WWII Events Reduce Population in One Shanghai District While Increasing It in Others*

Impact Analysis of Japanese Occupation on Population Shifts Across Shanghai's Districts During WWII

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December 3, 2024

This paper evaluates the impact of three historic events on the population dynamics of Shanghai during WWII: the Japanese occupation of the Chinese-administered area, France's surrender in WWII, and the Japanese occupation of the International Settlement. Data from the Virtual Shanghai research platform and historic publications are analyzed using a difference-in-difference model to estimate the effects of these events. The results indicate that the Japanese occupation of the Chinese-administered area led to an overall increase in Shanghai's population across all districts. In contrast, France's surrender during WWII had a negative impact on population numbers in all districts except the French Concession. Similarly, the Japanese occupation of the International Settlement caused population declines in all districts except the International Settlement itself. These findings underscore the complex demographic shifts resulting from geopolitical events and reveal how wartime occupation reshaped urban populations in uneven ways, reflecting resilience and displacement patterns.

1 Introduction

Overview paragraph

Estimand paragraph

Results paragraph

Why it matters paragraph

*Code and data are available at: https://github.com/Jingying-yu/Shanghai_population_change

Analyses and findings in this paper are structured into several sections: Section 2 – Data, **?@sec-model** – Model, **?@sec-results** – Results, and **?@sec-discussion** – Discussion. The Data section examines all variables and attributes kept for analysis, followed by an explanation of their measurement and purpose. The Model section defines the generalized linear model used for further analysis, explain its components, and presents model justifications. The Result section focuses on visualizing and presenting the model results through data presented in Data section. The Discussion section further evaluate the interpretations behind the model results presented in the previous section, and touches on any expanded topics as well as weaknesses and next steps.

2 Data

Data is cleaned and analyzed using the open-source statistical programming language R (R Core Team 2023) and supporting packages including tidyverse (Wickham et al. 2019), arrow (Richardson et al. 2024), readr (**readr?**), knitr (Xie 2023), kableExtra (**kableExtra?**), modelsummary (**modelsummary?**), rstanarm (Goodrich et al. 2022), dplyr (Wickham et al. 2023), and broom.mixed (**broom.mixed?**). These tools facilitate data manipulation, visualization, modeling, and reporting. Detailed descriptions of each dataset are provided in the subsections below.

2.1 Data Sources

The primary dataset is sourced from the appendix of the research publication (Zou (1980)), which includes selected excerpts from historical government census records. Due to the age of the original census documents, they are no longer available online. To address gaps in the primary dataset, complementary data was obtained from the research platform Virtual Shanghai (Henriot and Contributors (2024)), providing crucial insights to fill missing areas.

2.2 Historical Background

Between 1936 and 1942, China was in a state of political and social upheaval, marked by increasing Japanese aggression and internal instability. Shanghai, a critical urban center, was divided into three districts: the Chinese-administered district, the International Settlement (primarily governed by the U.K. and U.S.), and the French Concession (under French governance). The International Settlement and French Concession operated with significant autonomy compared to the Chinese government's limited authority over its district. Each district occupied distinct proportions of Shanghai's urban landscape.

Reference Timeline:

1. 1937-08-13: Japanese armed forces entered Shanghai

2. 1937-11-12: Japanese armed forces claims occupation of Shanghai –> ends Chinese district

1940-06-22: France surrendered to Germany –> French Concession stopped taking refugees

3. 1942-01: Japanese armed forces claims authority over International Settlement (which was mainly under the governance of U.K and U.S prior to this date)

4. 1945-08-15: Japan surrendered in WWII

5. 1945-10: most Japanese armed forces withdrew from Shanghai

2.3 Measurement & Methodology

The majority of the data used in this analysis were collected by police officers or hired local authorities within each district of Shanghai, as detailed in the source (Zou (1980), page 2).

This paper focuses on population data from 1936 to 1942, a timeframe determined by both historical relevance and data availability. The analysis centers on the impact of three major historical events, beginning with the Japanese occupation of the Chinese-administered district on November 12, 1937. Given that Japanese forces first entered Shanghai on August 13, 1937, the year 1936 is chosen as the baseline or "no-treatment" year for comparison. The analysis concludes with the year 1942, as district-specific population data after this year is unavailable. The lack of records for the period between 1943 and 1949 coincides with the political transition to the People's Republic of China, making 1942 the final year for which reliable district-based population data exists.

