Who Pays the Cost of Exclusion?: Selection into Immigration Under the 1885 Chinese Head Tax*

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Abstract

As immigration pathways to the U.S. and Canada become increasingly complex, costs, ranging from administrative fees to skill restrictions, play an increasingly central role in immigration policy. Despite their importance, however, the complexity and heterogeneity of modern-day immigration systems have made it difficult to assess whether these costs reduce migration, and if so, how the composition of the immigrant pool is affected. In this paper, I study a historical Canadian immigration policy, the 1885 Chinese Head Tax, which imposed a well-documented and time-varying per-person fee on Chinese immigrants to Canada, to estimate how increases in migration costs affected Chinese immigration to Canada. I begin by estimating the impact of the Head Tax on the inflow of Chinese immigrants to Canada and estimate an elasticity of immigration inflow with respect to migration cost of -3.1. I then document changes in the composition of the Chinese immigrant pool in Canada. I find that as the cost of migration increased, Chinese immigrants to Canada became more positively selected on the basis of height (a common measure of human capital in economic history) as well as numeracy and occupation. This paper builds on the literature studying selection into migration by using precise changes in cost and detailed microdata on immigrants at the time of arrival, rather than relying on proxies for cost or cross-sectional census data alone. I also build on the historical immigration

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literature by documenting patterns of Chinese immigrants in particular – an important but understudied group central to the evolution of exclusionary immigration policy in the U.S. and Canada.

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 fears of labor market competition, limited resources, and outright racial animosity. Historically, immigration policy was often explicit in its exclusion, imposing quotas or outright bans on immigration from specific countries. More recently, governments have attempted to combat the rising demand for a limited number of immigration slots by imposing a series of complex costs on potential immigrants, ranging from administrative fees to skill requirements to even physical barriers, in the case of the U.S.-Mexico border.

Despite the growing body of research on the broad reach and striking consequences of exclusionary immigration policies [Clemens et al., 2018, Chen and Xie, 2020, Feigenberg, 2020, Abramitzky et al., 2023], the complexity of the modern immigration system has made it difficult not only to cleanly identify how immigrants respond to changes in migration costs independent of other changes in immigration policy, but even to directly measure costs at all. The same increasing complexity, however, has emphasized the importance of understanding exactly how immigrants respond to migration costs: who is excluded when costs increase?

In this paper, I use an exclusionary immigration policy to study the effects of migration costs on immigration. 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 (1,500 USD in 2023), eventually evolved to a $500 entry fee (14,000 USD in 2023), which was more than double the average Chinese immigrant's annual salary in Canada in 1901 [Canadian Families Project, University of Victoria, 2012]. Using rich historical data on Chinese migrants I am able to leverage this temporal variation in the cost of migration to measure the direct effect of migration costs on immigration. By looking at Chinese immigrants specifically, I also document the effects of exclusion 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 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 precise structural breaks in monthly Chinese immigration inflow immediately after the announcement of each increase in the Head Tax. Over this time period I estimate the elasticity of immigration inflow with respect to migration cost to be -3.1, suggesting that in this time period Chinese immigration was highly elastic. Benchmarking this elasticity with other present-day estimates suggests that historical immigration was significantly more elastic with respect to cost than modern immigration.

In the second part of the paper, I examine the self-selection of the Chinese population into immigration to Canada.[1] 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* selection. On the other hand, if costs are instead modeled as *decreasing* in human capital,[2] 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

[1] 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.

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

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 as the Head Tax increased migration costs, Chinese immigrants became increasingly positively selected on height.[3]

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 small but significant increase in the average height of immigrants, an increase in numeracy, and an increase in the share of immigrants who were students or merchants. 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.

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 who faced relatively low migration costs, resulting in findings that are largely consistent the Roy-Borjas model of selection [Roy, 1951, Borjas, 1987, Abramitzky et al., 2013, Abramitzky and Boustan, 2017, Connor, 2019]. It is only in the last fifty years that the majority of immigrant groups to the U.S. and Canada have begun to face high migration costs. Researchers studying modern-day immigration have developed an alternate model of how costs affect selection into migration, which rationalizes findings of intermediate selection from countries with relatively higher inequality [Chiquiar and Hanson, 2005, McKenzie and Rapoport, 2010]. What has not yet been determined, however, is whether the differences between historical and modern-day selection into immigration 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. In this paper, I contribute to the literature by showing that the Chiquiar-Hanson model of skill-varying migration costs is in fact consistent with high migration costs even in a historical setting.

While there is considerable evidence on selection into immigration during the age of

[3]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.

mass migration, the vast majority of this work is focused on Europe, mostly due to a lack of origin country data in non-European countries. The limited body of work centered on Chinese immigrants in the late 19th century in the context of the Chinese Exclusion Act in the U.S. is primarily based on data from the decennial U.S. Census, leading to a lack of coverage of intercensal years or accounting for return migration [Chen, 2015, Chen and Xie, 2020]. I contribute to the literature on historical immigration by supplementing Canadian Census data with detailed migration microdata including the exact date of arrival to paint a broad picture of selection of Chinese immigrants into immigration to Canada in particular, compared to other destinations.

Section 2 of this paper provides more historical context on the Chinese Head Tax in Canada as well historical immigration to Canada more broadly, 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 describes the theoretical framework I use to analyze selection, and Section 6 presents both descriptive and causal effects of the Head Tax on the selection of potential Chinese migrants into immigration to Canada.

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 (including only

two Chinese 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 laborers" who could "subsist on much less than white men", thereby lowering wages and discouraging immigrants from other (white) countries [Chapleau and Gray, 1885]. 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]. 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

With the passage of the Chinese Immigration Act on July 20th, 1885, came a $50 'Head Tax' – a per-person flat entry fee for all 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 1,500 USD in 2023) was roughly equivalent to the cost of the cheapest one-way ticket from East Asia to the West coast, effectively doubling the cost of immigration from China to Canada [Chew, 1903]. As Chinese immigration to Canada continued to grow despite the tax, the government raised the tax to $100 on January 1st, 1901 (approximately 3,000 USD in 2023) and again to $500 on January 1st, 1904 (approximately 14,000 USD in 2023).[4] In comparison, the average adult Chinese immigrant man's annual earnings, as recorded in the 1901 Canadian Census, totalled only $235. The tax remained in place until 1923, when the Chinese Immigration Act of 1923 banned Chinese immigration to Canada altogether until its repeal in 1947.

[4]The $100 and $500 amendments to the Chinese Head Tax were passed in July of 1900 and 1903 respectively, but only went into effect on January 1st of the following year.

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.[5] While not all Chinese immigrants who arrived in Canada prior to 1885 were required to pay the tax, Appendix Figure A1 indicates that some pre-1885 arrivals did pay, likely in order to be able to freely exit and re-enter Canada. While these pre-1885 arrivals largely paid the $50 head tax (suggesting re-entry to Canada between 1885 and 1900), small spikes prior to 1885 indicate that some were required to pay more than $50 (approximately 6% of all immigrants in the Register data who arrived prior to 1885), suggesting re-entry in later years.[6]

The Chinese Immigration Act 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 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.[7] 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].

2.2 Canadian Immigration from Other Countries

In this paper, I compare Chinese immigrants with two different immigrant groups: all non-Chinese immigrants and Japanese immigrants. In this section, I briefly summarize the broader historical context around immigration to Canada – I present summary statistics

[5]Note that only 8.7% of pre-1923 arrivals recorded in the Chinese Register paid $0 in taxes. Of these non-taxpaying individuals, approximately 89% were merchants or the family of a merchant, and an additional 4% were students or working in other professions exempt from the tax.

[6]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.

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

comparing these groups in section 3.3 and discuss in further detail the specific assumptions required to compare these groups under my empirical design in section 6.2.

