

# A Mirror of History: Chinese Bond Market from 1921 to 1942<sup>1</sup>

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## **Abstract**

This article seeks to indentify “turning points” by evaluating the impact of events affecting the Chinese internal bond market from 1921 to 1942. We find that some external wars that are generally thought to be crucial are clearly mirrored in the bond market, such as the Japanese Invasion in Manchuria and the outbreak of the second Sino-Japanese war. We suspect that some events (e.g. the Sino-Japanese Cease-Fire in Tangu) have been downplayed by historians. Surprisingly, an event like the Japanese Attack on Pearl Harbor which has been assigned a central place was found no financial effect. Interestingly, we show external conflicts had stronger long-term impacts than major civil conflicts had on the bond yields, while their short-term influences were similar. We conclude that the bond market reveals an “objective” version of the history of Republic Era.

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## 1. Introduction

The history of the Republic of China (1912-1949) has been studied by numerous traditional historians, who have never reached agreement on the importance of many historical events. The disagreements arise due to their different political stands, (e.g. historians based in Mainland China, Taiwan and Western countries differs significantly in their political views), cultural backgrounds and availabilities of source materials. As a consequence, the students of the history of this period have learned various versions of the history and get confused about which version is possibly “true”.

The goal of this paper is to search for a relatively “true” version of the history by examining how people at the time viewed the event. The significance is assigned to an event here if it was perceived significantly by contemporaries. Following the literature on looking at the changes in the value of financial assets as a mirror of historical events (Willard et. al., 1996; Weidenmier, 2002; Brown & Burdekin, 2000 & 2002; Oosterlinck & Weidenmier, 2007; Frey & Kucher, 2000; Oosterlinck, 2003; Waldenstrom & Frey, 2008; Sussman & Yafeh, 2000; Zussman et. al., 2008 and etc.), we first collect a novel dataset on monthly bond prices of eleven major Chinese internal central government bonds from February 1921 to December 1942. Second, we proceed to employ an endogenous structural break method (Qu & Perron, 2007) to indentify turning points in the yields of the bonds under study. Third, we look for coinciding events that are likely to have been responsible for them, with special attention to political and war events which are generally considered crucial. Finally, starting from the important historical “facts” highlighted in contemporary newspapers or emphasized by historians, we try to verify whether some important events were not reflected in the financial market, and if not, why.

We find that some external military events that are generally thought to be crucial are clearly reflected in the yields of the bonds. This hold true, in particular, for the Japanese Invasion in Manchuria in September 1931 and the outbreak of the second Sino-Japanese

war in July 1937, both of which were viewed as serious danger to Chinese sovereignty and produced quantitatively significant negative market response. On the other hand, some other similar military campaigns which have not been assigned an important place in the Republican history by traditional historians were found to influence the financial market strongly. When Chinese army (joint with British army) lost the war in Burma-- leading to the Japanese occupation of the Yunnan-Burma Road in May 1942, for example, the yields of most bonds rose by more than 30 percent. Interestingly, when comparing the financial impacts of external conflicts and major civil conflicts (for instance, the Northern Expedition led by the nationalist party to overthrow the Beijing government from July 1926 to December 1928), we find that investors responded devastatingly to both types of events in an equivalent magnitude in a short period, however, in a longer term, the external conflicts were regarded more detrimental to the government's ability to service its debt.

Almost all governments during the Republic period used debt financing as a crucial financing avenue and as the debts accumulated, payment difficulties appeared, followed by either moratoria or so-called "bond consolidations" which reduced interest rates and extended maturity. These economic events, no doubt, affected the bond market. For example, the January 1924 "break" is discovered right after the first bond consolidation by the Beijing government in early 1920s. The bonds under study survived through this consolidation with their yields declining by about 35 percent on average. It seems that the bondholders were satisfied by more secured collaterals and more concentrated financial resources for the government to pay the existing bonds resulted from this bond consolidation even though they beard the costs of lower interest rate and longer maturity. Another example is that the Nanjing government-the successor- partially defaulted on bonds by consolidating the existing bonds into five series of bonds in 1935. While except these two events, other financial events seem to matter little.

Following a careful survey for historical "facts" from contemporary newspapers and

history books, we show that some events to which newspaper editors or historians attach great attention are found only to disturb the bond market slightly or no impact at all. Serious floodings along the Yangtze River, large scale factious wars, numerous turnovers of high-ranking government officials, political conflicts/settlements between the Nationalist party and the Communist party, the Japanese Attack on Pearl Harbor and many other important events are only possibly responsible for some of the blips in bond yields. Namely, investors took these events less serious than newspaper editors or historians did.

The limitations of using the method employed in this paper as a way to pursue a true version of history are well noticed by the authors. As Frey and Kucher (2000) point out, investors are only a special group of people, whose views are not necessarily representative; furthermore, event which is important for its own sake, say it triggers a series events later, but does not affect the perceived probability of debt service is totally ignored by investors. Despite the limitations, we argue that this exercise shed new light on the study of the history of Republic China. Our study period is a time of political tumult for China including external and civil wars, revolutions, concessions, institutional reforms, indemnity payments, instabilities in the central government and so on. It is difficult to make judgment on which event can be regarded as “crucial”, even with the benefit of hindsight. Although historians have indentified some “crucial” historical facts based on conventional methods employed in history, those methods are retrospective and subjective. For instance, Chinese historians with different political ideologies may disagree on historical “facts” as well as the importance attributed to them. Therefore, a study like ours which is based on a straightforward rule -- applying econometric methods to quantitatively assess investors’ beliefs--- and is objective will inject fresh blood to the historical study of Republic China.

The paper proceeds as follows. Section 2 provides an overview of the general history of and the internal bond history from Later Qing to the Republic Era. The third section

discusses the data. Section 4 and 5 outline the theoretical model and the empirical framework, respectively. We present the empirical results in the sixth section, followed by some discussions on the relationship between bond yield, and inflation rate and interest rate in Section 7. Section 8 concludes.

## **2. Background**

### **a. Overview of the History from the Later Qing to the Republic Period**

During the nineteenth century, China was ruled by the Manchus Qing. Their leadership could be described – politely – as increasingly ineffective as the century progressed. An early harbinger of decline was China’s humiliating defeat in the First Opium War (1839-42) which, among other things, illustrated the outdated state of the Chinese military.<sup>4</sup> Internal weakness invited later invasions, which resulted in more defeat and humiliation.<sup>5</sup> China’s government was forced to accept unequal treaties, including opening up ports, paying large amounts for reparations, ceding lands, and making various other concessions of sovereignty to foreign “spheres of influence”. Coupled with the external disasters, domestic rebellions were rampant across the nation, further weakening an already shaky regime.<sup>6</sup>

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<sup>4</sup> During the late eighteenth and early nineteenth centuries trade between Chinese and European merchants expanded, which caused hostility toward the west by the conservative Qing regime. Because of the unpopularity of European manufactured products in China and huge demand for Chinese goods such as silk, tea and ceramics in the European market, China experienced a substantial trade surplus. It is said that in order to help balance Britain's huge trade deficit with China, the British introduced opium to China; by 1838, the British were selling 1,400 tons annually to China. In the same year, the Qing regime tried to ban the opium trade and the British declared war on China, leading to the Opium War.

<sup>5</sup> These included the Second Opium War (1856-1860), the Sino-French War (1884-1885), the first Sino-Japanese War (1894-1895) and the Intrusion of Eight Nation Alliance in 1901 (see Elleman, 2001 for details).

<sup>6</sup> Among the numerous domestic rebellions, the most famous are the Taiping Rebellion (1851–1864) and the Boxer Rebellion (1899-1901).

After the overthrow of the monarchy in 1911, the center of political life was lost and the republican government was not able to fill the power vacuum. From 1912 to 1927, China fell into the so-called Warlord Period. Nominally republican with a “central” government in Beijing, there were nonetheless some dissenting 1,300 warlords. The most comprehensive assessment concludes that 140 noticeable conflicts occurred between warlords during this period, some crossing provincial boundaries (Ch’en 1968).

