Evaluating the Consequences of High Migration Costs: Evidence from the 1885 Chinese Head Tax*

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Abstract

Migration costs play a key role in global migration today. However, measuring their effects on the quantity and composition of immigrants is difficult in modern contexts with complex immigration systems. In this paper I study the 1885 Chinese Head Tax, which directly increased the cost of migration for Chinese arrivals to Canada. Using detailed arrival microdata I estimate the elasticity of immigration with respect to measurable costs to be between -4.1 and -2.3, comparable to indirect estimates from the literature. I also show that rising fees induced increasingly positive selection on proxies for human capital among Chinese immigrants.

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1 Introduction

Nearly as long as there has been immigration to the U.S. and Canada, there have also been efforts to limit the inflow of immigrants, motivated by concerns about labor market competition, apprehensions regarding limited resources, or outright racial animosity. While restrictive immigration policy can take many forms, ranging from country-level quotas or bans to language, skill, or employment requirements, a key lever that governments have used throughout history has been monetary cost. Understanding how cost impacts immigration, however, is challenging: the majority of costs today are imposed *implicitly* (e.g., legal costs) making it difficult to measure or even identify changes in the dollar cost of migration for prospective migrants.[1] Even when measurable, explicit changes in migration costs today are generally small relative to the total cost of migration (for instance, variation in visa fees (Jena and Reilly, 2013)) leading to undetectable effects.

Existing research that leverages exogenous shocks to migration costs therefore typically uses proxies for cost, such as border wall construction (Feigenberg, 2020), liquidity constraints (Cai, 2020), or smuggling distance (Friebel et al., 2024). These proxies bundle together multiple dimensions of cost and are thus difficult to generalize across different settings or to translate to an elasticity with respect to an explicit dollar cost.

In this paper I use a historical immigration policy that directly increased the cost of migration to study how monetary migration costs affect both the quantity and composition of legal immigrants. The 'Chinese Head Tax' was a lump-sum fee uniquely levied on Chinese immigrants to Canada during the late 19th and early 20th centuries. The head tax, initially a $50 entry fee (1,750 in 2024 USD), eventually evolved to a $500 entry fee (17,500 in 2024 USD), which was more than double the average salary of a Chinese immigrant to Canada at the time (Canadian Families Project, University of Victoria, 2012). Using rich administrative data on Chinese migrants, their characteristics, and their date of arrival in Canada, I am able to leverage this temporal variation in the cost of migration to measure the direct effect

[1] A recent example of an increase in migration-related costs is President Trump's 2025 proclamation imposing a $100,000 fee on firms applying for the H-1B visa. Tying such a shock, however, to an explicit dollar amount paid by migrants is difficult not only because data is limited or because the pass-through of the H-1B fee to prospective immigrant workers is unclear, but also because of simultaneous firm-side responses and other Trump-era changes to immigration enforcement.

of migration costs on immigration. By looking at Chinese immigrants specifically, I am also able to document the effects of high migration costs on an immigrant group that has been understudied despite their central role in the evolution of immigration and immigration policy in the U.S. and Canada.

I begin by showing the direct impact of the Head Tax on the magnitude of legal Chinese immigration to Canada. Using a comprehensive and detailed record of Chinese immigrants at the time of their entry into Canada, known as the Chinese Register, I find sharp structural breaks in monthly Chinese immigration inflow following the announcement of each increase in the Head Tax. I supplement my data with detailed estimates of other measurable components of migration cost, such as the cost of transpacific passage, to obtain an estimate of the direct cost of migration for prospective Chinese migrants to Canada from the late 1800s to the early 1900s. Throughout the paper I provide 'cost-sensitivity' ranges for all estimated coefficients, representing the range of potential estimates under other plausible cost series.[2]

Over this time period I estimate the 'overall' elasticity of monthly immigration inflow with respect to measured migration costs to be -4.1, significant at the 99 percent level (with a cost-sensitivity range of -4.7 to -2.8), suggesting that Chinese immigration to Canada was highly elastic. This estimated elasticity, however, may conflate purely cost-based responses with responses to simultaneous changes in non-cost factors such as perceived discrimination, anticipated economic prospects, or other policy changes. To isolate the effect of measured migration cost alone, I start by restricting my analysis to small windows around each individual Head Tax increase. I observe a relatively larger elasticity of -4.8 around the initial implementation of the Head Tax in 1885, when other policy changes went into effect and changes in non-cost factors would have been most salient, but find that elasticities around the $100 Head Tax (-2.7) and $500 Head Tax (-4.1), when non-cost factors were less likely to have changed discontinuously, are still significant and economically meaningful.

To further distinguish cost effects from the effects of non-cost drivers, I use non-taxpaying immigrants (merchants, diplomats, and students were exempted from the Head Tax), who would have been subject to similar non-cost factors as taxpayers but not to the Head Tax

[2]See Appendix B for further details. Note that this cost estimate captures purely the observable or 'direct' components of migration cost and does not include nonpecuniary elements such as fear and uncertainty, stigma, or family separation.

itself, as a control group. I interpret these relative results as a **lower bound** (in magnitude) on the true cost elasticity of immigration, since non-taxpaying occupational categories are mutable and prospective migrants may have 'relabelled' themselves to enter under exempted categories, changing the composition of the comparison group and biasing estimates towards zero. Using a difference-in-differences approach to identify the additional effect of the Head Tax on taxpaying migrants (relative to non-taxpaying migrants), I estimate an elasticity of migration with respect to cost of -2.3 (with a cost-sensitivity range of -3.2 to -2.1).

These results are robust to alternate specifications, such as including additional controls for 'push' and 'pull' factors and subsetting to alternate time periods. I find suggestive evidence of substitution towards other destination countries, such as Australia and Mexico, but no evidence of anticipatory migration right before Head Tax increases. Benchmarking my range of preferred cost elasticities (-4.1 to -2.3) against other estimates that use proxies for migration cost in more modern settings suggests that migration in my setting is somewhat more elastic than migration across the U.S.-Mexico border and somewhat less elastic than *intended* illegal migration from Africa to Europe as reported in survey data, but my preferred range overlaps with both estimates from the literature.

In the second part of the paper I examine the self-selection of the Chinese population into immigration to Canada.[3] Ex-ante, the economics literature on immigration does not yield a clear prediction of how an increase in the cost of migration would affect self-selection into migration, particularly in a historical context. The majority of papers in this literature use as a guiding framework the Roy-Borjas model of selection into migration, in which the decision to migrate is based on the relative returns to skill in the destination country as compared to the origin country (Roy, 1951; Borjas, 1987). In the canonical model, migration costs are constant regardless of human capital, suggesting that if lower-skilled Chinese men had relatively more to gain from immigration to Canada than higher-skilled Chinese men, we would expect to see negative selection into immigration from China to Canada. Furthermore, we would expect an increase in migration costs to discourage only those prospective immigrants with the least to gain from immigration, resulting in even more *negative* selec-

[3]Throughout this paper I refer to self-selection, the individual decision to migrate as a function of skill or human capital, as selection. Self-selection should be distinguished from imposed selection, i.e. restrictions on immigration based on skill or human capital, which is not the focus of my paper.

tion. On the other hand, if costs are instead modeled as *decreasing* in human capital,[4] as in Chiquiar and Hanson (2005), the lowest-skilled Chinese men would also face the highest costs, suggesting that we would expect to see intermediate selection into immigration initially, and that increases in migration costs would generate more *positive* selection into immigration from China to Canada.

I find suggestive evidence that Chinese immigrants to Canada initially exhibited intermediate selection on height relative to the Chinese population but that as the Head Tax increased migration costs, Chinese immigrants became increasingly positively selected on height.[5] I confirm these descriptive findings by estimating a model of the effect of migration cost on various outcomes as recorded at the time of arrival to Canada. I find that higher migration costs were associated with a significant increase in the average height of immigrants, a decrease in the average age of immigrants, and a large decrease in the share of immigrants who paid the Head Tax (indicative of occupations such as laborer, which were not exempted from the Head Tax and associated with lower human capital). I further find that the effect of migration cost on height is driven entirely by the changes in taxpayer-status composition, while age changes reflect a combination of two opposing responses: a decrease in average age from a larger share of tax-exempt immigrants and an increase in average age among taxpayers themselves. I find suggestive evidence that numeracy also increased in response to increases in migration cost, both overall and within taxpayer groups, although these results are not significant at conventional levels. My results suggest that selection into immigration from China to Canada in the late 19th and early 20th century exhibited skill-varying costs, consistent with the Chiquiar-Hanson model.

This paper contributes to the study of the effects of monetary migration costs on migration inflow. A large body of work studies the economic impact of immigration policy, such as the introductions of quotas or bans (Clemens et al., 2018; Abramitzky et al., 2023; Long et al., 2024) or changes in enforcement intensity (Angelucci, 2012; Miles and Cox, 2014;

[4]Migration costs might be decreasing in skill if, for instance, lower-skilled individuals were more likely to face liquidity constraints.

[5]Height is commonly used in the economic history literature as a measure of human capital (Humphries and Leunig, 2009; Stolz and Baten, 2012; Kosack and Ward, 2014; Escamilla-Guerrero and López-Alonso, 2023), and is particularly useful in our setting both because past a certain age it would have been difficult to manipulate in anticipation of migration and because it was directly measured by immigration officials rather than self-reported.

Feigenberg, 2020). These papers typically treat such policy changes, many of which include implicit changes in migration cost, as a bundle, using the first-order effects on migration inflow to study downstream economic outcomes. In this paper, I am able to isolate the specific channel of monetary migration costs and study its direct effect on migration inflow, shedding light on the mechanisms through which these broader policy changes operate.

A smaller body of work focuses explicitly on the dollar cost of migration. Friebel et al. (2024) study the effects of smuggling costs on unauthorized migration from Africa to Europe and find that *intended migration* as measured by survey data is highly elastic to smuggling cost. Descriptive work by Jena and Reilly (2013) suggests that migration flow is not significantly affected by variation in visa application fees in the UK. Finally, Angelucci (2015), Bazzi (2017), and Cai (2020) study the effects of income or wealth shocks on migration, finding that liquidity constraints are an important determinant of migration decisions. This paper contributes to this literature by using large changes in the dollar cost of migration and detailed administrative data on actual migration to directly estimate the elasticity of legal international migration with respect to migration cost.

This paper also adds to our understanding of Chinese migration (and non-European migration more broadly) to North America during the age of mass migration. While there is considerable evidence on historical immigration to the U.S. and Canada, much of it focuses on Europe, in part due to limited origin-country and high-frequency migration data for non-European populations. Existing quantitative work on Chinese immigrants in the late nineteenth century—often studied through the lens of U.S. exclusion—frequently relies on decennial census data, limiting the granularity of observations and biasing the measurement of inflow downwards through return migration (Chen, 2015; Chen and Xie, 2020; Long et al., 2024; Postel, 2025). Using detailed administrative records with exact dates of arrival and individual characteristics, I contribute to this literature by providing a high-frequency picture unbiased by return migration of responses in both the volume and composition of Chinese migrants to Canada to increases in cost.

Finally, this paper contributes to the literature on selection into migration and how costs shape the composition of immigrant groups. I provide, to my knowledge, the first evidence of selection into immigration in a historical setting with high costs. Previous work on historical

immigration to the U.S. and Canada has primarily focused on groups facing relatively low migration costs, resulting in findings that are largely consistent with the Roy–Borjas model of selection (Roy, 1951; Borjas, 1987; Abramitzky et al., 2013; Abramitzky and Boustan, 2017; Connor, 2019). In contrast, many immigrant groups in the U.S. and Canada today face substantially higher migration costs, and modern work has emphasized frameworks with skill-varying costs that can rationalize intermediate selection, particularly from higher-inequality origin countries (Chiquiar and Hanson, 2005; McKenzie and Rapoport, 2010). An open question, however, is whether the differences between historical and contemporary patterns of selection are purely driven by higher costs today, or if other fundamental shifts have caused the nature of selection into immigration to change over the past century. By examining selection responses in a historical setting with unusually high monetary entry costs, this paper shows that historical selection patterns are consistent with modern frameworks featuring skill-varying migration costs under sufficiently large migration costs.

Section 2 of this paper provides more historical context on the Chinese Head Tax and historical Canadian immigration, Section 3 describes the data sources I use for my analysis, and Section 4 presents results on the effects of the Head Tax on the inflow of Chinese immigrants. Section 5 presents both descriptive and causal effects of the Head Tax on the selection of potential Chinese migrants into immigration to Canada. Section 6 concludes.

2 Background and Historical Context

Although the history of Chinese immigration to North America reaches back to the 1700s, it was not until the Gold Rush of the 1850s that large numbers of Chinese immigrants began to settle along the West Coast. While initially concentrated in California, later discoveries of gold in British Columbia expanded Chinese immigration to Canada, and by 1860 there were an estimated 7,000 Chinese inhabitants of British Columbia (Chan, 2019). Following the Gold Rush, Chinese immigrants largely took on low-wage jobs in the manufacturing and service industries, and contributed heavily to the construction of the Canadian Pacific Railway during the early 1880s. As the completion of the railway approached, sinophobic sentiment began to foment and in 1884 the Royal Commission of Chinese Immigration was

formed to investigate the possibility of restricting Chinese immigration to Canada (Chan, 2016).

The Royal Commission collected testimony from a total of 51 witnesses. Chinese immigrants were simultaneously accused of being a "moral blight", corrupting their vicinities through uncleanliness and disease, gambling, prostitution, and opium, and of being "skillfull [*sic*] laborers" who could "subsist on much less than white men", thereby lowering wages and discouraging immigration from European countries (Chapleau and Gray, 1885).[6] The overall recommendation of the Commission, primarily motivated by an effort to stem public discontent among white Canadians, was to introduce moderate legislative restrictions on Chinese immigration.

2.1 Chinese Head Tax in Canada

Initial Tax and Amendments. With the passage of the Chinese Immigration Act on July 20th, 1885, came a $50 'Head Tax'—a per-person flat entry fee imposed exclusively on immigrants from China. While the Royal Commission had originally suggested a $10 head tax, intended to pay for health inspectors at entry ports, it was clear that the higher $50 fee was implemented with the goal of dissuading Chinese immigrants from settling in Canada. The $50 Head Tax (approximately 1,750 in 2024 USD) which went into effect on January 1st of 1886 was roughly equivalent to the cost of a one-way ticket from East Asia to the West coast at the time, effectively doubling the cost of immigration from China to Canada (Chew, 1903). As part of the Chinese Immigration Act, in 1885 immigration officials began to record detailed information on each Chinese immigrant to Canada at the time of arrival. This 'Register', which I describe further in section 3.1, is the primary data source for this paper.

As Chinese immigration to Canada continued to grow despite the tax, the government raised the tax to $100 in 1901 (approximately 3,800 in 2024 USD) and again to $500 in

[6] Chinese immigrants were particularly disparaged for their apparent failure to assimilate, as made clear in newspaper reports at the time and by the Royal Commissioners themselves, who wrote that "the Chinese being a non-assimilable race, clearly marked off from white people by color and national and race characteristics, their presence in a country is not unattended with disadvantages, foremost among these being the irritation, discontent and resentment they inspire in white laborers" (Chapleau and Gray, 1885).

1904 (approximately 17,500 in 2024 USD).[7] The $100 and $500 amendments were passed in July of 1900 and 1903 respectively, going into effect on January 1st of the following year. In comparison, the average adult Chinese immigrant man's annual earnings, as recorded in the 1901 Canadian Census, totalled only $239. The tax remained in place until 1923, when the Chinese Immigration Act of 1923 banned Chinese immigration to Canada altogether. It was not until 1947 that the ban was repealed, and it was not until 1962, when immigration restrictions based on country of origin were completely removed, that Chinese immigration to Canada resumed.

Adherence. While exceptions to the tax were made for diplomats, merchants, students, and others, the vast majority of Chinese immigrants were forced to pay the tax. Failure to do so would result in being deported or imprisoned, and as a result many immigrants had to either borrow money or enter indentured servitude contracts to cover the cost of the tax. Appendix Figure A1, which plots the average non-zero tax paid by Chinese immigrants in each year, suggests nearly perfect adherence to the Chinese Head Tax by port officials.[8]

While Chinese immigrants who had arrived in Canada prior to 1886 were not required to pay the tax, the Register records close to 6,000 Chinese immigrants who had arrived prior to 1886 and voluntarily registered with port officials after the Head Tax went into effect, likely in order to be able to freely exit and re-enter Canada. While these pre-1886 arrivals largely paid the $50 head tax (suggesting re-entry to Canada between 1886 and 1900), approximately 6% paid more than $50 in fees, suggesting either re-entry in later years or multiple payments of the Head Tax.[9]

Illegal Migration. While I have no way of observing or identifying Chinese immigrants who entered illegally, i.e. without registering, there is reason to believe that very few Chinese immigrants were able to do so. Passenger ships between Hong Kong and Vancouver or

[7] Dollar amounts are adjusted based on historical price index estimates from Bureau of Labor Statistics (1975).