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

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."[8] Essentially, while immigrant groups other than Chinese immigrants were largely unrestricted in immigrating to Canada for the majority of the span of the Chinese Head Tax, by 1908 this was no longer the case for ethnic minorities, and by 1914, all immigrants experienced restricted mobility due to World War I and subsequent legislation. As a result, I focus on immigration prior to 1908 when comparing Chinese immigrants to Japanese immigrants, and I focus on immigration prior to 1914 when comparing Chinese immigrants to all immigrants.

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

3 Data

3.1 Migration Data

3.1.1 Chinese Register

My first and primary source of data is the Register of Chinese Immigrants to Canada, 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 "Chinese 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 arrival. In addition to serving as a full count of immigrants of Chinese origin who entered Canada during the years affected by the head tax, the Register also records any Chinese immigrants who had already entered Canada prior to the implementation of the Chinese Immigration Act in 1885 (and therefore were not subject to the tax), but chose to pay the tax and register with immigration authorities so that they could exit and re-enter the country without paying additional fees.

Although this dataset allows me to precisely observing the timing of entry into Canada, it does not record the outflow of Chinese immigrants, and so it does not accurately capture the stock of Chinese immigrants in Canada in any given year.[9]

3.1.2 Hong Kong Harbourmaster Reports

I digitize annual reports by the Harbourmaster of Hong Kong between 1870 and 1930, a novel data set with rich information on migration to and from Hong Kong [The University of Hong Kong Libraries]. In particular, these reports record the total number of passengers departing from Hong Kong on "passenger ships cleared by the emigration officer", separately

[9] While the Register also excludes 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 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. Entry by land would only have been possible by way of the United States, where there were even stricter restrictions on Chinese immigration. In fact, there are even accounts of Chinese immigrants arriving by ship in Canada and attempting to cross the border *into* the US by land, to circumvent the US Chinese Exclusion Act.

by destination port. By summing total emigrants to Vancouver and Victoria, I construct an annual measure of emigration from Hong Kong to Canada.[10] Since passenger ship lines from China to North America almost exclusively departed from Hong Kong, data from Hong Kong ports should accurately capture direct emigration to Canada. Although immigrants who departed from other ports in China to intermediate countries such as Japan or Indonesia en route to Canada would not be counted in these data, this was relatively rare.[11] Appendix B compares migration estimates from the Harbourmaster report data and the Chinese Register data. I find in Appendix Figure A2 that while the magnitudes implied by the two data sources diverge in later years, the overall peaks and troughs of migration are remarkably similar.

3.2 Census Data

I supplement the above annual migration data with microdata from the 1881-1921 decennial Canadian censuses.[12] While 100% of the 1881 census has been digitized, only a random sample of the other censuses, ranging from 4-5% coverage of the population, has been digitized and made publicly available, resulting in a relatively small sample size. Additionally, since the variable Year of Immigration, indicating a respondent's year of arrival in Canada conditional on being an immigrant, is only available beginning in 1901, I cannot use prior censuses for analysis of immigrant outcomes by year of arrival and thus I use the 1881 and 1891 censuses only to measure the population stock of immigrant groups. Another major obstacle in using the census data is attrition due to return migration. If return migrants are differentially selected from the immigrant population, then the characteristics of immigrants who arrived in Canada in 1880 as measured in the 1901 census would not be representative

[10] 98.2% of Chinese immigrants in the Chinese Register are recorded as having arrived in either Vancouver or Victoria.

[11] Between 1886 and 1896, when the Harbourmaster reports include lists of the names of all emigrant ships departing Hong Kong, over 90% of Chinese immigrants recorded in the Chinese Register listed as their method of conveyance the name of a Hong Kong passenger ship bound for either Vancouver or Victoria. Estimating the percentage of immigrants who arrived directly from Hong Kong via ship using the method of conveyance listed in the Register likely understates the true percentage of Chinese immigrants that arrived directly from Hong Kong, since for some Chinese immigrants, the method of conveyance was either misspelled beyond recognition or listed simply as 'ship'.

[12] 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.

of the full population of immigrants who arrived in Canada in 1880.

Nevertheless, the extensive set of variables included in the census create a rich cross-sectional view of the country at different points in time, acting as a complement to the detailed data on inflows from the Chinese Register, which does not suffer bias from return migration. In addition to having variables not available in migration data, such as marital status, literacy, earnings, and home ownership, the census data also include non-Chinese immigrants, unlike the migration data. Data on other immigrants allow me to directly compare the characteristics of Chinese immigrants to other immigrant groups who were not subject to the Chinese Head Tax, but otherwise would likely have experienced similar immigration pushes and pulls. Comparing similar immigrant groups also ameliorates the selection problem caused by return migration – if we think for instance that Japanese and Chinese immigrants would have been similarly selected into return migration in the absence of the Head Tax, then a differences-in-differences empirical strategy would account for return migration, although the estimated effect of the Head Tax on Chinese immigrant characteristics would then be a combination of the effect of the Head Tax on selection into immigration and the effect of the Head Tax on selection into return migration.

3.3 Summary Statistics

Table 1 summarizes various characteristics of the immigrant population in the Census and the Chinese Register. Columns (1)-(3) use the pooled 1901-1921 Censuses to compare the entire immigrant population, defined as those who were born outside of Canada, with the Japanese and Chinese immigrant populations, defined as those who were born in Japan and China respectively. 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 58% of all immigrants to Canada), slightly less likely to be married, and less likely to have immigrated in earlier years or as children. Chinese immigrants were also less likely than all immigrants to be literate (68% of Chinese immigrants could read compared to 93% of all immigrants), and Chinese immigrant men were more likely to be working as laborers and earned only 52% as much on average as all immigrant men. Japanese immigrants were more similar than the overall immigrant population to Chinese immigrants along all dimensions.

Columns (4)-(5) use the Chinese Register data to compare Chinese immigrants who immigrated between 1886 and 1923 and were required 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 80% of taxpayer Chinese immigrants were laborers, less than 5% of non-taxpayers were laborers.[13] 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. Overall, the characteristics of Chinese immigrants as recorded in the Chinese Register are similar to those recorded in the Canadian census—both groups are overwhelmingly male and have similar age and year of arrival distributions, although Chinese immigrants in the census are more likely to have arrived as children, indicating 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 than in the Canadian census.

4 The Effects of the Chinese Head Tax on Immigration Flows

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) in Figure 1.[14] Chinese immigration to Canada dropped following the implementation of the $50 Head Tax in 1885 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

[13] 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.

[14] 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.

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 peak from 1911-1913 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 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 is increased. I then quantify the effect of the Head Tax on Chinese immigration by estimating a time series model.

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.[15] To more clearly visualize level shifts in immigration net of cyclicality (immigration was much higher in summer months) and time trends I regress log monthly Chinese immigration on indicators for each calendar month and a linear time trend and graph a six-month moving average of the residuals in Figure 2a. I run regressions separately for windows of three years around each Head Tax increase to avoid contamination from subsequent or prior Head Tax increases and plot the residuals for all three increases on the same axes by month relative to the Head Tax increase.[16] We observe a clear, 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 test whether these visual breaks are econometrically significant, 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:

[15] I drop the 564 individuals for whom the month of arrival was not recorded. These are nearly all individuals who arrived prior to 1886.

[16] 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.

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

where F_t represents the inflow of Chinese immigrants in month t and μ_m is a month fixed effect for one 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 two-year window around each Head Tax increase, again restricting the estimation sample to a three-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 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 would be significant structural breaks. 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. Therefore it is understandable that the predicted structural break in immigration may have taken place prior to the actual implementation of the increase, in anticipation. 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 implmentation of the increase.

