The globalisation of financial markets and monetary policy

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1. Introduction

It has been said that the recent globalisation of financial markets has been driven by increasing capital mobility among countries. Hence, we should consider what kind of impact the globalisation of financial markets has had on the effectiveness of monetary policy.

Looking at the movements of real long-term interest rates in the seven main industrialised countries, G7[2], it would seem that they have been equalising since the late 1980s.[3] And if this phenomenon reflects the equalisation of asset returns because of the global integration of financial markets, we cannot deny the effect in respect of the conduct of monetary policy. This is because monetary policy affects the real economy through various channels and, as one of these channels, the changing of the short-term interest rate by the central bank has an effect on domestic real economic conditions through its influence on the long-term interest rate. If the domestic real long-term interest rate converges to those of other countries, it will be more difficult for monetary policy to affect the long-term interest rate, and consequently its effects on the domestic real economy will be weakened.

Table 1
Difference in real long-term interest rate of each country and mean of the other countries

Sample period	US	JP	DE	UK	FR	IT	CA
1993Q1–1997Q4	2.04	4.52	3.04	4.80	1.33	3.63	1.66
1980Q1–1989Q4	1.14	1.65	1.52	1.76	1.42	1.75	1.53
1990Q1–1997Q4	1.00	1.03	0.97	0.84	0.85	2.11	0.99

Note: Figures represent the standard deviation of the real long-term interest rate of each country minus the mean of the other countries.

However, some previous studies have indicated that world capital markets are still far from perfectly integrated. In fact, monetary policy has seemingly influenced domestic long-term interest rates. In addition, many studies have pointed out that the phenomenon of "home bias", which means the preference of domestic investors to hold domestic assets, has been observed in many countries' markets in spite of globalisation.[4] The observations of home bias indicate that arbitrage transactions

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[2] The United States, Japan, Germany, the United Kingdom, France, Italy and Canada (referred to as MI-7 in the graphs).

[3] The movements of G7 real long-term interest rates are plotted in Chart 1. The standard deviations of differences in the real long-term interest rate of each country and the mean values of other countries' rates are smaller in the 1980s and 1990s than the 1970s, except for some countries and periods (Table 1).

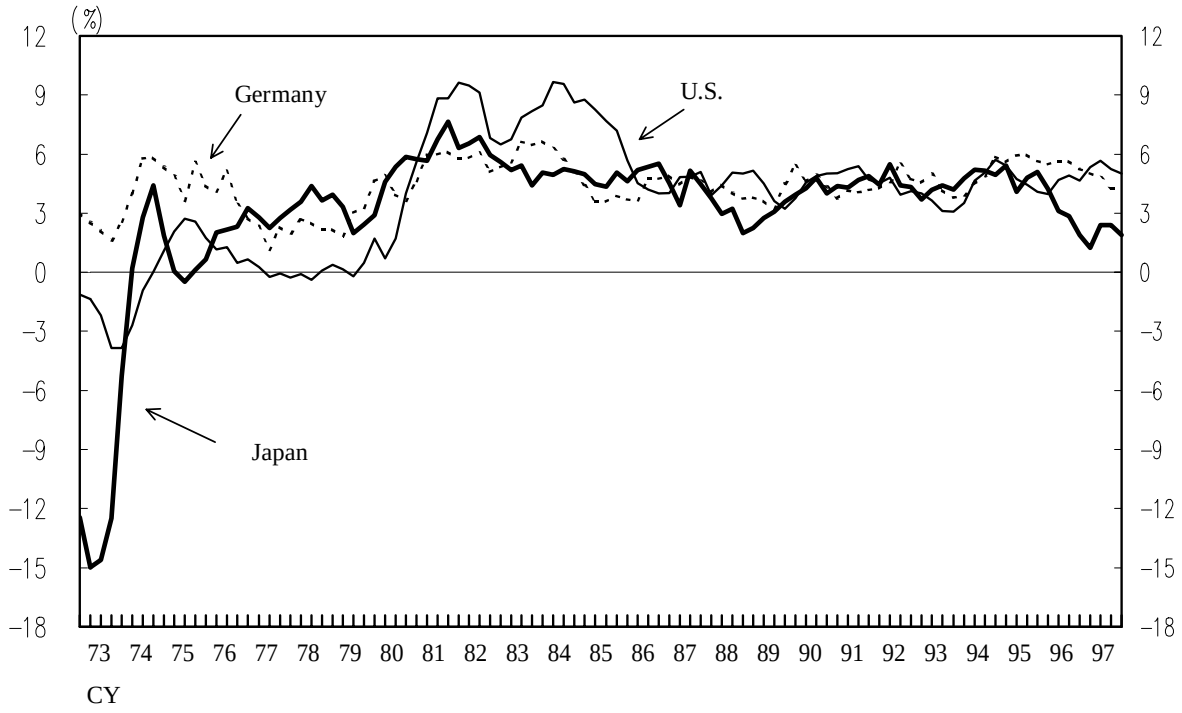
[4] Most of the analyses dealing with home bias focus on the stock markets. For example, French and Poterba (1991) tried to measure investors' portfolios and expected asset returns in three countries, the United States, Japan and the United Kingdom, based on several assumptions. Results indicate that (1) domestic stocks account for the greatest weight in their portfolios: i.e. 94% for the United States, 98% for Japan and 82% for the United Kingdom, and (2) investors in these countries expect the highest returns from their own country's stocks. For example, Japanese investors expect a return of 6.6% from their domestic stock markets, which is about 3 points higher than the figures of 3.2% for US investors and 3.8% for UK investors. Other analyses focusing on home bias include Tesar and Werner (1992), Frankel (1993) and Kang and Stultz (1995).

