

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

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June 15, 2011

Abstract: This paper constructs a staged development framework with multi-period discrete choices to study the colonization of Hong Kong, which served to facilitate the trade between Britain and China of many agricultural and manufactured products including opium. It provides a complete characterization of the endogenous transition from the pre-Opium War era, to the post-Opium War era and then to the post-opium trade era over the period 1773-1933. We begin with a brief chronicle of the historical development of Hong Kong and a basic descriptive analysis of the economic data that we put together from various limited sources. Based on the existing evidence, we then specifically design our dynamic model to allow opium trade to depend on (i) the British government's valuation of the volume of trade with China and the net silver receipt from it, (ii) the barriers that Britain faced in conducting opium trade and the moral cost associated with it, (iii) the cost of the war, and (iv) the shifts in China's demand for opium. We show that while low opium trading costs and high warfare initially postponed the British government's declaration of the Opium War, its high valuation of the total volume of bilateral trade, the rising opium trading costs and the anticipated demand increase eventually led to the war that established the legalization of opium trade and the colonization of Hong Kong. We also show that, in response to drastic drops in opium demand and rising opium trading costs, it became optimal for the British government to abandon opium trade soon after the founding of the Republic of China. We conclude with a series of historical data and documentation that support our theoretical findings.

JEL Classification: D78, E65, N40, O53.

Keywords: Colonial Economy, Opium Trade, Endogenous Policy and Institutions, Staged Development.

Acknowledgment: We are grateful for valuable comments and suggestions by Rick Bond, Mario Crucini, Boyan Jovanovic, Derek Laing, Douglass North, Pietro Peretto and Ray Riezman, as well as participants of the Summer Meetings of the Econometric Society and the Midwest Macro Meetings. Financial support from Academia Sinica, the Chinese University of Hong Kong, and the National Science Council (NSC 98-2911-H-001-001), which enabled this international collaboration, is gratefully acknowledged. Jian Tang, Long Ho Wong and Jianpo Xue provided excellent research assistance. Needless to say, the usual disclaimer applies.

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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, 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 this 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 China. In our paper, we start with 1773 when official record of opium trade began and end with 1933 because consistent trade data were unavailable afterward. We divide the chronicle of this historical time span in three distinctive subperiods.

- (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 net silver receipt from it, 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.

¹Acemoglu, 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.

- (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 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.

Certainly 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 case. 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 Hong Kong colonization captured in the aforementioned three phases. Based on the economic data collected from various limited sources and many historical documents, we designed a model with the following key features:

- (i) In addition to the 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 opium trade, 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

²The details of the colonization can be found in the Treaty of Nanking (1842), the Treaty Tientsin (1858) and the Convention of Peking (1860).

³Following the North (1994) convention, 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.

- (iii) We allow the British government to value both the volume of trade with China and the net silver receipt from it. It also takes 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 and the observed comovement in its quantity and price, we allow the quantity and the relative price of opium to respond to a demand shock.
- (v) 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.

The main findings of our paper concerning the process of Hong Kong colonization are in three folds. 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 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 was legal. Finally, due to a significant drop in opium demand and a rising opium trading cost, opium trade was abandoned, leading to 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 based on 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 The Chronicle of Historical 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 regulated international trade” (Gull 1943, p. 3), which operated “in a system through which the Government could control foreign trade” (Gull 1943, p. 8).⁴ The EIC era was terminated

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

in 1833. Soon after, in 1840, there was the outbreak of the first Opium War. After a two-decade long military and political fights, the post-treaty period began; from 1860 and onward, opium trade was fully liberalized 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

British involvement in the opium trade through EIC 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 prices 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 trade had become relatively more significant over time (see Refer to 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 the beginning of the first Opium War, 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” (as Matheson wrote in May 1839). To 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 about three years and led to the Treaty of Nanking, which was signed on August 29, 1842. The major terms involved in the Treaty required: (i) Hong Kong to become a British colony; (ii) Cohong (the Chinese counterpart of EIC) to be abolished; (iii) the opening of five coastal cities, Amoy, Canton, Foochow, Ningpo and Shanghai, as Treaty Ports; and, (iv) 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 gave a lot of freedom of trade to the British merchants. At the same time, 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

⁵Opium imports from India 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 first President of the Republic of China, Yuan Shikai, in 1916.

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

⁷According 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).

again. Eventually this led to the outbreak of the second Opium War in October 1856, which ended with the Treaty of Tientsin in 1858.⁸ Under the major 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 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 and 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 remained at 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 reduced to zero a few years after the establishment of the Republic of China (see Chart 2).⁹ Nevertheless, the price of opium was quite stable for most of the period, both in absolute and in relative (to rice) terms.

The Anglo-Chinese trade diminished by the end of the nineteenth century due to the fact that opium trade 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, Sichuan, which contributed to 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 following table 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 is evident from the table above that imported opium was replaced by domestic production (see

⁸The second Opium War was a joint effort by Britain and France, as 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 Xianfeng in the Convention of Peking in 1860.

⁹Because of different measurement units, the pre- and post-Opium War data series are not necessarily compatible. To avoid such measurement inconsistency, we design our data plots within each subperiod.

also the discussion in Zhong 2010, p. 148). Further evidence can be established using the customs and dues (known as likin) collected from opium. While 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 domestic opium.

The decline of imported opium can be identified from two sources: (i) the international opposition to opium trade based on moral judgement, and (ii) the Britain's reduced incentives for promoting opium exports to China. With regard to moral concerns about opium, Blue (2000) points out that the British government after 1895 "were steadily subjected to denunciations by the vocal anti-opium movements in Britain and the United States" (p. 37) and "promised to reduce the export of Indian opium to China by 5100 chests per annum ... [that] would have brought an end to the trade [in 1917]" (p. 41). With regard to Britain's incentives, exporting opium was no longer necessary for assuring its tea imports from China. Not only did British tea imports from China drop from 96% to 10% from 1866 to 1903, but the openings of the Treaty Ports after the Opium Wars also led to the increase in the consumption of western products (such as clocks, watches, matches, lamps, etc.).