[8] Note that only 9.3% of immigrants recorded in the Register as arriving between 1886 and 1923 paid $0 in taxes. Of these non-taxpaying individuals, approximately 89% were merchants or the family of a merchant and an additional 5% were students, missionaries, ambassadors, or tourists.

[9] While the Chinese Immigration Act initially permitted Chinese immigrants to leave and re-enter the country without repaying the Head Tax, an 1892 amendment required repayment of the tax if a Chinese immigrant left Canada for more than twelve months.

Victoria, the primary mode of transportation for Chinese immigrants to Canada, were run by a Canadian company on set schedules, and meticulous accounting of cargo would have made illegal entry by sea nearly impossible. Illegal entry by land would only have been possible by way of the United States, where there were even stricter restrictions on Chinese immigration.[10] Finally, to prevent prospective immigrants from entering under the identity of a prior immigrant, immigration officials recorded each immigrant's height and any identifying physical characteristics or abnormalities and eventually each Head Tax certificate included a photo of the prospective immigrant. Nevertheless, because my data is not able to measure the extent of illegal migration, in this paper I focus explicitly on the effects of migration costs on *legal migration*.

Additional Restrictions. The Chinese Immigration Act of 1885 and its subsequent amendments also included a number of other restrictions on Chinese immigration, such as a capacity limit for incoming ships carrying Chinese passengers, mandated health inspections at ports of entry, and the complete prohibition of "any person of Chinese origin who is a pauper or likely to become a public charge" from entry into Canada.[11] Even beyond immigration restrictions, discrimination against Chinese immigrants during this time period was widespread, including federal disenfranchisement by the Electoral Franchise Act of 1885 and the Dominion Elections Act of 1898, and riots in protest of continued Chinese immigration (Schwinghamer, 2023).

2.2 Canadian Immigration from Other Countries

While I focus on Chinese immigration to Canada in this paper, it is helpful to understand the broader context of Canadian immigration during the time the Head Tax was in effect and in particular to identify other changes in immigration policy aside from the Head Tax that may have affected Chinese immigration.

Overall, immigration to Canada stayed relatively flat between 1880 and 1900, and then

[10] In fact, there are even accounts of Chinese immigrants arriving by ship in Canada and attempting to cross the border *into* the U.S. by land, to circumvent the U.S. Chinese Exclusion Act.

[11] Statutes of Canada. An Act Respecting and Restricting Chinese Immigration, 1900. Ottawa: SC 63-64 Victoria, Chapter 32.

began to rapidly increase at the turn of the century until an abrupt drop in immigration in 1914 due to World War I, after which immigration stayed relatively low. While the Chinese Immigration Act was the first ever restriction on immigration to Canada for a specific ethnic group, as immigration to Canada accelerated at the turn of the century, other restrictive and xenophobic immigration policies began to emerge starting in 1908.[12]

In 1919, the federal government passed an amendment to the Immigration Act which permitted banning immigrant groups unsuited to Canada due to their "peculiar customs, habits, modes of life and methods of holding property and because of their probable inability to become readily assimilated."[13] Essentially, while the Chinese Head Tax was the lone restriction on immigration to Canada for the majority of its span, by 1908 additional restrictions on immigration for other ethnic minorities emerged and by 1914, all immigrants experienced restricted mobility due to World War I and subsequent legislation. As a result, throughout the paper I focus on immigration prior to 1908, although my results are robust to inclusion of post-1908 data.

3 Data

3.1 Chinese Register

My primary source of data is the Register of Chinese Immigrants to Canada (henceforth the 'Register'), which is a record maintained from 1885 to 1949 of all Chinese immigrants to Canada (Ward and Yu, 2008). Upon entry into Canada, immigration officials were required to record in this Register the full name, age, sex, occupation, and height of each Chinese immigrant, as well as the amount of tax paid by the immigrant and the port, date, and method of initial arrival in Canada. The Register thus provides a full count of legal immigrants of Chinese origin who entered Canada during the years affected by the Head Tax, recorded at

[12]The Continuous Journey Regulation of 1908, for instance, prohibited the entry of immigrants who did not travel directly to Canada from their country of origin, effectively cutting off immigration from India and other countries without direct passage routes to Canada. In the same year, the Canadian and Japanese governments negotiated a 'Gentlemen's agreement', which capped the number of Japanese immigrants to Canada at 400 annually (Dyk, 2023).

[13]Statutes of Canada. An Act to Amend the Immigration Act, 1919. Ottawa: SC 9-10 George V, Chapter 25.

a daily frequency.[14] In addition to fully counting arrivals from 1886 onwards, the Register also records the voluntary registration of pre-1886 immigrants, including their reported date of entry into Canada. This measure is biased downwards from the true pre-1886 immigrant inflow for two reasons: first because registration for pre-1886 arrivals was voluntary and second because of attrition due to return migration. I show that my main results are robust to excluding all pre-1886 arrivals.

Sample. As discussed in Section 2.2, my preferred sample excludes immigrants after 1908 to avoid the confounding effects of the introduction of other restrictive immigration policies and shocks to Canadian immigration. My preferred sample starts in 1882 to minimize underreporting due to return migration while maintaining at least three years of pre-tax arrivals. I drop individuals for whom the month or year of arrival was not reported or illegible (less than 1% of the sample). Finally, I include all immigrants in my preferred sample: both those who were required to pay the tax and those who were exempt from the tax, but I investigate heterogeneity in immigration responses to the Head Tax by taxpayer status.

3.2 Supplementary Data

While I rely on the Chinese Register for my main analyses, an alternate empirical specification includes controls for 'push', 'pull', and 'network' factors. I approximate 'push' factors influencing the level of outmigration from Southern China using data on emigration from Hong Kong, which I digitize from annual reports by the Harbourmaster of Hong Kong between 1870 and 1930 (The University of Hong Kong Libraries, 2023).[15] I approximate 'pull' factors affecting the attractiveness of Canada as a destination by using data on total annual immigration to Canada (Employment and Immigration Canada, 1982). Finally, I approximate 'network' factors influencing the specific attraction of Chinese immigrants to Canada

[14]Note that new entries were not created for immigrants re-entering the country, who were not required to repay the Head Tax, therefore my data explicitly cover only newly entering immigrants to Canada.

[15]These reports record the total number of passengers departing from Hong Kong on "passenger ships cleared by the emigration officer", separately by destination port. Since passenger ship lines from China to North America almost exclusively departed from Hong Kong, data from Hong Kong ports should accurately capture 'push' factors influencing the level of outmigration from Southern China.

in particular using data from the decennial Canadian censuses, which record the population stock of Chinese-born residents of Canada.[16]

3.3 Estimating Baseline Costs

In addition to the Head Tax, there were several other components of the cost of migration for prospective Chinese migrants to Canada. The most substantial of these was the cost of transpacific steamship passage from Hong Kong to the West Coast of Canada. Between 1891 and 1901, I use exact prices, which ranged from $60 to $110, obtained from a report by the president of the Canadian Pacific Steamship Company (the main operator of Canadian transpacific passenger ships). Outside of this period I extrapolate passage prices based on secondary source material. I approximate other baseline migration costs (including foregone wages, adjustment costs after arrival, and internal travel to Hong Kong) to be $14 over the period that I study. Because these historical costs cannot be pinned down exactly, I also report 'cost sensitivity' ranges for all estimates based on plausible ranges of baseline costs. Appendix B provides a detailed explanation of these estimates and the cost sensitivty ranges.

Throughout the paper I arrive at my preferred estimate of the nominal cost of migration by adding the Head Tax amount + the cost of passage based on the date of arrival + $14. I then adjust all nominal dollar amounts to 2024 USD using historical price index estimates from the Bureau of Labor Statistics (1975).[17]

3.4 Characteristics of Chinese Immigrants to Canada

Table 1 summarizes various characteristics of the Chinese immigrant population as recorded in both the Register and the Census. Columns (1)-(2) use the Chinese Register data to compare Chinese immigrants who immigrated between 1882 and 1908 and were required

[16]Data are compiled from Programme de Recherche en Démographie Historique (2021), Inwood (2009), Canadian Families Project, University of Victoria (2012), Canadian Century Research Infrastructure (2011), Canadian Century Research Infrastructure (2015), for the 1881, 1891, 1901, 1911, and 1921 censuses respectively.

[17]Both Canada and the U.S. were on the gold standard through World War I, so the Canadian dollar was exactly equal to the U.S. dollar until 1914. Afterwards, the Canadian dollar maintained parity except for a brief period from 1920-22 when the Canadian dollar was equivalent to roughly 0.9 USD (James Powell, 2005). I adjust for this in the relevant years.

to pay the Head Tax to those who immigrated during the same time period but were not required to pay the Head Tax. As described in Section 2.1, exemptions from the Head Tax were granted for certain occupations such as merchants or students, which is further confirmed by the fact that while over 75% of taxpayer Chinese immigrants were laborers, less than 10% of non-taxpayers were laborers.[18] Non-taxpayers were younger, had higher average numeracy (as measured by the Whipple Index, see Table notes for details), and were slightly taller than taxpayers. The wife and children of exempted Chinese immigrants were also exempted from paying the Head Tax, which resulted in relatively more women and children among non-taxpayers relative to taxpayers.

Columns (3)-(4) of Table 1 use the pooled 1901-1921 Censuses to compare the entire immigrant population, defined as those who were born outside of Canada and reported arriving in Canada between 1882 and 1908, to the Chinese immigrant population, defined as those who were born in China and arrived in Canada between 1880 and 1914.[19] Relative to all immigrants, during this time period Chinese immigrants were much more likely to be male (98% of Chinese immigrants were male, compared to 59% of all immigrants to Canada), slightly less likely to be married, and less likely to have immigrated after 1903 or as children. Chinese immigrants were also less likely than other immigrants to be literate (69% of Chinese immigrants could read compared to 92% of all immigrants) or numerate, and Chinese immigrant men were more likely to be working as laborers and earned only 54% as much on average as other immigrant men. Overall, the characteristics of Chinese immigrants as recorded in the Chinese Register are similar to those recorded in the Canadian census—both suggest an immigrant population that was overwhelmingly male and had similar age and year of arrival distributions, although Chinese immigrants in the census were more likely to have arrived as children, suggesting disproportionate outmigration of adult Chinese immigrants relative to children. The Chinese Register recorded significantly more laborers than the census, however this is likely due to the coarser, more ambiguous occupational coding of Chinese immigrants in the Chinese Register compared to the Canadian census.

[18]It is possible that the occupation listed in the Chinese Register referred to an immigrant's occupation prior to arrival in Canada rather than their planned occupation upon arrival in Canada, which may be why non taxpayers were recorded as laborers at all.

[19]The Canadian Census did not record year of immigration prior to 1901.

4 Effects of the Head Tax on Immigration Flows

In Figure 1 I begin by showing raw trends in the annual number of Chinese immigrants to Canada (indicated by the solid line) and all immigrants to Canada (indicated by the dashed line).[20] Chinese immigration to Canada dropped following the implementation of the $50 Head Tax in 1886 but grew over time until the tax was doubled to $100 at the start of 1901. Immediately following the increase, Chinese immigration dropped by 55% from 4,654 in 1900 to only 2,108 in 1901. By 1903, however, Chinese immigration to Canada had reached an all-time peak, with 8,177 new Chinese immigrants registered in that year alone. When the Canadian government finally raised the tax to $500 in 1904, Chinese immigration to Canada fell to just 59 new immigrants. While other rises and falls in Chinese immigration such as the large increase and subsequent decrease from 1910-1915 largely mimic overall trends in immigration to Canada, the sharp drops in Chinese immigration immediately following increases in the Head Tax are suggestive of a decrease in the level of immigration in direct response to higher migration costs.

To formalize these descriptive results I first test for structural breaks in the inflow of Chinese immigrants at dates when the Head Tax was increased. I then quantify the effect of the Head Tax on Chinese immigration by estimating the elasticity of migration with respect to migration cost, and finally benchmark this elasticity estimate with other estimates from the migration literature.

4.1 Detecting Structural Breaks in Chinese Immigration

To detect granular changes in Chinese immigration around specific dates I use monthly Chinese immigration inflow as recorded in the Chinese Register. In Figure 2a I graph a 6-month moving average of residualized log monthly inflow, controlling only for calendar month fixed effects (raw log monthly inflow is plotted in Appendix Figure A2).[21] There is a clear,

[20] Because the Chinese Register was first created when the Chinese Immigration Act was passed midway through 1885, inflow counts prior to 1886 are represented by the number of Chinese immigrants who later voluntarily registered with the government, and are therefore likely to be underestimates of true immigration levels.

[21] I run regressions of log monthly inflow on indicators for calendar month separately for windows of six years around each Head Tax increase to minimize contamination from subsequent or prior Head Tax increases. I then plot the residuals for all three increases on the same axes by month relative to the Head

marked decrease in immigration immediately following each of the Head Tax increases. This drop is largest and most persistent around the $500 Head Tax (dot-dash line) and smallest around the $100 Head Tax (dashed line).

To formalize these visual breaks, I use a Chow test to test whether there is a significant change in regression coefficients at each increase. I use the following regression specification:

$$\log(F_t) = \mu_{m(t)} + \delta t + \varepsilon_t \tag{1}$$

where F_t represents the inflow of Chinese immigrants in month t and μ_m are month fixed effect for each of twelve calendar months m. I also include a linear time trend δt. I estimate Equation (1) separately for $t < t_0$ and $t > t_0$ where t_0 is a hypothesized breakpoint, and jointly test the null hypothesis that $\delta^{t<t_0} = \delta^{t>t_0}$ and $\mu_m^{t<t_0} = \mu_m^{t>t_0}$ for all m. I conduct this test at every month in a four-year window around each Head Tax increase, again restricting the estimation sample to a six-year window around each increase, and plot the resulting F-statistics in Figure 2b. I also plot a horizontal line representing the 95% critical value for the Chow test.

Around each Head Tax increase, the largest F-statistic (indicating the breakpoint t_0 with the strongest evidence of a change in the parameters δ and μ_m from before t_0 to after t_0, or the 'suggested structural break') falls within a few months of the date that the increase went into effect. The suggested structural break around the $50 Head Tax occurs the month after the initial Head Tax was implemented, although the noisiness of monthly inflow in subsequent months suggests that any of the months in the three years following the initial Head Tax could represent structural breaks in inflow significant at the 95% level. The suggested structural break around the $100 Head Tax occurs four months before the increase was implemented. Note that each of the Head Tax increases (which went into effect January 1st of 1886, 1901, 1904) were legislated (and therefore able to be anticipated by prospective immigrants) in July of the previous year, indicated by the dotted vertical line in Figure 2a. Therefore it is reasonable that the predicted structural break in immigration

Tax increase. Because there were only 2.5 years between when the $100 Head Tax went into effect in January of 1901 and when the $500 Head Tax was *announced* in July of 1903, I use slightly shorter post-increase and pre-increase periods around the $100 and $500 Head Taxes respectively.

may have taken place prior to the actual implementation of the increase, in anticipation of the policy change. Finally, the suggested structural break around the $500 Head Tax, by far the most significant structural break in the full time series, occurs the month prior to the implementation of the increase.

4.2 Estimating Overall Immigration Elasticity

Having established that the Head Tax and its subsequent increases had significant effects on the quantity of Chinese immigration to Canada, I now turn to quantifying these effects. I begin by estimating the following simple model:

$$\log(F_t) = \gamma^{\varepsilon} \log(C_t) + \mu_{m(t)} + \delta t + \varepsilon_t \tag{2}$$

The first term on the right-hand side of Equation (2) captures the effect of the Head Tax, with C_t representing the total cost of migration in month t in 2024 USD, constructed as specified in Section 3.3 and Appendix B. The dependent variable $\log(F_t)$ again represents the log of the inflow of Chinese immigrants in month t to Canada as recorded in the Chinese Register and $\mu_{m(t)}$ and δt again represent calendar month fixed effects and a linear time trend respectively. The primary object of interest is the coefficient γ^{ε}, which represents the elasticity of immigration inflow with respect to the cost of migration.

Column (1) of Table 2 presents the results of estimating Equation (2) using data on the monthly inflow of *all* Chinese immigrants between 1882 and 1908. I estimate γ^{ε} to be -4.11, suggesting that a 10% increase in migration cost corresponds to roughly a 41% decrease in monthly migration inflow. This decrease is significant at the 99% level. The bracketed row below the standard error reports the range of estimates implied by plausible alternate migration cost series (see Appendix B.3 for details); for my main Column (1) estimate, this range is $[-4.65, -2.83]$. In Columns (2) and (3) I separately estimate Equation (2) using $\log(F_t + 1)$ for the monthly inflow of taxpayers and non-taxpayers respectively, which keeps zero-flow months in the taxpayer-status-specific monthly panels.[22] I find that the

[22]For this exercise, I count all pre-1886 immigrants as taxpayers since everyone was in compliance with the Head Tax of $0. In Column (3) I therefore exclude pre-1886 immigrants from the sample. From 1886 onwards, I classify immigrants as taxpayers if they are recorded as paying any fee in the Register.

inflow of (potentially) taxpaying immigrants is more elastic with respect to migration cost than the full sample of immigrants, estimating γ^{ε} on this sample to be -5.28. Conversely, the elasticity of the inflow of non-taxpayers with respect to migration cost is 0.65 and is not statistically significant at conventional levels.[23] The small but positive estimate may indicate a relabelling effect, where the incentive to immigrate under a tax-exempted category grew as the tax increased.