among countries do not work sufficiently and that various asset returns have not yet perfectly equalised.

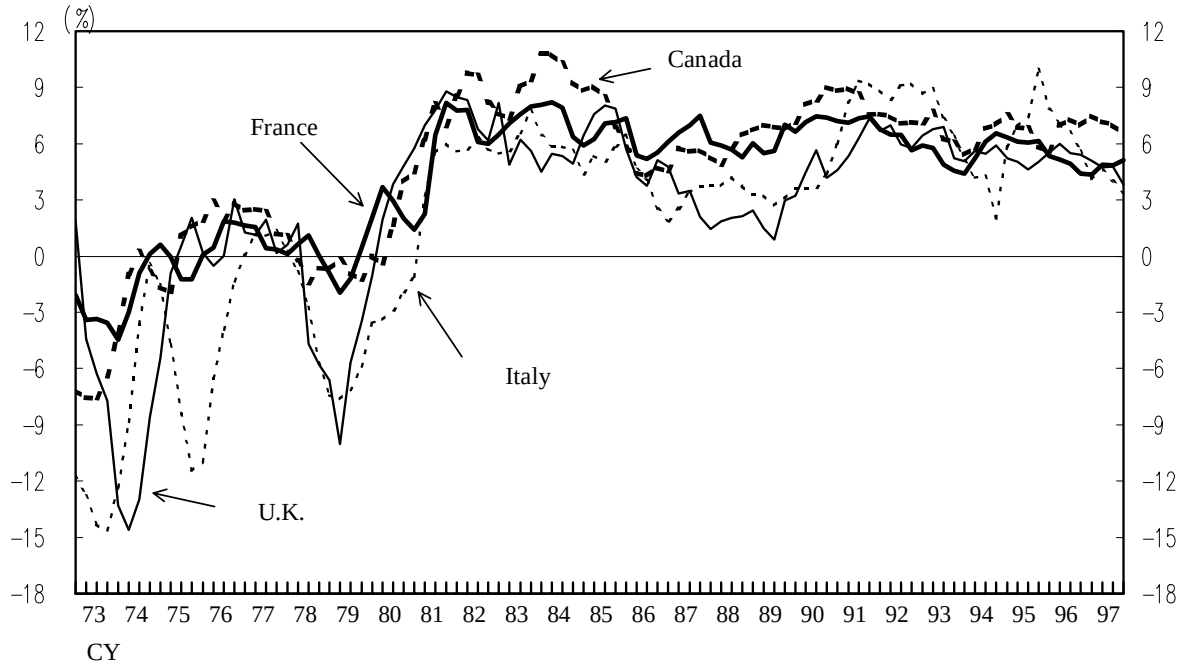
Chart 1

Real Long-Term Interest Rates of MI-7 Countries

(1) U.S., Japan, Germany



(2) U.K., France, Italy, Canada



On the other hand, domestic short-term interest rates are, in general, under the control of the central bank despite the globalisation of financial markets. However, in the case of a global financial shock, the central bank has to conduct, in a sense, bold money market operations to mitigate the impact on domestic financial markets.

