Contained Crisis and Socialized Risk

Unconventional Monetary Policy
by the Bank of Japan in the 1890s*

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Abstract

In the 1880s, Japan experienced its first stock investment boom, which was highly leveraged by the banking sector. In 1890, its first financial crisis occurred and triggered a de-leveraging process. With a high lower bound of conventional interest rate intervention under the fixed exchange rate regime, the Bank of Japan decided to implement a massive securities purchases first time among major industrial economies and continued this unconventional policy until the early 1900s. We examine how the unconventional intervention for a decade affected the stock prices and trade volumes, and show that the upward distortion in market pricing was considerable and that the equity-risk premium accordingly dropped, which meant socialization of the risk associated with industrial investment.

Key words: lower bound of conventional monetary policy; unconventional monetary policy; securities purchases by central bank; equity-risk premium; fixed exchange rate; Bank of Japan.
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Introduction

For the Western economies in the financial crisis from 2008, and for Japan first time in the early 2000s by a modest scale and second time from 2014 by a large scale, massive asset purchases by their central banks that were described "quantitative" or "unconventional" against conventional interest rate intervention, became a tool of monetary policy to boost their economies. When implemented, possible channels of transmission of the policy were not precisely anticipated, because of a lack of well-established empirical works.

As time has advanced, now empirical analysis is feasible. Using the US data, Meinusch and Tillmann (2016) showed that the quantitative easing lowered interest rates and raised stock prices, output, and inflation. Furthermore, Foley-Fisher, Ramcharan and Yu (2016) showed that the quantitative easing in the US lowered bond risk premium, which relaxed financial constraint of firms. In line with this view, Chen, Filardo, He and Zhu (2016) found that a reduction in the bond spreads was the primary channel. Using the Eurozone data, Haitsma, Unalmis and de Haan (2016) found that the surprises effect on the stock markets was considerable, and Eser and Schwaab (2016) showed that a reduction in default-risk premium was the primary channel to boost the economy of the monetary union. It has become clear that the unconventional monetary policy, often through the securities markets channel, is effective.

Regarding which of conventional or unconventional monetary policy is effective, the evidence is less clear. Hanisch (2017) showed that, in the case of Japan, the policy impact itself was greater when conventional interest rate intervention was adopted than when the unconventional quantitative easing was adopted since 2001. Gambacorta, Hoofmann and Peersman (2014) found the same tendency in all advanced economies since 2008, although it is even less clear whether advanced economies could have averted a depression in the late 2000s without the unconventional policies. Their findings are consistent with those on large spillover effects of unconventional monetary policy, which literally means that the easy money leaked, as discussed by Park and Um (2016), Fratzscher, Lo Duca and Straub (2016), Lim and Mohapatra (2016), Tillmann (2016), and MacDonald (2017).

In short, we now know that the unconventional policies were effective to boost the economy, although whether its impact be greater than that of conventional policy is not clear, that the securities market is considered to be an important transmission channel of the unconventional policies, and that the unconventional policies distort securities markets such that risk premium is lowered after implementation of the unconventional policies.

In fact, the massive securities purchases were not an innovative tool in a strict sense among major economies. The Bank of Japan adopted the corporate shares purchases program in 1890, to rein in the shock of a financial crisis, and continued the policy through the 1890s. Japan adopted the silver standard from 1885 to 1897 and the gold standard from 1897. These fixed exchange rate regimes meant a high lower bound of conventional interest rate intervention. Touching the lower bound of conventional policy, as central banks of advanced economies in the 2000s and 2010s have been doing, the Bank of Japan implemented a program of corporate shares purchases through rediscounting to avert the collapse of the entire financial system. We study how this very first version of unconventional monetary policy affected the two major stock exchanges then, the Tokyo Stock Exchange and the Osaka Stock Exchange, constructing a new monthly data set that includes money injection through rediscounting, share prices and

trade volumes of individual firms at the Tokyo Stock Exchange and the Osaka Stock Exchange from first-hand documents created by the Bank of Japan at that time but not published.[1]

The rest of the paper is organized as follows. Section 1 reviews institutional contexts and historical background, Japan's first stock market boom accelerated by the banking sector in the late 1880s, its clash in 1890, and the Bank of Japan's decision to purchase shares through rediscounting in 1890 and then introduces the data. Section 2 examines how this policy affected prices of shares on the Tokyo Stock Exchange and Osaka Stock Exchange. As it was a first innovative policy implemented by the Bank of Japan without lessons to be learned from the West, the Bank of Japan carefully tracked the effect by recording share prices and trade volumes. We can utilize this information with the same aim, and pin down the policy effect. Section 3 measures distortions of the both markets reflected in the equity-risk premium.

1 Bank loans collateralized by shares and the Bank of Japan

1.1 The lower bound of monetary policy under the silver/gold standard

After toppling the shogunate in 1868, the new imperial government promulgated the National Bank Act of 1872, modeled on the US national bank system, where each bank is entitled to issue banknotes. Then the Bank of Japan Act of 1882 stipulated that the Bank of Japan be the only issuing bank and all national banks be transformed to be ordinary banks. The Bank of Japan provided these banks with base money primarily through rediscounting and overdraft. Meanwhile, until the Bank of Japan was established in the year, existing banks had formed correspondent banking system that connected one another. Through the correspondent network, conventional monetary policy, that is, the discount rate affected the financial market.

The Stock Exchange Act of 1878 resulted in establishment of the Tokyo Stock Exchange and the Osaka Stock Exchange in the year.[2] The Code of Civil Procedure was promulgated and came into force in 1890, and the Commercial Code was promulgated became effective in 1899. Along with this development, from the early 1880s, modern cotton-spinning companies and railway companies were founded as joint stock companies based on technologies brought in from the Western world. While they raised funds through share issuance and bank loans at the beginning, they replaced their bank loan reliance with bond flotation and augmented reliance on direct financing as they established a reputation in the market from the 1890s.

The Bank of Japan adopted the silver standard from 1885, where the bank committed to the conversion of the yen to a certain amount of silver on request and switched to the gold standard in 1897, where the exchange rate of the yen was fixed against the sterling pound. The commitment to the silver/gold standard imposed a serious restriction on the monetary policy. When the balance of trade went deficit, the deficit should be eliminated or capital should be imported to keep the external balance. However, In the early 1890s, Japan never issued government bonds in offshore markets and issued them only by a small amount in the late 1890s. Only after the Russo-Japanese War, when Japan issued huge amount of bonds in the London market to finance the war and the Japanese government bonds became a popular emerging

[1] The data are available in the online version of this article at the publisher's website.

