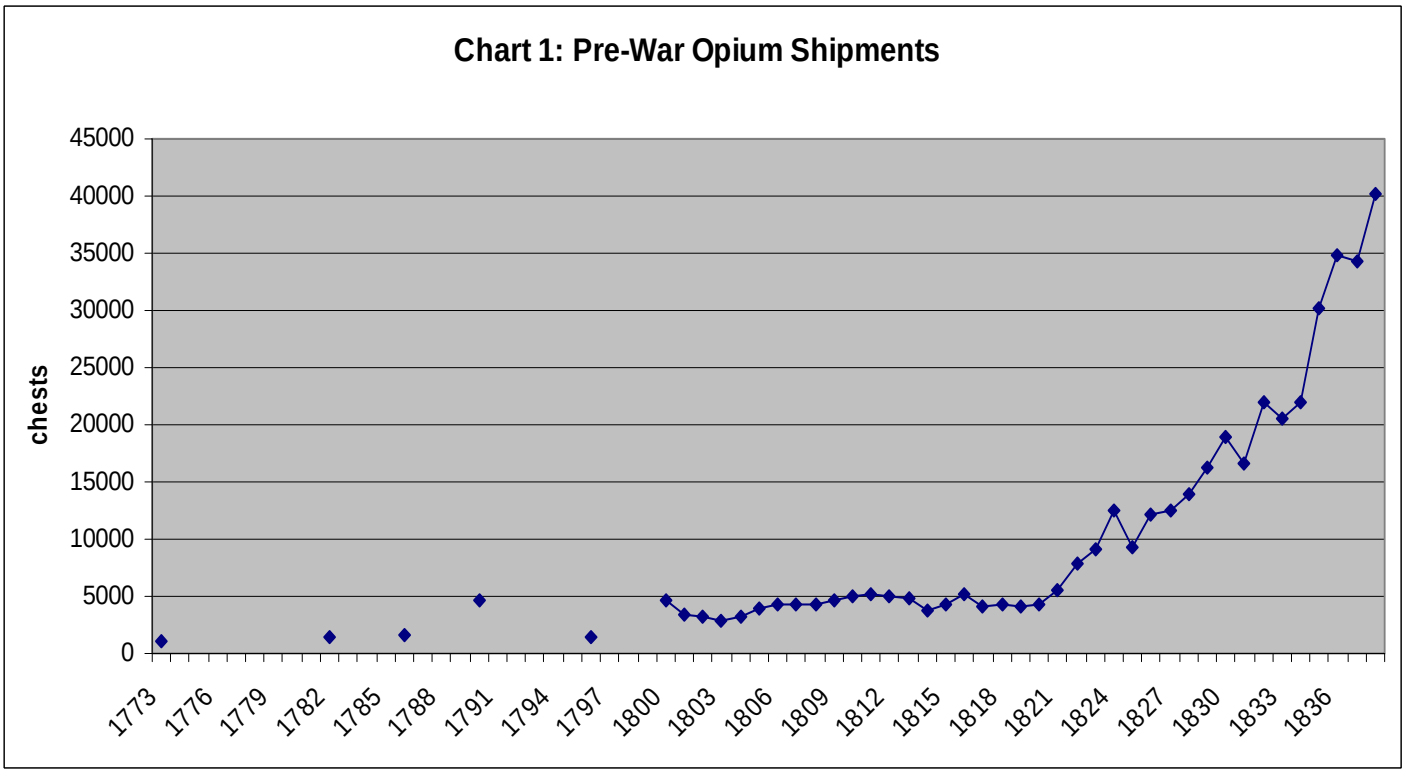
Chart 1: Pre-War Opium Shipments
chests
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
1773
1776
1779
1782
1785
1788
1791
1794
1797
1800
1803
1806
1809
1812
1815
1818
1821
1824
1827
1830
1833
1836

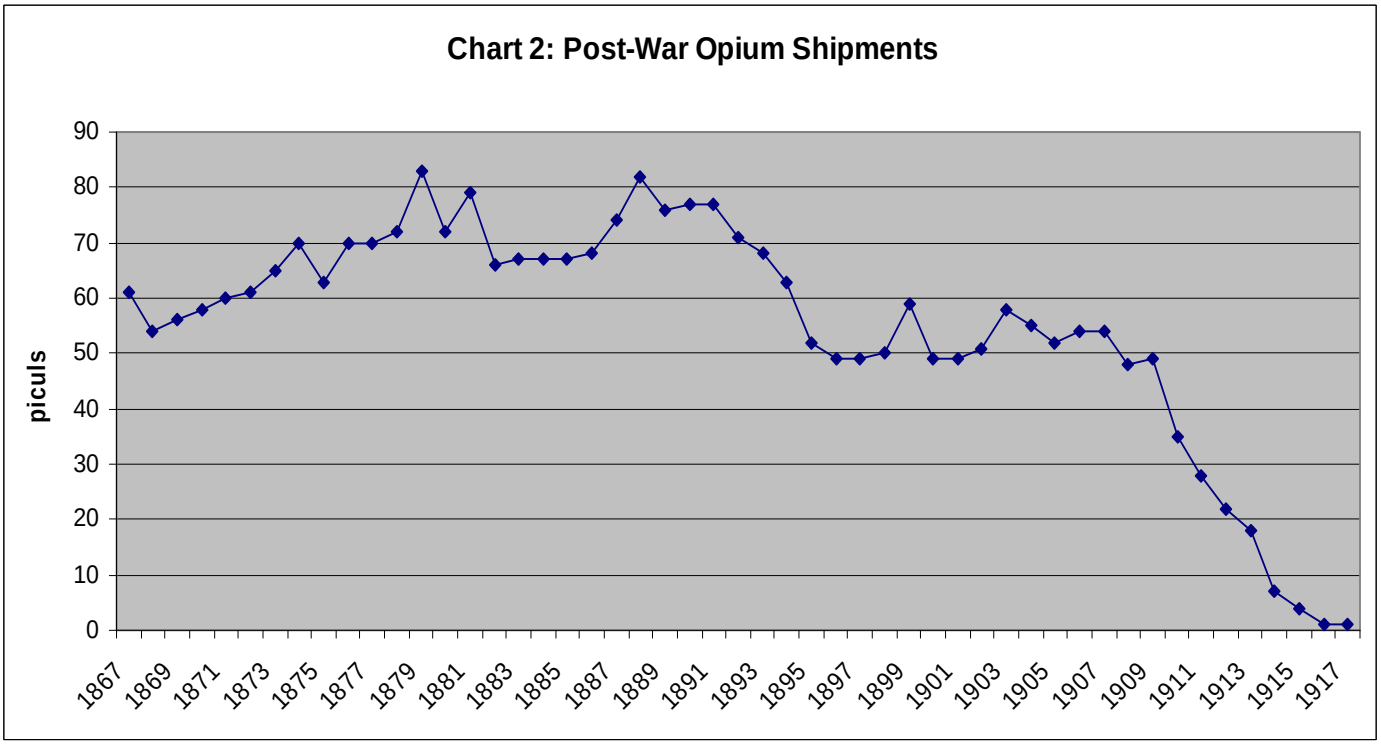
Chart 2: Post-War Opium Shipments
piculs
90
80
70