4.3 Isolating Cost Effects from Non-Cost Confounders

The above estimate, the 'overall' elasticity of -4.1, captures the response (in terms of immigration inflow) to a *bundle* of changes. While the primary measurable change over this time period was a change in direct migration costs, the initial implementation in 1885 came with other policy clauses (such as capacity constraints on incoming Chinese passenger ships) and throughout this period increased hostility and discrimination may have led to lower perceived returns to migration, even holding costs fixed. In this section, I attempt to disentangle responses to direct costs from responses to these non-cost factors, first by focusing on short-run responses to cost shocks, and then by using tax-exempt immigrants as a control group.

Short-run Responses. I re-estimate equation (2) separately for six-year windows around the \$50, \$100, and \$500 Head Taxes and present the results in Columns (4)-(6) of Table 2 respectively.[24] Relative to the overall estimated elasticity of -4.11, I estimate a somewhat larger elasticity around the \$50 Head Tax ($\hat{\gamma}^{\varepsilon} = -4.76$), a smaller but still negative elasticity around the \$100 Head Tax ($\hat{\gamma}^{\varepsilon} = -2.73$), and a similar elasticity around the \$500 Head Tax ($\hat{\gamma}^{\varepsilon} = -4.13$). The larger response of Chinese immigrants to the \$50 Head Tax is suggestive of an additional (non-cost) disincentive effect from the initial implementation of the Head Tax, when non-cost factors like increased hostility would have been most salient, and when other non-Tax policy changes went into effect. The short-run responses to later tax increases,

[23] These results are robust to alternate transformations of the dependent variable, including $\log(F_t)$ with zero-months excluded and a Poisson Pseudo-Maximum Likelihood specification.

[24] As above, I use slightly shorter time periods around the \$100 and \$500 Head Taxes to avoid an overlap in time periods, hence the smaller number of observations.

however, are more likely to reflect the direct effect of migration costs, since later tax increases were not bundled with other policy changes and were reflections of long-run increases in hostility, which would be absorbed by time trends.

Non-taxpayer Controls. To further purge potential contamination from non-cost factors, I adopt a difference-in-differences style approach by comparing the flow of taxpaying immigrants to the flow of non-taxpaying immigrants over this time period. As noted above, it is possible that changes in migration cost caused changes in the composition of taxpayer groups by inducing laborers to try to enter as tax-exempt merchants or students. I therefore interpret these differenced results as a lower bound (in magnitude) on the true elasticity of immigration inflow with respect to cost, since this 'relabelling' compositional shift would bias my estimates toward zero.

To extract the additional effect of the Head Tax on taxpayer inflow, relative to the inflow response of non-taxpayers to non-Head Tax costs and other factors, I use the following estimating equation:

$$\log(F_{gt}+1) = \theta D_g \left[\log(C_t) - \log(B_t)\right] + \alpha_g + \lambda_t + \varepsilon_{gt} \tag{3}$$

where F_{gt} is the monthly inflow of group $g \in \{\text{taxpayer}, \text{non-taxpayer}\}$ in month t, the first term on the right-hand side represents the effect of the log-cost differential induced by the Head Tax (where C_t is the taxpayer migration cost as above, B_t is the no-tax migration cost, and D_g is an an indicator equal to one for taxpayer cells).[25] I also include taxpayer-status and arrival-month fixed effects, represented by α_g and λ_t respectively. The parameter of interest θ captures the elasticity of taxpayer inflows with respect to the Head Tax, net of non-tax costs and other factors common to both groups in the same month. Table 3 reports this estimate for the full sample of 1882-1908 arrivals (coding pre-1886 arrivals as taxpayers because they faced a statutory Head Tax of zero) and the \$100 and \$500 windows (note that estimates for the \$50 window are not well-identified since, by definition, there are no non-taxpayers prior to 1886). I estimate an elasticity over the entire period of -2.3, with

[25] I use the $\log(x+1)$ transformation because the taxpayer-status-specific monthly series contains some zeros. I show robustness to this specification in Appendix Table A2.

a cost-sensitivity range of -3.2 to -2.1. The short-run elasticity for taxpayers relative to non-taxpayers is larger in magnitude near the $500 increase and indistinguishable from zero around the $100 increase.

4.4 Robustness and Alternative Margins of Adjustment

I include additional results showing robustness of my overall cost elasticity estimate to the inclusion of additional controls and alternate time windows in Appendix Table A1.

Robustness. First, I estimate the overall cost elasticity using a modified version of Equation (2) that includes year-level controls for 'push', 'pull', and 'network' factors that may have affected Chinese immigration through non-cost channels:

$$\log(F_t) = \gamma^{\varepsilon} \log(C_t) + \alpha_1 E_{y(t)} + \alpha_2 I_{y(t)} + \alpha_3 P_{y(t)-1} + \alpha_4 (P_{y(t)-1})^2 + \mu_{m(t)} + \varepsilon_t \qquad (4)$$

where the elasticity of monthly immigration inflow F_t with respect to the cost of migration C_t is again represented by γ^{ε}, $E_{y(t)}$ (note that $y(t)$ indexes the year of month t for variables that are only measured annually) represents total emigration out of Hong Kong which I use as a proxy for 'push' factors, $I_{y(t)}$ represents total immigration into Canada which I use as a proxy for 'pull' factors, and $P_{y(t)-1}$ represents the lagged stock of Chinese immigrants living in Canada, which I use as a proxy for China×Canada-specific 'network' factors.[26] Column (2) of Table A1 presents the results of estimating equation (4). I estimate an elasticity of -3.60, which is similar to my preferred estimate of -4.11 and is also significant at the 99% level, with a slightly *smaller* R^2 than my preferred specification of just a linear time trend.

As additional robustness checks I estimate models (2) and (4) with an expanded sample

[26] While Hatton and Williamson (1994); Boustan (2007); Clark et al. (2007) and other papers that empirically evaluate determinants of migration using time series data generally model migration as a function of the destination country's economic conditions (e.g. wages, employment) **relative to** the origin country's economic conditions, the lack of data on economic conditions in China in the late 1800's and early 1900's complicates perfect adherence to the models in this literature. I follow Clark et al. (2007) in including push factors, pull factors, and $P_{y(t)-1}$ and $(P_{y(t)-1})^2$, which they show to be the largest determinant of migration flows outside of immigration policy.

from 1882 to 1921 in Columns (3) and (4) of Table A1. Column (3) has an estimated elasticity indistinguishable from 0 at the 95% level and poor model fit, likely driven by noise from the rapid increase and fall in immigration prior to World War I. Column (4), which controls for total immigration to Canada, performs much better and estimates an elasticity of -3.75, only slightly smaller in magnitude than my preferred estimate and significant at the 99% level. Finally, since registration was voluntary for Chinese immigrants who had arrived prior to 1886, the Register estimates of inflows prior to 1886 could be *underestimates*, biasing my estimate of the effect of the Head Tax downwards. In Columns (5) and (6) of Table A1 I estimate models (2) and (4) with a restricted sample from 1886 to 1908. I find similar estimates of elasticity under both models.

Alternative Margins of Adjustment. In Appendix C I explore the possibility that prospective Chinese migrants to Canada responded to the Head Tax by adjusting either their timing or their destination locations. I first test for the possibility that migrants adjusted their **timing** by including additional interaction terms for short windows immediately before and after each Head Tax increase, and then by excluding these short windows altogether. The results suggest a slightly larger response immediately after but no anticipatory response immediately before each Head Tax increase, and the overall elasticity estimates remain close to the preferred estimate.

I next explore the possibility of destination **location** substitution by using annual Hong Kong Harbourmaster reports to track emigration from China to alternate destination ports. I find suggestive evidence that Chinese migrants did substitute to alternate destinations in response to higher migration costs to Canada, initially redirecting to Australia after the 1885 Head Tax implementation, then (likely in response to more restrictive immigration policy in Australia in the 1890s) redirecting to Mexico and Peru following later Head Tax increases. These results speak to the applicability of my results to the setting of modern-day immigration, where immigration to most countries is more heavily restricted.

4.5 Benchmarking Elasticity Estimates

In this section, I benchmark my estimates of the elasticity of migration with respect to cost, ranging from -4.1 to -2.3, against other existing estimates.

First, Angelucci (2012) uses border enforcement between the U.S. and Mexico as a proxy for migration cost. Angelucci (2012) estimates the elasticity of migration likelihood with respect to Border Patrol line watch hours to be between -0.85 and -0.41. Roberts et al. (2010) estimate an elasticity of smuggling cost with respect to border patrol watch hours of between 0.25 and 0.38, while Gathmann (2008) estimates the price elasticity of enforcement more generally to be between 0.24 and 0.48. Together, these estimates suggest an elasticity of migration with respect to smuggling cost of between -3.5 and -0.85, somewhat smaller than my estimates.

On the other hand, Friebel et al. (2024) use *distance* as a proxy for migration cost, leveraging an exogenous shock to the length of smuggling routes between Africa and Europe to estimate an elasticity of intention to migrate (measured using a survey) with respect to distance of -3.3, and an elasticity of migrant apprehensions (serving as a proxy for actual migration) with respect to distance of -6. The same paper estimates the elasticity of cost, as measured in survey data, with respect to distance to be between 0.88 and 0.93, and cannot reject an elasticity of 1. Together, these estimates suggest an elasticity of migration with respect to cost of between -6.8 and -3.5, somewhat larger than my estimated range.

There are several reasons why these two estimates from the literature may differ slightly from my estimate or from each other. First, all estimates of migration flows in these papers rely on annual survey data, which may be underreported depending on the setting, and is collected at a much lower frequency than my monthly data, which may lead to more noise in the estimates and an inability to pick up on short-term responses. Second, the landscape of immigration policy has changed considerably over time and also differs substantially between Africa-Europe migration and Mexico-U.S. migration. Stricter immigration policy worldwide today may have led to more inelastic migration, as other potential migration destinations close off.

Finally, the estimates above focus on illegal migration, which differs substantially from

legal migration (the focus of this paper). If illegal migration is costlier at baseline than legal migration (as may be the case between Africa and Europe, where smuggling routes are often circuitous to avoid apprehension) then a decrease in migration cost as proxied by distance may understate the actual reduction in cost for illegal immigrants, leading to an overestimate of the migration elasticity. On the other hand, if illegal migration is less costly at baseline than legal migration (as may be the case between the U.S. and Mexico, where legal migration is not a viable route for many), then migration responses may be less elastic for illegal migration than for legal migration.

Overall, I conclude that my estimates of the elasticity of migration with respect to cost, although unique in the literature, are approximately in line with other estimates using cost proxies.

5 Effects on Selection

Having established that the Head Tax reduced immigration from China, I now turn to the question of which immigrants were excluded by this increased cost. I begin this section by giving an overview of two different models of immigration and their predicted patterns of selection. I then present descriptive evidence on the initial selection of immigration from China to Canada prior to the implementation of the Head Tax in the 1880s. Next I use microdata on the characteristics of immigrants to visualize how selection evolved as the Head Tax grew. I conclude by empirically testing for changes in selection around increases in the Head Tax.

5.1 Theoretical Framework

The decision of whether or not to immigrate is fundamentally a tradeoff between the gains from migration and the cost to migrate. In a Roy-Borjas model where the cost of migration is the same for everyone, only those with sufficiently large gains from migration to offset the cost will choose to migrate (Roy, 1951; Borjas, 1987). Under this framework, an increase in the cost of migration would discourage only those with the least to gain from migration. With the assumption that the returns to skill were lower in Canada relative to China for

prospective Chinese immigrants, the Borjas (1987) model predicts that Chinese migrants to Canada would initially be negatively selected on skill, and would become even more negatively selected as the Head Tax increased.[27]

Conversely, if migration costs are modeled as decreasing in skill (e.g. if borrowing is more difficult for low-skilled migrants) following Chiquiar and Hanson (2005), then even a skill-neutral migration tax would have heterogeneous effects. Under this framework, an increase in the Head Tax would disproportionately affect low-skilled prospective migrants, discouraging precisely those with the *most* to gain from migrating. The Chiquiar and Hanson (2005) model predicts negative or intermediate selection on skill initially and that Chinese migrants would become more positively selected as the Head Tax increased (under the continued assumption that the returns to migration for Chinese migrants at this time are decreasing in skill). Appendix D contains formalized versions of both models.

The Borjas (1987) and Chiquiar and Hanson (2005) models generate opposite predictions for how an increase in migration costs would affect the selection of prospective Chinese immigrants into immigrating to Canada. In the following section, I use the exogenous variation in migration costs generated by the Head Tax and its subsequent amendments to test between these two models.

5.2 Initial Selection

To identify whether immigrants are selected negatively or positively on skill relative to the origin country population requires representative skill data on two populations: the immigrant population and the origin country population. For the former I again use the Chinese Register. While the Register covers the universe of legal Chinese immigrants to Canada between 1886 and 1923 (and a substantial fraction of immigrants prior to 1886), it contains no direct measures of skill in the form of education or literacy. To measure selection in this data I use height, a common metric of human capital in the economic history literature, particularly in the context of historical selection into migration (Humphries and Leunig, 2009; Stolz and Baten, 2012; Kosack and Ward, 2014; Escamilla-Guerrero and López-Alonso, 2023). Unlike other measures of selection such as wages or education, after

[27] This assumption is discussed in detail in Appendix D

a certain age height is largely independent of any further human capital investment and therefore is likely to be unaffected by the decision to migrate.[28] Additionally, since height was measured by immigration officials at the time of registration, it is likely more accurately and consistently measured than other self-reported variables in the Chinese Register, such as occupation.

The average height of Chinese men recorded in the Register who immigrated to Canada prior to 1886 between the ages of 23 and 50 was 162.8cm.[29] How does this average height compare to the average height of Chinese men at the time?

Obtaining any data on the native Chinese population in the 19th century poses a significant hurdle. The biggest advantage of using height as a metric of selection is that it has been used in other settings to measure the human capital of samples of the Chinese population in the 19th and early 20th centuries, and while I do not have raw data on the height in China during this time period, I can use estimates from previous work to characterize the height of the origin population over the late 19th and early 20th centuries

I use three sets of benchmark figures: first, Olds (2003) estimates the average height of adult Taiwanese men born between 1860 and 1865 (the modal age bin for pre-1886 arrivals) to be 162.5cm. While these data were collected between 1920 and 1930, and so require adjustments for age-related shrinkage and death patterns, they cover the entire population and therefore do not suffer from selection issues.[30] Second, Baten and Hira (2008) summarize data on Chinese migrant workers in Indonesia in the 1880s and find that the average height for the 1860-1864 birth cohort was 161.5cm.[31] Finally, data on Chinese immigrants to the U.S. and Australia, who were likely neutrally or positively selected due to occupation-based immigration restrictions, yield estimates of the height of the 1860-1865 birth cohort

[28]Note that this is not necessarily the case for migrant youth, whose parents might invest in better nutrition in anticipation of migration.

[29]Following the literature, I exclude men below the age of 23 who may not have finished growing at the time of migration, and men above the age of 50 who may have begun to shrink in height (Baten et al., 2010). Since a large fraction of Chinese immigrants were young men, this excludes roughly 40% of the sample.

[30]Taiwan was under Qing rule until 1895, when it was ceded to Japan, so Taiwanese men born before 1870 would have grown to their full height under similar conditions to Southern Chinese men born at the same time, particularly due to Taiwan's geographic proximity and socioeconomic similarity to Southern China at the time.

[31]Migrant workers in Indonesia were almost certainly negatively selected from the Chinese population, since the majority were contract workers (indicating minimal migration costs) on plantations with high mortality and bad working conditions.

of between 163cm and 165cm (Morgan, 2004; Carson, 2006; Morgan, 2009). Together, these references for Chinese height in the late 19th century suggest that Chinese immigrants to Canada were neutrally or potentially slightly positively selected on height relative to the Chinese population, which is in line with the predictions of the Chiquiar and Hanson (2005) model of selection into immigration.

5.3 Evolution of Selection

Figure 3 graphs the average height of Chinese immigrant men between ages 23 and 50 by year of arrival in Canada, with larger points representing years with more Chinese immigrants. As discussed above, the average height of Chinese immigrant men prior to 1886 was 162.8cm, which corresponds to neutral or slightly positive selection on height relative to the Chinese population. The average height of Chinese immigrants rose to 163.4 under the $50 Head Tax, 163.8cm under the $100 Head tax, and 164.2cm under the $500 Head Tax, indicating that the selection of Chinese immigrants to Canada on height became increasingly positive as the cost of migration increased.[32]

The literature on historical Chinese height indicates that accounting for birth cohort effects suggests an even larger increase in selection, since a wide range of other data sources consistently show a 1-2cm decrease in the average height of Chinese men between the 1850 birth cohort and the 1890 birth cohort (Baten et al., 2010). These roughly correspond to the immigrant cohorts of 1880 and 1920 respectively, indicating that all else equal, average heights would have decreased over this time period. Instead, average heights increased, suggesting that selection into immigration from China to Canada became increasingly positive as the Head Tax grew. This is again in line with the predictions of the Chiquiar and Hanson (2005) selection model with skill-varying costs.