4.2 Estimating 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 estimate a time series model of Chinese immigration to Canada based on prior work by Hatton and Williamson [1994], Boustan [2007], Clark et al. [2007] with the following specification:

$$\log(F_t) = \alpha_0 + \gamma^{\varepsilon} \log(C_t) + \alpha_1 E_{y(t)} + \alpha_2 I_{y(t)} + \alpha_3 P_{y(t)-1} + \alpha_4 (P_{y(t)-1})^2 + \mu_{m(t)} + \varepsilon_t \quad (2)$$

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 $\mu_{m(t)}$ again represent month fixed effects. The second term on the right-hand side of Equation 2 captures the effect of the Head Tax, with C_t representing the cost of migration in month t (measured in 2023 USD). As discussed in Section 2.1, the approximate cost of passage from Hong Kong to British Columbia was $50 (approximately 1,500 USD in 2023). Accordingly, I approximate $C_t = 1500 + TAX_t$ where TAX_t is the Head Tax level in month t. The primary object of interest is the coefficient γ^{ε}, which represents the elasticity of immigration inflow with respect to the cost of migration.

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. As a proxy for various origin country 'push' factors, I instead include $E_{y(t)}$ (note that $y(t)$ indexes the year of month t for variables that are only measured annually), total emigration out of Hong Kong in each year as recorded in the Harbourmaster reports,[17] and to account for destination country 'pull' factors the regression includes $I_{y(t)}$, total immigration into Canada in each year.[18]

While these controls account for factors influencing emigration from Southern China and immigration to Canada independently, they do not control for the specific *network effects* of the size of the existing Chinese immigrant community in Canada, which Clark et al. [2007]

[17] As discussed in Section 3.1.2, the majority of Chinese immigrants to Canada departed from Hong Kong. Additionally, since emigration to Canada comprised less than 8% of total emigration from Hong Kong even at its peak, there were likely minimal spillover effects of Canadian immigration policy on total Hong Kong emigration.

[18] Data on total annual immigration to Canada is obtained from a report by Employment and Immigration Canada [1982].

show to be the largest determinant of migration flows outside of immigration policy. To this end, and following Clark et al. [2007], I include controls for $P_{y(t)-1}$, the lagged stock of Chinese immigrants living in Canada as well as $(P_{y(t)-1})^2$.[19]

Column (1) of Table 2 presents the results of estimating equation (2) using data on immigrant inflow from the Chinese Register between 1882 and 1921 (the last year for which I have population stock data). I estimate γ^{ε} to be -3.14, suggesting that a 10% increase in migration cost corresponds to a 31% decrease in monthly migration inflow. This decrease is significant at the 99% level. I re-estimate equation (2) separately for three-year windows around the \$50 Head Tax (Column (2)), \$100 Head Tax (Column (3)), and \$500 Head Tax (Column (4)) respectively. The \$50 and \$500 Head Tax samples yield nearly identical estimates of this elasticity. The \$100 Head Tax sample yields a much larger elasticity, although with a larger standard error.

To get a sense of the quantity of these effects and allow non-parametric estimation of the effect of each Head Tax, I also estimate equation (2) using F_t rather than $\log(F_t)$ as the outcome variable, and regress the outcome on indicators for each tax. The results imply that the \$50 Head Tax was associated with 45 fewer immigrants per month relative to no Head Tax, the \$100 Head Tax was associated with 163 fewer immigrants per month relative to no Head Tax, and the \$500 Head Tax was associated with 782 fewer immigrants per month relative to no Head Tax, all significant at the 95% level.

Recall that since registration was voluntary for Chinese immigrants who had arrived prior to 1885, the Register estimates of inflows prior to 1885 are likely *underestimates*, biasing our estimates of the effect of the Head Tax downwards. My results are robust to restricting the data to inflows from 1886-1924 and instead using the \$50 Head Tax as a baseline.

[19] I compute the stock of Chinese immigrants living in Canada every ten years starting in 1871 using the number of people born in China as reported in the Canadian Census. I then interpolate the population stock in intercensal years using a natural cubic spline. Results are robust to using linear interpolation.

5 Selection into Immigration: Theoretical Framework

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. The decision of whether or not to immigrate is fundamentally a tradeoff between the gains from migration and the cost to migrate. In a 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. Under this framework, an increase in the cost of migration would discourage only those with the least to gain from migration. If the returns to migration for prospective Chinese immigrants to Canada were decreasing in skill, for instance, then Chinese migrants would initially be negatively selected on skill, and under the Head Tax we would expect Chinese migrants to become even more negatively selected.

Conversely, if we model migration costs as decreasing in skill (e.g. if borrowing is more difficult for low-skilled migrants), 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 and resulting in Chinese migrants becoming more positively selected (under the continued assumption that the returns to migration for Chinese migrants are decreasing in skill).

To formalize the contrasting predictions under these two frameworks, 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].[20] 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

$$\ln(w_{Canada}) - \ln(w_{China}) - \pi > 0 \tag{3}$$

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

[20] I follow the notation of Chiquiar and Hanson [2005] throughout.

to migrate), which Borjas [1987] models as constant. Wages are modelled as

$$\ln(w_c) = \mu_c + \delta_c s \tag{4}$$

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 4 into equation 3 yields the following condition for migration:

$$\mu_{Canada} + \delta_{Canada} s - \pi > \mu_{China} - \delta_{China} s \tag{5}$$

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.[21]

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.[22] 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.[23] As a result, the standard Roy-Borjas model would

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

[22] 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.

[23] For instance, age-adjusted estimates of the return to literacy using the 1901 Canadian census (the

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:

$$\ln(\pi) = \mu_\pi - \delta_\pi s \tag{6}$$

In particular, the model assumes that baseline costs μ_π decrease in skill at a rate of δ_π, whether due to lower wages, liquidity constraints, or ease of adaptation to the receiving country. Now migration occurs iff

$$\mu_{Canada} + \delta_{Canada} s - \exp(\mu_\pi - \delta_\pi) > \mu_{China} - \delta_{China} s \tag{7}$$

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

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.

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.[24]

The Borjas [1987] and Chiquiar and Hanson [2005] models each generate distinct predictions for how an exogenous increase in migration costs would affect the selection of Chinese migrants into immigrating to Canada. The Borjas [1987] model predicts that the more skilled migrants would no longer choose to immigrate, leaving only the lowest-skilled migrants, leading to a decrease in the average skill of the already negatively-selected immigrant pool. 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. In the following sections, I use the exogenous variation in migration costs generated by the Head Tax and its subsequent amendments to test between these two models.

6 Effects on Selection

I begin this section by presenting descriptive evidence on the initial selection of immigration from China to Canada prior to the implementation of the Head Tax in the 1880s. I then 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.

[24] 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.

6.1 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 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.[25] 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.

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 [Olds, 2003, Morgan, 2004, Carson, 2006, Baten and Hira, 2008, Morgan, 2009, Baten et al., 2010].[26]

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

[26] Olds [2003] uses data from 1921-1931 during the Japanese occupation of Taiwan; Morgan [2004] uses records of Chinese government employees in the 1930s and 1940s; Carson [2006] uses data on Chinese immigrants who were imprisoned in the Western U.S. during the 19th century; Baten and Hira [2008] use data on contract migrants from China to Suriname and Indonesia collected in the 1880s; Morgan [2009] uses data on Chinese immigrants to Australia who were imprisoned in Melbourne between 1853 and 1927; Baten et al. [2010] compile several of the above data and add a small dataset of Chinese migrants to the U.S. collected between 1907 and 1948. All data focus on men of Chinese ethnicity from Guangdong (excluding Olds [2003], which looks at Taiwan), the province from which over 96% of Chinese immigrants in the Register originated.

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.[27] How does this average height compare to the average height of Chinese men at the time?