In this paper, we look at the determinants of real interest rates in G7 countries and the impact of the global financial crisis in autumn 1998 on Japanese short-term financial markets, in order to examine the effectiveness of monetary policy amid the globalisation of financial markets.[5]

In Section 2, we analyse empirically the determinants of real interest rates in G7 countries and consider the implications. In Section 3, we consider central banks' control of domestic short-term interest rates under the stress of a global financial shock by reviewing the experiences of Japan's short-term financial markets in autumn 1998. The last section concludes the analysis and indicates possible subjects for future study.

2. Determinants of real interest rates in G7 countries

In this section, we analyse the determinants of real long-term interest rates in G7 countries in order to examine the effectiveness of monetary policy amid the globalisation of financial markets.

2.1 Determinants of real interest rates and factors preventing their equalisation

As monetary policy has direct effects on the nominal short-term interest rate, it also has a significant influence on the real short-term interest rate, defined as the difference between the nominal short-term interest rate and the expected rate of inflation (Chart 2). On the other hand, the real long-term interest rate reflects real domestic economic conditions over the long horizon, being affected by the real short-term interest rate.

If world financial and capital markets were perfectly integrated, real interest rates would be equalised internationally through the interest arbitrage transactions across different countries. However, it is generally thought that world real interest rates have not yet been equalised across countries and that differences in real domestic and foreign interest rates remain.[6]

In the portfolio model of two country asset markets, the real interest rate difference is expressed by the sum of the expected change in the real exchange rate and the risk premium which stems from imperfect substitution between domestic and foreign assets (Fukao (1990)). This risk premium should be regarded as a home bias phenomenon in that domestic investors prefer holding domestic rather than foreign assets. There are several reasons why domestic and foreign assets are imperfect substitutes, including exchange rate volatility risk, differences in default risk, institutional aspects such as taxation or regulation of foreign exchange transactions, conventions regarding the payment of principal and interest, and cash transfers.[7]

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5 Details of data properties and sources are described in the Appendix.