60
50
40
30
20
10
0
1867
1869
1871
1873
1875
1877
1879
1881
1883
1885
1887
1889
1891
1893
1895
1897
1899
1901
1903
1905
1907
1909
1911
1913
1915
1917

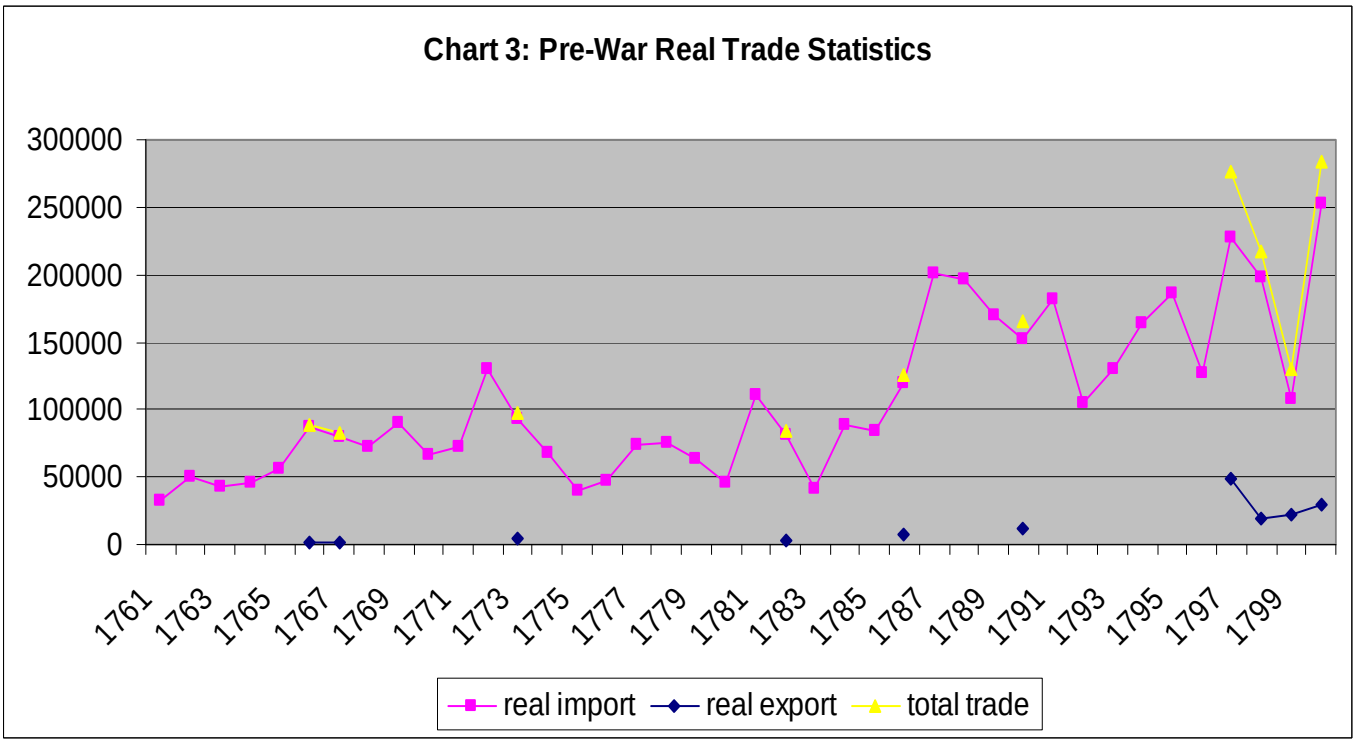
Chart 3: Pre-War Real Trade Statistics
300000
250000
200000
150000
100000
50000
0
1761
1763
1765
1767
1769
1771
1773
1775
1777
1779
1781
1783