In 1928, the nationalist party, under the leadership of Chiang Kai-Shek, unified China after waging a series of wars against the warlords- the famous Northern Expedition. The capital city was moved from Beijing to Nanjing (Hereafter, we call the new regime Nanjing Government.). The new born government tried to focus on the national economic re-construction. However, the recovery process was interrupted periodically by Sino-Japanese diplomatic-military events. The outbreak of the second Sino-Japanese war in 1937 ended nearly one decade of Chinese nation building.

#### **b. The central government’s fiscal status and the bond**

In parallel with the aforementioned turmoil, the financial status of the Qing dynasty deteriorated quickly. According to the British Ambassador in Shanghai - Jamieson’s calculation<sup>7</sup>, the average annual budget surplus for the early 1890s was slightly 5,000 silver taels. When the First Sino-Japanese War occurred in July 1894, the royal court could not afford the huge military expenditure. The first domestic bond was issued soon after the war started. Another domestic bond was issued in 1898 to pay the fourth installment of the indemnity of the Treaty of Shimonoseki (signed on April 17, 1895 after the Chinese defeat in March). This domestic bond raised 20 million taels which was only 10% of the indemnity (Qian, 1983).<sup>8</sup> These two bonds were defaulted after the monarchy stepped

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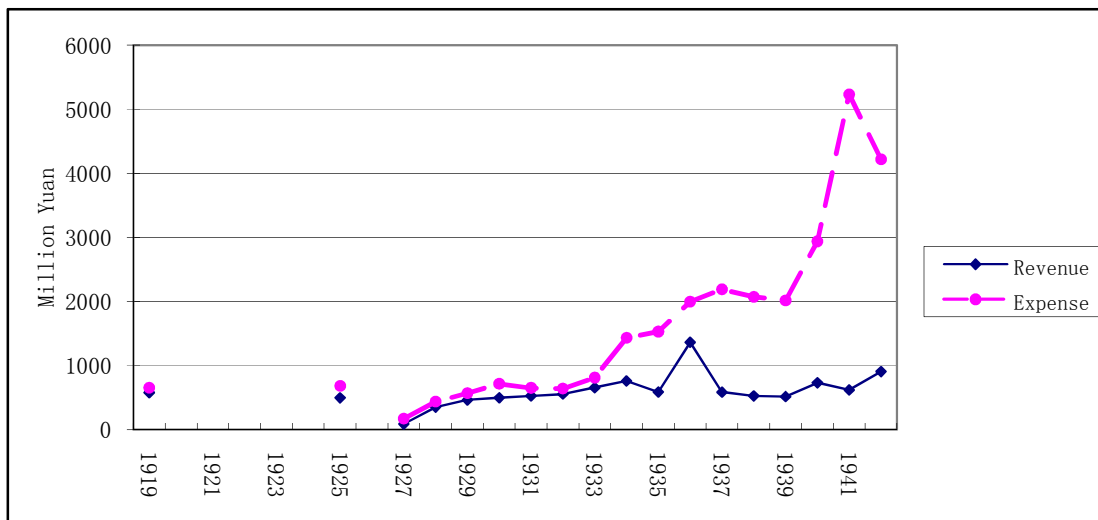
<sup>7</sup> British Parliament Papers. Report on the Revenue and Expenditure of the Chinese Empire, 1895. pp. 5-20.

<sup>8</sup> The remaining portion of the reparation was paid by foreign debts including Franco-Russian Government Loan, Anglo-German Government Loan 1896 and 1898 (Denby 1916; Jin 2000)

down.

Since the establishment of the Republic of China in 1912, the following two consecutive republican governments, Beijing and Nanjing governments suffered serious financial distresses. Figure 1 shows the central government revenue and expenditure from 1919-1942. This huge deficit should be covered by various mixtures of borrowing and taxation.

Figure 1. The Real Revenue and Expense in Chinese Central Government from 1919-42



Source: The data on nominal revenue and expense are from Yang (1985), *The Fiscal History of Republic China* (Yang Yin-Pu, *Min Guo Cai Zheng Shi*), The Chinese Fiscal Economics Press, p. 3, 43, and 102. The data on inflation is from Wang Yu-Ru(2008), *Urban Wholesale Price Change and Economic Growth in Modern China*.

Before the World War I , Beijing government relied on foreign debts to finance its expenditure.<sup>9</sup> When the funding opportunity abroad became dimmer during the WW I , Beijing government switched its sources of funding from foreign to domestic market. As a result, eleven new domestic bonds were issued between 1912 and 1921. Because of the

<sup>9</sup> Notable examples are the Loan from Messrs. C. Birch Crisp and Co. in 1912 and the Reorganization Loan in 1913. Also see Goetzmann, Ukhov and Zhu (2007) for a detailed description of the Chinese financial market during Republic Period.

financial difficulty of central government, the payment of the coupon was defaulted occasionally, which largely ruined the credibility of the government. In 1921, Beijing government conducted the first bond consolidation in order to restore the government's credibility. Old bonds were swapped by new bonds with more secure collaterals and the maturity of seven bonds was extended.

The Nanjing government honored the domestic bonds issued by her predecessor- the Beijing government and raised 29 bonds, worth 1,040 million Yuan, during 1927-31 (Jin and Wang 1991). 81% of the funds were allocated to the economic activities, including supporting recovery activities, infrastructure investment, consolidation of the financial industry and relief.

After the Japanese acquired Manchuria in 1931, the revenue for Nanjing government declined sharply. An increasing debt burden coupled with declining revenue led to the Bond Consolidation in 1932, which extended the maturity and reduced the interest rate of the outstanding bonds. Nonetheless, the government resumed issuing bonds in 1933 to further alleviate its fiscal burden. At the end of 1936, there were 49 bonds outstanding, worth 2,399 million Yuan (Li, 2004). The massive amount of outstanding bond payment triggered another bond consolidation in 1936. The existing bonds were consolidated into 5 series, called Series A, B... and E (see Table 1 in the data section), with a reduced value of 1,460 million Yuan.

### **3. Data**

Due to the large number of bonds traded on the Beijing Stock Exchange and the Shanghai Stock Exchange, we restrict ourselves to eleven important bonds in terms of their capitalization and data availability. The consistent time series price data are available



only after the first bond consolidation in 1921.<sup>10</sup>

Our data sources include Banker's Magazine (BM: *Yin Hang Yue Kan*) and Bankers' Weekly (BW: *Yin Hang Zhou Bao*). The BM published by the Beijing Banking Association on a monthly basis between January 1921 and December 1928. The BW was published by the Shanghai Banking Association on a weekly basis from May 1917 to March 1950. Unfortunately, like the data sources used in other articles on the historical bond market in many other countries, our data sources also contain very little information on bond turnovers.<sup>11</sup>

For the period of 1921-35, we focus on five domestic bonds issued by the Beijing government (We call them Beijing bonds). As in Table 1, we have the monthly maximum and minimum prices for these five bonds with the numbers of observation range from 86 to 161. These bonds were carried on by the Nanjing government after 1927. Four out of the five bonds ended before October 1931. The Consolidated 6 Percent Bond has the longest time series which stopped in November, 1934. In order to provide more evidence on the analysis of the bonds for the period around 1931, another bond called The Disband bond, issued on July, 1929 is added.

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<sup>10</sup> We try to collect the bond price data before 1921 from Chinese Newspapers, especially, the Shenbao (Shanghai Newspaper). We find the Newspapers did not systematically record the prices for a bond. For example, one day, it recorded the price for a certain bond; Then in the following days, this bond did not show up, instead, another bond added; Then this bond showed up again after disappearing for a while. Furthermore, we do not find any rule that could be applied for how the editors chose to report the prices for bonds. Hence, we could not extend our dataset to any earlier period before February 1921 by referring to Newspapers like many other scholars do (e.g. Velde & Weir (1992) collect price data for French bonds during 1746-1793 from Newspapers).

<sup>11</sup> We only find monthly turnovers on the bonds under study for 1924 and 1925. The lack of information on turnovers is a common problem for the studies on the historical bond market in many countries. For instance, Frey and Kucher (2000) can not find data on turnovers on sovereign bonds traded on the Swiss bourse from 1928 to 1948. Similarly, Brown and Burdekin (2000) do not have information on turnovers for the Confederate cotton bonds floated in London during the American Civil War.