[2] For details, see Kobayashi (2012), pp. 73–96.

market asset, flexible capital import became feasible and greatly relaxed the constraint on monetary policy.[3] By contrast, the Bank of Japan did not have such a flow channel of capital import in the 1890s. It follows that the Bank of Japan needed to raise discount rate to cool down the economy whenever the balance of trade went deficit such that imports decreased and the trade account was balanced. It then implied that the lower bound of the conventional monetary policy remained high through the 1880s to the 1890s. If the economy entered a boom that resulted in an increase in imports and deficit of trade account, the Bank of Japan raised discount rate and it triggered a recession. If the recession caused a financial crisis, a serious difficulty faced the Bank of Japan. Unless domestic demand sufficiently shrank and trade account was balanced, the Bank of Japan could not lower the discount rate. With a high lower bound of conventional policy, the Bank of Japan had to contain possible spillover of a financial crisis. This was a tough challenge to the Bank of Japan in 1890.

1.2 Financial crisis in 1890 and rediscount of notes collateralized by shares

In 1878, when the Stock Exchange Act came into force, the Tokyo Stock Exchange and the Osaka Stock Exchange were established. After the leading firms in Japan such as the Osaka Cotton Spinning and the Japan Railway Company showed successful results in the early 1880s, the rush for corporation establishment followed, particularly in the cotton-spinning and railway industries. This boom led Japan's industrialization, which gained momentum with the expansion of the capital market in the late 1880s, and, the direct financing continuously increased its share in corporate finance.[4]

While joint stock companies issued shares to raise funds to raise funds directly from individual investors during the mid-1880s, the investment boom was sustained not only by the household assets of the wealthy class but also by bank loans to investors. For example, assume that investor **A** first purchased some shares using his household assets. Then **A** borrowed money from a bank by collateralizing the shares he purchased and purchased more shares. Investor **A** again collateralized the shares, borrowed more, and purchased more shares. The bank loans collateralized by shares allowed highly leveraged investment and supported the stock investment boom.[5] More than 40 percent of bank loans and bank overdrafts from the mid-1880s to the mid-1890s are estimated to have been collateralized by corporate shares,[6] indicating that the rush of startups from the mid-1880s might not have been possible without bank loans and overdrafts collateralized by shares. Equity prices per se tend to be procyclical and the banking sector is affected through own capitalization. The swing would be drastically exacerbated when lending is collateralized by shares.

The National Bank Act of 1872 and other laws and regulations assumed commercial banking business of the British type but did not assume loans to investors for stock investment. Regardless of the government policy, such loans for stock investment endogenously grew in the

[3] See Suzuki (1994); Sussman and Yafeh (2000); and Nakabayashi (2013).

[4] See Hoshi and Kashyap (2001), pp. 15–44 and Teranishi (2006), pp. 17–18.

[5] See Shimura (1969), pp. 52–59.

[6] See Ishii (2006), p. 43 and Ishii (2010), pp. 265, 274–275.

late 1880s. This finance propped up the first rise in the manufacturing sector of the Japanese economy (Figure 1).

INSERT Figure 1 Here

Source: Ohkawa, Takamatsu and Yamamoto (1974), pp. 202, 240.
Note: The data are available in the online version of this article at the publisher's website.

However, the credit expansion through loans collateralized by shares suddenly began to contract when a slowdown in January 1890 triggered a fall in share prices. This credit contraction induced a fall in share prices and raised a tension in the financial market. When the share price level that had been sustained by high leverage based on loans collateralized by shares began to fall, it devalued the collateral held by banks and debased the banks' assets, which is called de-leveraging. The de-leveraging process of falling share prices and bank failures proved to be a serious challenge in a few months, in particular with the lower bound of conventional intervention in interest rate under the fixed exchange regime, The Bank of Japan and the Japanese government needed to decide whether to let the financial system fall into a meltdown and force banks to go back to commercial banking business or to recognize the role of bank loans collateralized by shares and to control it. The conventional monetary policy, lowering discount rate, was not constrained under the fixed exchange regime in the 1890s.

After all, in May 1890, the Bank of Japan designated the shares of major companies such as the railway companies, as acceptable collateral, and publicly opened the channel of rediscounting accommodation notes discounted by banks if the notes were collateralized by designated shares. Even before this decision, the Bank of Japan often loaned or rediscounted against the collateral of corporate shares and bonds, but the procedure was not publicly opened. Furthermore, the Bank of Japan Act did not allow it to discount accommodation notes not backed by commercial transactions. As an exception, the Bank of Japan decided to rediscount accommodation notes collateralized by corporate shares it designated on the basis of collateral value it specified.[7]

The "rediscount of notes collateralized by shares" with "rediscount of promissory notes" became the primary channels of rediscounting at the Bank of Japan's central branch in Tokyo and the branch in Osaka, which together accounted for roughly 40 percent of the total rediscount until the mid-1890s.[8] Furthermore, it extended the designation of corporate shares to the shares of medium-sized railway companies in the late 1890s.

The rediscount of accommodation notes with collateral became more than 50 percent of the total rediscount of the Bank of Japan in the late 1890s and 60 percent in the early 1900s. Corporate shares accounted for about 60 percent of the total collateral in rediscounting; this fell to 30 percent in the mid-1900s, and then dropped to 2 percent as corporate shares were replaced by the Japanese Government Bonds as collateral.[9] Therefore, from the 1890s to the early 1900s, which was the essential phase of Japan's industrialization, the Bank of Japan directly injected fund to stock investment.

[7]See The Bank of Japan (1923), p. 187 and Oshima (1952), pp. 73–75.

[8]"Nippon Ginko tokei geppo (Monthly statistics of the Bank of Japan)," in the file of the library of the Bank of Japan.

[9]See The Bank of Japan (1983), pp. 56–59.

1.3 Data

While it has been mentioned that the rediscounting by the Bank of Japan of accommodation notes collateralized by corporate shares could distort the market,[10] the effect of the policy on the capital market as a whole has not been quantitatively addressed. The Bank of Japan recorded the prices and trade volumes of all on-market trades at the Tokyo Stock Exchange from October 1890 to May 1898, and at the Osaka Stock Exchange from January 1891 to October 1899 in the handwritten document titled "Nippon Ginko tokei geppo (Monthly statistics of the Bank of Japan)." Furthermore, the "Nippon Ginko tokei geppo" reports the amounts of rediscounting. From these records, we construct the monthly series of share prices, trade volumes, and the amount of rediscounting, and examine the policy effect on the capital market.