The survey process faced several challenges, primarily due to population volatility caused by wartime conditions. Population shifts were frequent and unpredictable as military conflicts unfolded. Additionally, survey efforts encountered varying degrees of difficulty across districts due to logistical and political constraints. Resistance from the local population, often rooted in political risks, further complicated data collection efforts. These challenges underline the complexities of accurately recording population dynamics during a period of significant unrest and upheaval.

2.4 Variables of Interest

Table 1: Explanatory models of flight time based on wing width and wing length

Year	Pop CHN District	Pop IS	Pop FC
1936	2155717	1180969	477629
1937	2155717	1218630	477629
1938	2074693	1272552	504731
1939	2098331	1257703	495942

Year	Pop CHN District	Pop IS	Pop FC
1940	1479726	1233394	477629
1941	957339	446692	835523
1942	1049403	1585673	854380

This paper primarily evaluates three historic events between 1936 - 1942: 1. The Japanese occupation of Shanghai's Chinese-administrated District – 1937-11-12 2. France surrendered to Germany – 1940-06-22 3. Japanese armed forces claims authority over International Settlement – 1942-01

The first and third events should have very straight-forward consequences on population. The shifting over governing power to a foreign, hostile country would intuitive cause local population to panick and evacuate. In this paper, we initially assumed that Japanese occupation would decrease population in the corresponding area.

The effect of the second event is less direct. In 1940, European battlefield is still filled with WWII soldiers. When France surrendered to Germany in June, Japan – an ally of Germany, accepted France's new status as mutural German allies. The Japanese forces chose to stay out of the French Concession District in Shanghai. (User (n.d.)) The French Concession remained un-conquered until the Japanese withdrew from Shanghai in 1945.

2.4.1 Outcome variable

The outcome variable in this analysis is the *population* from 1936 to 1942.

District-level population data is missing for the years 1938, 1939, 1940 (partially), and 1941 in the government records. For 1938, 1939, and 1940, the population counts for all districts are unavailable due to undocumented reasons. To estimate these values, the population for the International Settlement and French Concession is deduced by adding the refugee population in their camps to their respective 1937 population counts. The population of the Chinese-administered district is then estimated by subtracting the total number of refugees in the two foreign districts from its 1937 population.

The missing population data for 1941 is estimated by calibrating the pre-established 1942 population dataset (zhengfu (n.d.)) against the primary data. A multiplier is derived to adjust the 1941 data to align as closely as possible with the available records, providing an approximate but consistent estimation.

Table 2: Explanatory models of flight time based on wing width and wing length

Year	Chinese-administered Population	International Settlement Population	French Concession Population
1936	2155717	1180969	477629
1937	2155717	1218630	477629
1938	2074693	1272552	504731
1939	2098331	1257703	495942
1940	1479726	1233394	477629
1941	957339	446692	835523
1942	1049403	1585673	854380

2.4.2 Predictor variables

Time variable: year Observations used in modelling and other analysis in this paper is ranged between 1936 to 1942. No observation is selected before 1936 as the growth pattern varies significantly from the event of our interest (Japanese occupation of Shanghai's different districts), and no value is elected beyond 1942 due to data constraints. No annual population records exists on a district bases beyond 1942. Foreign districts in 1949 as new political party came to power and the People's Republic of China was declared.

2.4.2.1 Binary Indicators

District indicators: - Variable *district_is* abd *district_fc* are two binary variable used to indicate the district identity of an observation. There are 3 possible district identity in Shanghai during 1930s-40s: Chinese-administrated District, International Settlement, and French Concession.

The Chinese-administrated District is governed by local Chinese authority. Land type in this area is primary rural, most of the local population are farmers. Percentage of foreign (out-of-province) immigrants or refugees is low. (Zou (1980)) In this analysis paper, Chinese-administrated District takes value of $district\_is = 0$ and $district\_fc = 0$ (it is neither International Settlement nor French Concession).