After the Bond Consolidation in 1936, all domestic bonds were consolidated into 5 bonds, named, Consolidation Bonds A, B, C, D and E. Similarly, we compile the monthly maximum and minimum price dataset of these five bonds from March 1936 to December 1942 (except for the period from September to December in 1937, the market shut down due to the outbreak of the Second Sino-Japanese War). Furthermore, we have 1425 daily price data observations of the five bonds which spans from May 2, 1938 to March 26, 1942.

The maturity date for the bonds was not fixed since the government paid out a fixed sum each year for interest and amortization, just as for a term loan, but instead of implicitly amortizing a part of each bond each year there was a random draw of some of the bonds to be reimbursed in full each year.<sup>12</sup> Therefore, we examine the time series property of the bond yield (calculated as interest rate divided by price), instead of the Yield to Maturity, which better captures the internal rate of return for a bond.

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**Table 1. Information on the Eleven Chinese Government Bonds: 1921-1942**

Bond	Total amount (Million) <sup>1</sup>	Annual Interest Rate (%)	Final Maturity <sup>2</sup> (Years)	Collaterals	Issue date	Data availability <sup>3</sup>	Obs.
7 <sup>th</sup> Year	45	6	20	0.225 Million Yuan from the Department of Finance per year <sup>4</sup>	Jul 1918	Feb 1921- Oct 1931	129
Financial	60	6	7	The residual of maritime custom revenue after paying foreign debts and indemnity <sup>5</sup>	Mar 1920	Mar 1921- Nov 1928	93
Consolidated 7 Percent	13.6	7	10	The residual of the maritime custom revenue and the inland transaction tax revenue after paying foreign debts, indemnity and three domestic bonds <sup>6</sup>	Feb 1921	Jul 1921- Dec 1928	90
Consolidated 6 Percent	80	6	10	Same as the Consolidated 7 Percent Bond	Jun 1921	Jul 1921- Nov 1934	161
8 Percent	96	8	7	All other tax revenue except the Maritime Custom Revenue and the Salt tax revenue	Jan 1922	Jul 1922 - Aug 1929	86
Disband	50	8	10	Additional custom revenue from new tax item	Jul 1929	Apr 1930 – Jul 1935	64
Consolidation Bond A <sup>7</sup>	150	6	12	The residual of the maritime custom revenue after paying foreign debts and indemnity	Feb 1936	Mar 1936 - Dec 1942	78
Consolidation Bond B	150	6	15	Same as Consolidation bond A	Feb 1936	Mar 1936 - Dec 1942	78
Consolidation Bond C	350	6	18	Same as Consolidation Bond A	Feb 1936	Apr 1936 - Dec 1942	77
Consolidation Bond D	550	6	21	Same as Consolidation Bond A	Feb 1936	Apr 1936 - Dec 1942	77
Consolidation Bond E	260	6	24	Same as Consolidation Bond A	Feb 1936	Apr 1936 - Dec 1942	77

Source: Banker's Magazine (BM: Yin Hang Yue Kan), published on a monthly basis between January 1921 and December 1928 by the Beijing Banking Association; Bankers'

Weekly (BW: Yin Hang Zhou Bao), published on a weekly basis from May 1917 to March 1950 by the Shanghai Banking Association; Qian (1984), Historical Materials on Domestic Government Bonds of Old China 1894-1949 (Qian Jia Ju, Jiu Zhong Guo Gong Zhai Shi Liao 1894-1949), Zhonghua Shuju Press, Beijing.

Notes:

1. Before the monetary reform in 1936, all bonds issued were denominated in Silver Yuan. After 1936, all bonds were denominated in Chinese paper currency (Fabi). Fabi pegged to British pounds as 1 Yuan equal to 1 Shilling and 2.375 Pennies in 1936 (Hsiao, 1974, pp. 190 Table 9a.).
2. The government paid out a fixed sum each year for interest and amortization, just as for a term loan, but instead of implicitly amortizing a part of each bond each year there was a random draw of some of the bonds to be reimbursed in full each year. All bonds were anonymously held. Those bondholders whose bonds were drawn to be paid in full went to the branches of Bank of China and Bank of Communications to get the reimbursement.
3. For the five Beijing bonds, the monthly data start from July 1921 to August 1924 in the Banker' Magazine. Then we compute the monthly maximum and minimum using the daily data (1553 observations) from the BM for the period of Sep 1924-Dec 1928. The 7<sup>th</sup> Year, consolidated 6 Percent, and 8 Percent (also named 96 Bond) for the period 1928-34 are calculated by using the weekly data (not reported every week) in the BW. For the Consolidation Bonds, the monthly data start from March 1936 to April 1938. We compute the monthly maximum and minimum using the daily data from May 1938 to December 1942. The daily data was not available for April 1942, thus the daily sample stop at the end of March 1942. The monthly data of April 1942 are obtained from a table of monthly bond price in May 1942.
4. The tax revenue from all Bureaus of the Transaction Tax outside of the 50 Miles from Beijing served as complementary collateral.
5. The fund from the Department of Finance served as complementary collateral.
6. According to the Item 8 of the Report to the President on the Bond Consolidation on 13 March, 1921, the collaterals for these the consolidated 7 and 6 percent bonds include the residual of the maritime custom revenue and the inland transaction tax revenue after paying foreign debts, indemnity and three domestic bonds (the 3<sup>rd</sup> Year Bond, the 4<sup>th</sup> Year bond, and the 7<sup>th</sup> Year bond). If the residual is not enough for paying the debt, salt tax revenue will be used. There would be at least 14 million Yuan available for paying the debt under the aforementioned tax revenue. Another 10 million Yuan would be used under the Wine and Tobacco Tax revenue (Qian, 1984, pp. 71).
7. Bond A, B, C, D and E replaced 6, 5, 9, 8 and 5 bonds respectively.

#### 4. Theoretical Model

Historical events are mirrored in asset prices. In contrast to assigning significance to a historical event based on hindsight, asset prices reflect how contemporaries viewed the event at the time. Consider a bond with maturity for  $T$  periods, which pays coupon payment  $c_t$  in each period and principal  $C_0$  in the last period. However, there is uncertainty whether the government will pay the coupon and principal or not. We let the payment probability be  $p_t$  for coupon payments and  $p_0$  for the principal. In other words,  $1-p_t$  and  $1-p_0$  are the default probabilities for coupon payments and principal, respectively. Suppose investors have subjective discount rate,  $\beta$ , the discounted cash flow model suggests that the bond price ( $BPrice$ ) is given by

$$BPrice_t = \sum_{t=1, \dots, T} \beta^t p_t c_t + \beta^T p_0 C_0 \quad (1)$$

Since the coupon payments and the principal are often pre-determined, the changes in bond price are subject to changes in payment probability and real interest rate. Assume ex-ante payment probabilities are fixed over time, i.e.  $p_t = p_0 = p$ .<sup>13</sup> We derive the payment probability as follows

$$Pr(\text{Payment}) \equiv p = BPrice_t / (\sum_{t=1, \dots, T} \beta^t c_t + \beta^T C_0) \quad (2)$$

The expression suggests that the payment probability relates to bond price and interest rate. If interest rate does not change abruptly, a dramatic change in bond price indicates there is a sharp change in default probability perceived by bond investors. Since the governments in the Republic of China are often threatened by domestic rivals and foreign invasions, debt might not be honored by the new government if the

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<sup>13</sup> Weidenmier and Oosterlinck (2007) use a discounted cash flow model to estimate the default probability. Their method requires the knowledge on the timing of each coupon payment and the principal. In our case, we do not estimate the default probability directly because the government did not always have enough revenue to pay the coupons and principal according to the payment schedules of Chinese bonds were uncertain because the government did not have enough revenue to pay off the debt.

incumbent government stepped down. The payment probability characterizes the survival probability for the incumbent government.

## 5. Empirical Model

We employ the multivariate model developed by Qu and Perron (2007) to analyze the monthly maximum and minimum bond yields. The model provides an algorithm based on quasi maximum likelihood procedure and a series of tests for determining the number of endogenous breaks in the data. It allows us to detect structural changes in a system of equations without prior knowledge on the locations of breaks.