A panel unit root test on the level of share price series rejects the hypotheses of common unit root and individual unit root for the Tokyo Stock Exchange and individual unit root of the Osaka Stock Exchange.[11] That is, both in Tokyo and Osaka, individual share price series were not random walk and the assumption that they were stationary in level terms is not rejected. We thus perform panel estimation, with controlling for cross-section fixed effects if necessary, on level terms in the following sections.

The amount of the rediscount and the outstanding balance as of the end of the month at Tokyo and Osaka branches of the Bank of Japan are shown in Figure 2. Note that the outstanding monetary base issued by the Bank of Japan as of the end of 1890 was 102.9 million yen.[12] Roughly 4 million and 2 million outstanding balance of the rediscounting at Tokyo and Osaka branches respectively meant about 4 and 2 percent of the monetary base.

INSERT Figure 2 Here

Source: "Nippon Ginko Tokei Geppo," on file in the library of the Bank of Japan.
Notes: Original documents lack information about decomposed number of rediscounting of the Tokyo Head Office from June 1898. The data are available in the online version of this article at the publisher's website.

[10] See Ishii (2010), p. 266.

[11] (1) Tokyo Stock Exchange: a) Common unit root test (Levin, Lin and Chu test): *t* statistics: -6.4576^{***}, Number of cross sections: 95, Number of total observation: 2,609; b-1) Individual unit root test (Im, Pesaran and Shi test): *W* statistics: -5.0264^{***}, Number of cross sections: 84, Number of total observations: 2,576; b-2) Individual unit root test (ADF-Fisher test): χ^2 : 256.2844^{***}, Number of cross sections: 95, Number of total observations: 2,609; b-3) Individual unit root test (PP-Fisher test): χ^2: 268.5740^{***}, Number of cross sections: 95, Number of total observations: 2,746. (2) Osaka Stock Exchange: a) Common unit root test (Levin, Lin and Chu test): *t* statistics: -0.7330, Number of cross sections: 47, Number of total observations: 1,571; b-1) Individual unit root test (Im, Pesaran and Shin test): *W* statistics: -0.0335, Number of cross sections: 47, Number of observations: 1,591; b-2) Individual unit root test (ADF-Fisher test): χ^2: 135.4938^{***}, Number of cross sections: 47, Number of total observations: 1,591, b-3) Individual unit root test (PP-Fisher test): χ^2: 117.4364^{**}, Number of cross sections: 47, Number of total observations: 1,723.

[12] See The Bank of Japan (1891), p. 318.

2 The effect of rediscount with collateral shares

2.1 Effects of intervention in the Tokyo market

Table 1 shows the effects of the Bank of Japan's policy measures, the official discount rate for the Tokyo market of by the Tokyo Head Office of the Bank of Japan (TKDR_t), the dummy variable of being designated as collateral for rediscount by the Bank of Japan ($\mathrm{BOJC}_{i,t}$), which takes the value 1 if shares of firm i were designated as collateral for the rediscounting by the Bank of Japan in month t, the value of promissory notes discounted by the Tokyo Head Office of the Bank of Japan (TKPND_t), the value of rediscounted notes collateralized by securities (TKPNCD_t), the interaction term between the official discount rate and the collateral designation dummy variable ($\mathrm{TKDR}_t \times \mathrm{BOJC}_{i,t}$) and that between the rediscounting of notes collateralized by designated shares and the collateral designation dummy variable ($\mathrm{TKPNCD}_t \times \mathrm{BOJC}_{i,t}$), and the diffusion index (DI_t) to control for cyclical effects, on the share price of firm i at the Tokyo Stock Exchange in period t ($\mathrm{TKP}_{i,t}$) by fixed effects models as follows.

$$
\begin{aligned}
\log[\mathrm{TKP}_{i,t}] = \beta_0 &+ \beta_1 \log[\mathrm{TKDR}_t] + \beta_2 \mathrm{BOJC}_{i,t} \\
&+ \beta_3 \log[\mathrm{TKDR}_t] \times \mathrm{BOJC}_{i,t} + \beta_4 \log[\mathrm{TKPND}_t] \\
&+ \beta_5 \log[\mathrm{TKPNCD}_t] + \beta_6 \log[\mathrm{TKPNCD}_t] \times \mathrm{BOJC}_{i,t} \\
&+ \beta_7 \log[\mathrm{DI}_t] + \epsilon_{i,t} + \mu_i,
\end{aligned} \tag{1}
$$

where $\epsilon_{i,t}$ denotes error term and μ_i the dummy variable of firm i. As described above, 50 to 60 percent of collateral securities for the rediscounting of promissory notes collateralized by securities were designated shares and the others were the government bonds in the 1890s.

INSERT Table 1 HERE

Source: See Appendix Table.
Note: The data are available in the online version of this article at the publisher's website.

In all specifications, the official discount rate (TKDR_t) has a significantly negative coefficient. In the final phases of expansion and in the following contraction phases, the Bank of Japan needed to raise the official discount rate to cool down the domestic demand, which resulted in a decrease in trade deficit and was necessary to retaining the confidence in the Yen. This mandate inevitably lowered the share prices in general. The high lower bound of the official discount rate put the central bank in the doubly bound constraints.

A general vehicle to boost the economy in such phases was rediscounting promissory notes (TKPND_t), which in general sustained the share prices as shown by a significantly positive coefficient in all specifications. Then we examine the effects of designation of specific shares as collateral for rediscounting. Regarding the companies whose shares were designated as collateral for rediscounting in May 1890, our estimates cannot capture the effect because the data are available only from October 1890 when the effect of designation had already been priced in. However, in the late 1890s, the Bank of Japan additionally designated shares mainly

of medium-sized railway companies as a collateral for rediscounting. We can capitalize the event.[13]

Next, the value of rediscounted notes collateralized by securities (TKPNCD_t) has a significantly positive variable with a greater absolute value than that of the value rediscounting promissory notes (TKPND_t). This means that the rediscounting of designated shares has a significant and greater power to prop up share prices in the Tokyo market. Because the newly designated companies were smaller than those that had been already designated, the collateral designation dummy variable ($\mathrm{BOJC}_{i,t}$) itself has a significantly positive coefficient in specifications 1–2 and 1–3. However, in specification 1–2, the interaction term between the official discount rate and the collateral designation dummy variable ($\mathrm{TKDR}_t \times \mathrm{BOJC}_{i,t}$) has a significantly positive coefficient. This means that when the rate was hiked, the share prices of the newly designated companies rose. The power of designation to bolster the designated companies' shares was considerable. As expected by the result, the interaction term between the value of rediscounted notes collateralized by securities and the collateral designation dummy variable ($\mathrm{TKPNCD}_t \times \mathrm{BOJC}_{i,t}$) has also a significantly positive coefficient in specification 1–3. A focused injection of money affected the prices of the focused shares.