As a colony of the United Kingdom, Hong Kong acted as an important entreport (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 accounted for about 1/3 of the British exports to China from 1890 to 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 trading center in the Anglo-Chinese opium trade. 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 Anglo-Chinese opium trade basically disappeared in the international arena. In the 1920-30 period, UK's woollen export to China dropped significantly and was compensated by rice (see Section 2.3 below). In 1929, China raised trade barriers (in the form of tariffs) from 5% to a range of 7.5-22.5% (Gull p. 115). Throughout this era, the relative role of Britain played in China's international trade diminished, whereas the composition of trade exhibited 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 historical 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 (Tuck 2000, vol. 2, Appendix G, Instructions to Lord Macartney, Sept. 8, 1792 by Henry Dundas, p. 237). 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 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. Nevertheless, 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 1785.¹⁰ 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 overall price level and individual prices of tradeables. As a result, we design two aggregate price indices for British exports and imports separately, using individual tradable prices.¹¹ Based on the computed export and import price levels, we deflate the trade statistics to obtain the respective real measures and summarize the result in Chart 4.¹² Again, these charts point 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, especially before 1800, tea and silk were the two major import items of Britain from China; they

¹⁰Recall that opium trade was started formally in 1773 (with official record) which highlighted its importance in the prosperity of Britain-China trade.

¹¹We take the aggregate price indices as Cobb-Douglas aggregators using the expenditure shares as weights.

¹²Replacing the computed prices by the Sauerbeck-Statist’s overall price index of Mitchell (1988) yields similar results.

accounted for more than 70% of the total British imports from China. On the export side, there were three major items, woollens, cotton and opium; these accounted for more than 80% of the total British exports to China.¹³ 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 woollens fell drastically from 41% to 10%. In the post-Opium War period, tea and silk continued to be the two major import items of Britain in the first two decades, accounting for about 80% of total imports. However, this pattern was reversed 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 import substitution policy of tea growing adopted 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, but was essentially eliminated after 1917.

Britain suffered a trade deficit due to its large quantity of tea import from China. As Britons were “addicted” to tea at that time, Britain continued paying for it using silver dollars. In the second half of the eighteenth century, the trade deficit of Britain against China was rising, resulting in a continuous outflow of silver from Britain to China. Chart 5 provides more details about the British silver outflows and its net export during the pre-Opium War period. Starting in the middle of the eighteenth century, opium started being smuggled into China and its traded volume rose drastically in the next few decades. These confirm the role of opium trade played in mitigating British trade deficit and silver outflows.

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 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 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). As documented in the previous section, in the post-Opium War era, Hong Kong was the most important entreport of trade between Britain and China. In short, Britain’s colonization of Hong Kong was largely due to Hong Kong’s geographical advantage.¹⁴

The Barrier of Opium Trade

The attitude of the Chinese government toward opium trade was consistent over time: it was

¹³Indeed just woollen and opium already accounted for more than 70% of the average total British trade.

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

regarded as evil and unjustified. Imperial edicts were issued starting in 1729 for the prohibition of the use, trade and production of opium. The growing consumption of opium raised the awareness and concerns regarding its devastating effects of the Chinese high-ranking administrators.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 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 the Hong Kong conglomerate 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-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 the barrier of 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. Notably, the 1906 opium suppression campaign that planned to eliminate opium in China within ten years is a solid piece of evidence.

¹⁵There was an imperial edict banning opium in 1813. Since then, the Canton Governor had “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).

The Moral Cost of Opium Trade

Although opium export to China helped Britain balance its trade deficit from tea import quickly, it was done with reluctance, disgrace and sinfulness, which will be referred to as the “moral cost” of opium trade. This moral cost of opium trade can be identified from two different sources: the British and other foreigners.

Opium was forbidden in England, indicating that the British was fully aware of its harmful effects. 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). Even 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). There was an even stronger anti-opium sentiment in the British public opinion. Such sentiment has been clearly documented elsewhere (see Bard 2000, pp. 12-13, and the references cited therein). Here we just mention the following four pieces of evidence: (i) 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;^{16,17} (ii) 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); (iii) on the same occasion, 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); and (iv) the following quotation from Blue (2000) provides the best summary: ‘In April 1906, a private member’s motion put by Liberal MP Theodore Taylor again condemned the opium trade as

¹⁶During 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 zealotness came from personal acquaintance with the drug’s harmful 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).

¹⁷Later 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).

“morally indefensible” and called on the new government to take measures to bring it to a speedy end’ (pp. 40-41).

Opium trade was largely viewed as immoral by other foreigners 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.

These documents point to a rise in the moral cost of opium trade, particularly after the turn of the twentieth century and the establishment of the Republic of China.

3 The Basic Model

As documented, 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 and woollen and cotton products. The major import goods from China to Britain were tea and silk. Over this period, opium rose to become the single most important trade item.¹⁸ It is therefore essential 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. We shall consider a central-planner problem: given production and trading technologies as well as the asset accumulation facing the representative producer-trader, the British government seeks to optimize to achieve its objectives over the total trade volume and the net silver receipts derived from its bilateral relationship with China.

Let Y^o denote the output of opium and Y^c the composite output of all other goods; the 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 Colonial 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:

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

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

¹⁸See Section 2.3 above the related evidence.

severe silver outflows incurred by EIC.¹⁹ This trade subsidy to the representative producer-trader is denoted by S_t (in the form of bullion injection). The British government's net silver receipts from trading with China (R_t) equals its trade surplus net of its subsidy to the EIC:

$$R_t = X_t - M_t - Z^T S_t, \quad (2)$$

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:

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

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.

The production cost of each output is given by a standard quadratic function: $q_i (Y_t^i)^2 / 2$, 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 as 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 asset 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 the following difference equation:

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

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, it is officially banned from import 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 a(n) (opium) war can effectively

¹⁹See Table 4 and Chart 16 for related evidence. Note that Britain had been on the gold standard since the mid eighteenth century and therefore had to purchase silver from continental Europe.