The International Settlement district is a generalized term for section of lands that allowed the occupation of foreign (non-Chinese) residence. Foreigners in Shanghai were not allow to reside in areas outside of the bounds of this district. Governance power of foreign population within the district – including the policing, taxing, etc, are transferred to foreign authorities. This district takes up most of the central-city in Shanghai during the 1930s-40s, with foreign investment attracting many business opportunities and subsequently job opportunities. Due to the complicated political authorities within the district, the part of Shanghai remains initially untouched by the Japanese forces as the entered Shanghai's Chinese-administrated District.

International Settlement district takes the value of *district_is = 1* and *district_fc = 0* in this paper.

French Concession district is a land district given solely to the French. French residency are given the authorization to self-govern within this area. Due to political reasons on the Western battlefield, this district remains untouched by the Japanese forces all the way until they withdrew from Shanghai. The French Concesion district takes value of *district_is = 0* and *district_fc = 1* for all analysis in the paper.

Historic Event indicators: - *cd_occupied*, *french_surrender*, and *is_occupied* are binary variables that mark the whether or not a major historic event that may have impacted Shanghai's population during the observation period (1936-1942) has occured yet. 1. The Japanese armed forces declared occupation of the Chinese-administrated district on 1937-11-12. With expectation that Shanghai's population will internally shift out of the Chinese-administrated district, the binary variable *cd_occupied* is used to measure the impact of this event on the population change in Shanghai. 2. As WWII impacted the Eastern globe, on the primary battlefield (Western Battlefield), France surrendered to Germany on 22 June 1940. Since Japan sided with Germany in WWII, France's whiteflagging to Germany led to Shanghai's Japanese forces promising not to invade the French Concession on the condition that the district stop taking refugees and support Japanese governance. The paper uses the binary variable *french_surrender* to evaluate the impact this event has on the overall population in Shanghai. 3. In January of 1942, the Japanese forces occupied the International Settlement. Local authority handed over its governing power to the invading forces. This event's impact on Shanghai's population is measuring using the binary variable *is_occupied*.

Table 3: Explanatory models of flight time based on wing width and wing length

Year	Population	district_is	district_fc	cd_occupied	french_surrender	is_occupied
1936	477629	0	1	0	0	0
1937	2155717	0	0	1	0	0
1938	1272552	1	0	1	0	0
1940	477629	0	1	1	1	0
1941	957339	0	0	1	1	0
1942	1585673	1	0	1	1	1

3 Model

The goal of our modelling strategy is to evaluate the impact of 2 historical events in Shanghai during WWII.

Here we briefly describe the Difference-in-Difference analysis model used to investigate the impact of the Japanese forces taking over the Chinese district and International Settlement in

November 1937 and December 1941 on population shift between different Districts in Shanghai.

Background details and diagnostics are included in Appendix Section A.

3.1 Model set-up

$$y_i|\mu_i, \sigma \sim \text{Normal}(\mu_{i,t}, \sigma)$$

$$\mu_i = \alpha + \beta_k$$
$$\alpha \sim \text{Normal}(0, 2.5)$$

$$\beta_k \sim \text{Normal}(0, 2.5) \quad \text{for } k = 1, ..., 12$$

$$\sigma \sim \text{Exponential}(1)$$

Where:

- y_i: Observed population in district i at year t.
- α: The intercept for when all variables take value of 0.
- β_1: coefficient for temporal observation *year*. Controls for the effect of time (on an annual basis) on Shanghai's population.
- β_2: coefficient for the dummy variable *district_is*. Take on value of 1 if the district of the observation is International Settlement districts (1 if *district type* is IS, 0 otherwise). The coefficient measures the effect of district identity on population of Shanghai within a given year.
- β_3: *district_fc*: Dummy variable for French Concession districts (1 if i is FC, 0 otherwise). The coefficient measures the effect of district identity on population of Shanghai within a given year.
- β_4: the coefficient for *cd_occupied* indicator. This indicator takes a value of 1 after the Chinese-administered district was occupied by Japanese forces in year 1937 (1 if $t \geq 1937$, 0 otherwise). The coefficient measures the effect of this indicator on population of Shanghai within a given year.
- β_5: coefficient for indicator *french_surrender* which takes on a value of *1* after the French Surrendering to Germany in 1940, leading to the French Concession rejecting refugees in Shanghai (1 if $t \geq 1940$, 0 otherwise). The coefficient measures the effect of this indicator on population of Shanghai within a given year.