When contemporary central banks quantitatively intervene in the market through purchases of securities, they expect their securities purchases to revitalize the trades of shares locked up in the market and potentially lead to general prices rise. Thus in this section, we examine how the Bank of Japan's interventions affected trade volumes in the markets.

Table 2 shows how the policies of the Bank of Japan affected trade volumes of individual shares on the Tokyo Stock Exchange ($\mathrm{TKVOL}_{i,t}$), by regressing this variable on the policy variables by the fixed effects model as follows.

$$
\begin{aligned}
\log[\mathrm{TKVOL}_{i,t}] = \beta_0 &+ \beta_1 \log[\mathrm{TKDR}_t] + \beta_2 \mathrm{BOJC}_{i,t} \\
&+ \beta_3 \log[\mathrm{TKDR}_t] \times \mathrm{BOJC}_{i,t} + \beta_4 \log[\mathrm{TKPND}_t] \\
&+ \beta_5 \log[\mathrm{TKPNCD}_t] + \beta_6 \log[\mathrm{TKPNCD}_t] \times \mathrm{BOJC}_{i,t} \\
&+ \beta_7 \log[\mathrm{DI}_t] + \epsilon_{i,t} + \mu_i,
\end{aligned} \tag{2}
$$

where $\epsilon_{i,t}$ denotes error term and μ_i the dummy variable of firm i.

INSERT Table 2 HERE

Source: See Appendix Table.
Note: The data are available in the online version of this article at the publisher's website.

While the conventional policy measure, the official discount rate (TKDR_t) has a significantly negative coefficient in all specifications, the general vehicle of money injection, the rediscounting of promissory notes (TKPND_t) has a significantly positive coefficient in all specifications. These results show that the interest hikes provided a downward presser for trades but the rediscounting in general helped the market turn around.

[13]Information about the names of listed companies and whether their shares were designated as collateral is available in the online version of this article at the publisher's website.

Meanwhile, the discounting of promissory notes collateralized by securities (TKPNCD_t) has a significantly negative coefficient in all specifications although the interaction term between the official discount rate and the collateral designation dummy variable ($\mathrm{TKDR}_t \times \mathrm{BOJC}_{i,t}$) and that between the discounting of promissory notes collateralized by securities and the collateral designation dummy variable ($\mathrm{TKPNCD}_t \times \mathrm{BOJC}_{i,t}$). This means that money injection focused on specific shares helped only the focused shares be more actively traded but the effect on the overall market was limited.

2.2 Effects of intervention in the Osaka market

Table 3, as Table 1, provides the effects of the policy measures in the Osaka market, by regressing the share price of firm i at the Osaka Stock Exchange in period t ($\mathrm{OSP}_{i,t}$) on the official discount rate for the Osaka market of by the Osaka Branch of the Bank of Japan (OSDR_t), the dummy variable of being designated as collateral for rediscount by the Bank of Japan ($\mathrm{BOJC}_{i,t}$), which takes the value 1 if shares of firm i was designated as collateral for the rediscounting by the Bank of Japan in month t, the value of promissory notes discounted by the Osaka Branch of the Bank of Japan (OSPND_t), the value of rediscounted notes collateralized by securities (OSPNCD_t), the interaction term between the official discount rate and the collateral designation dummy variable ($\mathrm{OSDR}_t \times \mathrm{BOJC}_{i,t}$) and that between the rediscounting of notes collateralized by designated shares and the collateral designation dummy variable ($\mathrm{OSPNCD}_t \times \mathrm{BOJC}_{i,t}$), and the diffusion index (DI_t) to control for cyclical effects by fixed effects models as follows.

$$
\begin{aligned}
\log[\mathrm{OSP}_{i,t}] = \beta_0 &+ \beta_1 \log[\mathrm{OSDR}_t] + \beta_2 \mathrm{BOJC}_{i,t} \\
&+ \beta_3 \log[\mathrm{OSDR}_t] \times \mathrm{BOJC}_{i,t} + \beta_4 \log[\mathrm{OSPND}_t] \\
&+ \beta_5 \log[\mathrm{OSPNCD}_t] + \beta_6 \log[\mathrm{OSPNCD}_t] \times \mathrm{BOJC}_{i,t} \\
&+ \beta_7 \log[\mathrm{DI}_t] + \epsilon_{i,t} + \mu_i,
\end{aligned} \tag{3}
$$

where $\epsilon_{i,t}$ stands for error term and μ_i of the dummy variable of firm i.

INSERT Table 3 HERE

Source: See Appendix Table.
Note: The data are available in the online version of this article at the publisher's website.

The conventional policy measure, the official discount rate (OSDR_t) has a significantly negative coefficient in all specifications as in the Tokyo market. Interest rises to maintaining the confidence in the Yen sent a significant downward pressure.

Both the interaction term between the official rediscount rate and the collateral designation dummy variable ($\mathrm{OSDR}_t \times \mathrm{BOJC}_{i,t}$) in specification 3–2 and that between the rediscounted notes collateralized by designated shares and the collateral designation dummy variable ($\mathrm{OSPNCD}_t \times \mathrm{BOJC}_{i,t}$) in specification 3–3 have a significantly positive coefficient. This indicates that a focused money injection to designated shares helped those shares to weather interest rate raises and sustain the prices in downturns as those in the Tokyo market.

However, contrasting to the Tokyo market, the rediscounted notes collateralized by designated shares (OSPNCD_t) has an insignificant coefficient in specification 3–1 and 3–2 and a negative coefficient in specification 3–3. The power of the unconventional policy measure failed to dominate the overall market in Osaka.