The first set of benchmark figures that I use is from Olds [2003], who uses data on Taiwanese men collected between 1920 and 1930 under Japanese occupation. Unlike data on migrants, these data cover the entire population, and so are not biased by selection into migration, and are likely representative of height in Southern China due Taiwan's geographic proximity and socioeconomic similarity to Southern China during the late 19th century.[28] Olds [2003] estimates that after adjusting for age-related shrinkage and death patterns, the average height for an adult Taiwanese man born between 1860 and 1865 was approximately 162.5cm, suggesting intermediate or slightly positive selection into immigration to Canada.[29]

As a second reference point, Baten and Hira [2008] summarize data on the heights of nearly 13,000 Chinese migrant workers in Indonesia in the 1880s. 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. Baten and Hira [2008] find that the average height of migrants was 161.5cm (for the 1860-1864 birth cohort), indicating that in the 1880s, migrants to Canada were also positively selected on height relative to migrants to Indonesia.[30]

Finally, additional 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 of between 163cm and 165cm [Morgan, 2004, Carson, 2006, Morgan, 2009]. Together, these references for Chinese height in the

[27] 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.

[28] 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.

[29] 25% of Chinese immigrants to Canada before 1886 were born between 1860 and 1864.

[30] Note that under the Roy-Borjas model of selection, if it was the case that Chinese immigrants to Canada were negatively selected, and that Chinese immigrants to Indonesia were simply more negatively selected via a lower cutoff skill level, this would imply fewer immigrants to Indonesia relative to Canada. In reality, emigration to Southeast Asia accounted for over 90% of Chinese emigration between 1840 to 1940 [McKeown, 2010], suggesting that Chinese immigrants to Canada were instead neutrally or positively selected.

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.

6.2 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.[31]

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.

In Figure 4a I use more granular monthly Register data to graph the average height in a three-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 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.

[31] The rapid increase in the average height of Chinese immigrants to nearly 167cm by the 1920s was driven by a small number of non-taxpayers, who were mostly students.

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 that report their profession to be laborer at the time of entry. 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.

Figures 4b and 4c show the six-month moving average of the Whipple Index and the share self-reporting as laborers respectively in a three-year window around each Head Tax increase. 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 no change or even a slight decrease following the initial $50 Head Tax and the increase to $100. Similarly, while the share of immigrants that are laborers does not appear to change noticeably after the $50 or $100 Head Taxes, there is nearly a 100% drop in the share laborer following 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 (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.

6.3 Estimation of Effects of Head Tax on Selection

To quantify the effect of migration cost on selection, I estimate the following equation:

$$y_{ict} = \alpha_0 + \gamma \log(C_t) + \mu_{m(t)} + \delta_c + \varepsilon_{ict} \tag{8}$$

for each outcome variable y_{ict} where i indexes individuals, c indexes birth cohort, and t indexes month of immigration. As before, C_t represents the cost of immigration in 2023 USD, computed as the approximate cost of passage (1500 USD) plus the amount of Head Tax in month t. I include calendar month fixed effects $\mu_{m(t)}$ and birth cohort fixed effects δ_c. The coefficient of interest γ, which represents the effect of a percentage increase in migration cost on outcome y_{ict}, is identified off of the comparison between individuals born in the same year who immigrated to Canada in the same month (but different years) who faced different migration costs.

The results of the estimation of Equation (8) are shown in Table 3. In addition to the outcomes of height (Column (1)), Whipple index (3), and share laborer (4), I also estimate this equation with age at arrival (2) (for which I exclude birth cohort fixed effects) and share student or merchant (5). Panel (a) estimates Equation (8) on the full Register sample, panel (b) focuses on a three-year window around the $50 Head Tax increase on January 1st, 1886, panel (c) focuses on a three-year window around the $100 Head Tax increase on January 1st, 1901, and panel (d) focuses on a three-year window around the $500 Head Tax increase on January 1st, 1904.

In the full sample, I estimate that increases in migration cost were associated with a small but significant increase in height. In particular, I estimate that a 100% increase in the cost of migration would suggest an increase in average height of a quarter of a centimeter. Interestingly, this overall effect is the average of much larger effects of 1.3cm and 0.8cm around the $50 and $100 Head Taxes and a null effect (indistinguishable from 0 at the 95% level) around the $500 Head Tax. Note, however, that the pre-period for the $500 Head Tax is the same as the post-period for the $100 Head Tax. Panel (d) may therefore be contaminated by the immediate effects of the $100 Head Tax.

Similar heterogeneity is observed in the effect of migration cost on age at arrival. In the full sample I estimate that a doubling of migration costs is associated with immigrants being 2.4 years younger on average which is similar in magnitude to the estimated effect around the $500 Head Tax. The effect around the $50 Head Tax, however, is actually positive, suggesting that immigrants right after the $50 Head Tax are 1.8 years older than immigrants right before. Recall, however, that the regression on age does not include birth

cohort fixed effects, so we can not rule out that there was simply a secular decrease in the age of Chinese immigrants over this time period, independent of the Head Tax.

In Column (3) I estimate that a doubling of migration costs results in a decrease in the Whipple Index by 12 (representing an increase in numeracy). Finally, I estimate in Columns (4) and (5) that increases in migration cost are associated with *both* increases in the probability of reporting being a laborer and the probability of being a student or merchant over the full sample. Once again this masks heterogeneity over time, since the $50 and $100 Head Taxes were both associated with fewer students/merchants and more laborers, but the $500 Head Tax was associated with an overwhelming increase in students/merchants and a corresponding decrease in laborers (as shown in Figure 4c).

In summary, my results are strongly suggestive of migration cost inducing small but significant increases in both the height and the numeracy of Chinese immigrants. I therefore conclude that increases in the Head Tax caused more positive selection into immigration.

7 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 approximately -3.1. 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.

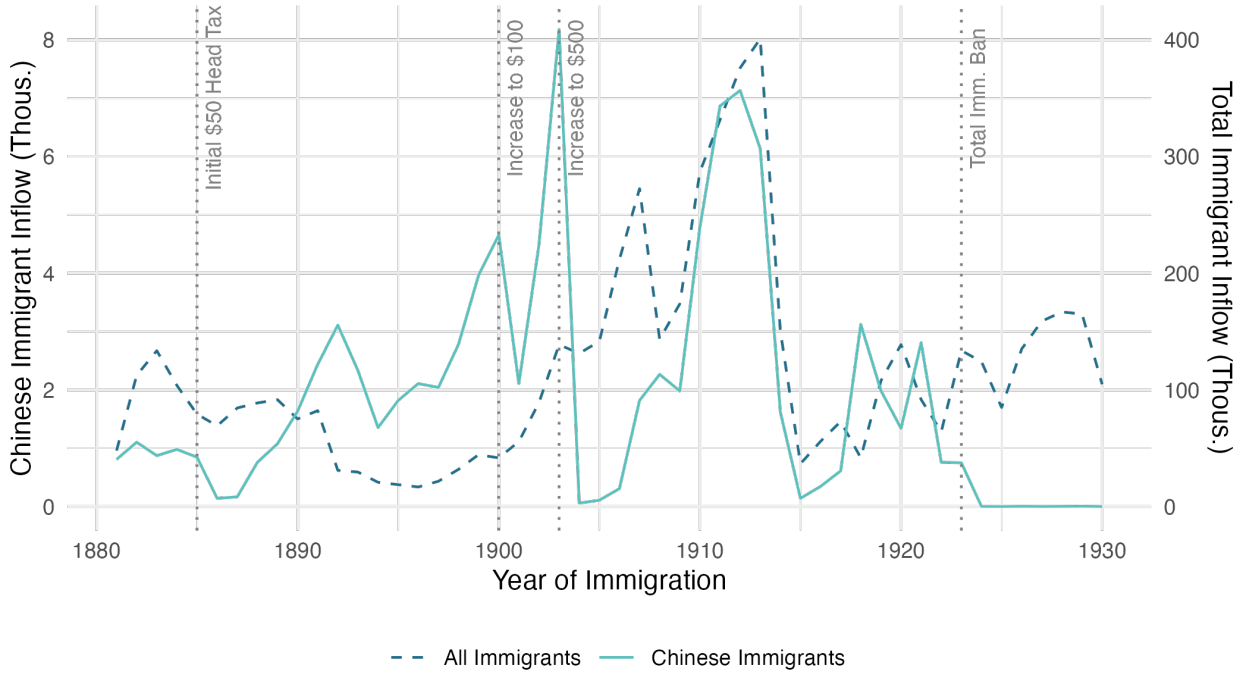
My findings indicate that migration cost plays an important role in migration decisions, and that higher migration costs in the late 19th and early 20th centuries excluded mostly immigrants with less health human capital (measured by height), lower occupational income, and less wealth. The shift towards 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.