- β_6: the coefficient for the indicator *is_occupied*. This indicator marks the Japanese occupation of the International Settlement in 1942 (1 if $t \geq 1942$, 0 otherwise). The coefficient measures the effect of this indicator on population of Shanghai within a given year.
- β_i *where* $i = 7, ..., 12$: coefficients for interaction terms below. Each term ajusts the impact of a historical events on a district-specific basis.

Interaction Terms:

- *district_is* × *cd_occupied*: Captures the effect of the 1937 occupation on the International Settlement in comparison to the Chinese-administered district (base district).
- *district_fc* × *cd_occupied*: Captures the effect of the 1937 occupation on the French Concession in comparison to the base district.
- *district_is* × *french_surrender*: Effect of the 1940 refugee rejection on the International Settlement.
- *district_fc* × *french_surrender*: Effect of the 1940 refugee rejection on the French Concession.
- *district_is* × *is_occupied*: Effect of the 1942 occupation on the International Settlement.
- *district_fc* × *is_occupied*: Effect of the 1942 occupation on the French Concession.

We run the model in R (R Core Team 2023) using the `rstanarm` package of Goodrich et al. (2022). We use the default priors from `rstanarm`.

3.1.1 Model justification

The Difference-in-Difference model is chosen to evaluate the impact of historical events by comparing the observed outcomes, population changes, to an imaginary counterfactual scenario where these events did not occur. The year variable captures the temporal trends, allowing the model to account for changes in population over time. The district variable identifies the three distinct regions in Shanghai (Chinese-administered district, International Settlement, and French Concession), each subject to unique governance and historical impacts. These inclusions enable the model to control for factors beyond the primary variables of interest (historical events).

The interaction terms in the model are essential because they capture how the impact of historical events (e.g., the 1937 occupation of Chinese-administered districts, the 1940 refugee rejection in the French Concession, and the 1942 occupation of the International Settlement) varies across different district types. By including interactions between event indicators and district types, the model accounts for district-specific responses to each event, controlling for the fact that the effect of an event on population changes may not be uniform across all districts. For instance, the 1937 occupation might lead to population declines in Chinese-administered districts but population increases in the International Settlement due to refugee

influx. These terms ensure that the model can differentiate and estimate the unique effects of each event within each district type, thereby improving precision and interpretability.

A negative relationship is expected between year and population because the period under study (1936–1942) was marked by military conflict and foreign occupation, creating an unstable living environment. Specifically: - Chinese-administered District: A population decline is expected due to the Japanese occupation in 1937. - French Concession: A population decrease is anticipated following France's surrender in 1940, which led to refugee rejection. - International Settlement: A population decline is expected after its occupation by Japanese forces in 1942.

4 Results

This section presents the population trends in Shanghai's districts between 1936 and 1942, the estimated effects of district type and key historical events on population, and the district-specific impacts of these events as captured by interaction terms. The analysis highlights distinct population shifts driven by both district characteristics and the varying effects of war-related events.

4.1 Population Trend

The population trends from 1936 to 1942 reveal distinct shifts across the three districts in Shanghai: the Chinese-administered area, the French Concession, and the International Settlement. In the Chinese-administered area, the population remained stable until 1937, after which a decline began in 1940, continuing through 1942. The International Settlement experienced consistent population growth throughout the period, with the largest increases occurring after 1938. The French Concession maintained population stability until 1940, followed by a slight increase in 1941, which plateaued in 1942.

4.2 Model results

Model results are summarized in Table 7 in Appendix (Section A).

4.2.1 District Impact on Population

Table 4: Explanatory models of flight time based on wing width and wing length

Parameters	Estimated Effect	Standard Error
(Intercept)	117928165.58	189545438.85

Parameters	Estimated Effect	Standard Error
year	-59841.02	98298.59
district_is	-943281.63	381299.41
district_fc	-1642126.91	350808.44

Model estimates highlight the influence of district type on population. The baseline population, Chinese-administrated district population, is represented by the intercept, is estimated at 11,792,816.58, with a standard error of 18,954,543.85. This estimate is not a realistic estimate since the year variable is not included. This intercept is population at year = 0, which does not actually exist. Temporal impact on population is estimated using the *year* variable, observing a decline of 59,841.02 across all districts, with a standard error of 98,298.59. The International Settlement exhibits a population difference of -943,281.63 (standard error: 381,299.41) compared to the Chinese-administered area, while the French Concession shows a difference of -1,642,126.91 (standard error: 350,808.44).