Table 4 shows how policy measures affected trade volumes on the Osaka Stock Exchange ($\mathrm{OSVOL}_{i,t}$), as in Table 2, by fixed effect models as follows.

$$
\begin{aligned}
\log[\mathrm{OSVOL}_{i,t}] = \beta_0 &+ \beta_1 \log[\mathrm{OSDR}_t] + \beta_2 \mathrm{BOJC}_{i,t} \\
&+ \beta_3 \log[\mathrm{OSDR}_t] \times \mathrm{BOJC}_{i,t} + \beta_4 \log[\mathrm{OSPND}_t] \\
&+ \beta_5 \log[\mathrm{OSPNCD}_t] + \beta_6 \log[\mathrm{OSPNCD}_t] \times \mathrm{BOJC}_{i,t} \\
&+ \beta_7 \log[\mathrm{DI}_t] + \epsilon_{i,t} + \mu_i,
\end{aligned} \tag{4}
$$

where $\epsilon_{i,t}$ stands for error term and μ_i of the dummy variable of firm i.

INSERT Table 4 HERE

Source: See Appendix Table.
Note: The data are available in the online version of this article at the publisher's website.

The results are the same for the Tokyo market. The conventional policy measure, the official discount rate (OSDR_t) has a significantly negative coefficient and the general channel of money injection and the rediscounting of promissory notes (OSPND_t) has a significantly positive coefficient. While the interaction term between the official discount rate and the collateral designation dummy variable ($\mathrm{OSDR}_t \times \mathrm{BOJC}_{i,t}$) and that between the rediscounting of promissory notes collateralized by securities and the collateral designation dummy variable ($\mathrm{OSPNCD}_t \times \mathrm{BOJC}_{i,t}$) have a significantly positive coefficient, the rediscounting of promissory notes collateralized by securities ($\mathrm{OSPNCD}_{i,t}$) has a significantly negative coefficient. The focused money injection failed to raise trade volumes beyond the targets.

2.3 Difference between Tokyo and Osaka

In summary, the focused money injection into the stock markets affected share prices more effectively at the Tokyo market than it did at the Osaka market. In Tokyo, the rediscounting of promissory notes collateralized by securities not only raised share prices of the targeted firms but also helped the overall market gain. In the Osaka market, the effect was limited only to the targeted firms.

In the Tokyo Stock Exchange, out of 145 listed shares, 20 were designated, while at the Osaka Stock Exchange, out of 99 listed, 14 were designated. Thus, the ratio of designated shares of the listed shares was not smaller in Osaka. However, railway companies, a representative sector of designation by the Bank of Japan, were actively traded on the Tokyo Stock Exchange, while cotton-spinning companies, which were not designated by the Bank of Japan, were actively traded in Osaka. Shares that were not directly propped up by the financial policy dominated trades at Osaka. Furthermore, Figure 2 shows that the rediscounting

and the outstanding balance were largely parallel at Osaka branch, whereas the outstanding balance surged at the Tokyo Head Office in the late 1890s. It implies that the Tokyo market increasingly depended on the asset purchases by the Bank of Japan in the same period.

3 Socialized risk and reduced equity-risk premium

3.1 Priced-in intervention

We have shown that the rediscounting of notes collateralized by the designated shares affected the price movements of individual designated shares, implying that the policy measures brought asymmetric effects on the risk of designated shares. Once a share was designated as a collateral, notes collateralized by the designated share were presumed to be discounted by the specified collateral value without limit. In particular, under downward pressures, increases in rediscounting of notes collateralized by designated shares are expected to lead to rises in share prices. Among the designated shares, railway companies occupied a large portion, and thus the asymmetric policy effect was especially large in the Tokyo market, where railway firms' shares were actively traded.

Meanwhile, since the designation was public information, as soon as a share was designated as a collateral, it was presumed to be factored in its price. Therefore, except for the very first moment, holders of designated shares could not earn excess returns. Then, the potential distortion of asymmetric intervention is expected to lead to a considerable decrease in equity-risk premium, which the investors required against price volatility risk.

3.2 Reduced risk-premium

Table 5 gives the equity risk premia, which is the price growth plus the dividend minus the yield of the Japanese government bonds, a presumably risk-free asset, for the shares whose information about paid-in capital and dividend is available.

INSERT Table 5 HERE

Source: Kling, Nakabayashi and Yuki (2009). Original sources are, a) share prices and dividends: Tokyo Stock Exchange (1928); b) GNP: Ohkawa et al. (1974), p. 237; and c) Consumer price index: Ohkawa, Noda, Takamatsu, Yamada, Kumazaki, Shinomiya and Minami (1967), p. 135

In the Tokyo market, the equity-risk premium drastically decreased on average from over 10 percent in the 1880s to less than 1 percent on average in the 1890s.

Table 6 shows the counterpart in the Osaka market, where designated shares accounted for a smaller portion in trade. In the Osaka market, a decrease in equity-risk premium in the same period was from 17 percent to 4 percent, more moderate than that in Tokyo (Table 6).

INSERT Table 6 HERE

Source: Kling et al. (2009). Original sources are, a) share prices and dividends: Osaka Stock Exchange (1928); b) GNP; and c) Consumer price index: see the notes of Table 5.

3.3 A common outcome of the unconventional monetary policies

These results indicate that, given its reliance on the financial policy of each market (Figure 2), the markets factored in the unconventional policy effects, and the return on risk-taking accordingly receded. In summary, the outcome was the share prices sustained at a high level by the unconventional monetary policy and the lowered yield of investment, as observed by Foley-Fisher et al. (2016) and Eser and Schwaab (2016) for the Western economies during the unconventional monetary policies after the 2008 financial crisis. In either case, the reduction in risk premium was delivered by asset purchases by the central banks whose balance sheets the taxpayers are ultimately responsible for. Therefore, we can consider the reduction in risk premium was a socialization of risk associated with corporate finance.

Conclusion

Equity finance in Japan rapidly grew from the 1880s to the 1890s, and this was supported by the banking sector first in the 1880s, and then boosted further under the Bank of Japan's policy of the rediscounting of notes collateralized by the designated shares in the 1890s. Since the collateral designation itself was public information, it was factored in the share price as soon as it was declared and the share price was adjusted in the upward direction. This resulted in a drastic fall of the equity-risk premium in the 1890s. That is, with a functioning market, the unconventional monetary policy was quickly arbitraged. These results are largely consistent with the Western experience from the 2000s to the 2010s (Foley-Fisher et al. (2016) and Eser and Schwaab (2016)).

The results also indicate that the designated sectors, mainly the railway industry, were to be able to raise funds much cheaper than otherwise. This cheap money was supplied through socialization of investment risk for specific industries by the Bank of Japan.