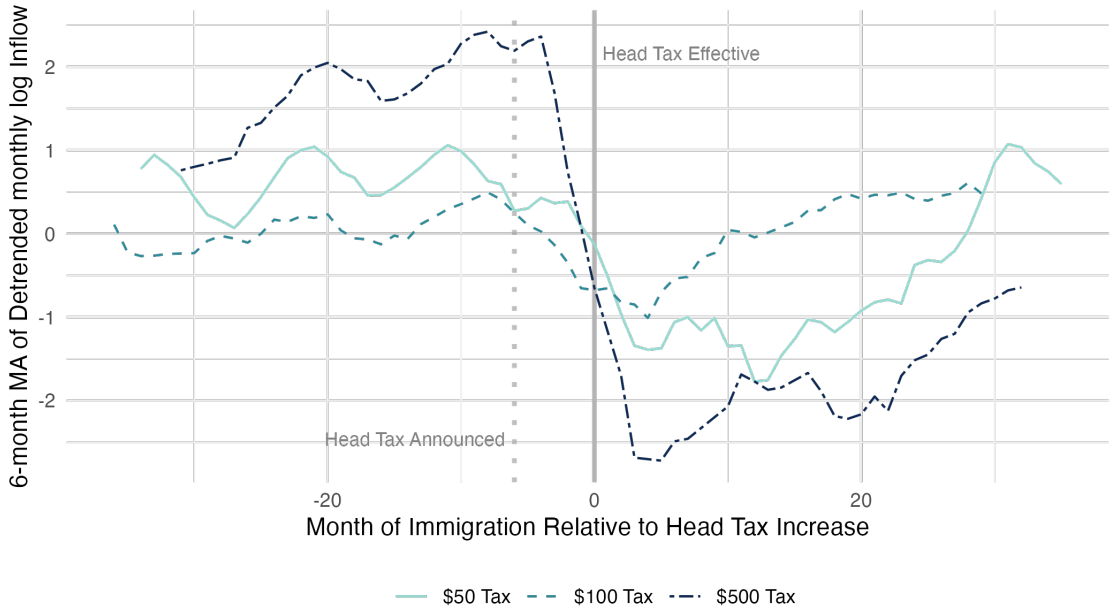
While there is still a great deal of room to dig further into other effects of migration costs, such as how the selection aspect of migration costs interacts with cultural or wage

assimilation after arrival, I believe that 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.

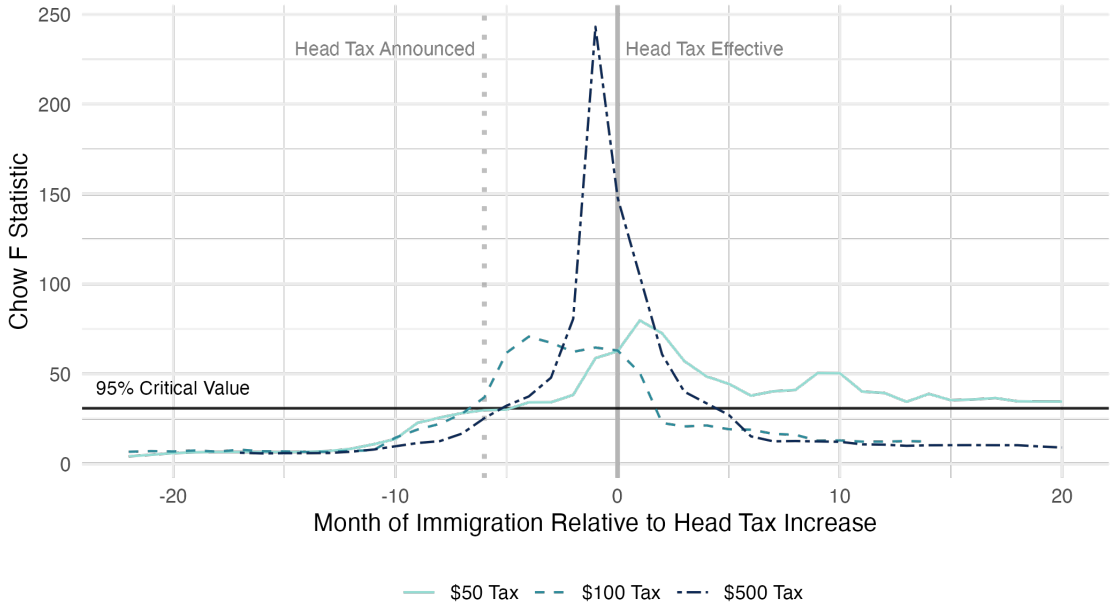
8 Figures

Figure 1: Inflow of Chinese immigrants to Canada (solid line), as measured by the Chinese Register [Ward and Yu, 2008], with 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 years in which the Head Tax was initially created or increased.





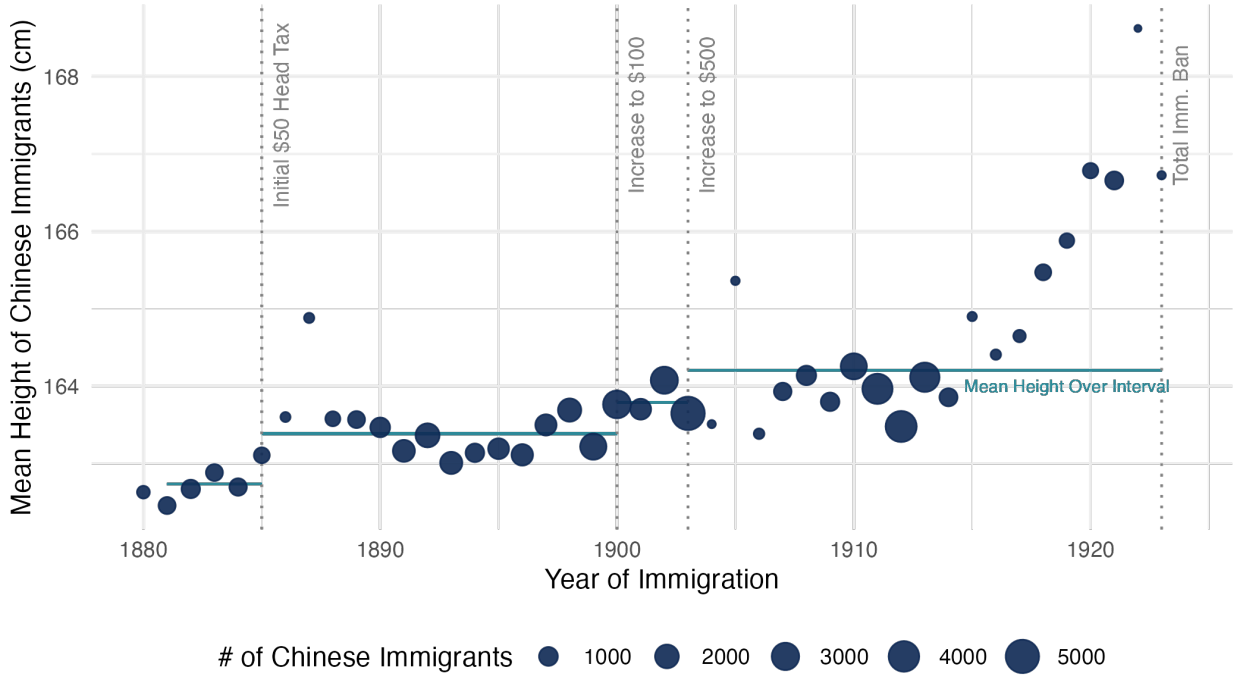
(a) 6-month moving average of residual log monthly inflow of Chinese immigrants to Canada by month relative to each Head Tax increase. Residuals are obtained by regressing log monthly inflow around each Head Tax separately on indicators for each month and a constant.