²⁰In the 1830s, opium was the largest British export to China (see Table 1 for 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).

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 differentiate the post-Opium War period into two subperiods (legal opium trade and post-opium trade), 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 export to China becomes:

$$X_t = Y_t^c + Z^o p_t Y_t^o [1 - (1 - Z^w) \delta] = Y_t^c + \psi(p_t) Y_t^o, \quad (5)$$

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

Based on the historic documents (see Section 2.2 under "The British Objective"), the period-by-period objective of the British government is specified as: $(1 - \zeta) [U(R_t) + \theta H(T_t)]$, 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 $H(T_t)$. 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 a drug that causes addiction and has detrimental socioeconomic consequences, its production is considered immoral. 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 India ceased) and denote with $\bar{\zeta}$ the differential unit moral cost during the Republic of China period. We thus have the following specification:

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

²¹Under 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).

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

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

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:

$$\begin{aligned} V(A_t) = & \max_{M_t, S_t, Y_t^c, Y_t^o} \{ (1 - \zeta) [U(Y_t^c + \psi(p_t)Y_t^o - M_t - Z^T S_t) + \theta H(Y_t^c + \psi(p_t)Y_t^o + M_t)] \} + \frac{V(A_{t+1})}{1 + \rho}, \\ \text{s.t.} & \quad A_{t+1} = (1 + r_t) A_t + Z^T S_t - M_t + (1 - \alpha^c - \beta w_t) Y_t^c + [\psi(p_t) - \alpha^o - \beta w_t] Y_t^o - \frac{q^c(Y_t^c)^2 + q^o(Y_t^o)^2}{2}, \\ & \quad M_t \geq 0, S_t \geq 0, Y_t^c \geq 0, Y_t^o \geq 0. \end{aligned}$$

We note that viewing Britain's behavior as the outcome of the central planner's optimization 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-Sheinkman conditions in the Appendix.

To close the model, we let $D^o(p, \kappa)$ be the Chinese demand for 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 "The Pre-Opium War Era: 1773-1839" heading). 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, opium demand slopes downward (with price) and importable demand rises with British income. Equilibrium in the market of each of the two goods requires equating the demand with the corresponding supply:

$$D^o(p) = Y^o, \quad (7)$$

$$D^M(\bar{I}) = M. \quad (8)$$

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, 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 7 and 11, and to Z^o by Charts 1 and 3.

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:

$$\alpha^c + \beta w + q^c Y^c = 4, \quad (9)$$

$$\alpha^o + \beta w + q^o D^o(p) = 4\psi(p), \quad (10)$$

(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 :

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

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 ($\bar{\delta}$), 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 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:

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

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

where the second expression yields $\bar{S} = S(p)$.²² Next, we define $\sigma_U \equiv -RU''/U'$ as the elasticity of marginal utility of net silver receipt 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 receipt. Hence, the subsidy for offsetting the trade deficit can be reduced.²³ The effects of a change in opium price on producer-trader's assets involve both a cost effect and a silver receipt 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 receipt from exporting opium increases so that asset accumulation is even higher.

²²Henceforth, we omit the subscript t . The notation “ ’ ” denotes total derivative.

²³The 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.

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:

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

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

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

$$Y^c = Y^c(p) \quad (16)$$

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

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:

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

Next define the price elasticity of the composite good supply as $\eta_p^c \equiv -(p/Y^c)(\partial Y^c/\partial p)$. 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. The rising trading cost of opium, which took place in this phase, led to an upward shift of both the opium supply curve and the composite-good supply curve. Consequently, a higher equilibrium level of both the opium price and the composite-good output were obtained.²⁴

²⁴ As a matter of fact, the correlation coefficient between the opium price and the composite output for the period of 1867-1917 is 0.56, which supports our findings.

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 of $\Psi(p)$. The second case is $1 > \Psi_p > 0$, which yields an upward sloping curve of $\Psi(p)$ 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 throughout):

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

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

Consider,

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 sloped 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:

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

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

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

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

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

From the information on the historical background, we know that the effective barrier on opium trade imposed by the Chinese government varies during the first phase. In particular, it has been recognized that in the early stages of Phase I, the effective barrier on opium trade is very low, as the Chinese officials were bribed not to 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 war expenses of Britain. We can define the net gain in utility or welfare of transiting from Phase i to Phase j as ${}_i\Delta_j$. Thus, we have:

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

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, $(\bar{\delta}, \bar{\zeta})$, 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. Such primitives include, most relevantly according to our historical data and documents, government objectives (especially θ) and warfare (G), as well as opium trade 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 ${}_I\Delta_{II}(\delta_c) = 0$. To show this, we must examine the effects of the trade barriers $\bar{\delta}$ on the welfare gain of moving from Phase I to Phase II. Consider,

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

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 ${}_I\Delta_{II}(\delta)$ schedule in Figure 3, which is upward sloping with ${}_I\Delta_{II}(0) < 0 < {}_I\Delta_{II}(1)$. The first inequality comes from the fact that $V_I(0,0) = V_{II}(0,0)$ 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, for any primitives $(G, \theta, \alpha^o, \kappa)$ suppressing

this threshold δ_c , it is more likely an institutional change would occur, leading 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 of 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, for any primitives $(\theta, \alpha^o, \kappa)$ suppressing this threshold ζ_c , an institutional change would likely to take place, resulting in abandonment of opium trade.

6 Comparative Statics

In the comparative-static exercises that follow, we consider the following categories of shocks on the critical levels of the transitional parameters δ_c and ζ_c : (i) a warfare cost shock (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 Warfare Cost Shock

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 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 costs.

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 the 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 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 Statics	Critical Value		Transition	
	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 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 historic environment and some important observations of the particular era before and after the Opium War. Of course, due to data limitation, it is impossible to formulate econometric tests on 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 support the claim that 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 small 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.