In summary, the outcome of the unconventional monetary policy with a lower bound of the conventional monetary policy in Japan more than one century ago was largely analogous to those of the contemporary ones. While it avoided a financial meltdown, it distorted the market, which is captured as the lowered risk premium. Provided that the risk premium was lowered, the distortion was not a mass income transfer to investors. Instead, it was a socialization of the risk associated with corporate finance. Then, the evaluation of the social cost of the distortion is to be based on whether the target sector was relevant. In the Japan's case in the 1890s, this was railway industry. With upholding the share prices of railway companies, investment in the industry was rendered low-risk-low-return. Essentially, it turned not to be far away from public investments in the transportation system by the government bond issuance. Given that the demand for transportation was then rapidly growing in an emerging Japan, probably it was a reasonable pick.

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INSERT Appendix Table HERE

Source: TKP, TKVOL, TKPNCD, OSP, OSVOL, OSPND, OSPNCD, and BOJC, "Nippon Ginko Tokei Geppo," on file of the library of the Bank of Japan. TKDR and OSDR: Historical statistics provided by Institute for Monetary and Economic Studies, the Bank of Japan (http://www.imes.boj.or.jp/hstat/ Last accessed: August 2, 2016). Diffusion index: Fujino and Igarashi (1973), p. 75, Appendix Table 2–9.
Note: The data are available in the online version of this article at the publisher's website.

Supplementary information

Supplementary information is available in the online version of this article at the publisher's website:

Supplementary NDP: Annual data of Net Domestic Product of Japan, 1885–1929.

Supplementary BOJ: Monthly data of rediscounting by the Tokyo Central Office and the Osaka Branch of the Bank of Japan, from September 1890 to December 1899.

Supplementary TSE: Monthly data of rediscounting by Tokyo Central Branch, The Bank of Japan; discount rate of commercial notes by Tokyo Central Office, The Bank of Japan; stock prices at the Tokyo Stock Exchange; average interest rate in Tokyo prefecture; and diffusion index, from September 1890 to December 1899.

Supplementary OSE: Monthly data of rediscounting by Osaka Branch, The Bank of Japan; discount rate of commercial notes by Osaka Branch, The Bank of Japan; stock prices at the Tokyo Stock Exchange; average interest rate in Tokyo prefecture; and diffusion index, from September 1890 to December 1899.

Appendix Table Variable definitions.

$TKP_{i,t}$	Average share price of firm i in period t (month) at the Tokyo Stock Exchange: (traded value)/(traded volume).
$TKVOL_{i,t}$	(Traded volume of firm i at the Tokyo Stock Exchange in period t (month))+1.
$TKDR_t$	Official discount rate of the Tokyo Head Office of the Bank of Japan in period t (month).
$TKPND_t$	Value of the promissory notes that were rediscounted by the Tokyo Head Office of The Bank of Japan in period t (month).
$TKPNCD_t$	Value of the promissory notes collateralized by securities that were rediscounted by the Tokyo Head Office of the Bank of Japan in period t (month).
$OSP_{i,t}$	Average share price of firm i in period t (month) at the Osaka Stock Exchange: (traded value)/(traded volume).
$OSVOL_{i,t}$	(Traded volume of firm i at the Osaka Stock Exchange in period t (month))+1.
$OSDR_t$	Official discount rate of the Osaka Branch of the Bank of Japan in period t (month).
$OSPND_t$	Value of the notes collateralized by securities that were rediscounted by the Osaka Branch of the Bank of Japan in period t (month).
$OSPNCD_t$	Value of the notes collateralized by securities that were rediscounted by the Osaka Branch of the Bank of Japan in period t (month).
$BOJC_{i,t}$	Dummy variable of being designated as collateral of bills to be rediscounted by the Bank of Japan: =1 if share of firm i was designated in period t, 0 otherwise.
DI_t	Diffusion index.
C	Constant.

Source : TKP, TKVOL, TNPND, TKPNCD, OSP, OSVOL, OSPND, OSPNCD, and BOJC: "Nippon Ginko Tokei Geppo," on file at the library of the Bank of Japan. TKDR and OSDR: Historical Statistics provided by Institute for Monetary and Economic Studies, the Bank of Japan (http://www.imes.boj.or.jp/hstat/ Last accessed: August 2, 2016). Diffusion index: Shozaburo Fujino and Fukuo Igarashi, *Tokei Shiryo Series No.2, Keiki Shisu: 1888 −1940 nen (Statistics Data Series No.2 Diffusion Index: 18888 −1940)* , Institute of Economic Research, Hitotsubashi University, 1973, p. 75, Appendix Table 2−9.

Note : The date are available in the online version of this artile at the publisher's website.

Table 1 Financial policy and stock prices at the Tokyo Stock Exchange: Monthly, October 1890–May 1898.

	1–1			1–2			1–3		
Estimation method	panel least squares			panel least squares			panel least squares		
Dependent variable	$\log[TKP_{i,t}]$			$\log[TKP_{i,t}]$			$\log[TKP_{i,t}]$		
Cross-sectional dimension	fixed effect			fixed effect			fixed effect		
Period dimension	pooled (no control)			pooled (no control)			pooled (no control)		
Independent variables	coefficient	*t* statistc		coefficient	*t* statistc		coefficient	*t* statistc	
C	-0.713	-3.33	***	-0.415	-1.83	*	0.740	4.17	*
$\log[TKDR_t]$	-0.327	-5.48	***	-0.434	-6.58	***	-0.366	-6.01	***
$BOJC_{i,t}$				-0.914	-3.80	***	-1.943	-5.63	**
$\log[TKDR_t]\times BOJC_{i,t}$				0.457	3.88	***			
$\log[TKPND_t]$	0.074	6.25	***	0.076	6.32	***	0.076	6.32	***
$\log[TKPNCD_t]$	0.138	8.95	***	0.130	8.26	***	0.120	6.94	***
$\log[TKPNCD_t]\times BOJC_{i,t}$							0.060	2.43	**
$\log[DI_t]$	0.484	16.69	***	0.486	16.73	***	0.482	16.56	***
Cross sections observed	129			129			129		
Periods (month)	93 (1890/10–1898/05)			93 (1890/10–1898/05)			93 (1890/10–1898/05)		
Total observations	2,696			2,696			2,696		
adjusted R^2	0.86			0.86			0.86		
F statistic	125.36	***		124.23	***		123.72	***	

Source : See notes of **Appendix Table.**

Notes : For definitions of the variables, see **Appendix Table**. ***, **and * respectively denote 1 percent, 5 percent and 10 percent level of significance. The data are availabe in the online version of this article at the publisher's website.