In Figure 4a I use more granular monthly Register data to graph the average height in a six-year window around each Head Tax increase, smoothed with a 6-month moving average. There is a striking if slightly delayed increase in the average height of immigrants after each

[32]The rapid increase in the average height of Chinese immigrants to nearly 167cm by the 1920s was in part driven by a small number of non-taxpayers, who were mostly students. The mean height among taxpayers under the $500 Head Tax was 164.0cm.

Head Tax increase. This figure provides descriptive evidence that the increases in height over the entire period of the Head Tax are linked to the specific dates at which the Head Tax was increased rather than just due to a general time trend.

I supplement this descriptive analysis of selection on the basis of height with two other measures of selection: the Whipple Index (a proxy for numeracy), and the share of immigrants recorded as taxpayers rather than exempt entrants. The Whipple Index, a common measure of numeracy in the historical literature, is computed as the share of the population reporting their age to be a multiple of 5, multiplied by 500 (Baten et al., 2010). A Whipple index of 100 indicates 'perfect' numeracy and a Whipple index of 500 indicates that everyone in the population reports an age ending in 0 or 5. Taxpayer status captures a complementary composition margin because exemptions were concentrated among categories such as merchants and students.

Figures 4b and 4c show the six-month moving average of the Whipple Index and the taxpayer share respectively in windows around the $100 and $500 Head Tax increases. Changes in the Whipple Index are substantially less obvious and less consistent than changes in height—there appears to be a decrease in the average Whipple index (an increase in numeracy) following the increase in the Head Tax to $500, but little change around the increase to $100. Similarly, the taxpayer share changes little around the $100 Head Tax, but falls sharply after the $500 Head Tax. This is due to the fact that nearly all of the (very few) Chinese immigrants to Canada in the months immediately following the $500 Head Tax were merchants or students, who were exempt from the Head Tax.

While suggestive of selection becoming increasingly positive following each Head Tax increase, this descriptive evidence does not take into account that the number of observations following each increase are much smaller (as observed in section 4) and does not account for changes in the Chinese population over this time period. In the following section I formally estimate the effect of the Head Tax on each of these outcomes.

5.4 Estimation of Effects of Head Tax on Selection

To quantify the effect of migration cost on selection, I use two complementary specifications. The first is the following individual-level equation:

$$y_{ibt} = \gamma \log(C_t) + \mu_{m(t)} + \delta_b + \varepsilon_{ibt} \tag{5}$$

for each outcome variable y_{ibt}, where i indexes individuals, b indexes five-year birth cohort bins, and t indexes month of immigration. As before, C_t represents the cost of immigration in 2024 USD. I include calendar-month fixed effects $\mu_{m(t)}$ and birth-cohort-bin fixed effects δ_b. The coefficient of interest γ is identified from comparisons between individuals in the same five-year birth cohort who immigrated to Canada in the same calendar month but faced different migration costs due to migration in different years.

While the above specification differences out birth-cohort effects, as in Section 4 we may worry that responses in the composition of migrants may be driven by factors other than cost alone. My second specification mirrors the taxpayer-status cost-differential design used in the prior section:

$$y_{ibt} = \theta \left[Taxpayer_i \times (\log(C_t) - \log(B_t)) \right] + \tau Taxpayer_i + \lambda_t + \delta_b + \varepsilon_{ibt}. \tag{6}$$

Here $Taxpayer_i$ indicates that immigrant i was recorded as paying the Head Tax, B_t is the no-tax baseline migration cost, C_t is the taxpayer migration cost, and λ_t are arrival-month fixed effects. This specification identifies θ by comparing taxpayers and exempt non-taxpayers in the same birth cohort bin arriving in the same month as the taxpayer-specific log cost differential (generated by the Head Tax) changes over time.

The results of estimating Equations (5) and (6) for the full sample of Chinese migrants to Canada between 1886 and 1908 are shown in Table 4.[33] In Appendix Table A3 I also show results focusing on six-year windows around the $100 and $500 Head Tax Increases separately. In addition to the outcomes of probability that the entrant is a taxpayer (1), height (Columns (2) and (3)), and Whipple index ((6) and (7)), I also estimate this equation

[33]For all following analyses, I drop pre-1886 migrants, who are voluntary registrants and are therefore highly likely to be a selected sample. Inclusion of pre-1886 migrants yields qualitatively similar results.

with age at arrival ((4) and (5)) (for which I exclude birth cohort bin fixed effects).

I estimate in Column (1) that increases in migration cost were associated with a significant decrease in the share of migrants that were taxpayers, driven entirely by the $500 increase. This evidence of increasingly positive selection is in line with the descriptive evidence above. Because of this compositional shift associated with higher levels of the Head Tax, however, I interpret estimates of θ not as semi-elasticities, but as measures of whether my γ_ε estimates are driven by taxpayer status composition alone or also by changes in selection within taxpayer group.

I estimate in Column (2) that increases in migration cost were associated with a small but significant increase in height. In particular, I estimate that a 10 log point increase in the cost of migration would suggest an increase in average height of 0.03cm. When I isolate the relative response of taxpayers to the log cost differential with non-taxpayers in Column (3), however, I find that this relationship disappears, suggesting that the increase in average height is driven entirely by the decreasing share of taxpayers, who were shorter than average than non-taxpayers (as shown in Table 1). Similarly, while Column (4) shows an overall negative relationship between migration cost and age at arrival, Column (5) shows that among taxpayers the Head Tax increases induced older migrants (perhaps those with more fewer liquidity constraints or higher returns to migration due to larger networks in Canada).[34] Finally, estimated effects of migration cost on numeracy in Columns (6) and (7), while not significant at conventional levels, are suggestive of increased numeracy among migrants who faced higher costs.

In summary, I find that increases in migration cost induced relatively more migrants to immigrate under tax-exempt categories associated with higher human capital, driving the average height of migrants up and the average age of migrants down. My results are broadly consistent with higher migration costs inducing more positive selection into immigration.

[34]If 'relabelling' of migrants, who previously would have immigrated as laborers but due to the Head Tax chose to immigrate under tax-exempt categories, did occur, these results could also reflect younger immigrants being more likely to 'relabel' (perhaps as students), 'moving' from the taxpayer pool to the non-taxpayer pool and driving the relative age of taxpayers up as the Head Tax increased.

6 Conclusion

In this paper, I find evidence that the Chinese Head Tax of 1885 had significant effects on the inflow of Chinese immigrants to Canada, estimating an elasticity of monthly inflow with respect to migration cost of between -4.1 and -2.3, comparable to modern day estimates of the elasticity of migration with respect to cost. I also find that while initially immigrants from China to Canada were neutrally or slightly positively selected on the basis of height relative to the broader Chinese population, as the Head Tax grew, Chinese immigrants became increasingly positively selected.

My findings indicate that migration costs play an important role in migration decisions, and that higher migration costs in the late 19th and early 20th centuries excluded mostly immigrants with lower human capital (as proxied by height and numeracy). The shift towards positive selection caused by an increase in migration costs can also be seen in the composition of immigrants today, which in the U.S. and Canada has grown increasingly positively selected over time as migration costs have increased.

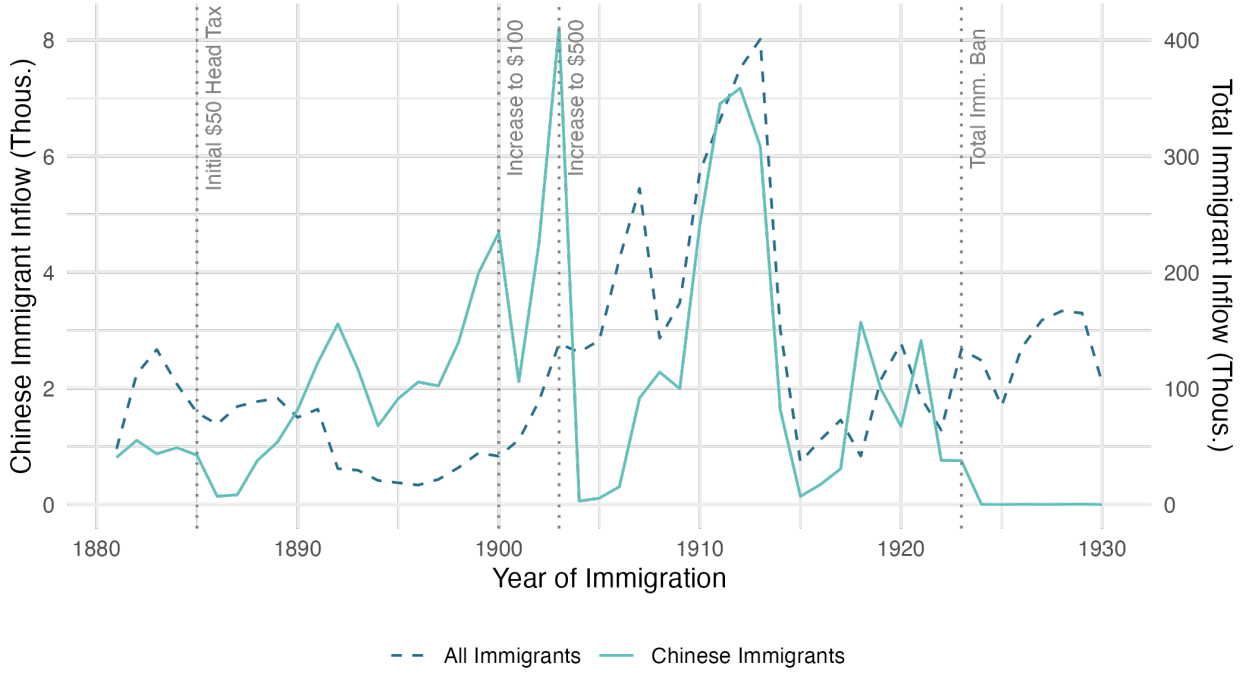
While there is still a great deal of room to dig further into other effects of migration costs, such as how the selection aspect of migration costs interacts with cultural or wage assimilation after arrival, the initial findings give some insight into the direct and indirect effects of the Head Tax, and the possible implications for present-day immigration policy. Selection into migration is a topic of great interest, and bears significant relevance to present-day immigration policies, many of which explicitly approve immigrants based on educational background and economic standing. Understanding how immigration costs, whether explicit (as in the case of the Head Tax), or implicit (as in the case of modern-day immigration), play a role in selection into migration and outcomes after arrival, is key to understanding how to best shape equitable immigration policy going forward.

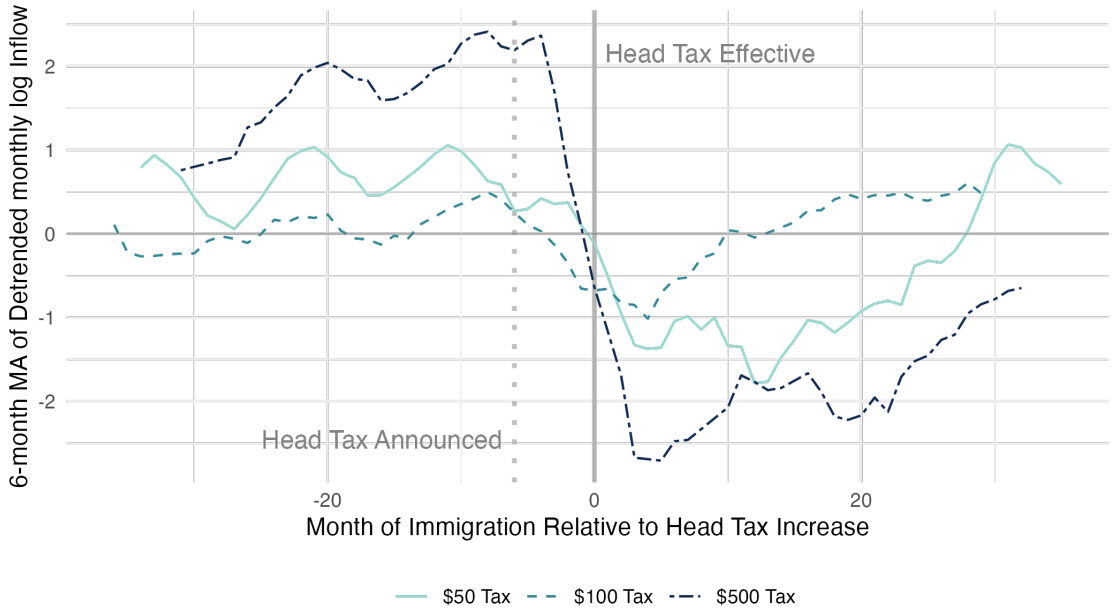
Table 1: Summary statistics for immigrants to Canada between 1882 and 1908 (Ward and Yu, 2008; Canadian Families Project, University of Victoria, 2012; Canadian Century Research Infrastructure, 2011, 2015).

	Chinese Register		Canadian Census	
	(1)	(2)	(3)	(4)
	Head Tax	No Head Tax	Chinese Imm.	Non-Chinese Imm.
% Male	98.91	89.08***	98.21	59.2***
% Married†	-	-	56.75	66.61***
Year of Immigration (%)				
Before 1886	7.025	0.5979***	5.622	6.262
1886-1900	58.65	24.85***	52.62	34.84***
1901-1903	28.63	10.99***	19.49	13.59***
After 1903	5.693	63.56***	22.26	45.3***
Age at Immigration (%)				
Under 18	6.685	34.16***	24.92	42.75***
18-24	33.73	16.26***	34.84	21.88***
25-34	36.99	24.85***	30.76	20.83***
Over 35	22.6	24.74**	9.487	14.54***
% Literate†	-	-	68.92	92.42***
Whipple Index	149.3	122.4***	166.3	117.9***
% Laborers‡	76.61	9.85***	40.33	26.39***
Mean Annual Earnings‡	-	-	412.2	769.8***
Height (cm)‡	163	163.7***	-	-
Obs.	50,817	2,676	2,458	91,009

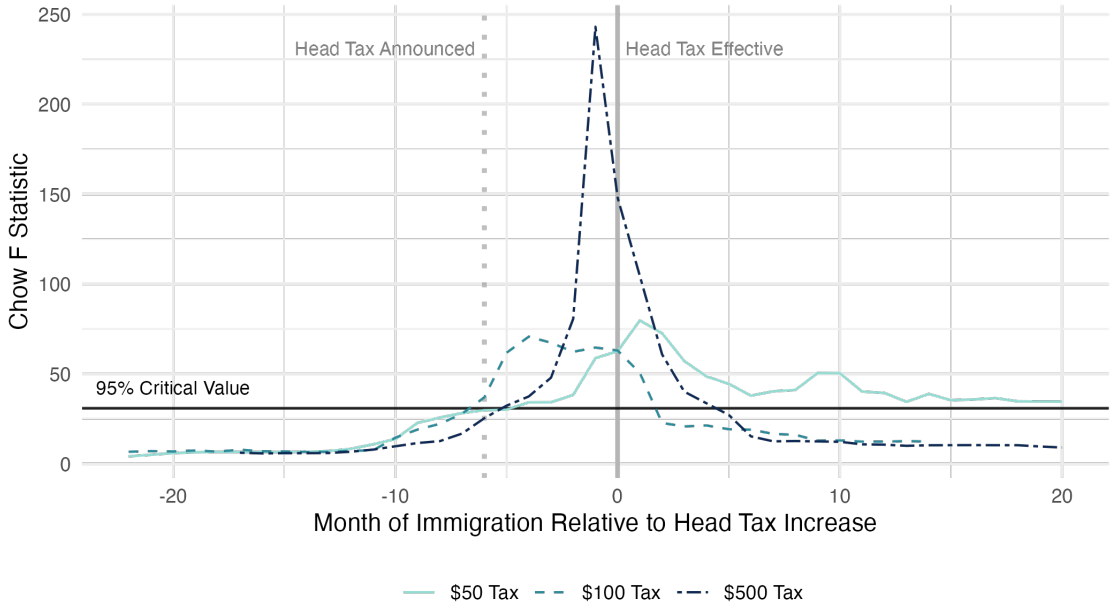
†Calculated for everyone aged 18 or older.
‡Calculated only for men aged 18 or older.
*p<0.1; **p<0.05; ***p<0.01. Stars in Columns (2) and (4) indicate p-values from tests of equality in means with Columns (1) and (3), respectively.
Notes: Columns (1) and (2) use 1882-1908 arrivals reported in the Chinese Register (as described in Section 3.1) who paid a non-zero Head Tax and zero Head Tax respectively. Column (3) pools Canadian census data (as described in Section 3.2) from 1901, 1911, 1921, subsetting to those born in China. Column (4) uses Canadian census data subsetted to foreign-born immigrants not born in China. Census means are weighted based on the coverage of that year's census (5% for 1901-1911 and 4% for 1921). Literacy is indicated by the ability to read in any language, as reported in the Canadian census. The Whipple Index is a measure of numeracy, calculated by multiplying the share of the sample who report ages ending in 0 or 5 by 500 ('perfect' numeracy would have a Whipple Index of 100, complete bunching would have a Whipple Index of 500).