In our context, the system of equations contains the monthly highest and lowest bond prices. The sample size is  $2 \times T$ . To estimate the unknown intercepts and breakpoints, we specify the following model

$$\begin{aligned}
 Y_t &= c_1 + u_t, & t = 1, \dots, T_1 \\
 Y_t &= c_2 + u_t, & t = T_1+1, \dots, T_2 \\
 &: \\
 Y_t &= c_{m+1} + u_t, & t = T_m+1, \dots, T
 \end{aligned} \tag{3}$$

The dependent variable  $Y_t = [Y_{ht}, Y_{lt}]'$  is a vector of bond prices at time  $t$ . The first equation with subscript  $h$  is the monthly maximum bond yield, whereas the second equation with  $l$  is the monthly minimum bond yield. The time series data is separated by  $m$  breaks in which the length of intercepts varies across  $m+1$  segments. This model restricts these two equations experience shifts simultaneously, but the magnitudes of the shifts can be different. The estimated intercepts are  $c_j = [c_{jh}, c_{jl}]'$  for  $j=1 \dots m+1$ . The vector of disturbance at time  $t$  is  $u_t = [u_{ht}, u_{lt}]'$ , which is allowed to be autocorrelated and heteroskedastic. In this model, there is a trimming parameter,  $k$ , which controls the minimum distance between two consecutive breaks relative to the

sample size in an equation  $T$ . We set the trimming parameter to allow each segment to have at least two years for the monthly data. The maximum number of breaks allowed is four.

To select the number of breaks, we follow the two-step procedure recommended by Qu and Perron (2007). First, we detect whether any structural change exists in the model. In particular, we evaluate the  $\sup F(m|0)$  to test the null hypothesis of no break ( $m=0$ ) against the alternative that there is at least one break ( $m=k$  where  $k$  is unknown). If structural break is detected, we then determine the number of breaks by a sequential testing procedure on evaluating the  $SEQ(m+1|m)$  until the test statistic is no longer significant.<sup>14</sup>

As we argued before, the changes in bond yields capture the changes in default probability. In the empirical analysis, we compute the changes and the percentage changes in bond yields across two consecutive segments, i.e.  $[c_{hj}-c_{hj-1}, c_{lj}-c_{lj-1}]$  and  $[(c_{hj}-c_{hj-1})/c_{hj-1}, (c_{lj}-c_{lj-1})/c_{lj-1}]$ , to examine the changes in default probability.<sup>15</sup>

## 6. Empirical Results

In this section, we report the estimated timings and magnitudes of the structural changes. We start with the results from the Beijing bonds during 1921-35 in addition to the Disband Bond in 1929. Then we continue the analysis for the consolidated bonds during 1936-42.

### *Beijing Bonds and the Disband Bond, 1921-35*

We borrow the terminology for the changes in bond yield from Willard et. al

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<sup>14</sup> For example, if  $SEQ(2|1)$  is significant, we infer that there are two breaks instead of one. If we find the test  $SEQ(3|2)$  is insignificant, then we conclude that there are only two breaks. Additionally, we decide there are two breaks if there is no more space for inserting the third break given the trimming parameter,  $k$ .

<sup>15</sup> Our measure is close to that used in Weidenmier and Frey (2008). They employ the univariate model of Bai and Perron (1998, 2003) to estimate the changes in bond yield, and hence to examine the changes in probability of war from the prices of domestic and foreign bonds.

(1996), as a “break” meaning the change that persists for a long period of time (at least more than one year) and a “blip” meaning the change that persist not more than a couple of months. The structural breaks for these bonds are listed in the Appendix Table A. Since these bonds have very similar performance,<sup>16</sup> we take the 6 Percent Bond as an example to show the possible explanations for breaks and blips. Figure 1 plots the monthly maximum and minimum yield of the 6 Percent Bond and their fitted values from the multivariate model. In addition, we also collect information on important events, including the military events, natural disasters and financial news from the Shanghai Newspaper, the Bankers’ Magazine and the Bankers’ Weekly at the time.

### **The First Bond Consolidation: 1920-1923**

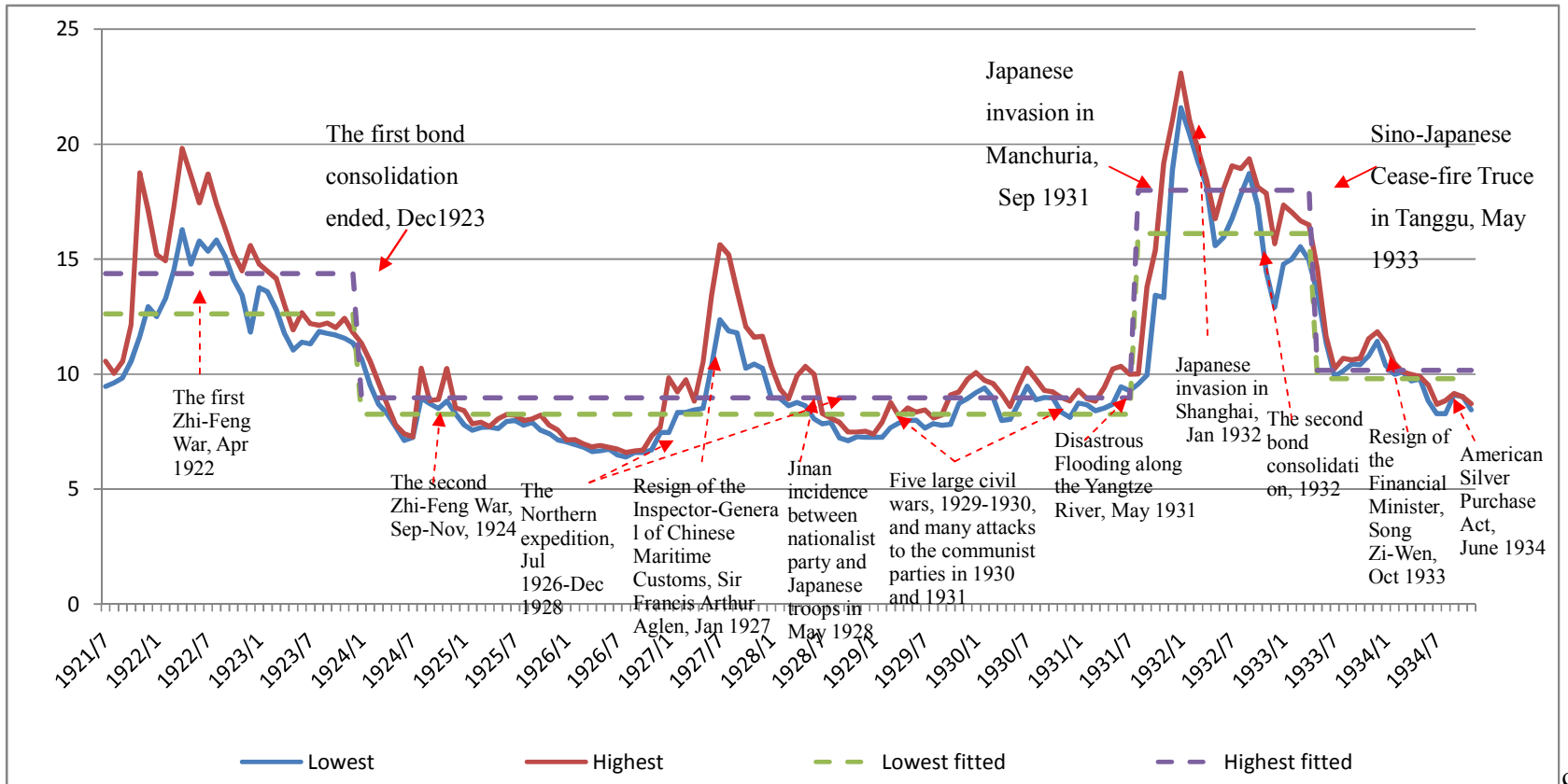
Looking into the timing of the structural breaks in Figure 1, the first break located in January 1924. The first break of the bond yield is the negative shift of 35% for the minimum yield and 38% for the maximum yield as a response to the end of the first Bond Consolidation. After the establishment of the Beijing government, there

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<sup>16</sup> Note that the structural breaks obtained from the 96 Bond are different from those from the other 4 bonds. The collateral of the 96 Bond was neither guaranteed by the Beijing government nor Nanjing government. It was not covered in the Bond Consolidation 1921. The 6 Percent, 7th Year, Financial and 7 Percent were supported by the fund established in the Bond Consolidation 1921, but the 96 Bond was only supported by the residual of salt tax (without a secured repayment fund supported by the custom or government revenues). Therefore, the bond price reacted to idiosyncratic news rather than news about political and war events because changes in government regime had less impact on the debt repayment. Furthermore, the bond price did not recover after the Nanjing government had come into power because the government did not honor the 96 Bond.