Data Support	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 7 and 11, 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. Pritchard has pointed out the basis of Anglo-Chinese relations was “the commercial intercourse” (Pritchard 1970, Preface). 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 documented in Chart 5, opium trade reversed the silver outflows of Britain. Thus, opium trade had been a very important component of British-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, the order of Commissioner Tse-hsu Lin required 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 supports our analysis.
- (D-6) The cost of trading opium rose drastically following the success of the 1906 imperial edict banning 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 imports 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 of 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. Using the data on opium price and quantity in the period 1867-1917, we computed the correlation coefficient to be -0.82 . This is consistent with our analysis.²⁵

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 War, in the end the war 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 by Britain 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 that enables us to characterize the trade-induced colonization of Hong Kong and the endogenous transition between various phases. We have illustrated theoretically how each transition emerged in response to various key factors including opium trading costs, warfare, the British government’s valuation of the total volume of trade with China, Britain’s moral cost of opium trade and China’s demand for

²⁵The opposite correlation between opium price and shipments shown in Charts 18 and 19 indicates that the overall relation between these two variables for the entire opium trade period (1773-1917) could be ambiguous. This may help us understand why Feige and Miron (2008) find “little evidence that legalization increased exports or decreased price” (p.911).

opium. Finally, we have put together historical data and documentation that provide support to our theoretical findings.

While our model is specifically designed to capture the historic 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 as well as Southeast and South Asia also 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, it 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 World War II 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.

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Appendix

(A Major Portion of this Appendix is Not Intended for 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 FSR, the first-order conditions with respect to M , \bar{S} , Y^c and Y^o are:

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

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

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

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

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 value 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 receipt and reduce the representative producer-trader’s asset accumulation, but, on the other, raise the total volume of trade. Imports are optimized when these marginal costs and marginal benefits 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 receipt to the gains from the higher assets accumulated in the future. The Benveniste-Scheinkman equation is:

$$V' = \frac{1 + r}{1 + \rho} V'_{+1}. \quad (\text{B5})$$

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:

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

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

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

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

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

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

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

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

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

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

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

and $\frac{d\Pi}{dp} = \frac{q^o}{4(1-\delta)} \frac{\partial D^o(p)}{\partial p} < 0$. ■

Proof of Lemma 2: Straightforward differentiation yields

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

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:

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

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

>From (C9), it is clear that under Assumption 1, $1 - \varepsilon_p^o > 0$ and under Assumption 2, $1 - \frac{R \sigma_H}{T \sigma_U} < 0$. 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:

$$-U' + \theta H' - \frac{1}{1+\rho} V' = 0, \quad (\text{C11})$$

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

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

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

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

$$-U' + \theta H' = \frac{1}{1+\rho} V'. \quad (\text{C15})$$

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:

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

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

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

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

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

Combining (7), (14), (15) and (17), we have: $\frac{dY^c}{dp} = \frac{\Omega_p}{q^c - \Omega_{Y^c}}$. Since $\frac{dY^c}{dp} < 0$ under Assumption 1, we conclude that $q^c < \Omega_{Y^c}$, 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:

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

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

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

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

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

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

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

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

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:

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

Thus, the ${}_I \Delta_{II}(\bar{\delta})$ 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:

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

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 :

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

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,

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

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 War and hence the trade volume is expected to increase.

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

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

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:

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

so that

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

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

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

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:

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

which is negative under Assumption 7. ■

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

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

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:

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

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:

$$(1 - \zeta) [-(1 + s)U' + \theta H'] - \frac{1 - s}{1 + \rho} V'_{+1} \leq 0, \quad M \geq 0, \quad (\text{D1})$$

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

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

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

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

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

$$-U' + \frac{1}{1 + \rho} V'_{+1} = 0, \quad (\text{D6})$$

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

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

Also, the asset accumulation equation is:

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

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

$$U' = \frac{1}{1 + \rho} V'_{+1} = \frac{\theta H'}{2}. \quad (\text{D10})$$

Then (D7) together with (D10) yield,

$$\alpha^c + \beta w + q^c Y^c = 4. \quad (\text{D11})$$

Also, (D8) and (D10) give,

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

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

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

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:

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

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

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

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).