Figure 1: Annual inflow of Chinese immigrants to Canada (solid line) as measured by the Chinese Register (Ward and Yu, 2008) with annual inflow of total immigrants to Canada (dashed line) as measured by official historical immigration statistics (Employment and Immigration Canada, 1982) for comparison. Vertical dotted lines mark changes to Canadian immigration policy affecting Chinese immigrants.





(a) 6-month moving average of residual log monthly inflow of Chinese immigrants to Canada by month relative to each Head Tax increase. Residuals are obtained by regressing log monthly inflow around each Head Tax separately on indicators for each month and a constant.



(b) F Statistic from a Chow test for a structural break (significant change in regression coefficients) at each month relative to each Head Tax increase. The regression used for the Chow test includes indicators for each month, a constant, and a linear time trend.

Figure 2: Residual trends in monthly immigration (panel (a)) and F-Statistics from Chow tests (panel (b)) by month relative to the initial $50 Head Tax (solid line), the increase to $100 (dashed line), and the increase to $500 (dot-dash line). The vertical dotted grey lines indicate when the increases were initially legislated (in all cases, the July prior to when the increase went into effect). Data is obtained from the Chinese Register (Ward and Yu, 2008).

Table 2: Estimation of Equation (2) to capture the overall effects of migration cost on monthly Chinese immigrant inflow to Canada.

	All Chi. Imm.	Taxpayers	Non-Taxpayers	$\leq$ 3yr from ↑\$50	$\leq$ 3yr from ↑\$100	$\leq$ 3yr from ↑\$500
	Dependent variable:					
	Transformed Monthly Chinese Immigrant Inflow					
	(1)	(2)	(3)	(4)	(5)	(6)
γ^{ε} (log Cost)	-4.11^{***}	-5.28^{***}	0.65	-4.76^{***}	-2.73^{***}	-4.13^{***}
	(0.58)	(0.96)	(0.39)	(1.11)	(0.67)	(0.35)
	[−4.65, −2.83]	[−6.03, −3.57]	[0.36, 0.88]	[−5.64, −3.22]	[−4.18, −2.47]	[−5.66, −3.89]
Time Period	1882-1908	1882-1908	1886-1908	1883-1888	1898-1903	1901-1906
Outcome Transform	$\log(F_t)$	$\log(F_t+1)$	$\log(F_t+1)$	$\log(F_t)$	$\log(F_t)$	$\log(F_t)$
Mean Monthly Inflow ($\overline{F_t}$)	167.7	159.4	9.8	50.5	325.6	229.1
Observations	319	319	271	72	66	63
Adjusted R^2	0.57	0.59	0.45	0.51	0.53	0.86

*p<0.1; **p<0.05; ***p<0.01

Notes: Monthly inflow of Chinese immigrants to Canada is measured using Chinese Register data (Ward and Yu, 2008). Column (1) uses the preferred estimation sample of all immigrants from 1882-1908. Columns (2) and (3) split the preferred sample into taxpayers and non-taxpayers respectively and use $\log(F_t+1)$ as the outcome so that zero-flow months remain in the taxpayer-status-specific monthly panels (note that I exclude pre-1886 arrivals in Column (3) since pre-1886 arrivals were not required to pay the tax). Columns (4)-(6) use the log monthly flow of all immigrants and focus on six-year windows around each Head Tax increase. All regressions include calendar month fixed effects and a linear time trend. I report Newey-West HAC standard errors in parentheses. The bracketed row below each standard error is a cost-sensitivity range: it shows the range of estimates obtained when I vary uncertain migration costs within the plausible lower and upper values described in Appendix B.3.

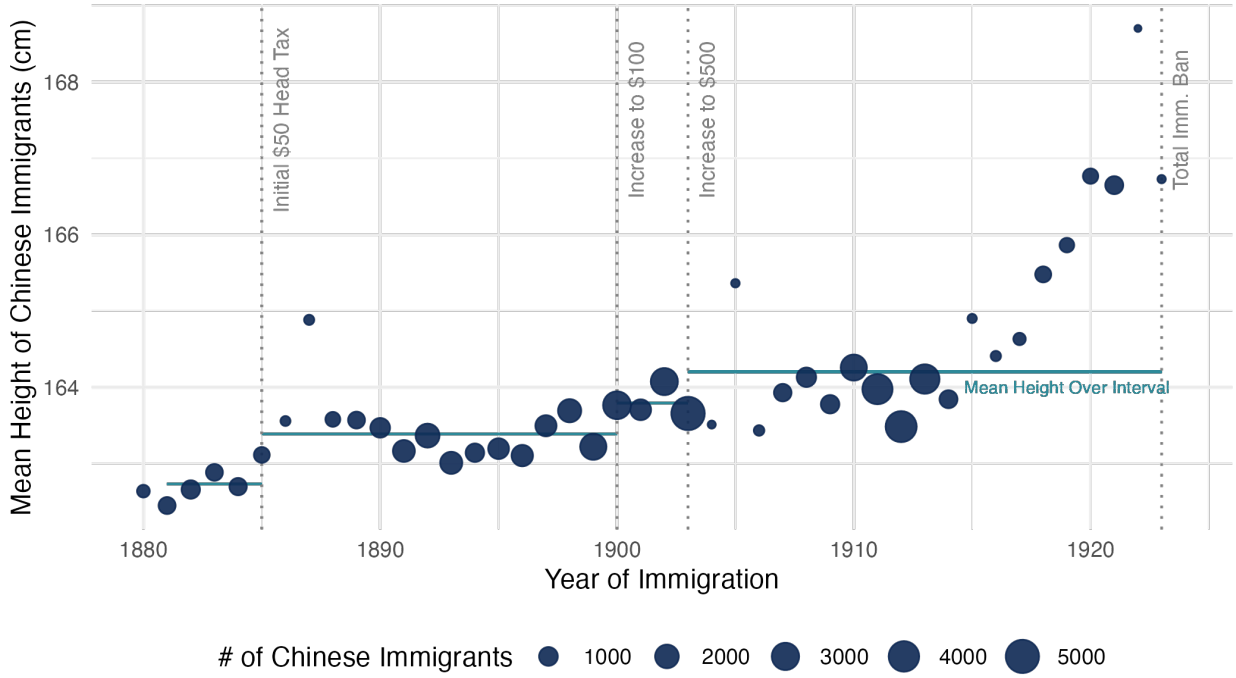
Table 3: Estimation of Equation (3) to capture the relative effects of the Head Tax on taxpaying elative to tax-exempt Chinese immigrants to Canada.

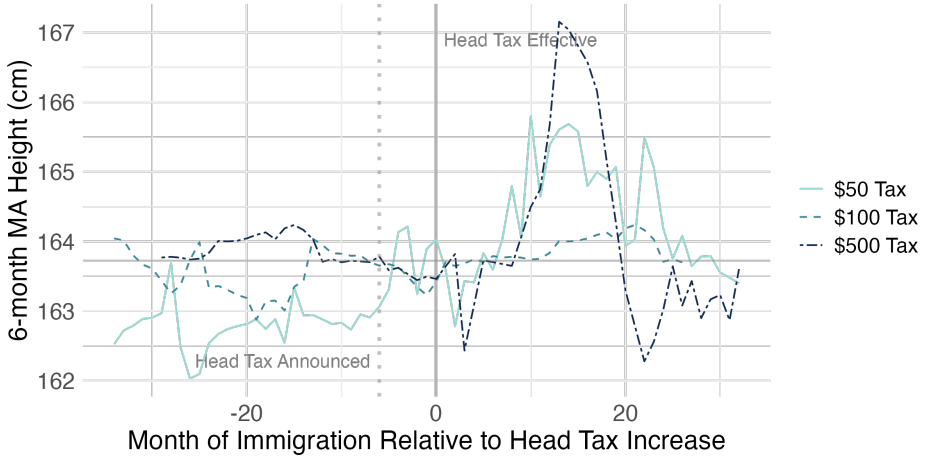
	All Chi. Imm.	$\leq$ 3yr from ↑\$100	$\leq$ 3yr from ↑\$500
	Dependent variable:		
	log Monthly Group Inflow ($\log(F_{gt}+1)$)		
	(1)	(2)	(3)
θ (Taxpayer $\times$ log cost differential)	-2.27^{***}	-0.17	-3.88^{***}
	(0.14)	(0.74)	(0.27)
Cost-sensitivity range	$[-3.22, -2.09]$	$[-1.22, -0.06]$	$[-5.41, -3.66]$
Time Period	1882-1908	1898-Jun 1903	Jun 1901-1906
Mean Monthly Taxpayer Inflow	158.7	317.8	217.3
Mean Monthly Non-Taxpayer Inflow	8.3	6.0	10.7
Observations	638	132	126
Adjusted R^2	0.79	0.91	0.89

*p<0.1; **p<0.05; ***p<0.01

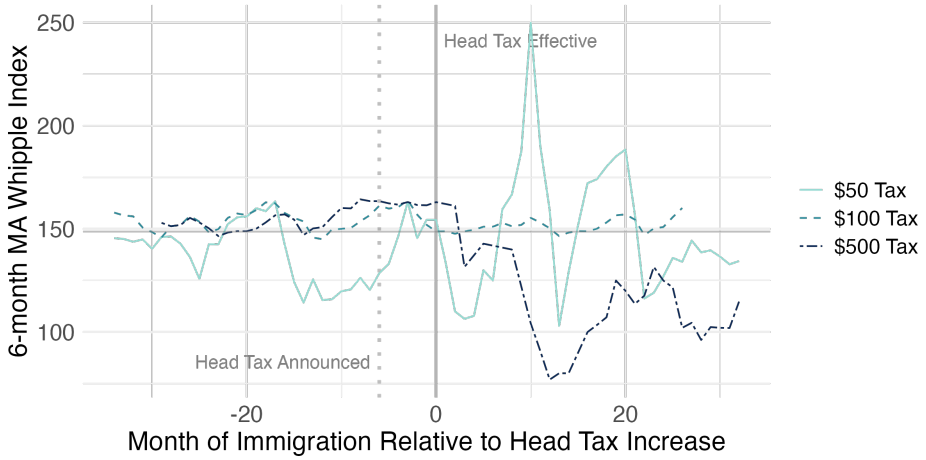
Notes: Each observation is a taxpayer-status by arrival-month cell from the Chinese Register (Ward and Yu, 2008). Taxpayers are entries recorded with positive fees, plus all pre-1886 arrivals, who faced a statutory Head Tax of zero. Non-taxpayers are entries from 1886 onward recorded with zero fees. Columns (1)-(3) correspond to the estimation windows used in Columns (1), (5), and (6) of Table 2, respectively. All regressions include arrival-month and taxpayer group fixed effects. I report HC1 standard errors clustered by arrival month in parentheses and a bracketed cost sensitivity range below each estimate.

Figure 3: Average height (cm) of 23-50 year-old Chinese immigrant men by year, as recorded in the Chinese Register (Ward and Yu, 2008). Points are scaled by the number of Chinese immigrants in a given year, vertical dotted lines mark years in which the Head Tax was initially created or increased, and horizontal solid lines represent average height over the periods corresponding to different Head Tax levels.

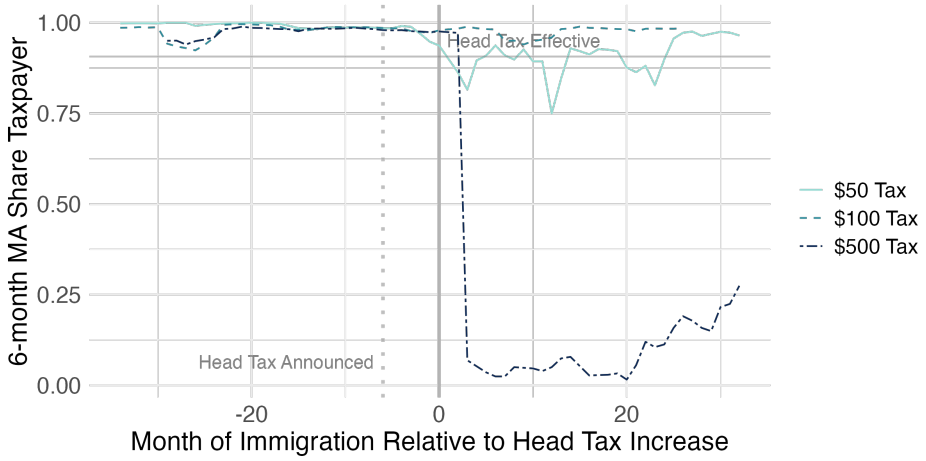




(a) Outcome: Height (cm)



(b) Outcome: Whipple Index (500 × share reporting age as multiple of 5)



(c) Outcome: Share recorded as taxpayer

Figure 4: 6-month moving average of Chinese immigrant height (panel (a)), Whipple index (panel (b)), and taxpayer share (panel (c)) relative to the initial $50 Head Tax (solid line), the increase to $100 (dashed line), and the increase to $500 (dot-dash line). Sample means are indicated by horizontal lines. Data is obtained from the Chinese Register (Ward and Yu, 2008).

Table 4: Selection effects of the Chinese Head Tax.

	Pr(Taxpayer)	Height (cm)		Age at arrival		Whipple index	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
γ^{ε} (log Cost)	-0.19^{***}	0.33^{***}		-2.18^{***}		-4.77	
	(0.01)	(0.12)		(0.11)		(3.54)	
Cost-sensitivity range	[−0.20, −0.15]	[0.20, 0.47]		[−2.35, −1.94]		[−5.40, −3.28]	
θ (Taxpayer × log cost differential)			−0.22		5.33^{***}		−12.71
			(0.29)		(0.30)		(7.97)
Cost-sensitivity range			[−0.24, −0.12]		[5.00, 7.40]		[−21.30, −12.47]
Observations	49,907	32,276	32,276	49,748	49,748	45,145	45,145
Full-Sample Mean	0.9	163.5	163.5	27.7	27.7	151.5	151.5
5-Year Birth-Cohort FE	Yes	Yes	Yes	No	No	Yes	Yes
Taxpayer + Arrival-Month FE	No	No	Yes	No	Yes	No	Yes

*p<0.1; **p<0.05; ***p<0.01

Notes: All outcome variables are measured using Chinese Register data (Ward and Yu, 2008). Panel A reports the full 1886-1908 sample. The $50 event window is omitted from the corresponding appendix table because all selection analyses are restricted to 1886-1908. The height sample is restricted to men aged 23-50 with non-missing height; the age sample is restricted to non-zero, non-missing age at arrival; the Whipple Index sample is restricted to men aged 18-47 with non-missing age; and the taxpayer-status sample is restricted to non-missing taxpayer status. The shared footer reports full-sample dependent-variable means and the fixed-effect structure. The log-cost row reports the coefficient from the main specification, which includes calendar-month fixed effects; all main-specification columns except age at arrival include five-year birth-cohort-bin fixed effects. The taxpayer log cost-differential row reports the coefficient from Equation (6), which includes arrival-month fixed effects and a taxpayer fixed effect; all taxpayer-differential columns except age at arrival include five-year birth-cohort-bin fixed effects. I report heteroskedasticity-robust standard errors in parentheses.

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A Appendix Figures and Tables

Figure A1: Average non-zero tax paid by Chinese immigrants to Canada in nominal dollars by year of registration as recorded in the Chinese Register, a complete administrative record of all Chinese immigrants who entered Canada and/or paid the Head Tax between 1885 and 1923 (Ward and Yu, 2008).

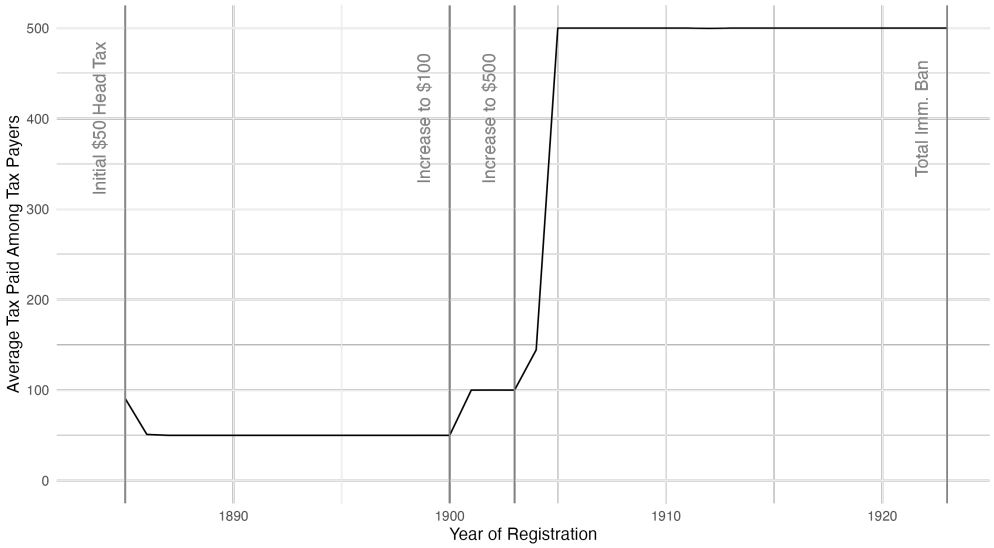


Figure A2: Raw log monthly inflow of Chinese immigrants to Canada by month relative to each Head Tax increase, as recorded in the Register (Ward and Yu, 2008). The vertical dotted line represents the month that each increase was first announced (six months prior, for all increases).