Figure 2: The Yields of 6 Percent Bond: July 1921- November 1934



Source: Banker's Magazine (*Yin Hang Yue Kan*), Bankers' Weekly (*Yin Hang Zhou Bao*), Shanghai Newspaper (*Shen Bao*)

were many bond issues. As the budget deficit deteriorated more as a war between the incumbent government and the Wan Faction occurred in July, 1920 and serious floods struck the Zhili Province (Where Beijing was located in) and Hunan Province for a couple of years around 1920. The government started frequently defaulting on the coupon payment and did not hold the random draw of some of the bonds to be reimbursed in full. Facing the discreditable behavior of the government, the National Bankers' Association proposed to the government to conduct the bond consolidation in order to restore fiscal and monetary order.

In March 1921, the bill of Bond Consolidation was passed by the President Yuan. The bill extended the maturity and reduced the face value of the outstanding domestic bonds. In July 1922, the government passed another bill to secure the collaterals of the consolidated bonds. After the bill was implemented in the late 1923, the domestic investors became more confident in the sources of funding for repayment and positive shifts in bond prices in the early 1924 followed (Shanghai Commercial and Saving Bank 1931; Bai 2000). Consequently, the yield decreased by more than 30% with the declining default risk.

### **The Japanese Invasion in Manchuria, September 1931**

The second break lies in the August 1931 for the 6 Percent Bond with the confidence interval between a month before and four months later (Appendix Table A). From the table 1, the time series price data of three bonds (the Financial Bond, the Consolidated 7 Percent Bond and the 8 Percent Bond) ends before 1930 and price data of the 7<sup>th</sup> Year Bond ends one month after this event. Therefore, the possible impact of an important event on these four bonds could not be able to found during this period. In order to make sure that this event did not only produce specific impact to the 6 Percent bond, the Disband Bond, which had an overlapping period with the 6 Percent Bond during this period, is added. The Disband Bond was also found to experience

the same structural break in September 1931 as the Consolidated 6 Percent Bond.

After Japan won the Russo-Japanese war in 1905, Japan became the only influential empire over Manchuria. It regarded Manchuria as a limitless supply of raw materials, a market for its manufactured goods, and as a protective buffer state against the Soviet Union in Siberia. Japan invaded Manchuria after the Mukden Incident in September 1931. The loss of Manchuria reduced the government tax revenue from this area as well as the transaction tax on trade between Manchuria and the rest of the nation, which largely weakened the collateral of government bonds. The loss of customs revenue and tax revenue on goods transaction was estimated as 50 million Taels per year, about one tenth of the national revenue on these two tax items.

Moreover, the weak military performance of Chinese army made people lose confidence in the government. They became worried about the default risks on bond. Therefore, the bond price dropped profoundly and the yield increased to more than 20% to compensate for the growing default risk. In fact, the bond holders' worry became true when the Central Committee of the Political Bureau of Nationalist Party had an emergency meeting in Shanghai and enacted a bill on stopping coupon payment and amortizing the bond for six months in January 1<sup>st</sup>, 1932. This bill was opposed by Shanghai Bankers' Association and appealed in January 17<sup>th</sup> in the same year.

### **Sino-Japanese Cease-fire Truce in Tanggu, May 1933**

The third break in the 6 Percent Bond occurred in May 1933, which coincided with the Sino-Japanese Cease-fire Truce in Tanggu in Tianjin City. Following the loss of Manchuria, the weakness of Chinese military boosted the Japanese ambition to further her goal in China. Japanese troops attacked Shanghai in January 28<sup>th</sup>, 1932, resulting in the demilitarization of Shanghai. They occupied Rehe province in March 1933 and attacked Great Wall later which threatened Beijing and Tianjin area. In May 1933, the two governments reached the cease-fire Truce in Tanggu in Tianjin, which

led to a temporary stop in Japanese invasion in China. The bond yield decreased sharply as the market realized the danger of loss of national sovereignty was relieved.

### **Events which caused blips**

In addition to the structural breaks, there were numerous blips in bond yield which persisted for a couple of months. The first Zhili-Fengtian War in April 1922 caused a large increase in bond yield to compensate for the increasing risk of the survivability of the incumbent government. However, the yield gradually declined after the incumbent government won the war. Similarly, the second Zhili-Fengtian War in August-October 1924 had similar temporary impacts on bond yield.

The yield was experiencing ups and downs during the Northern Expedition from July 1926 to Dec 1928. The fluctuations correspond to the process of the Northern Expedition. As the Beijing government (the incumbent government) lost the war gradually, the bond holders felt pessimistic about the probability of government debt service. During the same period, the Inspector-General of Chinese Maritime Customs, Sir Francis Arthur Aglen, resigned in January 1927. Since the officer had strong influence on the use of custom revenue - the major collateral of most bonds, it created an uncertainty on the payment of bond interest and principal. This economic event made the yield increase further. Only after the Nationalist party declared that she would carry on the Beijing bonds, the investors regained their confidence in Beijing bonds and bond price went up.

During the same period, a series of armed conflicts occurred between the nationalist party and the Japanese troops in Jinan - the capital city of Shandong Province in May 1928. This is the very early direct military confrontation between the Japanese and the Chinese military, who was nearly ending its mission of unifying China. The Jinan incidence led the Japanese government to deploy more troops in China, identified as a negative turning point in the Japanese Yen's return to gold

standard after the First World War (Grossman and Imai, 2009). Nonetheless, this event seems not to disturb the Chinese bond market. The possible explanation could be the bondholders were unaware of the long-term implication of Japanese expansionism when their own nation was in the middle of severe civil conflicts.

After the formation of Nanjing Government, the government tried to focus on nation building. However, the civil wars against the newly-established government occasionally broke out, which include five large scale military campaigns against the Warlords Tang Shengzhi, Feng Yuxiang, Yan Xishan and Li Zhongren during 1929-1930. Moreover, from 1930 to 1931, the Nanjing government was also busy in depleting the Communist party in inland China. The bond price experienced ups and downs responding to war news.

Serious flooding happened along the Yangtze Rive from May 1931 and lasted for a couple of months. One important treaty port city, Wuhan in Hubei Province, was damaged heavily according to the Report on Wuhan in the Banker's Weekly in August 1931,

“There is a very close relationship between Shanghai and Wuhan's financial and commercial industries. The loan in Wuhan from Shanghai was estimated at around five to six million Yuan. This flooding made Wuhan suffer huge damage. Therefore, it would have been very grateful if half of the loan could be repaid to Shanghai lenders.”

Hence, the financial industry in Shanghai was seriously affected by the flooding, which would cause recession in the market and the selling of bonds. From Figure 1, we can see that the yield is increasing during the period of 1929-1930 as the default risk due to the military risks and the natural disasters increased. However, the fundamental and dramatic structural break was only induced by the external military event, namely, the Japanese Invasion in Manchuria in September 1931. The drop in bond price was exacerbated by the military conflicts due to the Shanghai Incident

during January-March 1932. The consecutive wars and the serious floods depleted the financial resources of Nanjing Government, which led to the second bond consolidation by extending the maturity and reducing interest rate.

After the Tang-gu treaty, the yield was decreasing as the national risks was not a problem temporarily. The resign of the financial minister, Song Ziwen who was generally regarded as friendly to bondholders, caused panic in the bond market. The market recovered soon as the new financial minister carried similar financial policies as his predecessor. In June 1934, the US congress passed the American Silver Purchase Act which caused a huge outflow of silver in China. Since China was on the silver standard, the silver outflow caused deflation which made the bond price rise and, hence, the yield dropped.