Chart 1: Pre-War Opium Shipments

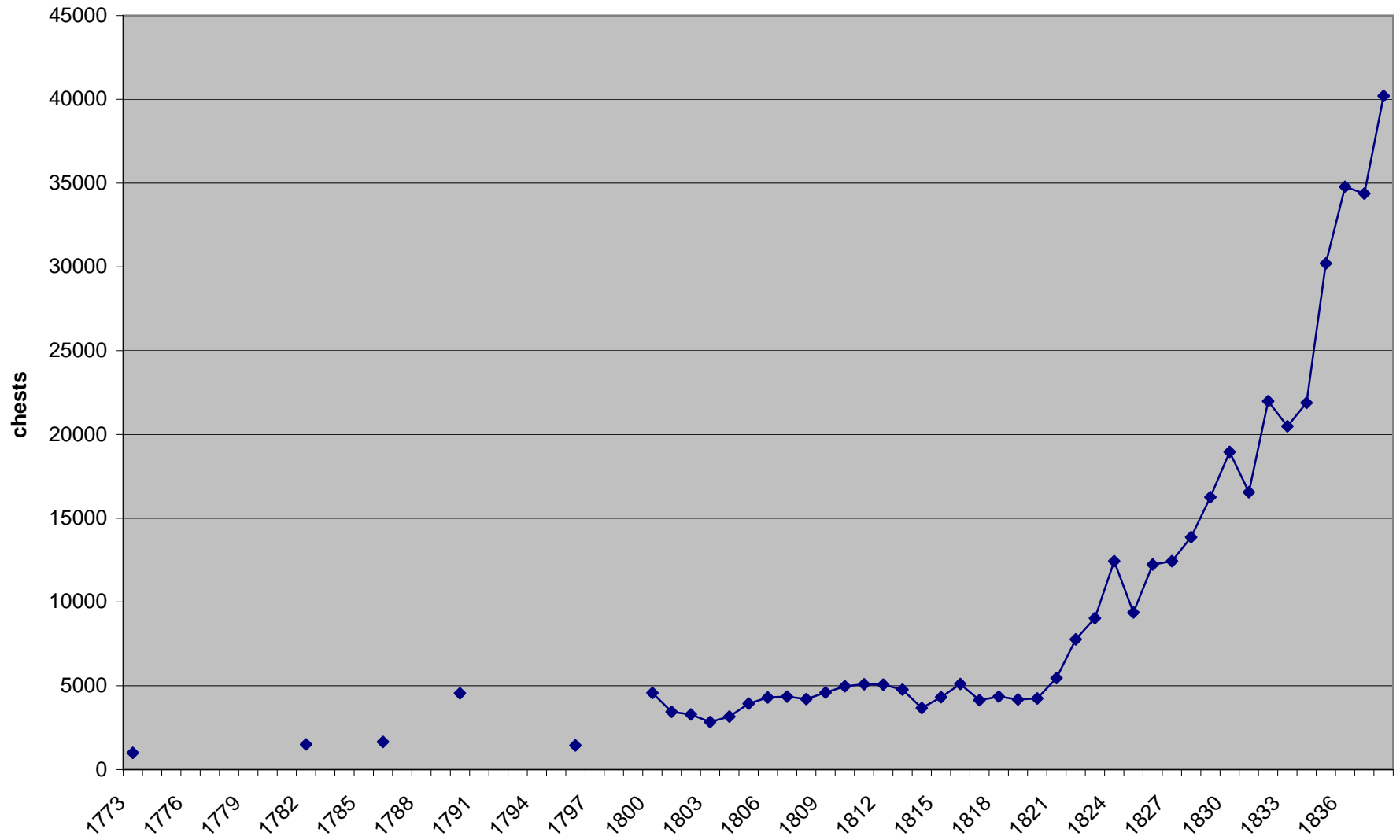


Chart 2: Post-War Opium Shipments