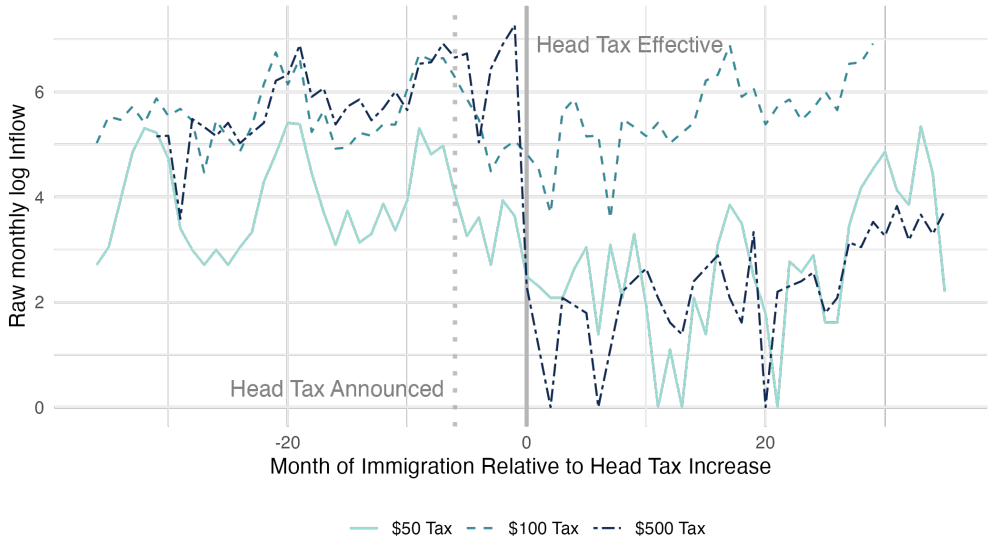


Table A1: Estimation of Equation (2) (Columns (1), (3), (5)) and Equation (4) (Columns (2), (4), (6)) with alternate assumptions and specifications.

	All Chi. Imm.	All Chi. Imm.	All (to 1921)	All (to 1921)	All (from 1886)	All (from 1886)
	Dependent variable:					
	log Monthly Chinese Immigrant Inflow ($\log(F_t)$)					
	(1)	(2)	(3)	(4)	(5)	(6)
γ^{ε} (log Cost)	-4.11^{***}	-3.60^{***}	-0.56	-3.75^{***}	-4.26^{***}	-4.43^{***}
	(0.58)	(0.57)	(0.62)	(0.87)	(0.59)	(0.61)
	[−4.66, −2.83]	[−5.21, −2.24]	[−0.86, −0.22]	[−4.79, −2.43]	[−4.81, −3.81]	[−5.81, −3.43]
Linear Time Trend	Yes	No	Yes	No	Yes	No
Addtl. Push/Pull Ctrls	No	Yes	No	Yes	No	Yes
Time Period	1882-1908	1882-1908	1882-1921	1882-1921	1886-1908	1886-1908
Mean Monthly Inflow ($\overline{F_t}$)	167.7	167.7	194.9	194.9	184.2	184.2
Observations	319	319	475	475	271	271
Adjusted R^2	0.57	0.53	0.06	0.39	0.59	0.56

*p<0.1; **p<0.05; ***p<0.01

Notes: The outcome variable $\log(F_t)$, log monthly inflow of Chinese immigrants to Canada, is measured using Chinese Register data (Ward and Yu, 2008). Columns (1) and (2) use the preferred estimation sample of all immigrants from 1882-1908 (note that Column (1) is the same as Column (1) in Table 2). Columns (3) and (4) expand this sample to include all immigrants from 1882-1921. Columns (5) and (6) restrict the sample to only include immigrants from 1886-1908. All columns compute cost using the preferred cost construction from Section 3.3. All regressions include calendar month fixed effects. Columns (1), (3), and (5) include only a linear time trend. Columns (2), (4), and (6) include controls for E_t (total emigration from Hong Kong in year t as obtained from annual Hong Kong Harbormaster Reports), I_t (total immigration to Canada in year t as obtained from (Employment and Immigration Canada, 1982)), P_{t-1} (lagged population stock of Chinese immigrants in Canada as interpolated from Canadian census data using a natural cubic spline), and P_{t-1}^2. I report Newey-West HAC standard errors in parentheses. The bracketed row below each standard error is a cost-sensitivity range based on the lower and upper migration cost assumptions described in Appendix B.3. These brackets are not confidence intervals.

Table A2: Taxpayer-status inflow estimates under alternative dependent-variable specifications.

	All Chi. Imm.			≤ 3yr from ↑$100			≤ 3yr from ↑$500		
	Dependent variable / estimator: Monthly Taxpayer-Status Inflow								
	$\log(F_{gt}+1)$ current	$\log(F_{gt})$ drop zeros	PPML	$\log(F_{gt}+1)$ current	$\log(F_{gt})$ drop zeros	PPML	$\log(F_{gt}+1)$ current	$\log(F_{gt})$ drop zeros	PPML
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
θ	−2.27***	−2.30***	−2.10***	−0.17	−0.26	0.06	−3.88***	−3.91***	−4.07***
	(0.14)	(0.20)	(0.15)	(0.74)	(0.87)	(1.13)	(0.27)	(0.35)	(0.38)
Cost-sensitivity range	[−3.22, −2.09]	[−3.60, −2.07]	[−3.07, −1.95]	[−1.22, −0.06]	[−1.52, −0.14]	[−0.81, 0.11]	[−5.41, −3.66]	[−5.51, −3.67]	[−5.45, −3.88]
Time Period	1882-1908	1882-1908	1882-1908	1898-Jun 1903	1898-Jun 1903	1898-Jun 1903	Jun 1901-1906	Jun 1901-1906	Jun 1901-1906
Observations	638	544	638	132	127	132	126	110	126
Month Clusters	319	319	319	66	66	66	63	63	63
Arrival-Month FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Taxpayer FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

*p<0.1; **p<0.05; ***p<0.01

Notes: Each observation is a taxpayer-status by arrival-month cell from the Chinese Register (Ward and Yu, 2008). Columns are grouped by the Table 3 columns: all Chinese immigrants, the $100 event window, and the $500 event window. Within each group, the three specifications use $\log(F_{gt}+1)$ (the current Table 3 dependent variable), $\log(F_{gt})$ after dropping zero-flow taxpayer-status month cells, and Poisson PML using the raw monthly group inflow count. Let B_t denote no-tax migration cost, T_t the Head Tax, and $C_t = B_t + T_t$ taxpayer migration cost. The reported coefficient is on the taxpayer-specific tax-induced log cost differential, $\log(C_t) - \log(B_t)$, from Equation (3). I report HC1 standard errors clustered by arrival month in parentheses. The bracketed cost-sensitivity row shows the range of estimates obtained when I vary B_t within the plausible lower and upper non-tax cost values described in Appendix B.3. These brackets are not confidence intervals.

Table A3: Event-window selection effects of the Chinese Head Tax.

	Pr(Taxpayer)	Height (cm)		Age at arrival		Whipple index	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: $100 event window [1898-June 1903]							
γ^{ε} (log Cost)	−0.02	0.75*		−0.35		−42.04**	
	(0.01)	(0.43)		(0.62)		(17.44)	
Cost-sensitivity range	[−0.02, −0.01]	[0.04, 1.90]		[−0.35, 0.22]		[−75.93, −18.05]	
θ (Taxpayer × log cost differential)			−0.03		12.78***		30.73
			(1.81)		(2.94)		(66.97)
Cost-sensitivity range			[−0.13, 1.90]		[10.72, 25.86]		[30.17, 91.60]
Observations	22,261	14,846	14,846	22,211	22,211	20,720	20,720
Panel B: $500 event window [June 1901-1906]							
γ^{ε} (log Cost)	−0.49***	0.45		−1.71***		−32.68***	
	(0.01)	(0.30)		(0.42)		(10.18)	
Cost-sensitivity range	[−0.72, −0.45]	[0.20, 0.44]		[−3.53, −1.45]		[−34.94, −29.68]	
θ (Taxpayer × log cost differential)			−1.22		3.30***		−52.71*
			(0.89)		(1.20)		(28.37)
Cost-sensitivity range			[−1.29, −1.16]		[3.21, 3.50]		[−81.65, −53.24]
Observations	14,436	8,939	8,939	14,383	14,383	12,909	12,909
Full-Sample Mean	0.9	163.5	163.5	27.7	27.7	151.5	151.5
5-Year Birth-Cohort FE	Yes	Yes	Yes	No	No	Yes	Yes
Taxpayer + Arrival-Month FE	No	No	Yes	No	Yes	No	Yes

*p<0.1; **p<0.05; ***p<0.01

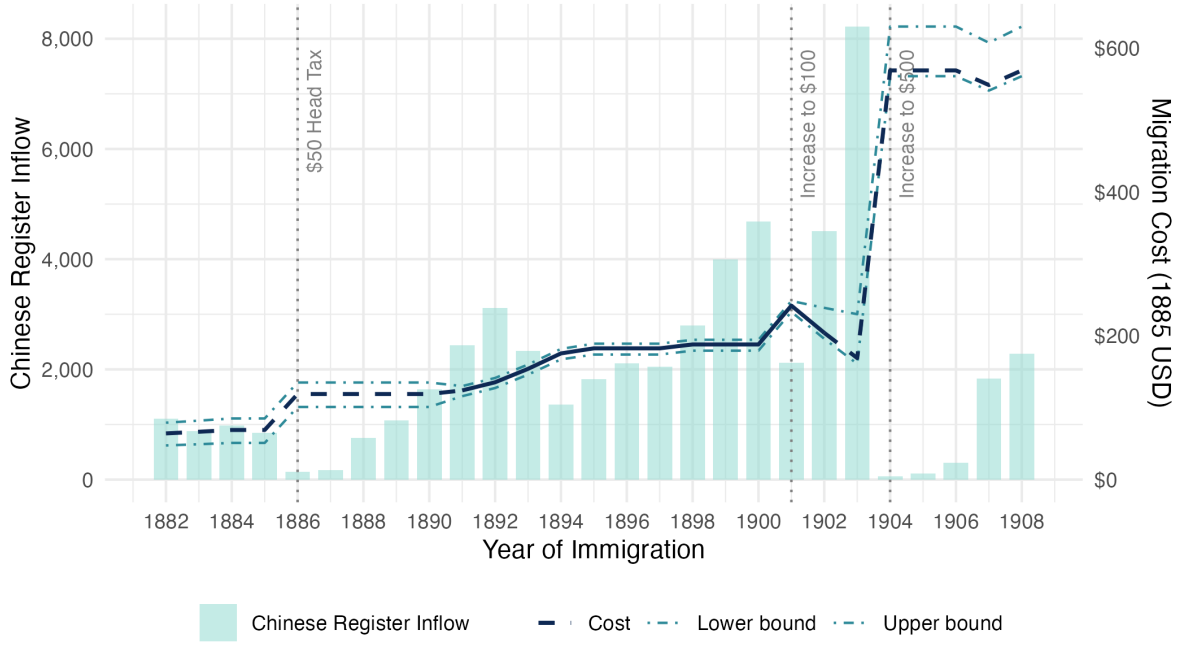
Notes: All outcome variables are measured using Chinese Register data (Ward and Yu, 2008). Panels A and B report event-window estimates around the $100 and $500 Head Tax increases. The $50 event window is omitted because all selection analyses are restricted to 1886-1908. The height sample is restricted to men aged 23-50 with non-missing height; the age sample is restricted to non-zero, non-missing age at arrival; the Whipple Index sample is restricted to men aged 18-47 with non-missing age; and the taxpayer-status sample is restricted to non-missing taxpayer status. The shared footer reports full-sample dependent-variable means and the fixed-effect structure used in both panels. The log-cost row reports the coefficient from the main specification, which includes calendar-month fixed effects; all main-specification columns except age at arrival include five-year birth-cohort-bin fixed effects. The taxpayer log cost-differential row reports the coefficient from Equation (6), which includes arrival-month fixed effects and a taxpayer fixed effect; all taxpayer-differential columns except age at arrival include five-year birth-cohort-bin fixed effects. I report heteroskedasticity-robust standard errors in parentheses.

B Estimating Migration Costs

To estimate the response of Chinese migration to migration cost, I construct an estimate of 'baseline' migration costs to which migrants were subject even absent the Head Tax. There are two components of this baseline cost, which I discuss in further detail in this section. The first is the cost of steamship passage, which I construct partly from primary-source data and partly from extrapolation based on additional sources. The second is a fixed $14 cost of adjustment, foregone wages, and internal travel.

To compute overall migration costs, I add these baseline costs to the Head Tax and adjust for inflation. Figure A3 plots this cost estimate against the Chinese immigration inflow as recorded in the Register. The solid line represents the period where steamship costs are based on primary-source materials, and the dotted/dashed lines represent my preferred estimate outside of that period, as well as upper and lower bounds.

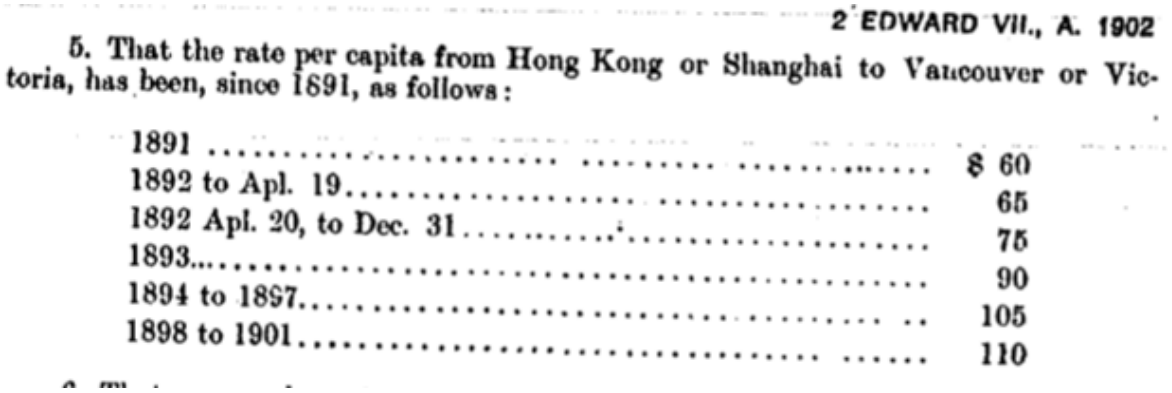
Figure A3: Migration cost estimates (in 1885 USD) plotted against Chinese immigration inflow.



B.1 Constructing Steamship Passage Costs

The primary source that I use to construct my estimate of steamship passage costs is from the 1902 Report of the Royal Commission on Chinese and Japanese Immigration, which contains a table outlining the exact price of steamship passage on a Canadian Pacific Steamship Company (CPSC) steamship from Hong Kong or Shanghai to Vancouver or Victoria by month from 1891 to 1901 (shown in Figure A4). In this section I unpack historical evidence on transpacific passage and fares, using the limited information available to construct ranges of estimates for passage costs outside of the 1891 to 1901 period.

Figure A4: Price table for fares on Canadian Pacific Steamship Company ships between 1891 and 1901, as reported to the Royal Commission on Chinese and Japanese Immigration on January 17, 1902 (Royal Commission on Chinese and Japanese Immigration into British Columbia, 1902).



2 EDWARD VII., A. 1902

5. That the rate per capita from Hong Kong or Shanghai to Vancouver or Victoria, has been, since 1891, as follows:

1891	$ 60
1892 to Apl. 19	65
1892 Apl. 20, to Dec. 31	75
1893	90
1894 to 1897	105
1898 to 1901	110

Pre-1887. Prior to 1887, other than ships specifically chartered by Chinese contractors, the only way to get to Vancouver/Victoria was via San Francisco. In a 1903 newspaper interview a Chinese immigrant recounts paying $50 for passage from Hong Kong to San Francisco as a boy in the 1880's (Chew, 1903). An account from Sinn (2013) suggests that the cheapest one-way fare between Hong Kong and San Francisco was $55 in 1866 and $40 in 1867, and that increased competition continued to drive this price down until the U.S. Chinese Exclusion Act in 1882, when reduced traffic brought the price back up. Passage between San Francisco and Victoria/Vancouver ranged from $2.50 to $20. I use a preferred estimate of $55 for the cost of passage prior to $1887 ($50 to San Francisco + $5 to British Columbia) with a lower bound of $45 and an upper bound of $65.

1887-1890. Starting in 1887, CPSC (previously Canadian Pacific Railway) started to use chartered vessels for steamship service between Hong Kong and British Columbia, but it was not until 1891 that the CPSC ran dedicated transpacific lines with new luxury ships built for that purpose (Encyclopaedia Britannica, 1911). Later price catalogs from the CPSC show higher prices for the same transpacific routes on newer ships, with a difference of roughly \$5.[35] I therefore use a preferred estimate of \$55 (1891 fare of \$60 adjusted by \$5) between 1887 and 1890 with a lower bound of \$45 and an upper bound of \$65.