4.2.2 Historical Events

Table 5: Explanatory models of flight time based on wing width and wing length

Parameters	Estimated Effect	Standard Error
cd_occupied	89350.01	350665.6
french_surrender	-735223.28	340852.1
is_occupied	-88982.32	361506.9

The effects of three historical events on population are also quantified. The Japanese occupation of the Chinese-administered area in 1937 (cd_occupied) is associated with an increase of 89,350.01 (standard error: 350,665.57). France's surrender in 1940 (french_surrender) results in a population decrease of 735,223.28 (standard error: 340,852.1). The Japanese occupation of the International Settlement in 1942 (is_occupied) corresponds to a population decrease of 88,982.32 (standard error: 361,506.9).

4.2.3 Historic Events' Impact on Each District

Table 6: Explanatory models of flight time based on wing width and wing length

Parameters	Estimated Effect	Standard Error
district_is:cd_occupied	89430.69	414726.8
district_fc:cd_occupied	38396.87	410271.2

Parameters	Estimated Effect	Standard Error
district_is:french_surrender	470617.65	352215.9
district_fc:french_surrender	1044470.54	352469.9
district_is:is_occupied	934059.10	476934.2

The interaction terms, which capture district-specific responses to historical events, provide additional insight. The Japanese occupation of the Chinese-administered area increases the population in the International Settlement by 89,430.69 (standard error: 414,726.8) and in the French Concession by 38,396.87 (standard error: 410,271.2). France's surrender increases the population in the International Settlement by 470,617.65 (standard error: 352,215.9) and in the French Concession by 1,044,470.54 (standard error: 352,469.9). The Japanese occupation of the International Settlement itself is associated with an increase of 934,059.1 (standard error: 476,934.2) in the International Settlement's population. Interaction terms differ from main effects by isolating the impact of historical events within each district type, providing a detailed analysis of population dynamics during this period.

5 Discussion

5.1 Interpretation of the Event Impacts

The results indicate that the Japanese occupation of the Chinese-administered area led to an overall increase in Shanghai's population across all districts. In contrast, France's surrender during WWII had a negative impact on population numbers in all districts except the French Concession. Similarly, the Japanese occupation of the International Settlement caused population declines in all districts except the International Settlement itself.

5.1.1 Impact of Occupation in Chinese District

- By intuition, we would think that the foreign-force occupation of a district would lead to its population to fled to other areas. However, this does not seem the case for the Chinese-administrated District within Shanghai.
- This counter-intuitive phenomenon might be caused by several factors. Firstly, the increase in the districts population might be cause by an influx of foreign state refugees. Shanghai was, and still is, one of the largest economic center in China and has an abundance of non-land-dependent job opportunity. interrupted agriculture, subsequently leading to a large volume of unemployed farmers. These unemployed population will likely flood to economic centers and industrial center in search of a new job. (Zou (1980), page 14)