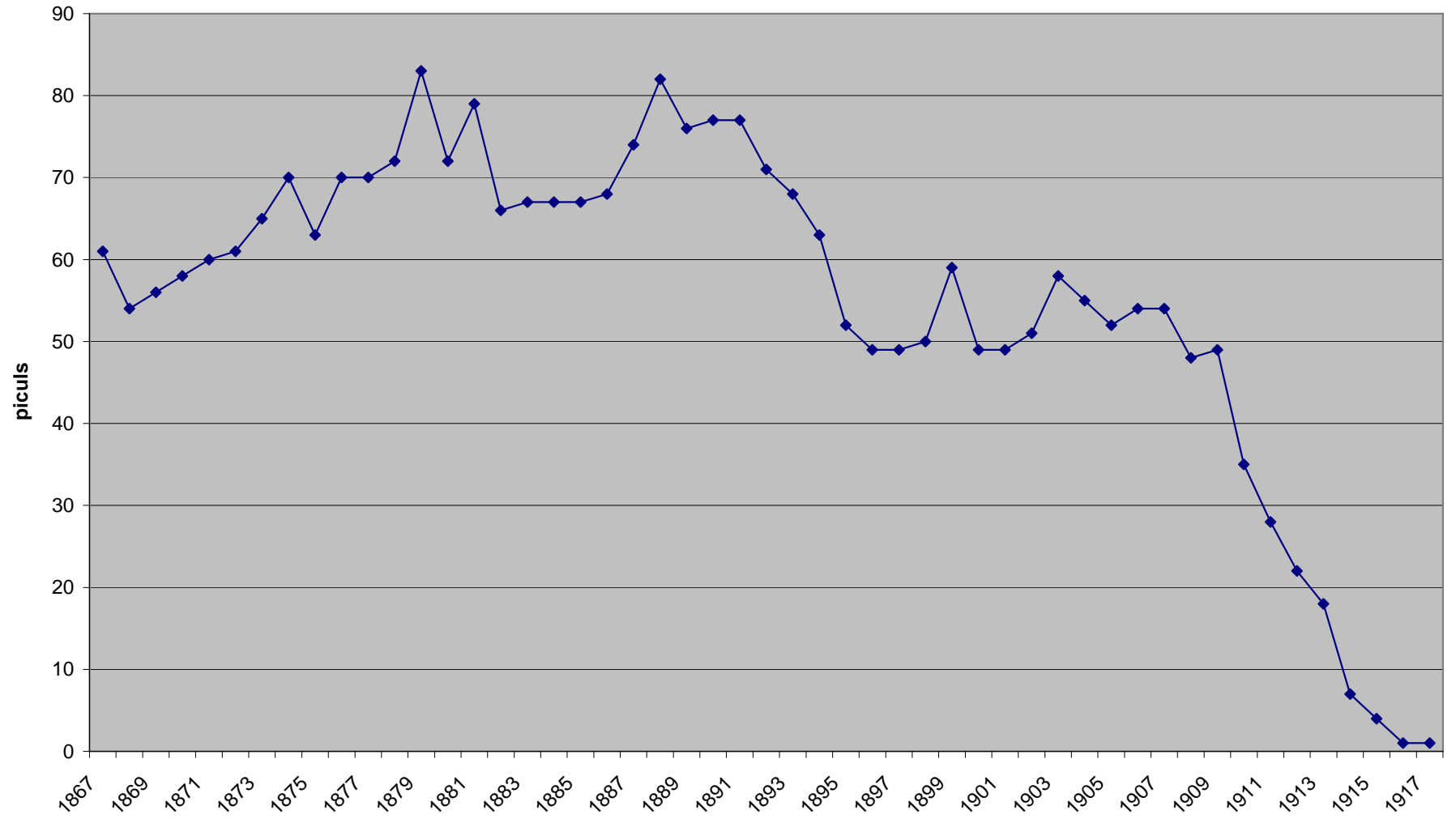


Chart 3: Pre-War Real Trade Statistics

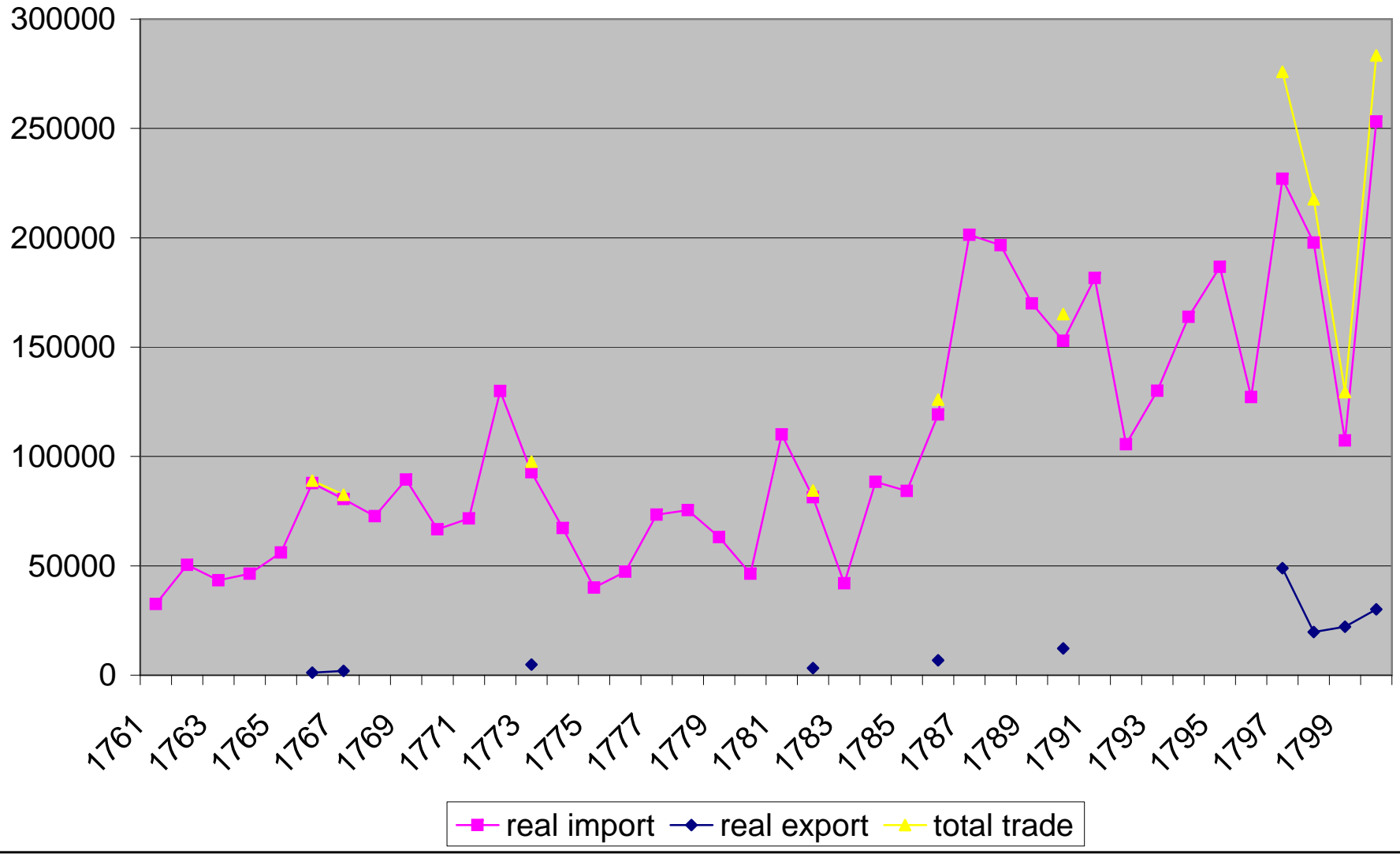