1785
1787
1789
1791
1793
1795
1797
1799
real import
real export
total trade

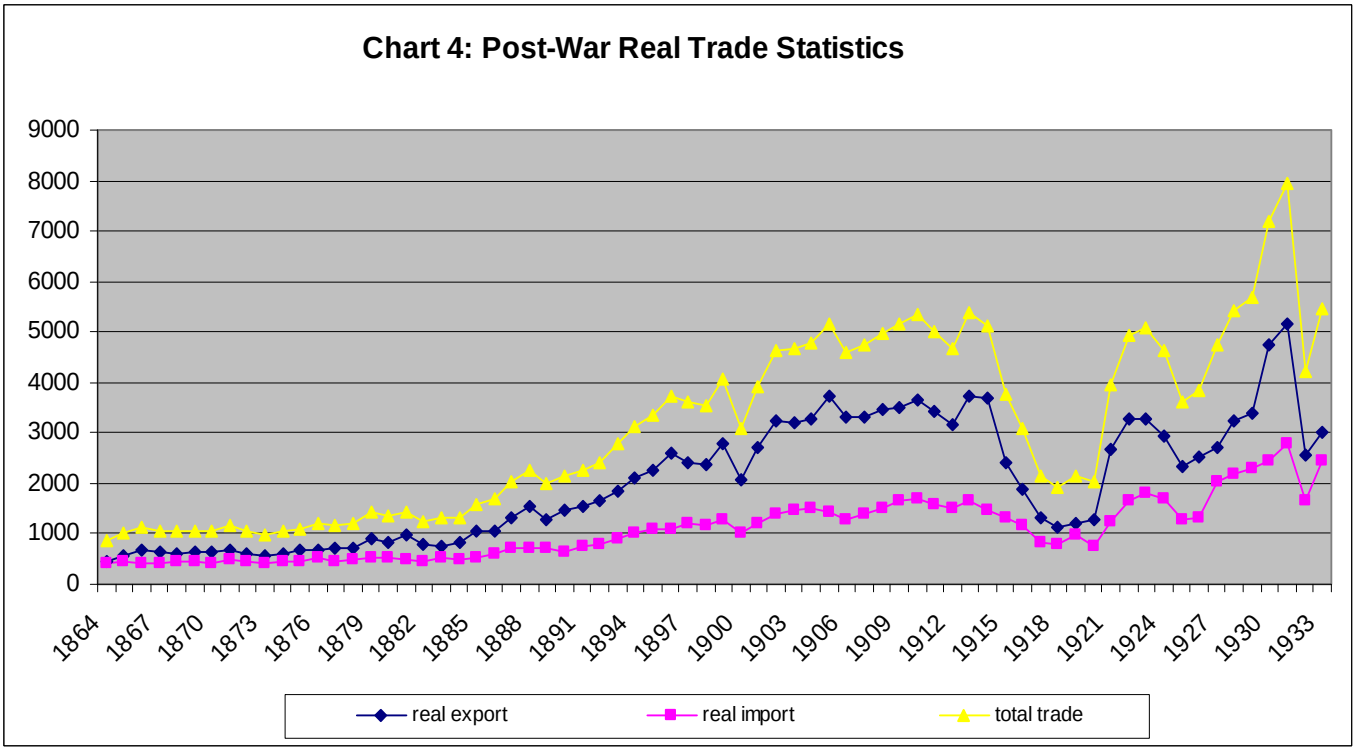
Chart 4: Post-War Real Trade Statistics
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
1864
1867
1870
1873
1876
1879
1882
1885
1888
1891
1894
1897
1900
1903
1906
1909
1912
1915
1918
1921
1924
1927
1930
1933
real export