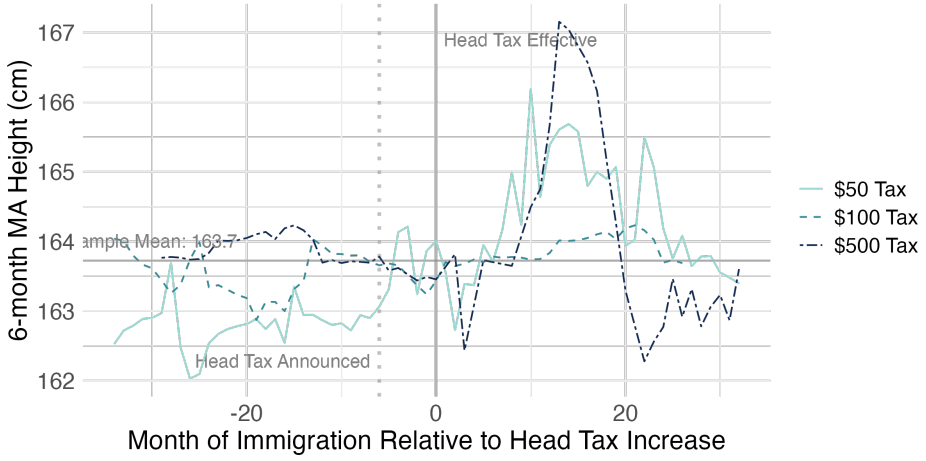


(b) F Statistic from a Chow test for a structural break (significant change in regression coefficients) at each month relative to each Head Tax increase. The regression used for the Chow test includes indicators for each month, a constant, and a linear time trend.

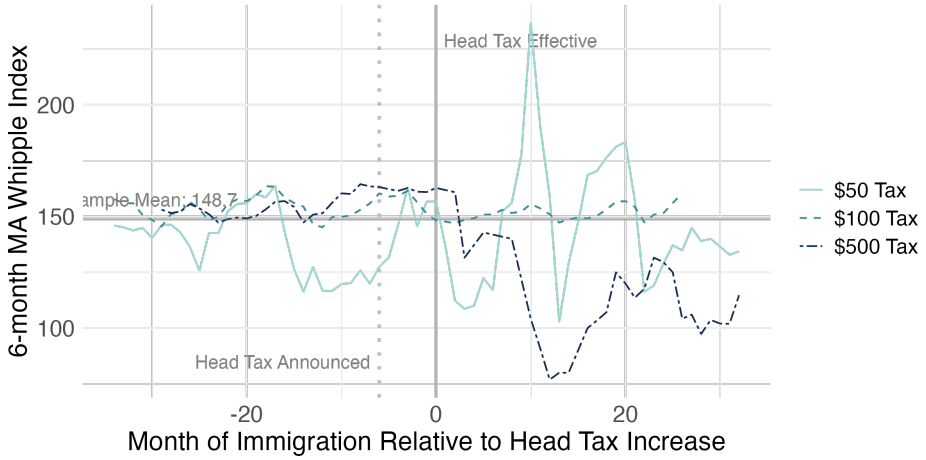
Figure 2: Residual trends in monthly immigration (panel (a)) and F-Statistics from Chow tests (panel (b)) by month relative to the initial $50 Head Tax (solid line), the increase to $100 (dashed line), and the increase to $500 (dot-dash line). The vertical dotted grey lines indicate when the increases 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].

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.

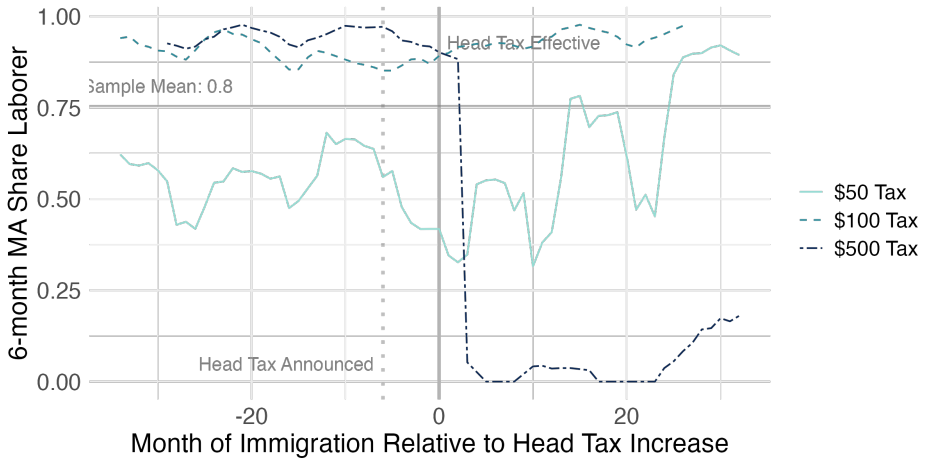




(a) Outcome: Height (cm)



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



(c) Outcome: Share reporting laborer as profession at time of arrival

Figure 4: 6-month moving average of Chinese immigrant height (panel (a)), Whipple index (panel (b)), and share laborer (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 1: Summary statistics for immigrants in pooled Canadian census data (1901, 1911, 1921) in columns (1)-(3) and Chinese immigrants in the Chinese Register (1886-1923) in columns (4)-(5) [Canadian Families Project, University of Victoria, 2012, Canadian Century Research Infrastructure, 2011, 2015, Ward and Yu, 2008].

	Canadian Census			Chinese Register	
	(1)	(2)	(3)	(4)	(5)
	All Foreign-Born.	Japanese Imm.	Chinese Imm.	Head Tax	No Head Tax
% Male	58.01	82.57	97.5	98.93	85.85
% Married*	64.27	53.55	57.46	-	-
Year of Immigration (%)					
Before 1886	15.71	0.6105	8.157	-	-
1886-1895	9.286	9.451	12.22	17.71	4.196
1896-1905	22.41	37.2	35.23	36.36	9.17
1906-1915	45.08	38.3	36.62	34.91	54.14
After 1916	7.516	14.44	7.773	11.03	32.5
Age at Immigration (%)					
Under 18	41.7	21.76	25.13	12.34	38.71
18-24	22.13	40.22	35.76	37.14	18.87
25-34	21.61	29.17	29.08	33.28	26.54
Over 35	14.55	8.854	10.04	17.24	15.88
% Literate*	93.04	73.9	67.95	-	-
Whipple Index	121.8	117.6	166.4	150	128.9
% Laborers**	18.79	32.11	33.03	80.84	4.655
Mean Annual Earnings**	844.7	516.5	438.9	-	-
Height (cm)**	-	-	-	161.6	157.5
Obs.	204,748	1,397	4,230	81,758	8,342

*Calculated for everyone aged 18 or older.