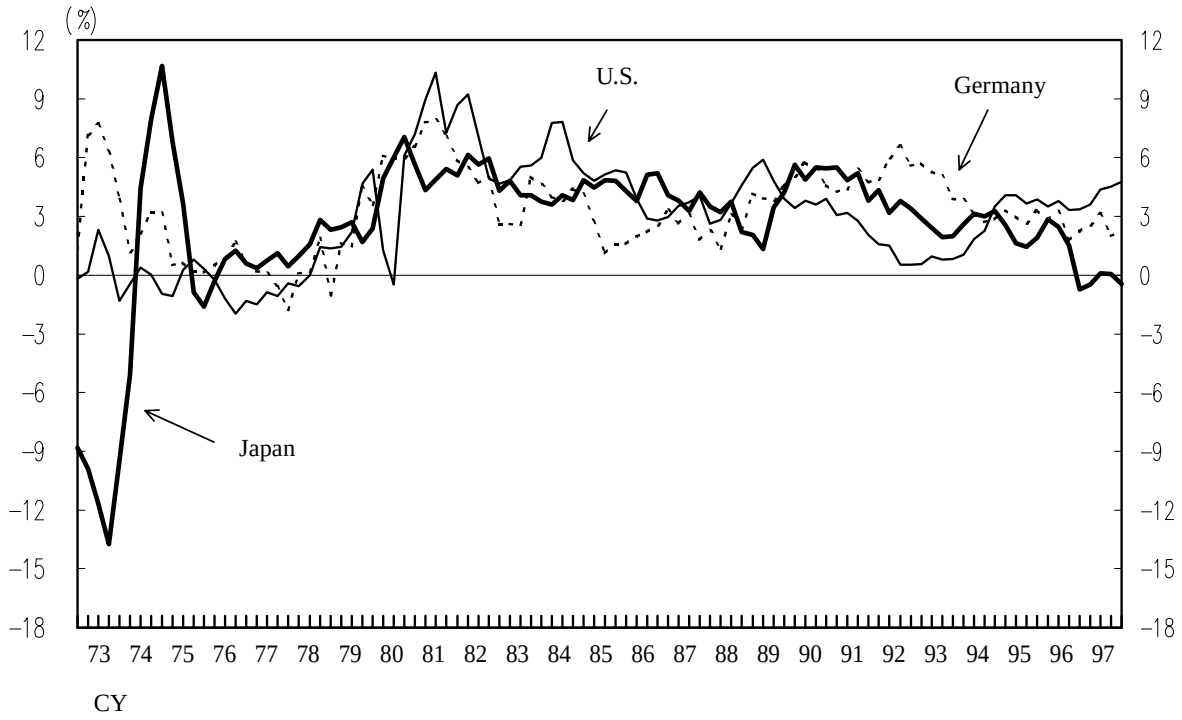
6 For example, Mishkin (1984) showed empirically that domestic real interest rates in different countries have not yet been equalised. Barro and Sala-i-Martin (1990) also described empirical results showing that domestic real interest rates are significantly affected not only by world factors such as world saving rates or world investment rates, but also by domestic factors. From these analyses, it can be inferred that real interest rates in different countries are still affected by domestic factors even amid the globalisation of financial markets.

7 An explanation of the risk premium stemming from the imperfect substitution between domestic and foreign assets comes from Kawai (1994). Shiratsuka and Nakamura (1998) point to five factors which prevent international investment diversification: (1) exchange rate volatility risk, (2) institutional and social factors in each country, (3) asymmetric information, (4) various kinds of regulations imposed on financial transactions, and (5) sovereign risk.