real import
total trade

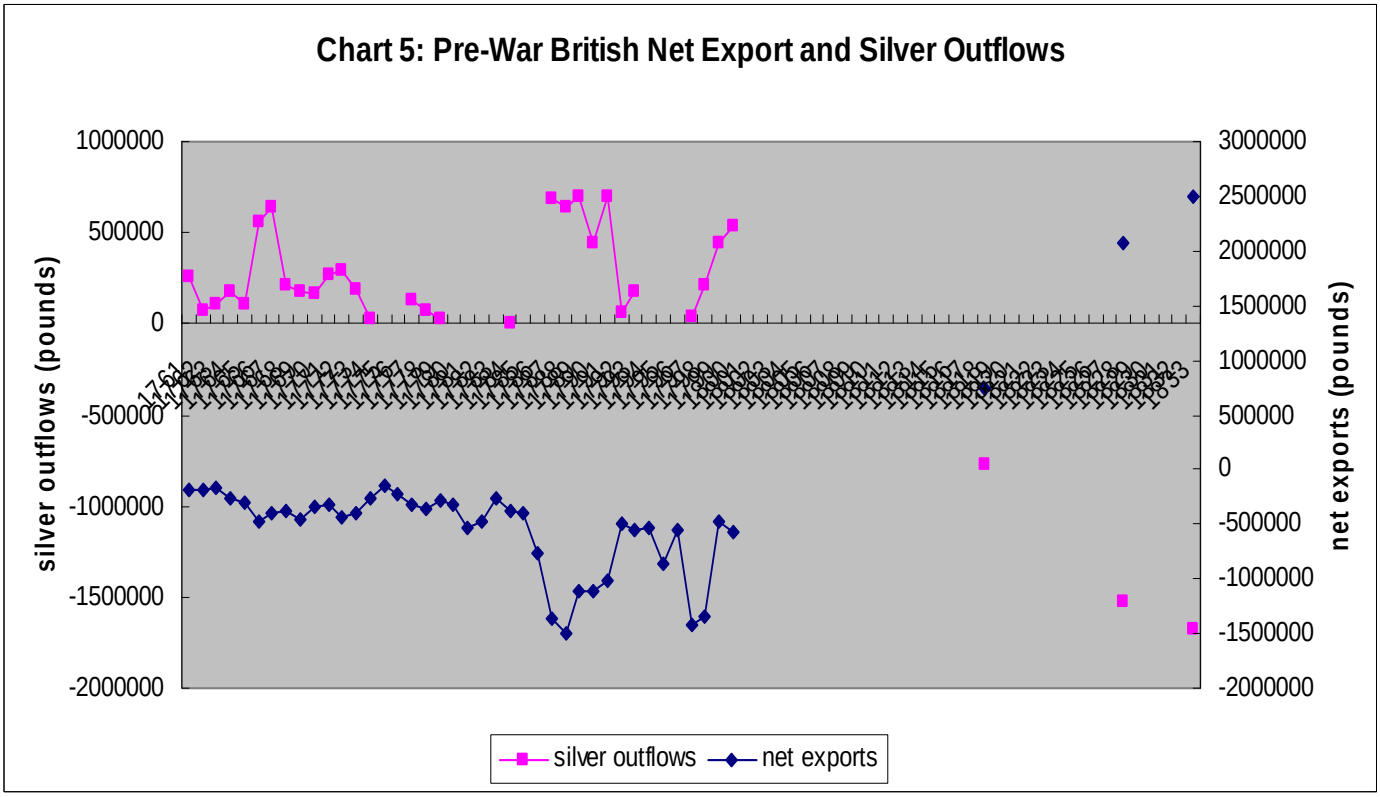
Chart 5: Pre-War British Net Export and Silver Outflows
silver outflows (pounds)
net exports (pounds)
1000000
500000
0
-500000
-1000000
-1500000
-2000000
3000000
2500000
2000000
1500000
1000000
500000
0
-500000
-1000000
-1500000
-2000000
silver outflows
net exports