Table 2 Financial policy and trade volumes at the Tokyo Stock Exchange: Monthly, October 1890–May 1898.

	2–1			2–2			2–3		
Estimation method	panel least squares			panel least squares			panel least squares		
Dependent variable	$\log[TKVOL_{i,t}]$			$\log[TKVOL_{i,t}]$			$\log[TKVOL_{i,t}]$		
Cross-sectional dimension	fixed effect			fixed effect			fixed effect		
Period dimension	pooled (no control)			pooled (no control)			pooled (no control)		
Independent variables	coefficient	*t* statistc		coefficient	*t* statistc		coefficient	*t* statistc	
C	9.079	8.21	***	12.834	11.21	***	15.869	13.02	***
$\log[TKDR_t]$	-4.807	-15.57	***	-6.007	-18.05	***	-4.988	-16.48	***
$BOJC_{i,t}$				-13.590	-11.19	***	-23.571	-12.61	***
$\log[TKDR_t]\times BOJC_{i,t}$				6.154	10.35	***			
$\log[TKPND_t]$	0.347	5.63	***	0.311	5.13	***	0.332	5.50	***
$\log[TKPNCD_t]$	-0.174	-2.18	**	-0.197	-2.49	**	-0.535	-6.20	***
$\log[TKPNCD_t]\times BOJC_{i,t}$							1.481	12.03	***
$\log[DI_t]$	1.037	6.91	***	0.981	6.68	***	0.905	6.21	***
Cross sections observed	129			129			129		
Periods (month)	93 (1890/10–1898/05)			93 (1890/10–1898/05)			93 (1890/10–1898/05)		
Total observations	2,697			2,697			2,697		
adjusted R^2	0.60			0.62			0.63		
F statistic	31.59	***		33.86	***		34.61	***	

Source : See notes of **Appendix Table.**

Notes : For definitions of the variables, see **Appendix Table**. ***, **and * respectively denote 1 percent, 5 percent and 10 percent level of significance. The data are availabe in the online version of this article at the publisher's website

Table 3 Financial policy and share prices at the Osaka Stock Exchange: Montly, October 1890–October 1899.

	3–1			3–2			3–3		
Estimation method	panel least squares			panel least squares			panel least squares		
Dependent variable	$\log[OSP_{i,t}]$			$\log[OSP_{i,t}]$			$\log[OSP_{i,t}]$		
Cross-sectional dimension	fixed effect			fixed effect			fixed effect		
Period dimension	pooled (no control)			pooled (no control)			pooled (no control)		
Independent variables	coefficient	*t* statistc		coefficient	*t* statistc		coefficient	*t* statistc	
C	0.841	3.51	***	2.262	8.67	***	1.849	6.68	***
$\log[OSDR_t]$	-0.588	-8.60	***	-1.176	-14.24	***	-0.630	-9.30	***
$BOJC_{i,t}$				-2.369	-11.32	***	-1.845	-6.74	***
$\log[OSDR_t]\times BOJC_{i,t}$				1.257	11.89	***			
$\log[OSPND_t]$	0.214	10.25	***	0.193	9.54	***	0.206	9.99	***
$\log[OSPNCD_t]$	-0.008	-0.50		-0.009	-0.57		-0.066	-3.59	***
$\log[OSPNCD_t]\times BOJC_{i,t}$							0.130	7.12	***
$\log[DI_t]$	0.263	8.33	***	0.264	8.67	***	0.262	8.42	***
Cross sections observed	99			99			99		
Periods (month)	106(1890/10–1899/10)			106(1890/10–1899/10)			106(1890/10–1899/10)		
Total observations	2,060			2,060			2,060		
adjusted R^2	0.87			0.88			0.87		
F statistic	131.27	***		139.79	***		132.92	***	

Source : See notes of **Appendix Table.**

Notes : For definitions of the variables, see **Appendix Table**. ***, **and * respectively denote 1 percent, 5 percent and 10 percent level of significance. The data are availabe in the online version of this article at the publisher's website.

Table 4 Financial policy and trade volumes at the Osaka Stock Exchange: Monthly, October 1890–May 1898.

	4–1			4–2			4–3		
Estimation method	panel least squares			panel least squares			panel least squares		
Dependent variable	$\log[OSVOL_{i,t}]$			$\log[OSVOL_{i,t}]$			$\log[OSVOL_{i,t}]$		
Cross-sectional dimension	fixed effect			fixed effect			fixed effect		
Period dimension	pooled (no control)			pooled (no control)			pooled (no control)		
Independent variables	coefficient	*t* statistc		coefficient	*t* statistc		coefficient	*t* statistc	
C	-2.113	-1.72	***	0.206	0.15		0.772	0.54	
$\log[OSDR_t]$	-0.531	-1.51	***	-1.419	-3.26	***	-0.679	-1.95	*
$BOJC_{i,t}$				-4.493	-4.07	***	-5.905	-4.19	***
$\log[OSDR_t]\times BOJC_{i,t}$				1.820	3.27	***			
$\log[OSPND_t]$	0.665	6.20	***	0.607	5.69	***	0.615	5.78	***
$\log[OSPNCD_t]$	-0.509	-5.90	***	-0.459	-5.34	***	-0.600	-6.38	***
$\log[OSPNCD_t]\times BOJC_{i,t}$							0.336	3.56	***
$\log[DI_t]$	1.875	11.62	***	1.834	11.46	***	1.826	11.42	***
Cross sections observed	99			99			99		
Periods (month)	106(1890/10–1899/10)			106(1890/10–1899/10)			106(1890/10–1899/10)		
Total observations	2,061			2,061			2,061		
adjusted R^2	0.64			0.65			0.65		
F statistic	37.36	***		37.69	***		37.74	***	

Source : See notes of **Appendix Table.**

Notes : For definitions of the variables, see **Appendix Table**. ***, **and * respectively denote 1 percent, 5 percent and 10 percent level of significance. The data are availabe in the online version of this article at the publisher's website.