1891-1901. While I use the available fare table as my preferred estimate of passage cost in this period, I note several key observations. First, Figure A4 shows a dramatic increase from \$65 in 1891 to \$110 in 1901. The same report also specifies that the return fare from Vancouver to Hong Kong or Shanghai had remained \$51 over the entire period, and that the fare from Yokohama to Vancouver or Victoria had remained \$45 since 1893, suggesting that the increase was not due to general transpacific voyage costs (Royal Commission on Chinese and Japanese Immigration into British Columbia, 1902). The fare begins to stabilize in the mid-1890s, approximately when Nippon Yusen Kaisha (NYK) established a line between Hong Kong and Seattle (only a short ferry ride from Vancouver and Victoria), suggesting that competition, combined with high demand from prospective Chinese migrants, played a large role in the high fares (Lange, 1999).

Post-1901. While NYK established a transpacific route in 1896, it was not until 1901 that the route explicitly included a stop in Victoria (Watt, 1902). It is likely that, faced with direct competition for the first time, CPSC reduced their fares to remain competitive. Several additional pieces of evidence corroborate this assumption. First, a 1903 letter addressed to a village in Guangdong references (translated from Chinese) sending "fifty [dolllars]...to cover your boat fare" Yip Sang Company (1903). Second, a letter written on September 17, 1910, which was intercepted on an incoming ship from China to Victoria as part of an opium smuggling investigation, stated that "...I had previously purchased second-class cabins paying

[35] See Figure A5 for a price table comparing fares on the Empress of Russia and Empress of Asia (both launched in 1912) to fares on the Empress of Japan and Monteagle (first launched in 1890 and 1898 respectively).

each $50..." (Murphy, 1913). Finally, an example fare table from CPSC catalogs (available starting in 1917) is shown in Figure A5. These catalogs show third class fares starting at $75 in 1917 and jumping to $100 by the end of 1919 (likely in response to inflationary pressures—the price index increased by nearly 60% over the same time period). Even by 1919, however, a $55 'Asiatic Steerage' fare remained available to Chinese men, suggesting relative stability in the cost of passage for Chinese immigrants over this time period (Canada Science and Technology Museum Library and Archives, 2024).[36] Therefore I estimate that fares rapidly declined to $55 between 1901 and 1903 and remained at $55 through 1924. As an upper bound, I leave the fare at $110 for the entire period.

Figure A5: Price table for minimum fares for transpacific steamship passage on Canadian Pacific Steamship Company ships between Vancouver or Victoria and various East Asian cities. Taken from a catalog published by Canadian Pacific Ocean Services on September 11, 1919 (Canada Science and Technology Museum Library and Archives, 2024).

Minimum Fares

BETWEEN VANCOUVER OR VICTORIA AND	First Class		Servant Accompanying Passenger			① Second Class		② Third Class		③ Asiatic Steerage Westbound For Men Only	
			European	Asiatic Servant							
	Empress of Russia / Empress of Asia	Empress of Japan / Monteagle	By all Steamers	Empress of Russia / Empress of Asia	Empress of Japan / Monteagle	Empress of Russia / Empress of Asia	Empress of Japan / Monteagle	Empress of Russia / Empress of Asia	Monteagle For Men Only	Empress of Russia / Empress of Asia	Empress of Japan / Monteagle
Yokohama	$250	$188	$167	$65	$55	$125	$94	$65	$55	$51	$45
Kobe	259	197	173	70	55	130	99	70	57	53	47
Moji, Monteagle only	.....	214	186	.....	55	.....	107	.....	60	.....	50
Nagasaki, Empresses only	278	214	186	75	55	139	107	75	.....	55	50
Shanghai	288	224	192	80	55	144	112	80	65	60	55
Manila ②	312	244	208	90	55	156	③122	90	65	60	55
Hongkong	312	244	208	90	55	156	122	90	65	60	55

① Exclusive use of four-berth room for two persons requires three full fares. ② Second class passengers to Manila, by Empress of Japan or Monteagle, are provided with first class accommodation beyond Hongkong. Chinese must not be ticketed to Manila. ③ Third class and Asiatic steerage fares apply to and from Seattle, via Vancouver.

B.2 Other Baseline Costs

I provide ranges of estimates of other costs potential migrants may have incurred. I do not include costs associated with extra fees charged to Chinese passenger ships departing Hong Kong (which were likely incorporated into passage fares), or financing and credit costs (while likely considerable, I treat these as a selection mechanism rather than an explicit cost). Together, my estimates of other baseline costs yield a preferred estimate of $14, with

[36] While the wording of 'Westbound For Men Only' is confusing, as it's unclear whether this means the fare is Westbound and For Men Only, or whether the Westbound passage is limited to men only, the footnote that states "...Asiatic steerage fares apply to and from Seattle, via Vancouver" suggests that the latter.

a lower bound of $6 and an upper bound of $20.

Internal Travel. I focus on internal travel from Guangdong (the province from which over 96% of Chinese immigrants in the Register originated) to Hong Kong (the nearest port with direct passage to Canada at the time). There were two primary modes of transportation between cities in Guangdong and Hong Kong: river steamer and train. River steamers were the primary mode prior to the opening of railways in the early 1900's, and the fares for the lowest class of passage between Guangzhou and Hong Kong ranged from 15 to 30 silver cents in 1912. Train fares were only slightly more expensive, ranging from 90 to 135 silver cents in 1911 (Jiang, 2016). Converting silver dollars to contemporary USD yields a nominal internal travel cost of 0-1 USD, even including the cost of a feeder train to Guangdong. The majority of immigrants to Canada remained in Vancouver or Victoria at the port of entry, so I do not consider internal travel costs within Canada.

Foregone Wages. The 1902 Royal Commission report also contains several secondary source references to wages in China. From Chester Holcombe, the "Acting Minister of the United States at Pekin": "Skilled labourers in China earn from 10 to 30 cents in silver each day... Unskilled labourers... earn from 5 to 10 cents each day..." and from Ewen W. MacLean, a Chinese interpreter living in China: "The common labourer gets $6 a month silver, that is $3 of our money" (Royal Commission on Chinese and Japanese Immigration into British Columbia, 1902). While very broad and likely biased, these estimates are not inconsistent with primary source data reported by Allen et al. (2011), which place wages in Beijing at between 3-6 grams of silver (or 12 to 25 silver cents) per day between 1870 and 1914. Allen et al. (2011) further cite government regulations from the late 1700's that set nominal wages for workers in public construction in Guangdong to be roughly half of those for workers in Beijing, suggesting lower wages in Guangdong. Assuming travel time of 20-30 days and allowing for a further 20-30 days for adjustment after arrival yields an estimate of 40-60 days of foregone wages of 2–18 silver dollars (or approximately 1–9 USD).

Adjustment and Subsistence Costs. Finally, the 1902 Royal Commission report contains a wide range of estimates of the cost of board and lodging for Chinese immigrants after

arrival in Canada. The most precise statement I could find was from Tim Kee, a Chinese tailor, who charged his employees "about $10 a month... [for] clothes, board and lodging" and estimated that Chinese workers splitting a small room could subsist on $7-$8 a month. Using the same range of 20-30 days for adjustment after arrival, I estimate the cost of adjustment after arrival to be $5-$10. Passenger fares on transpacific voyages generally included food, so I do not consider subsistence costs during the journey.

B.3 Reporting Ranges of Estimated Responses to Costs

Let C_t^p denote my preferred estimate of migration costs in time period t (the dark blue line in Figure A3), and let $\underline{C}_t$ and $\overline{C}_t$ denote the corresponding lower and upper cost bounds (the light blue dot-dashed lines). For any regression specification r that includes $\log(C_t)$, let $\widehat{\gamma}_r(C)$ denote the estimated coefficient on log migration cost when the specification is estimated using cost series $C = \{C_t\}_{t \in \mathcal{T}_r}$ over the regression sample $\mathcal{T}_r$. The main coefficient reported in the tables is therefore

$$\widehat{\gamma}_r^p \equiv \widehat{\gamma}_r(C^p).$$

To construct the cost-sensitivity range, I allow the uncertain components of migration costs to vary within the bounds described above. Let $\mathcal{P}$ denote the set of cost periods used in this appendix: pre-1887, 1887-1890, 1891-1901, and post-1901. For each vector $\lambda = (\lambda_p)_{p \in \mathcal{P}} \in [0,1]^{|\mathcal{P}|}$, define an admissible cost series by

$$\log C_t(\lambda) = (1 - \lambda_{p(t)}) \log \underline{C}_t + \lambda_{p(t)} \log \overline{C}_t, \qquad t \in \mathcal{T}_r,$$

where $p(t)$ maps time period t to its cost period. Thus $\lambda_p = 0$ uses the lower cost bound in period p, $\lambda_p = 1$ uses the upper cost bound, and intermediate values use costs between the two bounds. The set of admissible cost series for regression r is

$$\mathcal{C}_r = \{\, C(\lambda) : \lambda \in [0,1]^{|\mathcal{P}|} \,\}.$$

I then define the lower and upper cost-sensitivity estimates as

$$\underline{\widehat{\gamma}}_r = \min_{C \in \mathcal{C}_r} \widehat{\gamma}_r(C), \qquad \overline{\widehat{\gamma}}_r = \max_{C \in \mathcal{C}_r} \widehat{\gamma}_r(C).$$

In Tables 2 and 4, and in Appendix Tables A1 and A4, I report the interval $[\underline{\widehat{\gamma}}_r, \overline{\widehat{\gamma}}_r]$ in brackets below the standard error, computed separately for each reported estimate. This represents the range of possible elasticities over plausible migration cost series.

C Alternative Margins of Adjustment

To what extent did prospective migrants respond to the Head Tax by substituting to alternate years (delaying the timing of their migration to gather funds or migrating earlier in anticipation of future tax increases) or alternate locations? I explore these possibilities in this section, first testing whether the estimated inflow response to the Head Tax is driven by short-run adjustment in the years immediately before/after the Head Tax increases, then using data on emigration from Hong Kong to other destination ports to detect responses to Canadian Head Tax changes.

C.1 Alternative Timing

The baseline inflow estimates in Table 2 identify the average relationship between migration costs and monthly arrivals over the full estimation sample. A possible concern is that these estimates capture short-run timing responses rather than a persistent reduction in migration. In particular, prospective migrants could have accelerated departures into the months immediately before a tax increase, or delayed migration only temporarily in the months immediately after an increase.

To test for this timing margin, I augment Equation (2) as follows:

$$\log(F_t) = \gamma^{\varepsilon} \log(C_t) + \beta_w^- D_{t,w}^- \log(C_{t,w}^A) + \beta_w^+ D_{t,w}^+ \log(C_t) + \mu_{m(t)} + \delta t + \varepsilon_t. \tag{7}$$

Let T_j denote the effective month of Head Tax increase $j \in \{1886, 1901, 1904\}$. The indicator $D_{t,w}^-$ equals one if month t is in the w months immediately before any increase, $T_j - w \leq t \leq T_j - 1$, and $D_{t,w}^+$ equals one if month t is in the w months immediately after any increase, $T_j \leq t \leq T_j + w - 1$. For pre-increase months, $C_{t,w}^A$ is the anticipated post-increase cost C_{T_j}; otherwise it equals the contemporaneous cost. Thus β_w^- captures whether inflows respond before an increase to the anticipated higher cost, while β_w^+ captures any additional post-increase response beyond the baseline elasticity γ^{ε}.

Table A4: Alternative timing of the inflow response to the Chinese Head Tax.

	Baseline	Pooled 6m	Pooled 12m	$50 6m	$100 6m	$500 6m	Excl. ±3m	Excl. ±6m	Excl. ±12m
	Dependent variable:								
	log Monthly Chinese Immigrant Inflow ($\log(F_t)$)								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
γ^e (log Cost)	-4.11^{***}	-4.39^{***}	-4.65^{***}	-6.65^{***}	-1.69^{**}	-4.27^{***}	-4.13^{***}	-4.20^{***}	-4.72^{***}
	(0.58)	(0.61)	(0.52)	(1.66)	(0.73)	(0.63)	(0.55)	(0.65)	(0.80)
	[−4.66, −2.83]	[−4.84, −2.95]	[−4.96, −3.06]	[−7.95, −4.14]	[−3.49, −1.45]	[−5.91, −3.98]	[−4.70, −2.74]	[−4.69, −2.70]	[−4.97, −2.64]
Pre window × log anticipated cost		-0.11^{***}	-0.11^{***}	-0.14^{**}	-0.01	-0.05			
		(0.04)	(0.03)	(0.07)	(0.03)	(0.06)			
		[−0.11, −0.02]	[−0.12, −0.01]	[−0.16, −0.02]	[−0.04, −0.01]	[−0.05, −0.02]			
Post window × log current cost		-0.07^{***}	-0.08^{***}	0.08	-0.07^{***}	-0.03			
		(0.02)	(0.02)	(0.09)	(0.03)	(0.03)			
		[−0.12, −0.05]	[−0.13, −0.06]	[−0.05, 0.11]	[−0.08, −0.06]	[−0.05, 0.02]			
Time Period	1882-1908	1882-1908	1882-1908	1883-1888	1898-Jun. 1903	Jun. 1901-1906	1882-1908	1882-1908	1882-1908
Mean Monthly Inflow ($\overline{F_t}$)	167.7	167.7	167.7	50.5	325.6	229.1	165.1	161.7	151
Observations	319	319	319	72	66	63	299	282	247
Adjusted R^2	0.57	0.59	0.62	0.54	0.56	0.86	0.55	0.55	0.50

*p<0.1; **p<0.05; ***p<0.01

Notes: The outcome variable $\log(F_t)$ is log monthly inflow of Chinese immigrants to Canada, measured using Chinese Register data (Ward and Yu, 2008). Column (1) reproduces the preferred specification from Table 2. Columns (2) and (3) include pooled pre- and post-increase timing terms. Columns (4)-(6) estimate the same six-month timing specification separately around each tax increase. Columns (7)-(9) drop months within the indicated symmetric window around each increase. All regressions include calendar month fixed effects and a linear time trend, except Columns (4)-(6), which use event-month trends within the event samples. Newey-West HAC standard errors are reported in parentheses. The bracketed row below each standard error is a cost-sensitivity range based on the lower and upper migration cost assumptions described in Appendix B.3. These brackets are not confidence intervals.

Appendix Table A4 tests for various timing responses. Column (1) shows the baseline regression specification from Table 2. Columns (2) and (3) report the results of estimating Equation (7) using a window of 6 and 12 months respectively. There is evidence of a small but significant additional decrease in the months immediately after the Head Tax increases go into effect, but the estimate of the overall elasticity remains large and negative. Notably, there is no evidence of an anticipatory increase in migration in the months leading up to Head Tax increases going into effect, instead the coefficient on the pre-window term is negative. Columns (4)-(6) repeat this exercise with a 6 month window around each of the event-window samples used in Table 2 separately. Patterns remain similar: there is evidence of inflow being particularly depressed in the months immediately before and after a Head Tax increase, but the overall elasticity estimate remains similar to the preferred specification.

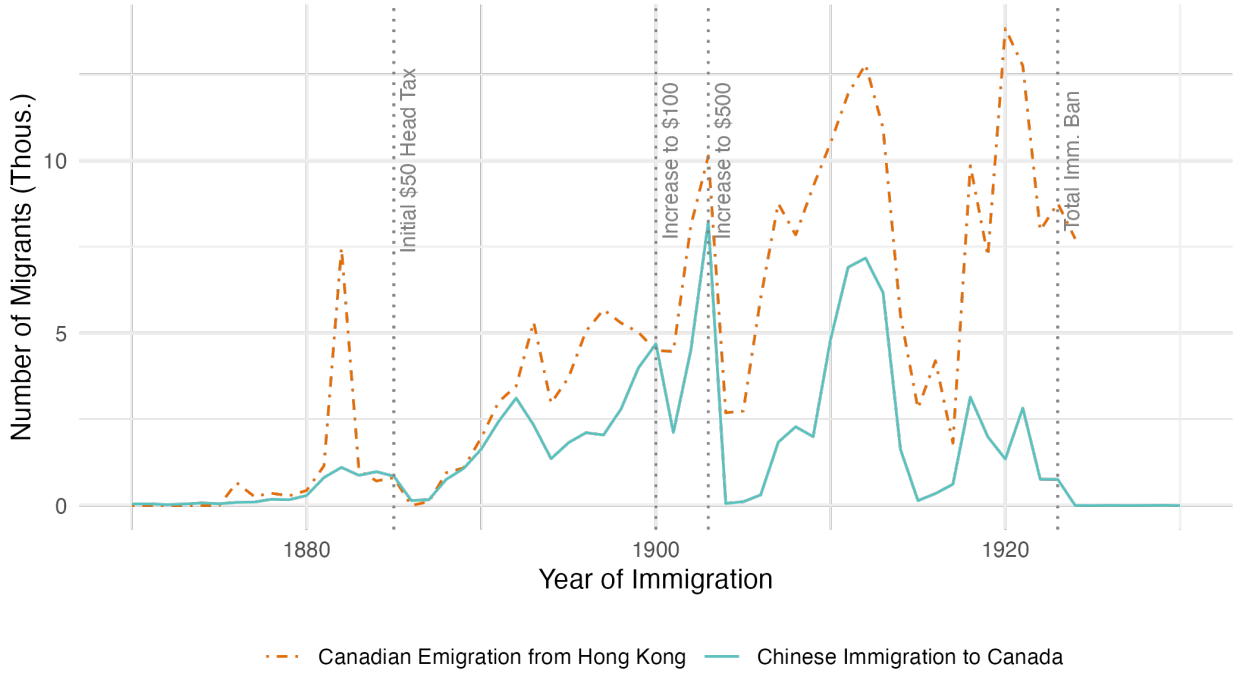
Finally, Columns (7)-(9) estimate the preferred specification in Equation (2) *excluding* symmetric windows around each increase and re-estimate the baseline specification. Once again estimates remain remarkably similar to my preferred elasticity estimate, suggesting that adjustment in timing was not a major channel of response for Chinese immigrants under the Head Tax.