** Calculated only for men aged 18 or older.

Notes: Column (1) pools Canadian census data (as described in section 3.1.2) from 1901, 1911, 1921, calculating the mean of each variable for all individuals born outside of Canada, weighted based on the coverage of that year's census (5% for 1901-1911 and 4% for 1921). Column (2) repeats this exercise for individuals born in Japan, and Column (3) repeats this exercise for individuals born in China. Column (4) uses the Chinese Register (as described in section 3.1.1) to calculate the mean of each variable for the population of Chinese immigrants who arrived in Canada between 1886 and 1923 and paid a non-zero Head Tax fee. Column (5) repeats this exercise for Chinese immigrants who arrived in Canada between 1886 and 1923 and paid no Head Tax fee. 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—for a population with a uniform distribution of ages and perfect numeracy, the Whipple Index would be 100, and for a population that only reports ages ending in 0 or 5, the Whipple Index would be 500.

Table 2: Estimation of Equation (2) to capture the effects of the Chinese Head Tax on monthly Chinese immigrant inflow to Canada.

	All Years (1882-1921)	$50 Tax (1883-1888)	$100 Tax (1898-1903)	$500 Tax (1901-1906)	All Years (1882-1921)
	Dependent variable:				
	log Monthly Chinese Immigrant Inflow ($\log(F_t)$)				Monthly Inflow (F_t)
	(1)	(2)	(3)	(4)	(5)
γ^{ε} (log Cost)	-3.14^{***}	-3.16^{***}	-6.48^{**}	-3.17^{***}	
	(0.19)	(0.61)	(2.59)	(1.19)	
γ_{50} ($50 Tax)					-44.39^{**}
					(20.07)
γ_{100} ($100 Tax)					-162.60^{***}
					(57.29)
γ_{500} ($500 Tax)					-782.00^{***}
					(63.69)
Dep. Var. Mean (SE)	4.5	3.2	5.6	4	194
	(0.1)	(0.2)	(0.1)	(0.3)	(10.5)
Observations	475	72	67	63	475
Adjusted R^2	0.41	0.58	0.54	0.89	0.48

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

Notes: The outcome variables $\log(F_t)$ and F_t are measured using Chinese Register data [Ward and Yu, 2008]. All regressions 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 $(P_{t-1})^2$, as well as calendar month fixed effcts.

Table 3: Estimation of Equation (8) to capture the effects of the Chinese Head Tax on the selection of Chinese immigrants into immigration.

Dependent Variable:	Height (cm)	Age at Arrival	Whipple Index	Pr(Laborer)	Pr(Student or Merchant)
	(1)	(2)	(3)	(4)	(5)
Panel (a): Full Sample(1882-1923)					
γ^{ε} (log Cost)	0.26***	−2.38***	−12.07***	0.02***	0.05***
	(0.05)	(0.03)	(1.62)	(0.003)	(0.002)
Dep. Var. Mean	163.7	25.8	148.8	0.8	0.1
Observations	53,904	93,397	78,592	78,658	78,658
Adjusted R^2	0.01	0.05	0.05	0.20	0.32
Panel (b): $50 Head Tax Sample (1883-1888)					
γ^{ε} (log Cost)	1.33***	1.80***	−6.45	0.37***	−0.06**
	(0.44)	(0.55)	(13.88)	(0.03)	(0.02)
Dep. Var. Mean	163.1	26	140.2	0.6	0.1
Observations	2,570	3,546	3,257	3,263	3,263
Adjusted R^2	0.01	0.02	0.05	0.08	0.02
Panel (c): $100 Head Tax Sample (1898-1903)					
γ^{ε} (log Cost)	0.81***	0.15	−38.79***	0.12***	−0.04***
	(0.20)	(0.28)	(8.07)	(0.01)	(0.01)
Dep. Var. Mean	163.7	28	154.5	0.9	0
Observations	14,789	22,089	20,607	20,627	20,627
Adjusted R^2	0.003	0.003	0.09	0.03	0.02
Panel (d): $500 Head Tax Sample (1901-1906)					
γ^{ε} (log Cost)	−0.12	−2.91***	−20.82	−0.65***	0.59***
	(0.41)	(0.46)	(15.71)	(0.02)	(0.02)
Dep. Var. Mean	163.8	27.4	156.3	0.9	0
Observations	8,907	14,312	12,846	12,856	12,856
Adjusted R^2	0.002	0.02	0.42	0.23	0.27

*p<0.1; **p<0.05; ***p<0.01 **Notes:** The column (1) sample is restricted to men aged 23-50 with non-missing height, the column (2) sample is restricted to those with non-zero non-missing age, the column (3) sample is restricted to men aged 18-47 with non-missing age, and columns (4) and (5) are restricted to men aged 18-65 with non-missing occupation. All outcome variables are measured using Chinese Register data [Ward and Yu, 2008]. All regressions include calendar month fixed effects and a constant, and all regressions except for column (2) include birth cohort fixed effects.