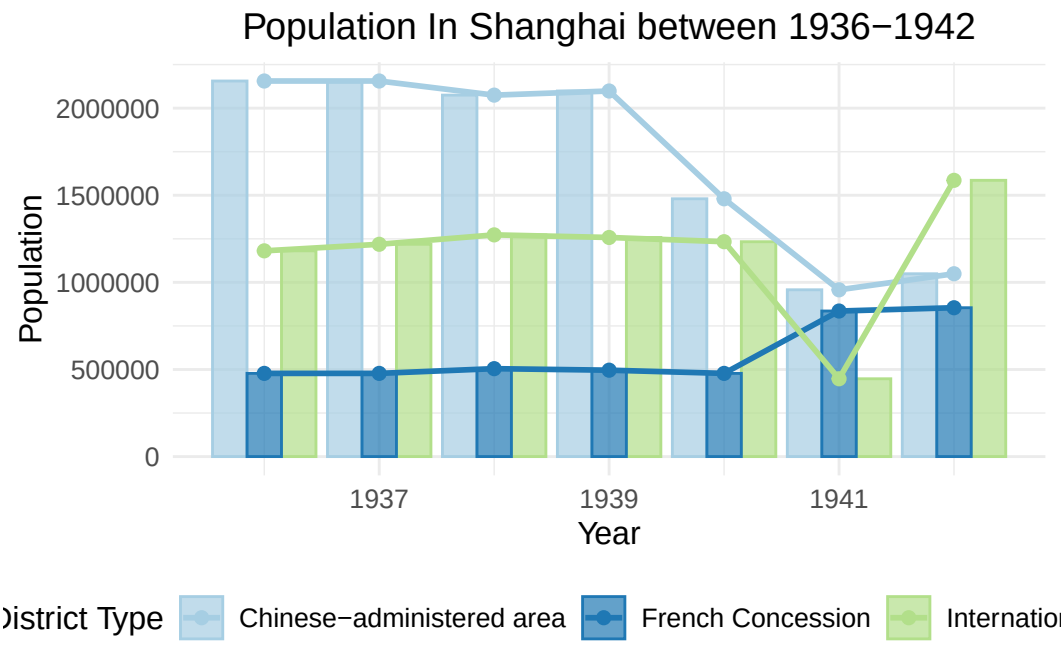

Figure 1: Population in Shanghai between 1936 - 1942

5.1.2 Impact of French Surrendering to Germany on Shanghai

5.1.3 Impact of Occupation in International Settlement

5.2 Reason why the French Concession was Exempted from Japanese Occupation

- During WWII, on the European battlefield, France surrendered to Germany on June 22nd of 1940 (Check this & reference with a credible source). Since Japan was on the same side as Germany during that time, Japanese armed forces decided allow the French Concession to retain its own governance.
- However, the French Concession is still constantly under the watch of the Japanese forces that has occupied the rest of Shanghai since 1942. ,etc.(can reference to video summary here)

5.3 Refugees from outside of Shanghai Province

- industrialization was not so popular back in the 1930s, many provinces are still mostly rural. But warfare messed with the land and the yields, causing many farmers to starve and ultimately have to seek refugee (find job) in industrialized city (where income is not dependent on land yield)

- many people flooded to Shanghai for this reason (can insert calculation in data table 20 from reference book here)

5.3.1 Job Oppurtunities in Shanghai

Aside from the instability caused by the Japanese armed forces, there are a few other reasons for Chinese population to move into the international settlement & French Concession. 1. Job opportunities - Heart of Shanghai city in the 1930-1940s, high pop density lead to boom of economy = more job opportunities - many factories are located with the settlements (less so in concession)

5.3.2 Barrier to Entry in Job Market

2. Barrier to Entry for certain job types

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5.4 Instability after Japanese Occupation ends in WWII: Chinese Civil War

- after the Japanese armed forces withdrawed from Shanghai, what follows is not recovery and rest for the local population
- Competition for power within China's 2 political parties caused full-scale political warfare, now known as the *Chinese Civil War*
- unlike Western political parties, Chinese political parties in the 1900s are more like parties of a throne. They each have their own ideology and an armed forces that follow. Most of all of the provinces are effected by this internal warfare, which ended in 1949 as lost and withdrawed to Taiwan.

5.5 Weaknesses and next steps

5.5.1 Data Measurement Weaknesses

- data was recorded during wartime, many numbers were missing
- base unit for population records is not ppl, it is instead "household". # of ppl in a household is estimated based on historical data
- many people chose to not report or partially report numbers due to convience or economic reasons, data may not be accurate

5.5.2 Next Steps

Appendix

A Model details

A.1 Model Summary Table

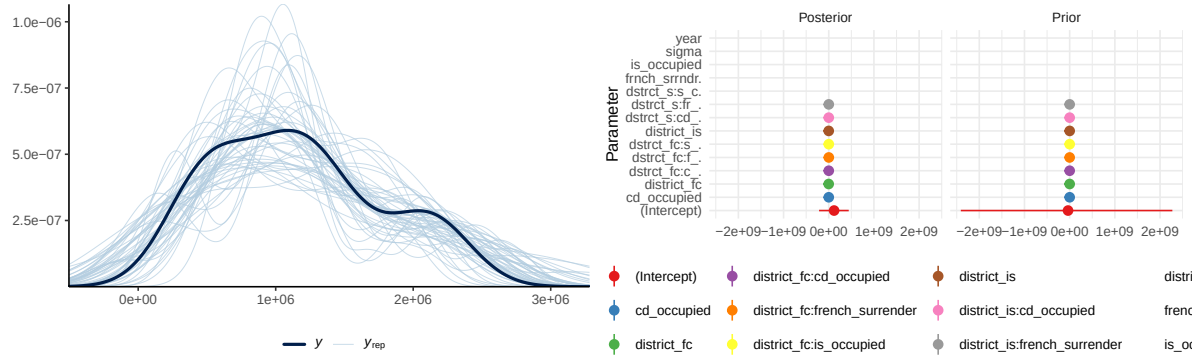
Table 7: Complete Model Summary for DiD model used in analysis