C.2 Alternate Locations

The main analysis studies immigration to Canada. Another possible margin of adjustment is destination choice: if the Head Tax discouraged migration to Canada, prospective migrants may have redirected migration to the United States, Australia, Southeast Asia, or other destinations. To examine this possibility, I use annual destination-level departures from Hong Kong Harbourmaster reports (The University of Hong Kong Libraries, 2023). These reports list annual totals of 'passengers on emigrant ships' departing Hong Kong by destination port. I transcribe the country-level destination rows from the report scans for 1870-1924 using Codex and group countries into six non-Canada destination categories: Southeast Asia, the United States, other destinations in the Americas, Australia and New Zealand, Pacific island destinations, and other non-Canada destinations (OpenAI, 2026). I manually verify results against original scans after transcription.

Note that these departure totals are *proxies* for emigration rather than precise counts.

Figure A6: Inflow of Chinese immigrants to Canada (solid blue line) as measured by the Chinese Register (Ward and Yu, 2008) and outflow of emigrants from Hong Kong to Canada (dotted orange line) as measured by the Hong Kong Harbourmaster reports (The University of Hong Kong Libraries, 2023). Vertical dotted lines mark years in which the Head Tax was initially created or increased.

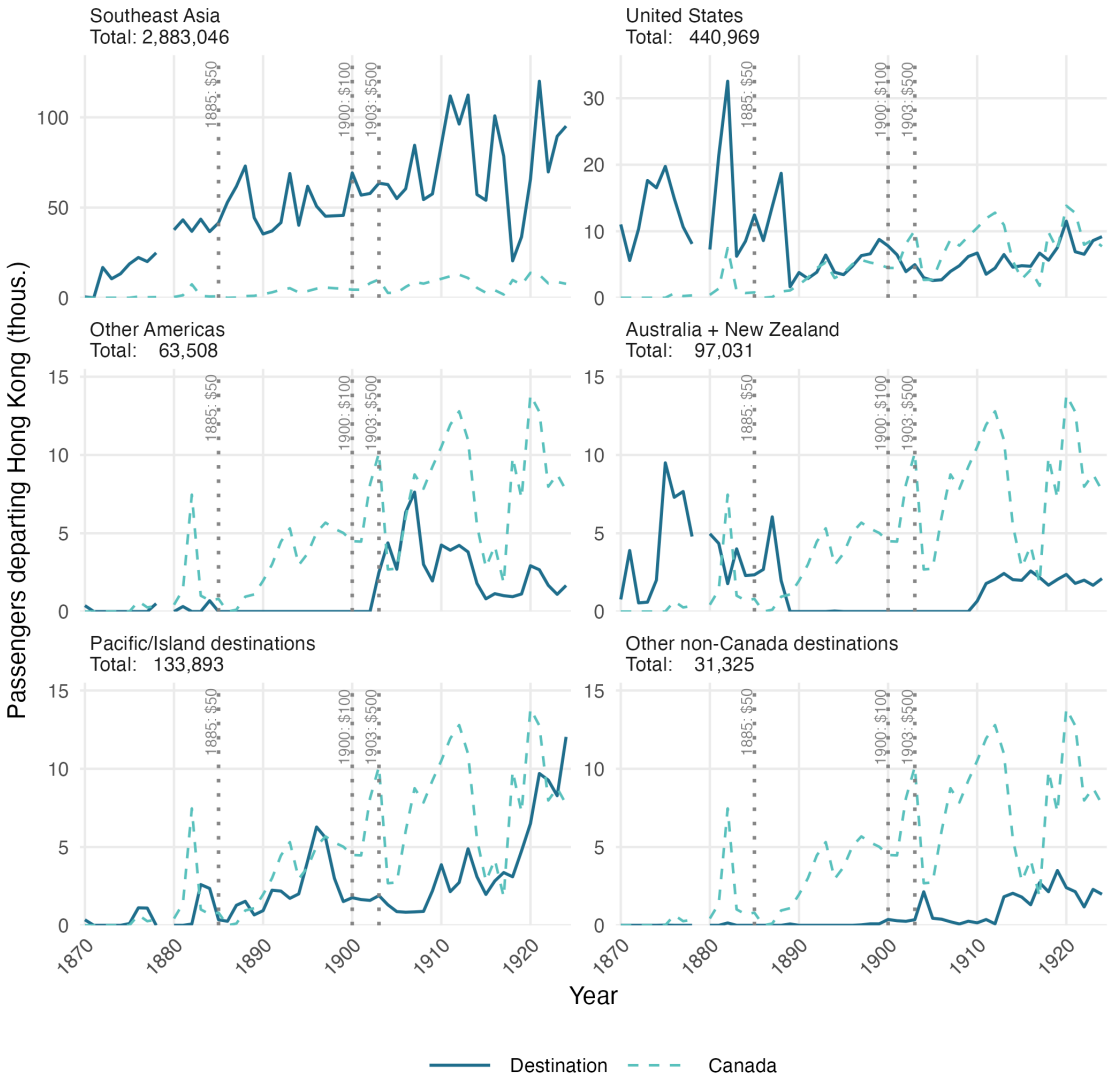


In Figure A6 I plot the departure totals for Canadian ports from the HK Harbourmaster reports against the actual inflow as recorded in the Register. As might be expected, the sharp spike in Canadian emigration in 1882 is nearly non-existent in the Register data, since registration was voluntary (and would have excluded return migrants) prior to 1886. In the first several years of the Head Tax, reported emigration aligns almost perfectly with reported immigration, but beginning in 1893, reported emigration consistently exceeds reported immigration, in some years by more than 5,000 migrants. This discrepancy could have been caused by re-entrants temporarily visiting China (who would have boarded emigrant ships but would not have been required to re-pay the Head Tax), migrants passing through Canada en route to another country (who were exempted from paying the tax), or non-Chinese passengers.[37] It is likely that similar discrepancies would appear in immigration totals for other

[37]It is unclear precisely what the total of 'passengers on emigrant ships' refers to, whether it counts non-Chinese passengers, non-emigrants, etc.

countries.

Figure A7: Grouped destination-specific departures from Hong Kong compared with departures to Canada.



Appendix Figure A7 plots each grouped non-Canada destination series against departures to Canada, including the total number of departures over the 1870-1924 period. Several facts emerge: first, 80% of emigration from Hong Kong was to Southeast Asia (almost entirely to the Straits Settlements)—any variation in immigration to Canada is dwarfed by small fluctuations in immigration to Southeast Asia. Second, migration to the U.S. is high until 1882, when the Chinese Exclusion Act was passed. Since the Chinese Exclusion Act entirely prohibited the immigration of Chinese laborers, it is unlikely that the Head Tax would

have prompted substitution towards the U.S.—it is likely that emigration to the U.S. in years following the Chinese Exclusion Act was mostly from re-entrants. Third, there is an uptick in Chinese emigration to Australia and New Zealand in 1887 following the implementation of the initial Head Tax, however a series of restrictive policies in different parts of Australia in 1889 halted Chinese immigration for many years, including during the subsequent Head Tax increases. Finally, emigration to other destinations in the Americas (primarily Mexico and Peru), spikes from zero to nearly 8,000 in the year following the implementation of the $500 Head Tax, suggesting that Mexico and Peru were important alternative destinations for Chinese migrants to Canada.

Appendix Table A5 formalizes these descriptive findings by estimating a country-group analogue of the inflow regression using annual Harbourmaster departures. For each destination group, I regress log annual departures to that group of countries on log Canadian migration cost and a linear time trend over 1882-1908. Note again that the elasticity estimate for Canadian emigration is smaller than my preferred estimate for the reasons discussed above, and because the series is at the annual level rather than at the more granular month level.

The destination estimates show evidence of a positive cross-elasticity for the level of emigration to Other American countries and Australia/New Zealand in response to increases in the cost of migration to Canada. This suggests that prospective Chinese migrants did in fact substitute towards other destination countries, particularly those with fewer immigration restrictions.

Table A5: Alternative destination responses in Hong Kong Harbourmaster departures.

	Southeast Asia	United States	Other Americas	Aust./N.Z.	Pacific/Island	Other non-Canada	Canada
	Dependent variable:						
	log Annual Hong Kong Departures ($\log(F_t + 1)$)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
γ^{ε} (log Cost)	0.13	-0.43^{*}	4.40^{*}	2.44	-1.06^{**}	-0.81	-2.74^{*}
	(0.15)	(0.26)	(2.54)	(1.51)	(0.47)	(1.21)	(1.49)
	[0.05, 0.20]	[−0.69, −0.15]	[1.12, 7.44]	[0.23, 4.49]	[−1.65, −0.33]	[−2.01, 0.62]	[−3.18, −2.07]
Time Period	1882-1908	1882-1908	1882-1908	1882-1908	1882-1908	1882-1908	1882-1908
Mean Annual HK Departures	52858.4	7165.4	1010.1	784.3	1868	186.7	4071
Observations	27	27	27	27	27	27	27
Adjusted R^2	0.26	0.23	0.41	0.58	0.07	0.48	0.36

*p<0.1; **p<0.05; ***p<0.01

Notes: The outcome variable is log annual passenger departures from Hong Kong to the destination group listed in each column, measured from Hong Kong Harbourmaster reports (The University of Hong Kong Libraries, 2023). The key independent variable is log Canadian migration cost, constructed using the same Head Tax and baseline migration cost schedule as the main inflow analysis. Each regression includes a linear time trend and uses the 1882-1908 sample. Newey-West HAC standard errors are reported in parentheses. The bracketed row below each standard error is a cost-sensitivity range based on the lower and upper migration cost assumptions described in Appendix B.3.

D Selection into Immigration: Theoretical Framework

In this section, I formalize the models discussed in Section 5.1. I start with the standard Roy-Borjas model of selection into migration under which migration costs are constant, then introduce the Chiquiar-Hanson extension to consider skill-varying migration costs (Roy, 1951; Borjas, 1987; Chiquiar and Hanson, 2005).[38] Both models frame the decision to migrate as dependent on the wage gains to migrating net of migration cost. In particular, a prospective Chinese migrant will choose to immigrate to Canada iff

$$\ln(w_{Canada}) - \ln(w_{China}) - \pi > 0 \tag{8}$$

where w_c represents the wage a worker would earn in country c, and π represents the time-equivalent cost of migration (the number of hours a worker would need to work to afford to migrate), which Borjas (1987) models as constant. Wages are modelled as

$$\ln(w_c) = \mu_c + \delta_c s \tag{9}$$

where μ_c represents the country-specific baseline wage in country c and δ_c represents the country-specific return to skill level s. Substituting equation 9 into equation 8 yields the following condition for migration:

$$\mu_{Canada} + \delta_{Canada} s - \pi > \mu_{China} + \delta_{China} s \tag{10}$$

Case 1: Positive Selection into Migration – In the case where $\delta_{Canada} > \delta_{China}$, i.e. if the returns to skill in Canada are greater than in China, then migration from China to Canada occurs only if skill exceeds some cutoff level $\theta \equiv \frac{-(\mu_{Canada} - \mu_{China} - \pi)}{\delta_{Canada} - \delta_{China}}$. In this case, migrants will be more skilled on average relative to the Chinese population, so a flatter wage distribution in China relative to Canada generates positive selection.

Case 2: Negative Selection into Migration – Conversely, if $\delta_{China} > \delta_{Canada}$, i.e. if the returns to skill in Canada are lower than in China, then migration from China to Canada occurs only for those with $s < \theta$, generating negative selection.[39]

[38] I follow the notation of Chiquiar and Hanson (2005) throughout.

[39] Note that under both types of selection, very high values of π or very low wage returns to migration

While it is difficult to directly estimate the returns to skill in China relative to Canada in the 19th and early 20th centuries due to a dearth of available Chinese historical data, estimates from Chancel and Piketty (2021) suggest that the two countries had similar levels of income inequality overall.[40] In practice, however, the returns to skill for Chinese immigrants were likely lower than the returns to skill for the general Canadian population and therefore lower than the returns to skill for the general Chinese population, likely due to language barriers and overt discrimination.[41] As a result, the standard Roy-Borjas model would predict negative selection on skill for immigrants from China to Canada ($\delta_{China} > \delta_{Canada}$).

Note that in this model, the cost of migration π and the baseline wage difference between Canada and China only affect the migration decision through the cutoff point θ, which affects only the extent of selection, rather than the direction. For instance, under negative selection ($\delta_{China} > \delta_{Canada}$), θ is decreasing in π. An increase in π, such as the one generated by the implementation of the Head Tax, would decrease the skill cutoff for immigration, and selection would become even more negative, since the higher-skilled end of the migrant pool no longer experiences high enough wage gains from migration to compensate for the higher cost.

Chiquiar and Hanson (2005) extend the Roy-Borjas model to allow time-equivalent migration costs to vary by immigrant skill level:

$$\ln(\pi) = \mu_\pi - \delta_\pi s \tag{11}$$

In particular, the model assumes that baseline costs μ_π decrease in skill at a rate of δ_π, whether due to higher earnings, liquidity constraints, or ease of adaptation to the receiving

generate the result that nobody migrates. Similarly, very low values of π or very high wage returns to migration generate the result that everybody migrates. Because I do not observe either outcome (i.e. I do not observe either everybody migrating or nobody migrating) in any of the years in which I have data, I disregard these edge cases.

[40] Chancel and Piketty (2021) estimate that in 1880, the bottom 50% of the income distribution held 17.3% of pre-tax national income in China, and 12.6% in Canada. However, they also estimate that the top 10% of the income distribution in China held 50.0% of pre-tax national income, versus only 39.0% in Canada. On net, these benchmarks yield estimated Gini indices (measures of income inequality) of 0.49 and 0.48 for China and Canada respectively.

[41] For instance, age-adjusted estimates of the return to literacy using the 1901 Canadian census (the earliest year with earnings data) suggest that while for the average adult man, literacy conditional on age boosted annual earnings by $238, for the average Chinese immigrant adult man, literacy was associated with only a $69 increase in annual earnings.

country. Now migration occurs iff

$$\mu_{Canada} + \delta_{Canada} s - \exp(\mu_\pi - \delta_\pi s) > \mu_{China} + \delta_{China} s \tag{12}$$

and under negative selection with sufficiently high migration cost, the poorest prospective migrants can no longer afford to migrate. This generates intermediate selection if $\delta_{China} > \delta_{Canada}$ – for the highest-skilled workers, the minimal wage gains from migrating to a more equal country are not enough to justify even the reduced cost of migration, while the lowest-skilled workers, who stand to gain the most from migration to a country with relatively lower returns to skill, are excluded by the high cost.

Under this framework, the Head Tax would affect selection into immigration in several ways. At one end of the initial migrant pool, the higher cost would unambiguously push low-skilled migrants out, making the migrant pool more positively selected relative to before the Head Tax. At the other end, the higher cost would still discourage those with less to gain from migrating, resulting in more negative selection, but the effect would be defrayed by higher skill levels. Additionally, several high-skill occupations were exempt from the Head Tax, such as merchants and students, effectively increasing δ_π and potentially inducing some higher-skilled workers to migrate. The magnitude of the effect will depend on each of these components individually, but unless the increase in δ_π is very small, the net effect of the Head Tax with skill-varying migration costs under initially intermediate selection would be such that there is an increase in the average skill level of the migrant pool, i.e. the tax will make selection more positive.[42]

In summary, the Borjas (1987) model predicts that in response to an exogenous increase in migration costs, the more skilled migrants would no longer choose to immigrate, leaving only the lowest-skilled migrants. This would lead to a decrease in the average skill of the already negatively-selected immigrant pool. Conversely the Chiquiar and Hanson (2005) model predicts that the reduction in high-skilled immigrants would be dominated by the reduction in low-skilled migrants who can no longer afford to migrate, leading to an increase in the average skill of the initially intermediately selected immigrant pool.

[42]Observe that both the Borjas (1987) and Chiquiar and Hanson (2005) models predict a reduction in immigration as a result of the Head Tax, which is what I find in section 4.