#### **Compare the investors' reaction toward domestic and international conflicts**

The 6 Percent Bond has the longest time series price data among our available sample bonds, which covers both eras of the Beijing and Nanjing governments. Therefore, we utilize it to compare how investors respond to the impacts of civil conflicts and Sino-Japanese conflicts. From our previous analysis, we have known that the bond yields experienced huge increase at the beginning of the Northern Expedition as the investors' expected that the Beijing government would lose the war and the default probability of the Beijing bonds increased. However, after the Nationalist party declared to carry on the Beijing bonds in order to win the support of bond holders, the yield decreased. There is no endogenous structural break identified.

However, the Japanese invasion in Manchuria in November 1931 caused a structural break with around 100% increase in bond yield, which show that the investors were very panic about the threat from a foreign nation. Compared with the around 50% increase in bond yield at the beginning of the Northern Expedition, we can tell that investors recognized the bond default risk would be larger if China were

occupied by the Japanese rather than the regime shift among different Chinese political powers.

### ***The Nanjing Consolidation Bonds: 1936-1942***

Table 1 shows that the five Nanjing Consolidation bonds have very close characteristics in terms of collaterals and interest rate. After careful econometric analysis of these five bonds, we find that prices of these five bonds are highly correlated. So we take the Consolidation Bond A as an illustration. Figure 2 depicts the yield of Consolidation Bond A.

### **The outbreak of the Second Sino-Japanese war: the Macro Polo Bridge Incident in July 1937**

After the third bond consolidation in 1936, the bond yield has a trend of declining as the collaterals of these bonds were secured. After the Macro Polo Bridge Incident in July 1937, the bond market stopped trading in September 1937 and re-opened in January 1938. The yield of consolidated bonds in February 1938 was about 95% higher than those before the market was closed in September 1937. The significance of the Macro Polo Bridge Incident suggests that investors revised their beliefs on the default risk of the bonds when the Second Sino-Japanese War broke out. The possibility of losing the nation, if the Nanjing government failed, increased the default risk of the consolidated bonds. Even if the Nanjing government survived from the war, investors worried about its ability for debt repayment after the intense warfare. The details on the yield changes of these five bonds are listed in Appendix Table B.

After this incident, the bond market was declining in Shanghai. In November 1937, Shanghai was occupied by the Japanese. Since World War II had not started yet, the Japanese had to be friendly toward other great powers, and the warfare did not disturb the foreign concession districts in Shanghai, where the Shanghai Stock

Exchange was located. Moreover, capital from all over the nation flooded into Shanghai since investors regarded Shanghai as the safe heaven for capital. Therefore, the Shanghai Stock Exchange thrived. However, we suspect that trading on the government bonds should be thin since there is no reason for us to believe that the investors would be interested in the bonds of a nation which was in the middle of a serious warfare. Unfortunately, we do not have the record on turnover and if our suspicion is true, the fluctuations in bond price will not be representative for the market. The power of the econometric estimation of the bond yield will be reduced. Therefore, we will not emphasize the estimation results for the bond yield during the war period.

#### **The Break in September/October in 1940**

The second turning point is September 1940. For Bonds B, C and D, the break happened in October in the same year (see Appendix table C). The break indicated a decrease of around 25% in the bond yield, which is theoretically interpreted as the investors at the time had gained some positive belief on the bond payment probability.

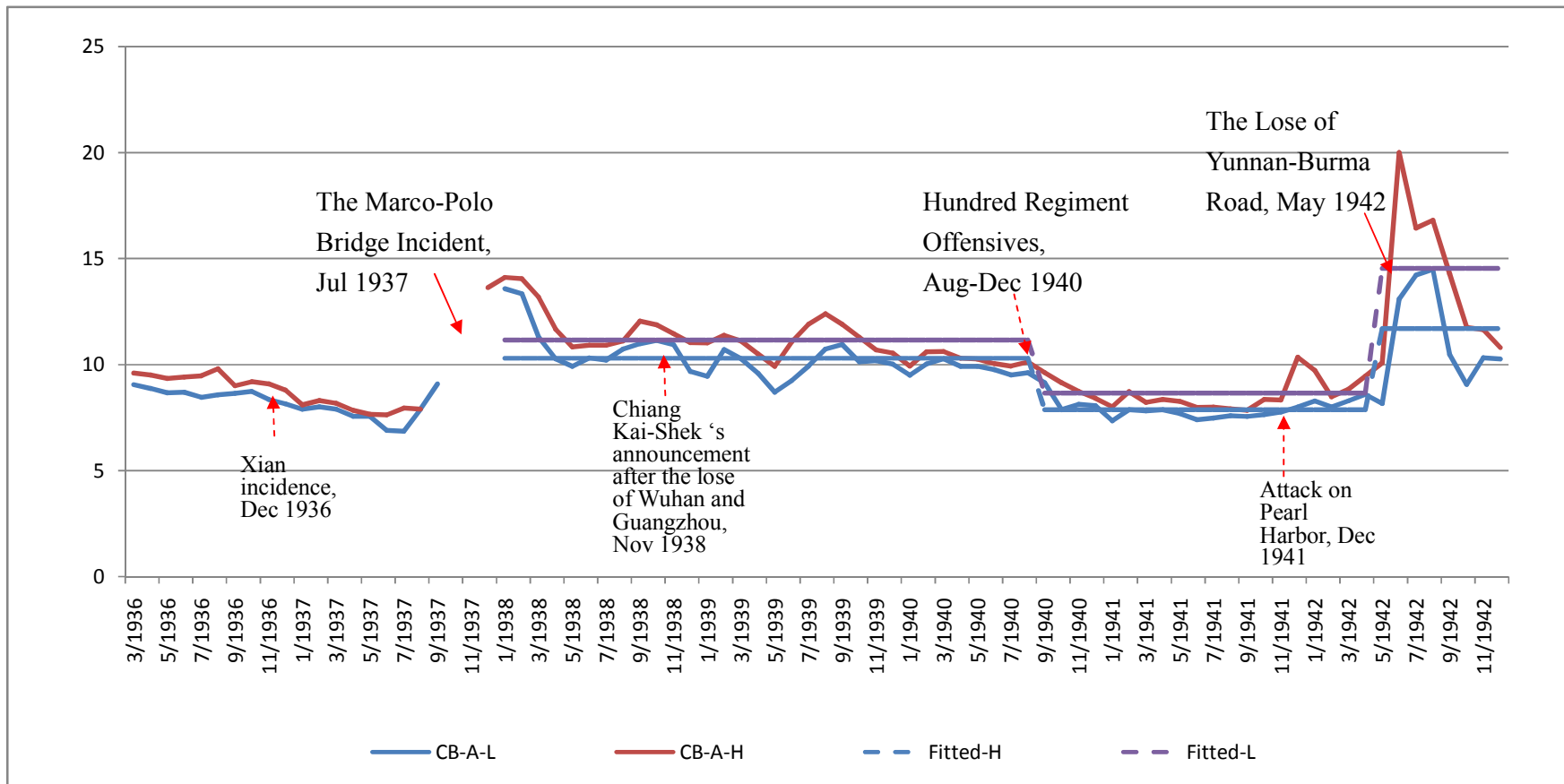
The interpretation of this turning point is complicated by the fact that it is far from clear how the complex political situation affected investors' sentiments. The Japanese planned to finish the war in China within three months. However, the Chinese proved to be much difficult to deal with than they expected. Then due to the financial and military resources constraints as the Japanese occupied larger and larger Chinese territory, they changed their strategy as switching to lure the Chinese government to surrender. In Europe, the German's consecutive successes the battle field made many Chinese feel very pessimistic about the War. In March 1940, a high-ranking government official, the second most powerful man in the Nationalist Party, Wang Jinwei, established a Japanese puppet government in Nanjing. On the other side, the temporary nationalist government in Chongqing led by Chiang Kai-Shek (the Nanjing



government fled to Chongqing after Nanjing was lost) insisted on the anti-Japanese War. The decrease in bond yield could be due to the investors' expectation that there was a sign of peace, or oppositely, the investors might be encouraged by the patriotism of the Chiang Kai-Shek government's determinacy to win the war.