Chart 4: Post-War Real Trade Statistics

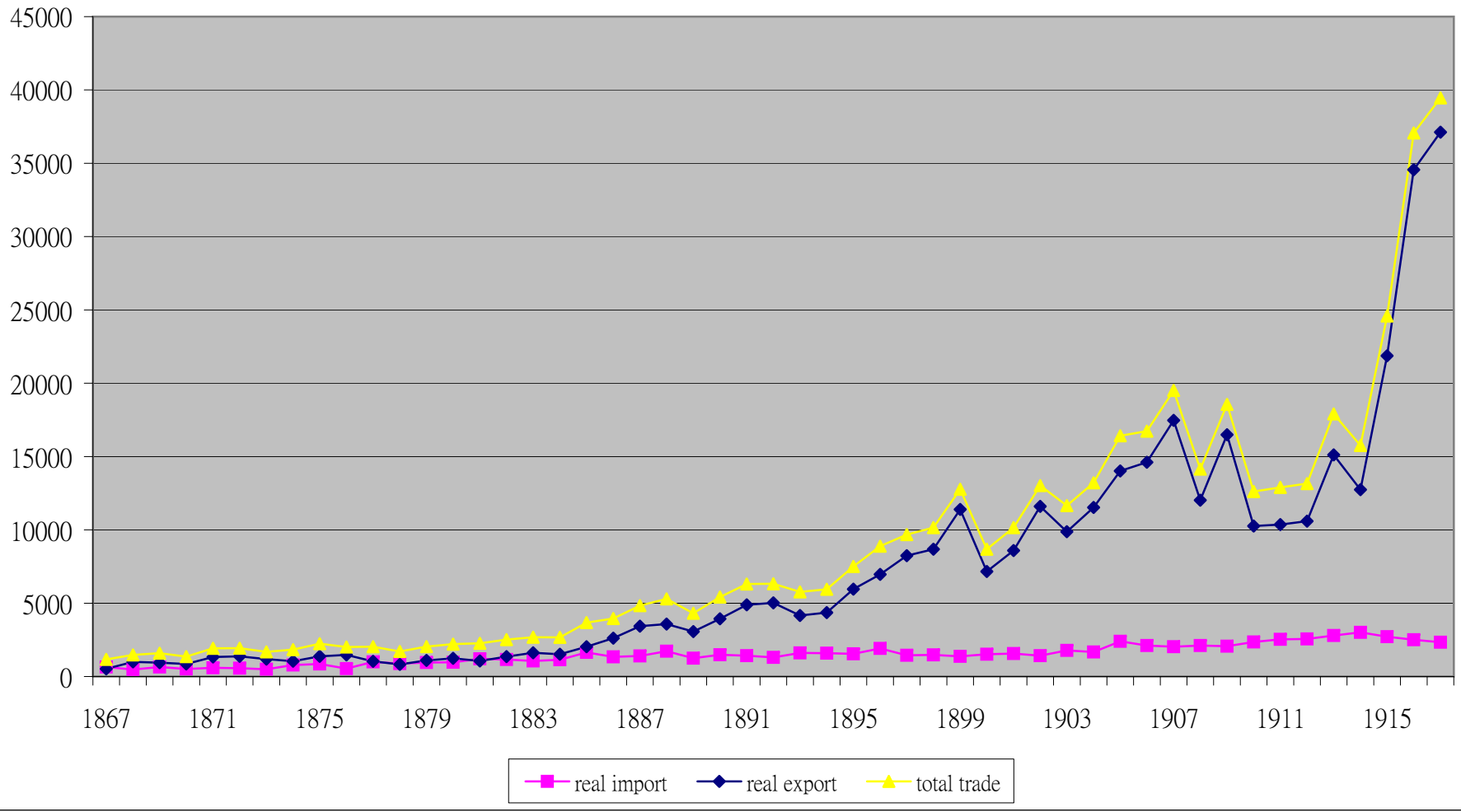
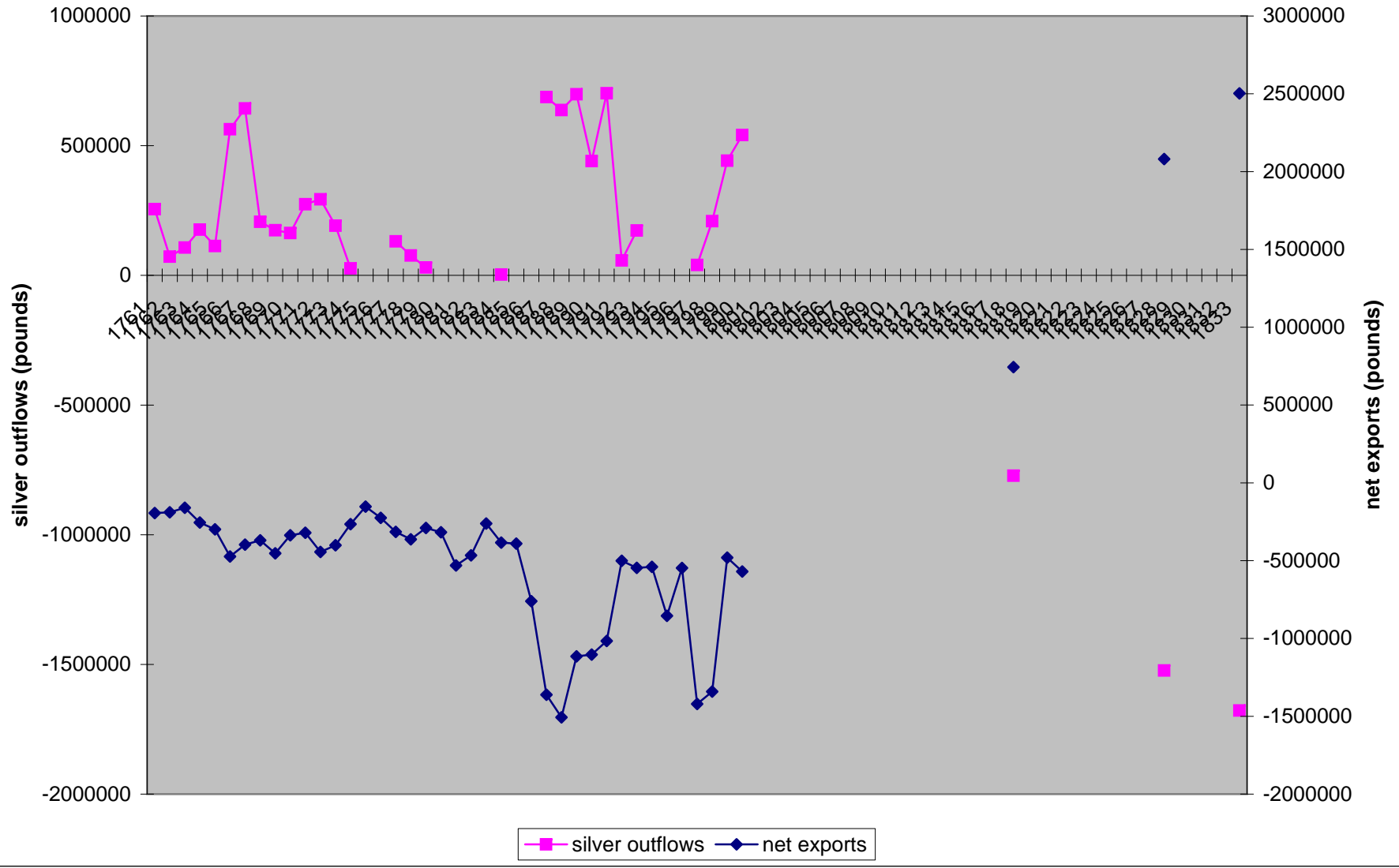