	Population model
(Intercept)	117 928 165.58
	(189 545 438.85)
year	−59 841.02
	(98 298.59)
district_is	−943 281.63
	(381 299.41)
district_fc	−1 642 126.91
	(350 808.44)
cd_occupied	89 350.01
	(350 665.57)
french_surrender	−735 223.28
	(340 852.10)
is_occupied	−88 982.32
	(361 506.88)
district_is × cd_occupied	89 430.69
	(414 726.84)
district_fc × cd_occupied	38 396.87
	(410 271.18)
district_is × french_surrender	470 617.65
	(352 215.89)
district_fc × french_surrender	1 044 470.54
	(352 469.86)
district_is × is_occupied	934 059.10
	(476 934.16)
district_fc × is_occupied	377 436.02
	(466 616.20)
Num.Obs.	21
R2	0.837
Log.Lik.	−289.106
RMSE	162 825.22

A.2 Posterior predictive check

In Figure 2a we implement a posterior predictive check. The posterior predictive check evaluates how well the model-generated predictions (y_{rep}) match the observed data (y). The overlay of the predictive distribution with the observed data indicates that the model captures the general trends and variability in the data. The similarity between the observed data and the model's predictions suggests that the model provides a good fit for the observed population data.

In Figure 2b we compare the posterior with the prior. The comparison between the posterior and prior distributions shows how the data influences the model parameters. The posterior distributions are narrower and more distinct compared to the priors, indicating that the data strongly informed the parameter estimates. Parameters like *cd_occupied* and *district_fc* show clear shifts in their posterior means, signifying their significant role in explaining population changes. Conversely, parameters with less distinct posteriors might indicate weaker evidence from the data.



(a) Posterior prediction check

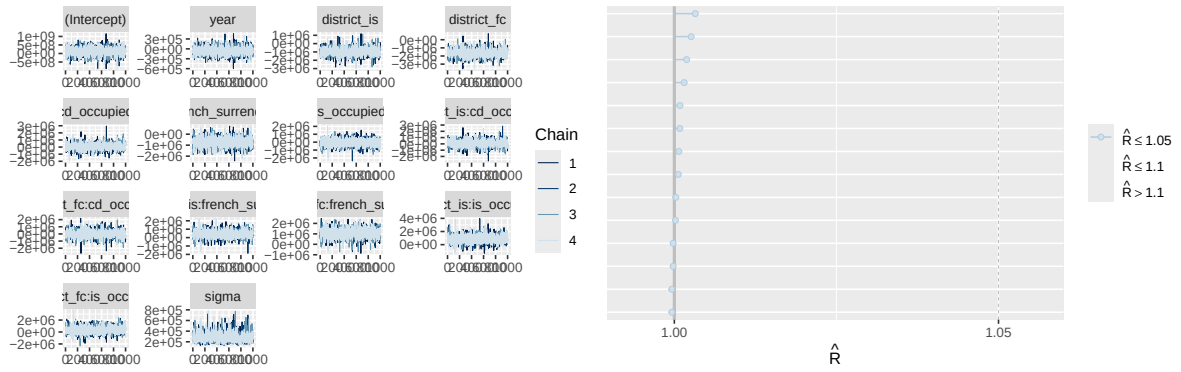
(b) Comparing the posterior with the prior

Figure 2: Examining how the model fits, and is affected by, the data

A.3 Diagnostics

Figure 3a is a trace plot. The trace plot displays the MCMC sampling for each parameter across the chains. The chains appear to mix well, with no clear trends or patterns, indicating that the algorithm explores the parameter space efficiently. This suggests good convergence, as the chains reach their stationary distribution without being stuck in local modes.