During the same period, the communist party fought the so-called "Hundred Regiment Offensives" against the Japanese from August to December, 1940. This campaign killed more than 20,000 Japanese soldiers. It was regarded as the one of the most important victories for Chinese since the War started. Moreover, before this campaign, there was rumor that communist party never fought the war even though they claimed that the nationalist party and communist party should stop the civil war and fight jointly against the Japanese invasion. This campaign stopped the rumor and proved the joint effort of these two parties protecting the country from being invaded. The major newspapers in China at the moment followed the progress of the campaign almost every day. Every single victory appeared as the headline. Therefore, another possible explanation for this structural break of the negative drop in bond yield

Figure 3. The Yields of Consolidation Bond A: Mar 1936 - Dec 1942



Source: Bankers' Weekly (*Yin Hang Zhou Bao*), Shanghai Newspaper (*Shen Bao*)

could be explained that the investors responded positively to the joint effort against Japanese of the two parties.

### **The lose of Yunnan-Burma Road, May 1942**

After the Japanese attack on Pearl Harbor in Dec 1941, the Sino-Japanese war became one part of the WW II. Therefore, the Chinese army was supported by the Allies, especially, the U.S. The Yunnan- Burma Road was the major transportation line for the U.S. to transport military resources from Burma to Mainland China since the ocean transportation was cut by the Japanese. The Japanese recognized the strategic importance of the Yunnan-Burma road and attacked the British army in Burma. The Chinese army was sent to Burma to support the British army. However, they lost the war and the Yunnan-Burma road was occupied by Japanese.

The lose of Yunnan-Burma Road not only cut the supply to Chinese army, which made the situation of Chinese army more difficult. Moreover, the British army joint with the Chinese army failed the war to win against the Japanese. This war news made the investors become desperate about the destiny of the nation. Therefore, it is not surprising for us to observe an increase in the yield.

### **Events which could have possibly caused blips**

After the outbreak of the second Sino-Japanese war, the fluctuations of the bond yield could have been affected by many war and political events. However, as we mentioned before, since the trade might be thin, the results from the endogenous structural break test could not be as reliable as for the bonds before the war. Moreover, during the war period, there were numerous war news and other political events, which all could have affected the bond market. Therefore, we could not be certain which event possibly caused the blips.

We propose two events which could possibly have caused some blips in the bond yield. Chiang Kai-Shek made an announcement to the nation about his determinacy to

win the war after the loss of Wuhan and Guangzhou in November 1938. This announcement was regarded as a turning point in the Nationalist party's policy toward Japanese. So the possible decline in the yield could be due to the encouragement of the national leaders' determinacy to win the war.

The other important event is the attack on the Pearl Harbor in December 1941. This event indicated China would not be the only nation who fought against Japanese alone. China would be one part of the WWII and get help from the Allies. If the investors were forward looking, the attack on the Pearl Harbor would indicate that the possibility for the Japanese to win the war became weak. The yield should decrease. Nonetheless, the Figure 2 shows the opposite that there was an increase in the bond yield. The market was either not forward looking or short sighted as the investors were shocked by the Japanese success against U.S. Therefore, there is an increase in the bond yield.

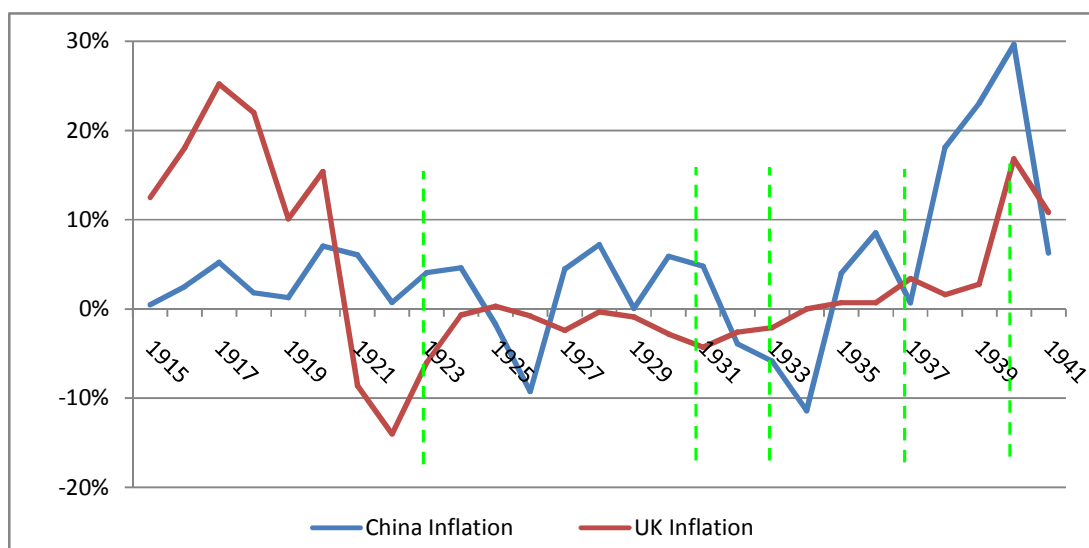
## **7. Discussions**

Our empirical results suggest that the dramatic shifts in bond yields match with important war, political and economic events. Moreover, some events are regarded as important events, but did not stir the financial markets (e.g. the Xian Incident in December 1936). However, the bond yield could be positively affected by other macro economic variables like interest and inflation rates. When interest rates increase, demand for bonds decreases because investors reallocate their funds to assets with higher return, therefore the bond price goes down and the yield goes up. Investors also demand fewer bonds when inflation is high because the real return of bond becomes lower. Therefore, the price goes down and the yield goes up.

The Figure 4 shows the inflation Rate in China during our study period. The dotted vertical lines inside the figure indicate the five dates of the turning points. We also display the information on the interest rate in U.K. as a comparison. We are

surprised to observe a commonality between the U.K. inflation rate and the Chinese inflation rate. During the beginning years, the U.K. inflation rate exceeded the Chinese one. During the years from 1920 to 1934, U.K. experienced deflation. In China, there were two periods of deflation, namely 1925-26 and 1932-34. The poor economic prospect in 1925-26 was due to the civil wars among warlords before the Nationalists united China in 1927. The Gold Standard collapsed in 1931 which made Chinese currency a silver standard currency appreciating relative to other currencies; in turn weak exports induced the recession during 1932-35. Since these inflation rate fluctuations were no more than 10%, we infer that the small fluctuations in the inflation could cause dramatic structural breaks in the bond price.

Figure 4: Inflation Rate in China and U.K.



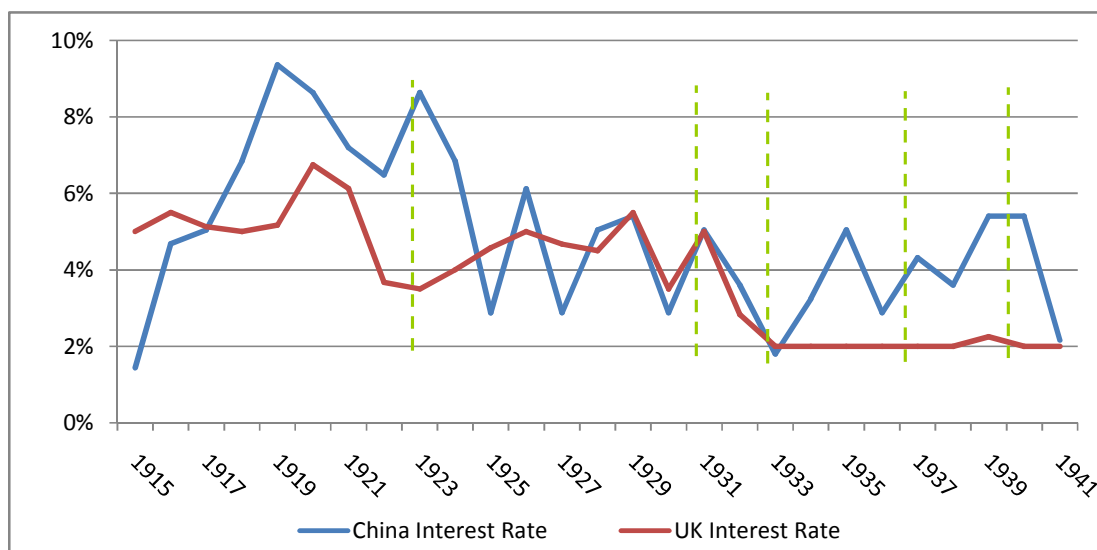
Note: China: Wholesale Price Index in Wang (2008); The U.K: Consumer Price Index in O'Donoghue et. al. (2004).