Chart 5: Pre-War British Net Export and Silver Outflows



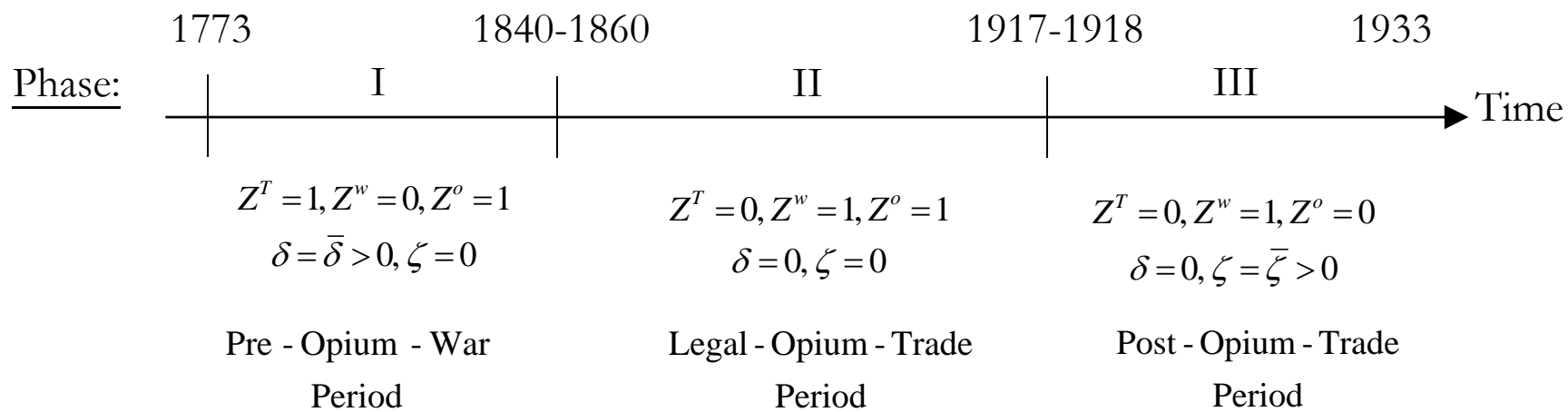


Figure 1: The Time Line

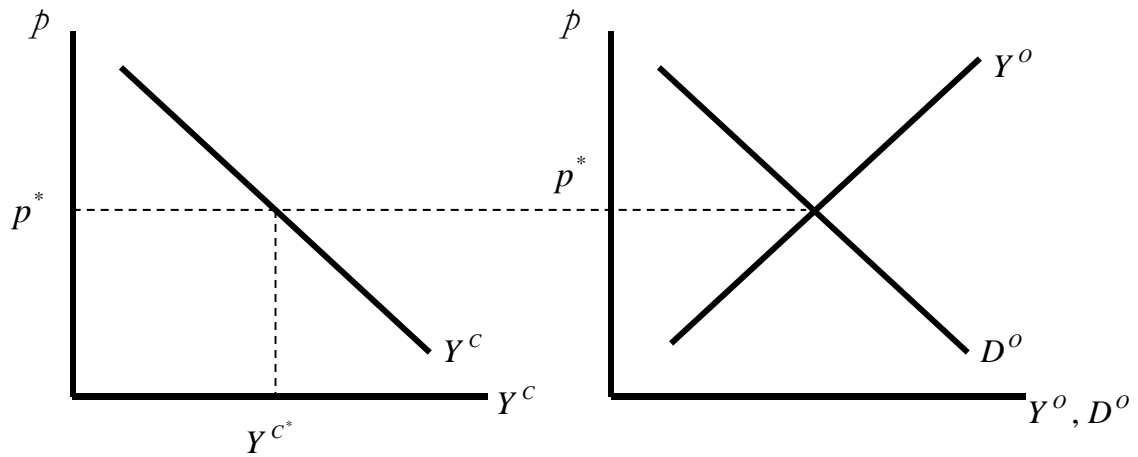


Figure 2: Goods Market Equilibrium in Phase II

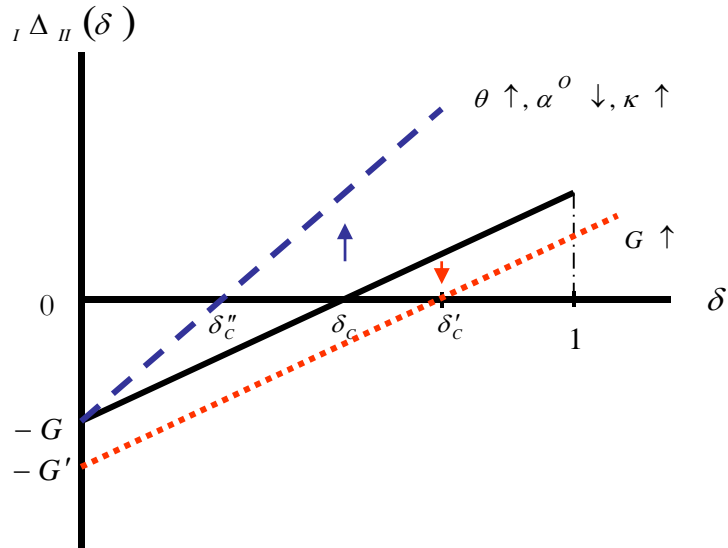


Figure 3: Comparative Statics on the Transition from Phase I to II

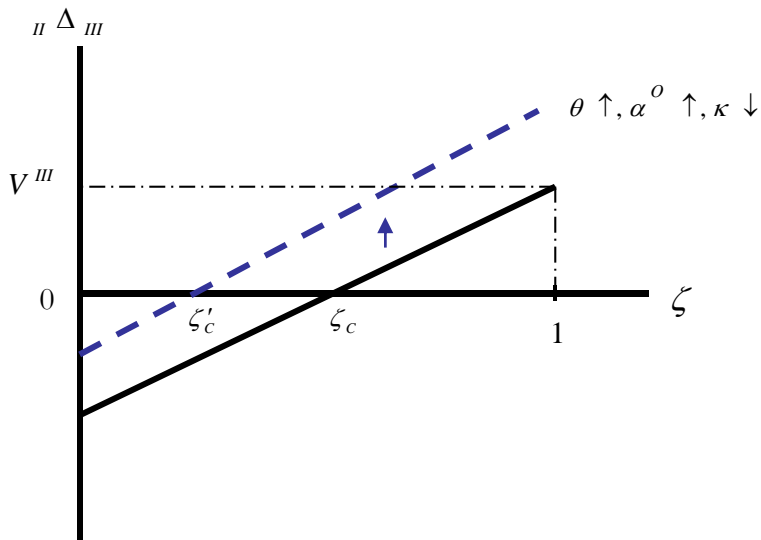


Figure 4: Comparative Statics on the Transition from Phase II to III