Figure 3b is a Rhat plot. The Rhat plot evaluates the convergence of the chains by comparing the within-chain and between-chain variance. All Rhat values are close to 1.0, indicating that the chains have converged. This suggests that the parameter estimates are reliable, and the sampling process provides consistent results across chains.



(a) Trace plot

(b) Rhat plot

Figure 3: Checking the convergence of the MCMC algorithm

B Idealized Survey Methodology

This appendix presents an idealized design for a population sampling survey, assuming that a data-recorder has unlimited time and authority to collect data within the historical timeframe of 1936–1942. The proposed methodology outlines a systematic approach to gathering detailed population data from Shanghai's districts during pivotal wartime events, with considerations for the practical constraints and technology available during that period. While acknowledging the inherent challenges of conducting such a survey, this design aims to provide a comprehensive framework for understanding population dynamics within the Chinese-administered areas, International Settlement, and French Concession.

B.1 Objective of the Survey

The purpose of this survey is to evaluate the relationship between key historical events and population shifts within Shanghai's districts between 1936 and 1942. Specifically, the study aims to document the population changes in three major districts—Chinese-administered areas, International Settlement, and French Concession—during pivotal events such as the 1937 Japanese occupation of Chinese districts, the 1940 rejection of refugees in the French Concession, and the 1942 occupation of the International Settlement.

B.2 Target Population

The survey targets residents and local representatives from the three major districts of Shanghai. These include long-term residents who were present before and during the historical events under study, as well as recent migrants and refugees arriving in these districts as a result of

wartime displacement. The goal is to achieve representative coverage across the three districts to capture the diversity in population trends and movement patterns.

B.3 Sampling Design

The sampling design employs stratified random sampling to ensure representation across the three major districts. Each district is treated as a separate stratum: Chinese-administered areas, International Settlement, and French Concession. A fixed number of households per district are selected based on district size, population density, and anticipated population shifts. Special attention is given to refugee populations within the International Settlement and French Concession to capture the impact of displacement. Enumerators use household lists and local community organizations, such as neighborhood associations and refugee aid committees, to randomly select respondents within strata.

B.4 Recruitment Strategy

The recruitment strategy involves direct engagement with local leaders, community groups, and refugee aid organizations. Enumerators collaborate with influential figures in each district to gain trust and permission to conduct the survey. Recruitment booths are set up in public spaces such as markets and parks to engage with potential respondents. Additionally, refugee aid centers are utilized to access displaced populations. Recruitment materials are printed in both Chinese and English to accommodate the linguistic diversity of Shanghai's residents.

B.5 Survey Instrument

The survey instrument consists of a structured questionnaire covering demographic information, migration history, wartime impact, and population and housing details. The demographic section collects age, gender, occupation, family size, and household composition. Migration history includes the origin, year of migration to the current district, and reasons for relocation. Wartime impact focuses on displacement, property loss, and wartime experiences. Lastly, the population and housing section gathers data on the number of residents, housing type, and living conditions. Open-ended questions are also included to capture respondents' personal narratives about wartime displacement and resettlement.

B.6 Data Collection Procedures

Data collection occurs between 1936 and 1942, with enumerators visiting households, public spaces, and refugee shelters. Enumerators are trained to conduct interviews in Chinese, Shanghainese, or English based on respondent preferences. Responses are recorded on pre-printed

forms, which are later transcribed and stored securely. To ensure accuracy, enumerators cross-check entries at the end of each survey day. Each enumerator is assigned a specific district to maintain consistency in data collection practices.

B.7 Limitations and Challenges

Some areas, particularly those under military occupation, may not be accessible for data collection, leading to incomplete coverage. Additionally, respondents may underreport family size or migration history due to privacy concerns or fear of government reprisal. Refugee populations are often transient and may not remain in one location long enough for follow-up interviews. Despite these limitations, the survey employs robust sampling and recruitment strategies to mitigate potential biases.

B.8 Ethical Considerations

Informed consent is obtained by informing respondents about the purpose of the survey and how their data will be used before they agree to participate. Personal identifying information is anonymized to ensure respondent privacy and security. Participation is entirely voluntary, and respondents can opt out at any time without consequences. The survey complies with ethical standards to respect the rights and dignity of all participants.

References

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