Second, as we mentioned before that the correlation between the yield and the inflation should be positive theoretically. Since we do not have the monthly inflation rate, we are not able to test the relationship between the bond yield and the inflation rate empirically. However, just from looking at the Figure 4, if it was the changes in the inflation which caused the break but not the important historical event in 1931 as

we identified before, there should be a decrease in bond yield due to a decrease in the inflation rate. Another example is the negative shift in September or October 1940, when there was huge increase in inflation from less than 5% to around 15% from 1939 to 1940.

Turning to the interest rate in Figure 5, we can see that the interest rate in China was usually higher than that in U.K. Similarly, the dotted vertical lines inside Figure 5 indicate the dates of the turning points. The Chinese interest rate was around 5%. Compared to the bond yield which had yield around 10% to 20% plus a discount at issue, we should know why there was an active bond market if there was a peaceful period. The small magnitude of the changes in the interest rate was less likely to cause the dramatic changes in the bond yield. Moreover, there were always fluctuations in the interest rate. If the fluctuations in the interest rate could have caused the structural breaks in bond, there should be more breaks in the bond yield.

Figure 5: Interest Rates in China and U.K.



Note: Shanghai interbank interest rate for daily loan, Source: Shanghai Qianzhuang Shi Liao (1961); The U.K.: Bank rate set by the Bank of England, Source: Bankers' Almanac (1980).

## **8. Conclusion**

The Republic Period is a time of political tumult for China consisting of external and civil wars, revolutions, concessions, institutional reforms, indemnity payments, instabilities in the central government and so on. Consensuses on the importance attached to some historical events were seldom reached among traditional historians when facing the aforementioned chaotic historical settings. Moreover, their interpretation of historical events would have been affected by their different political stands, cultural backgrounds, availabilities of source material, and etc.

This paper seeks to search for a “true” or “objective” version of the history for this period by quantitatively examining how bondholders viewed the events. Any event that decreased the government ability for its debt services induced a rise in the bond yields. A typical example is the outbreak of a war which not only increased the expected military expenditure of the bond issuance authority-the government, but also signifies a higher likelihood of the debt default (e.g. a country loses its impence). Hence, the movements in the bond yields convey information on people’s opinions regarding a specific historical event at a particular point of time.

We evaluate the impacts of the historical events on the bond market, with special attention to military and political events. We find, especially, some external military events that are generally thought to be crucial are clearly reflected in the yields of the bonds. This hold true for the Japanese Invasion in Manchuria in September 1931 and the outbreak of the second Sino-Japanese war in July 1937. Besides, we suspect that the two indentified turning points - the diplomatic event-Sino-Japanese Cease-Fire Truce in Tangu in May 1933 and the Chinese Lose of the Yunnan- Burma Road to Japanese in May 1942 might have been downplayed by traditional historians. On the other hand, some military campaigns which have been assigned an important place in the Republican history by traditional historians were found not to influence the

financial market: The most appealing example is the Japanese Attack on Pearl Harbor in December 1941, which historians of China believe that American involvement in the war against Japanese reversed the situation in the far-eastern battleground. Interestingly, when comparing the financial impacts of external conflicts and major civil conflicts (for instance, the Northern Expedition led by the nationalist party to overthrow the Beijing government from July 1926 to December 1928), we find that investors responded devastatingly to both types of events in an equivalent magnitude in a short period, however, in a longer term, the external conflicts were regarded more detrimental to the government's ability to service its debt.

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Appendix Table A: Structural Breaks of Beijing Bonds, 1921-34

Bond	Break	Year/Month	Bound	Jump in Min	Jump in Max	Events
<b>6 Percent</b>	1	1924/1	[-3,2]	-4.4 (-35%)	-5.4 (-38%)	Bond Consolidation 1921
	2	1931/8	[-1,4]	7.9 (95%)	9.0 (100%)	Invasion of Manchuria
	3	1933/5	[-1,1]	-6.3 (-39%)	-7.8 (-43%)	Tanggu Truce Cease-fire
<b>7<sup>th</sup> Year</b>	1	1924/1	[-1,2]	-6.2 (-41%)	-6.6 (-40%)	Bond Consolidation 1921
	2	1927/12	[-1,1]	-1.3 (-14%)	-1.8 (-19%)	Northern Expedition
<b>Financial</b>	1	1924/11	[-1,1]	-2.3 (-26%)	-2.8 (-30%)	Bond Consolidation 1921
	2	1927/2	[-1,1]	1.0 (16%)	1.7 (25%)	Northern Expedition
<b>7 Percent</b>	1	1923/12	[-1,1]	-5.2 (-38%)	-6.6 (-43%)	Bond Consolidation 1921
	2	1926/12	[-1,2]	1.9 (23%)	2.9 (33%)	Northern Expedition
<b>8 Percent</b>	1	1925/6	[-1,6]	-14 (-48%)	-15 (-44%)	Idiosyncratic news
	2	1927/3	[-2,2]	18 (116%)	23 (118%)	Idiosyncratic news
<b>Disband</b>	1	1931/9	[-1,2]	4.5 (40%)	5.2 (40%)	Invasion of Manchuria
	2	1933/5	[-1,1]	-4.5 (-29%)	-6.7 (-37%)	Tanggu Truce Cease-fire

Note: The choice of number of breaks needs to fulfill the following two criteria: 1) the minimum duration of each segment is one and half years and 2) the jumps of all jumps are larger than 10%. Bound is 90% confidence interval of the break date.

Appendix Table B: Macro Polo Bridge Incident, 1937/7

Month/Year	CB-A		CB-B		CB-C		CB-D		CB-E	
	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
<b>7/1937</b>	6.8	7.9	7.0	8.1	7.2	8.4	7.2	8.5	7.3	8.5
<b>2/1938</b>	13.3	14.1	14.2	15.9	14.9	15.9	14.9	16.2	14.9	16.1
<b>Changes</b>	6.5	6.1	7.2	7.8	7.8	7.6	7.7	7.8	7.6	7.6
<b>%Change</b>	95%	77%	102%	97%	109%	90%	107%	92%	104%	90%

Appendix Table C: Structural Breaks of Consolidated Bonds, 1938/3-1942/12

<b>Bond</b>	<b>Break</b>	<b>Year/Month</b>	<b>Bound</b>	<b>Jump in Max</b>	<b>Jump in Min</b>	<b>Events</b>
<b>CB-A</b>	1	1940/9	[-1,2]	-2.4 (-24%)	-2.5 (-22%)	Hundred Regiment Offensives
	2	1942/5	[-2,0]	3.8 (49%)	5.9 (68%)	Yunnan Burma Road
<b>CB-B</b>	1	1940/10	[-1,1]	-3.0 (-26%)	-3.4 (-27%)	Hundred Regiment Offensives
	2	1942/4	[-1,2]	3.0 (36%)	5.4 (59%)	Yunnan Burma Road
<b>CB-C</b>	1	1940/10	[-1,1]	-2.9 (-25%)	-3.3 (-26%)	Hundred Regiment Offensives
	2	1942/4	[-1,1]	2.7 (31%)	4.9 (52%)	Yunnan Burma Road
<b>CB-D</b>	1	1940/9	[-1,1]	-2.9 (-24%)	-3.3 (-26%)	Hundred Regiment Offensives
	2	1941/11	[-1,0]	2.0 (22%)	4.2 (43%)	Yunnan Burma Road
<b>CB-E</b>	1	1940/10	[-1,1]	-3.1 (-26%)	-3.3 (-25%)	Hundred Regiment Offensives
	2	1942/3	[-2,1]	2.9 (33%)	5.0 (51%)	Yunnan Burma Road

Note: The choice of number of breaks needs to fulfill the following two criteria: 1) the minimum duration of each segment is half years and 2) the jumps of all jumps are larger than 10%. Bound is 90% confidence interval of the break date.