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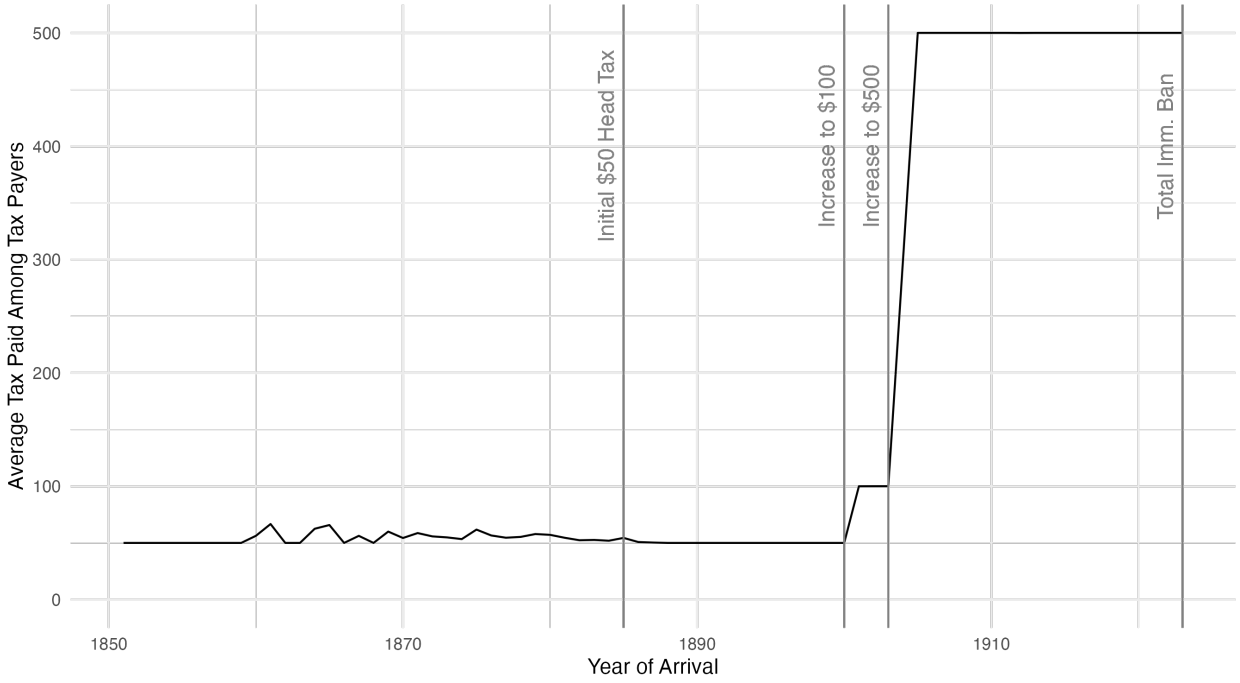
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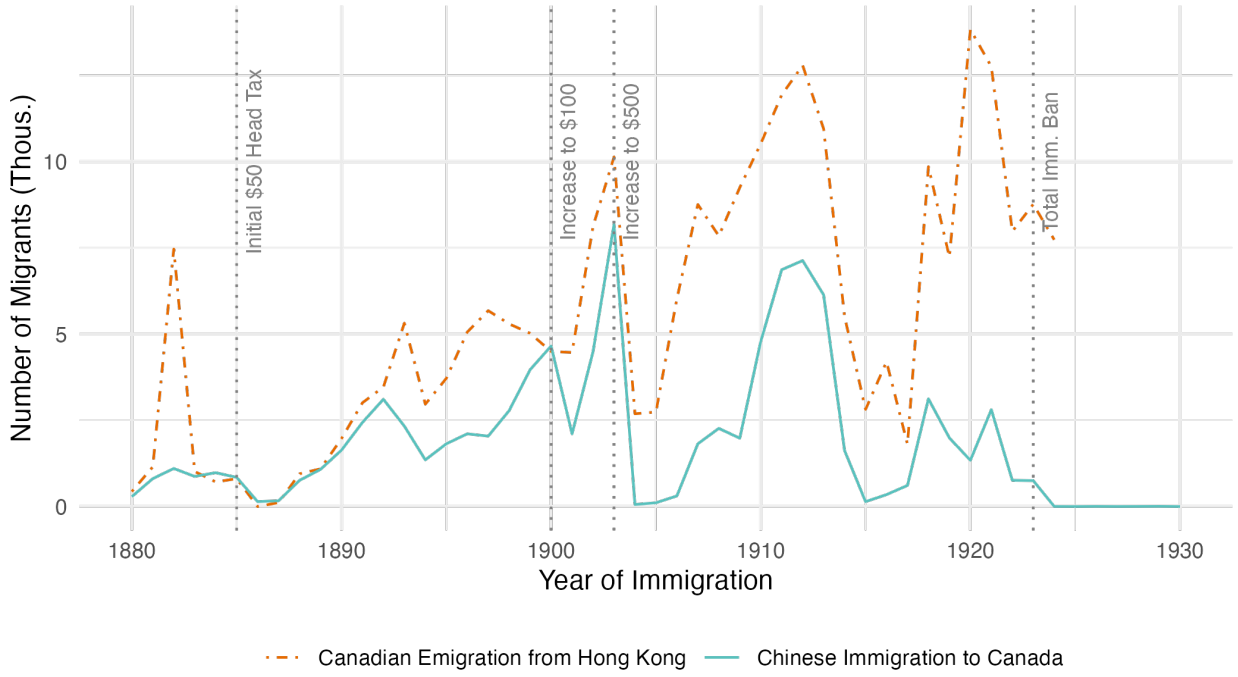
A Appendix Figures

Figure A1: Average non-zero tax paid by Chinese immigrants to Canada, by year of arrival in Canada, as recorded by the Chinese Register, which tracked all Chinese immigrants who entered Canada and/or paid the Head Tax between 1885 and 1949 [Ward and Yu, 2008]. Note that among Chinese immigrants who arrived in Canada prior to 1885, only those who re-entered Canada at some point following 1885 were forced to pay the Head Tax and therefore recorded in the registry, which is why we observe non-zero payments among immigrants arriving prior to 1885.



B Comparison of Chinese Immigration and Hong Kong Emigration Data

Figure A2: 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]. Vertical dotted lines mark years in which the Head Tax was initially created or increased.



Appendix Figure A2 compares the number of Chinese emigrants from Hong Kong to Canada as reported in the Harbourmaster reports to the number of Chinese immigrants to Canada as reported in the Chinese Register from 1886 to 1923. 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 can be explained in three ways. The first is that Chinese immigrants to Canada were permitted to leave and re-enter the country within a year without re-paying the Head Tax (or being re-recorded in the Register) upon re-entry. As a result, a returning Chinese immigrant who had already paid the Head Tax would

be counted in the emigration data as a passenger on an emigrant ship to Canada, but would not be counted in the Register data as a new immigrant. The second is that beginning in 1887, migrants who were passing through Canada en route to another country were exempted from paying the tax, and also would not have been recorded in the Register.[32] Finally, it is unclear whether the emigration data include only Chinese passengers. If they include non-Chinese passengers, such as British citizens travelling between parts of the Commonwealth, then the discrepancy between emigration and immigration may be in part due to non-Chinese passengers, who would not be recorded as immigrants in the Chinese Register.

C Counterfactual Inflow Calculation

I recursively calculate counterfactual immigration inflow $\widehat{FLOW}^{CF}_{China,t}$ from China to Canada in year t as follows:

$$\widehat{FLOW}^{CF}_{China,t} = \hat{\alpha}_0 + \hat{\alpha}_1 HKEMIG_t + \hat{\alpha_2} CANIMMIG_t + \hat{\alpha}_3 \widehat{POPSTOCK}^{CF}_{China,t-1} + \hat{\alpha}_4 (\widehat{POPSTOCK}^{CF}_{China,t-1})^2 \quad (9)$$

where $\hat{\alpha}_0, \hat{\alpha}_1, \hat{\alpha}_2, \hat{\alpha}_3, \hat{\alpha}_4$ represent the coefficients obtained from estimating equation (2), $HKEMIG_t$ and $CANIMMIG_t$ are taken directly from the data (as described in section 4), and $\widehat{POPSTOCK}^{CF}_{China,t-1}$ is the counterfactual population stock of Chinese immigrants in Canada, computed as the sum of the previous counterfactual population stock and the counterfactual net flow of immigrants:

$$\widehat{POPSTOCK}^{CF}_{China,t} = \widehat{POPSTOCK}^{CF}_{China,t-1} + \widehat{FLOW}^{CF}_{China,t}(1 - \widehat{OUTSHARE}_{China,d(t)}) \quad (10)$$

. I start from 1884 with $\widehat{POPSTOCK}^{CF}_{China,1884} = POPSTOCK_{China,1884}$, the year before the Head Tax was announced. Since actual outmigration from Canada back to China is not directly observed in the data, I use as a proxy $\widehat{OUTSHARE}_{China,d}$, the share of outmigration

[32] Although it is possible that some Chinese emigrants were turned away because they could not afford to pay the Head Tax, historian Arlene Chan has told me that Chinese immigrants were generally aware of the tax prior to coming to Canada, indicating that deportation is unlikely to explain much of the discrepancy between emigration and immigration.

in decade d, computed by:

$$\widehat{OUTSHARE}_{China,d} = \frac{\sum_{\{t|d(t)=d\}} FLOW_{China,t} - \Delta POPSTOCK_d}{\sum_{\{t|d(t)=d\}} FLOW_{China,t}} \tag{11}$$

where $\sum_{\{t|d(t)=d\}} FLOW_{China,t}$ is the total actual observed Chinese immigrant inflow summed over decade d and $\Delta POPSTOCK_d$ is the actual observed change in population stock over decade d (as measured by the difference in population stock between decennial censuses).[33] Decades are measured as the period between successive censuses (1882-1891, 1892-1901, etc.).

Note that the use of this proxy for outmigration in calculating counterfactual immigration inflow relies on two very strong assumptions: firstly, that outmigration over a decade happens at the same rate in every year, and secondly, that outmigration as a share of inflow would have been the same in our counterfactual. These assumptions are unlikely to hold, and therefore this exercise should be taken as suggestive.

[33] Recall that intercensal values of $POPSTOCK_t$ are computed by interpolating between decennial censuses. I use decennial values of population stock to avoid using interpolated values for estimation.