Table 5 Equity risk premium of shares listed at the Tokyo Stock Exchange: 1880–1914.

year	Comsuer price index	growth rate of nominal per capita GNP	growth rate of real per capita GNP	Average ratio of change in share prices	Average dividend yield	Average equity return	Yield of risk-free asset: Yield of Japanese Government Bonds	Equity risk premium
	a	*b*	*c*	*d*	*e*	$f=d+e$	*g*	$i=f-g$
average 1880–1889	-0.081	1.422	2.037	11.582	5.838	17.419	6.587	10.832
average 1890–1899	3.379	8.308	2.073	1.222	3.794	5.016	4.991	0.025
average 1900–1909	3.028	3.910	0.487	2.721	3.837	6.558	5.469	1.089
average 1910–1914	1.682	3.336	0.417	4.332	3.326	7.658	5.069	2.589

Source : Kling, Nakabayashi, and Yuki (2009). Original sources are, a) share prices and diviends: *Tokyo Shoken Torihikijo Goju nenshi (Fifty years of Tokyo Stock Exchange)* , Tokyo: Tokyo Stock Exchange, 1928, b) GNP : Kazushi Okawa, Nobukiyo Takamatsu, and Yuzo Yamamoto, *Estimates of Long-Term Economic Statistics of Japan since 1868, volume 1, National Income* , Tokyo: Toyo Keizai Shinposha, 1974, p. 237, c) Consumer price index: Kazushi Okawa, Tsutomu Noda, Nobukiyo Takamatsu, Saburo Yamada, Minoru Kumazaki, Yuichi Shionoya and Ryoshin Minamin, *Estimates of Long-Term Economic Statistics of Japan since 1868, volume 8, Prices* , Tokyo: Toyo Keizai Shinposha, 1967, p. 135.

Table 6 Equity risk premium of shares listed at the Osaka Stock Exchange, 1880–1914.

year	Comsuer price index	growth rate of nominal per capita GNP	growth rate of real per capita GNP	Average ratio of change in share prices	Average dividend yield	Average equity return	Yield of risk-free asset: Yield of Japanese Government Bonds	Equity risk premium
	a	*b*	*c*	*d*	*e*	*f=d+e*	*g*	*i=f−g*
average 1880–1889	-0.75	1.36	3.44	17.93	5.42	23.36	5.72	17.64
average 1890–1899	3.38	8.31	2.07	4.24	4.75	8.99	4.99	4.00
average 1900–1909	3.03	3.91	0.49	2.87	6.21	9.08	5.47	3.61
average 1910–1914	1.68	3.34	0.42	0.93	5.17	6.10	5.07	1.03

Source : Kling, Nakabayashi, and Yuki (2009). Original sources are, a) share prices and dividends: *Daikabu Goju nenshi (Fifty years of the Osaka Stock Exchange)* , Osaka: Osaka Stock Exchange, 1928. b) GNP and consumer price index: see the notes of **Table 5**.

Figure 1 Net domestic product of Japan, 1885–1914.

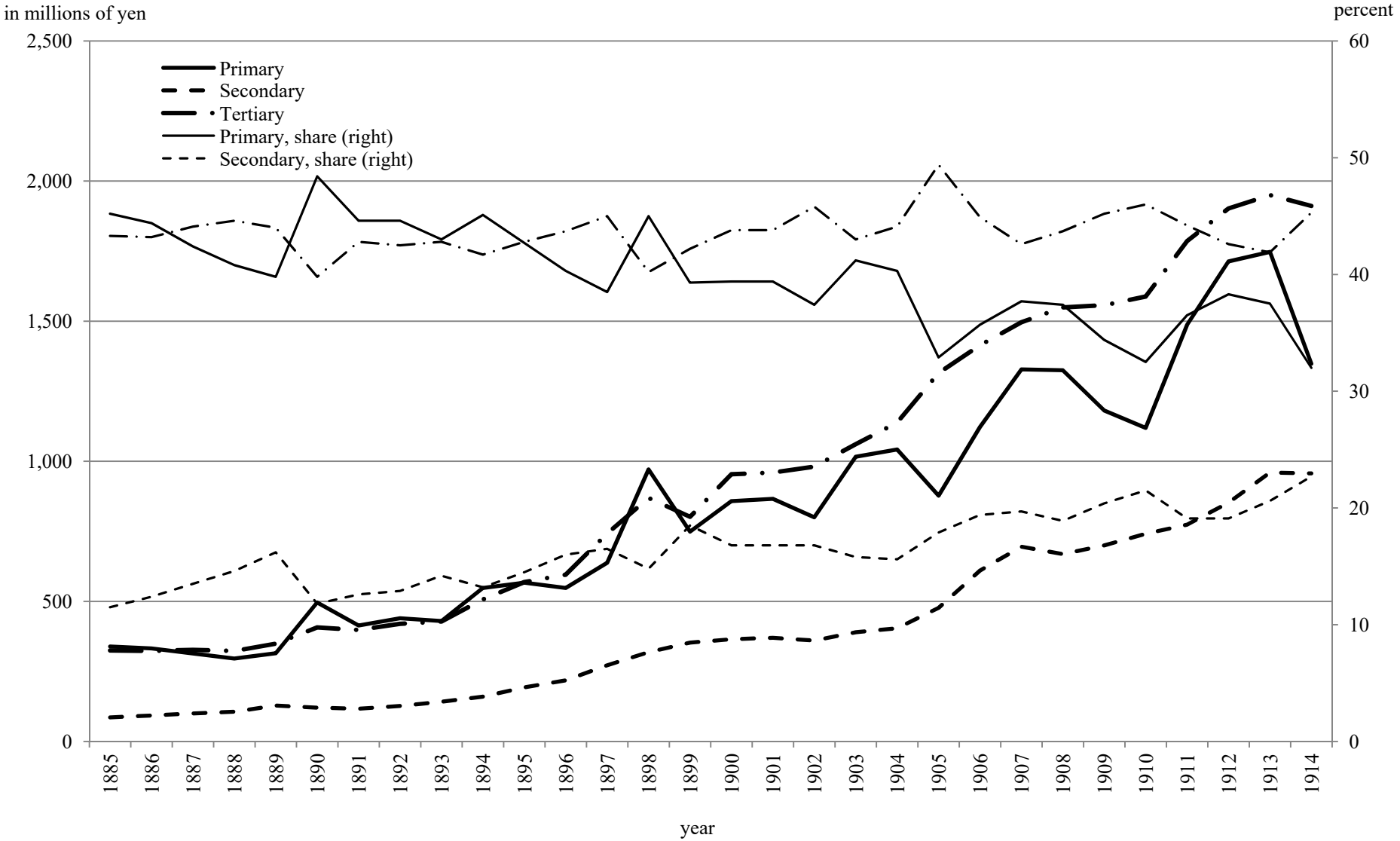

Figure 2 Rediscount of bills collateralized by designated shares by Tokyo and Osaka Branches of the Bank of Japan, monthly, August 1890–October 1899.