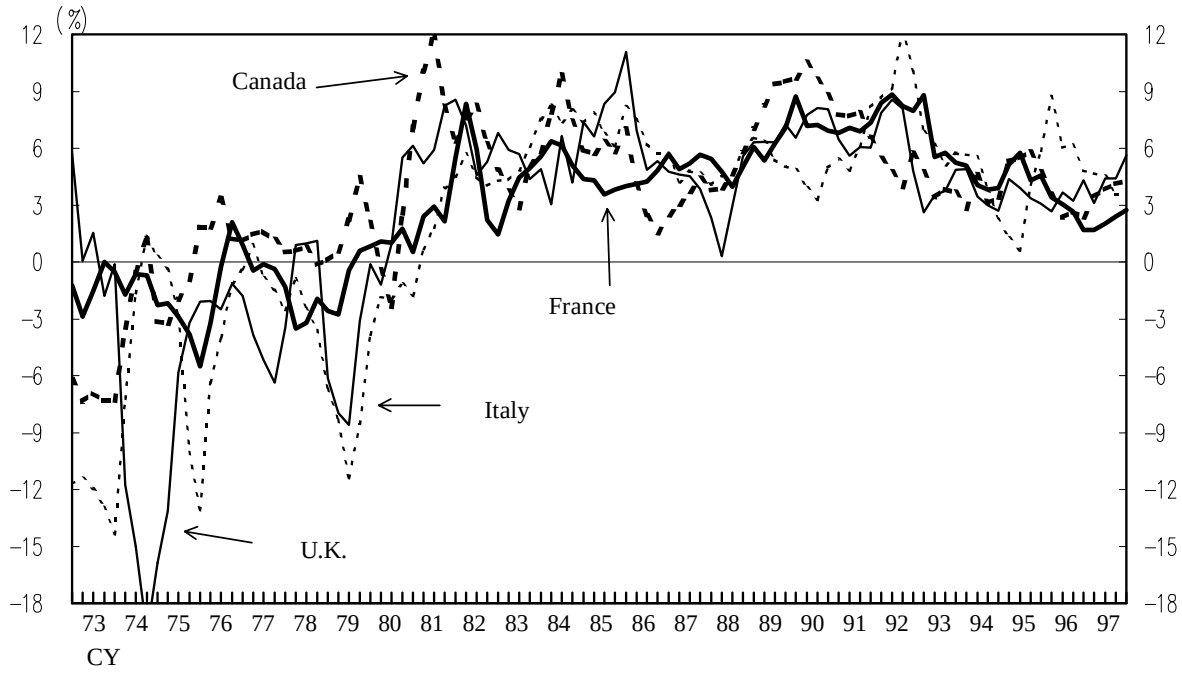
Chart 2

Real Short-Term Interest Rates of MI-7 Countries

(1) U.S., Japan, Germany



(2) U.K., France, Italy, Canada



2.2 The panel analysis

2.2.1 The model of empirical analysis

In this section, we study the determnation of real interest rates in G7 countries by empirical analysis using panel data, in order to focus on the relationship between globalising financial markets and the effectiveness of monetary policy.[8]

From the previous section, we can see that domestic monetary policy does, to some degree, affect the real long-term interest rate through its effects on the real short-term interest rate and arbitrage transactions between short- and long-term interest rates. However, if real interest rates in different countries were equalised, there would be less room for monetary policy in each country to affect globally equalised real interest rates. Thus, in the empirical analysis, as an explanatory variable we took the real short-term interest rate as a proxy for domestic monetary policy in order to determine whether monetary policy has significant effects on the domestic real long-term interest rate amid the globalisation of financial markets.

In addition, we used the accumulated ratio of domestic current accounts to nominal GDP (hereafter referred to as CA/GDP) as an explanatory variable in order to determine whether the risk premium stemming from the imperfect substitution of domestic and foreign assets is reflected in the domestic real long-term interest rate. An increase in CA/GDP simultaneously means an increase in both foreign assets held by domestic investors and the risk attaching to holding them. Thus, the increase in CA/GDP lowers the domestic real long-term interest rate and raises foreign real interest rates by an amount corresponding to that risk premium (Chart 3).[9]

The model specification[10] is as follows:

$$(1) \qquad r_{i,t}^{L} = \alpha_0 + \beta_i + \gamma_t + \alpha_1 r_{i,t}^{S} + \alpha_2 CAG_{i,t} + \varepsilon_{i,t}$$

where $r_{i,t}^{L}$ is the real long-term interest rate of G7 country i in period t, $r_{i,t}^{S}$ is the real short-term interest rate,[11] $CAG_{i,t}$ is CA/GDP and $\varepsilon_{i,t}$ is the error term. Two sets of dummy variables are

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8 The framework of the empirical analysis in this section is based on Ishi (1996).

9 Note that CA/GDP, which is only a proxy variable for the imperfect substitution between domestic and foreign assets, does not necessarily reflect all factors causing this imperfect substitution as described earlier.

10 As described previously, the difference between domestic and foreign real interest rates depends both on the risk premium stemming from imperfect substitution between domestic and foreign assets and on expected changes in the real exchange rate. To estimate the effects of expected changes in the real exchange rate on the real long-term interest rate, we added deviations of actual real effective exchange rates of G7 countries from their trends to the explanatory variable of the regression model, as suggested by Ishi (1996), and re-estimated it. The proxy for expected changes in the real exchange rate has significant effects on the real long-term interest rate. That is, if the actual real exchange rate is higher than its trend for one period, market participants are assumed to expect the real exchange rate to depreciate and the real long-term interest rate in the investors' country is higher than those of other countries. On the other hand, two other variables of this model, the real short-term interest rate and CA/GDP, have almost the same effect on the real long-term interest rate even when the model is estimated without the variable of expected change in the real exchange rate. This suggests that not only the risk premium stemming from the imperfect substitution between domestic and foreign assets but also the expected change in the real exchange rate possibly influence the spread between domestic and foreign real interest rates. However, the proxy variable in the above model may not be reliable in representing expectations of future exchange rate changes because its movement depends the detrended model used. We therefore disregard the expected real exchange rate in the analysis below.

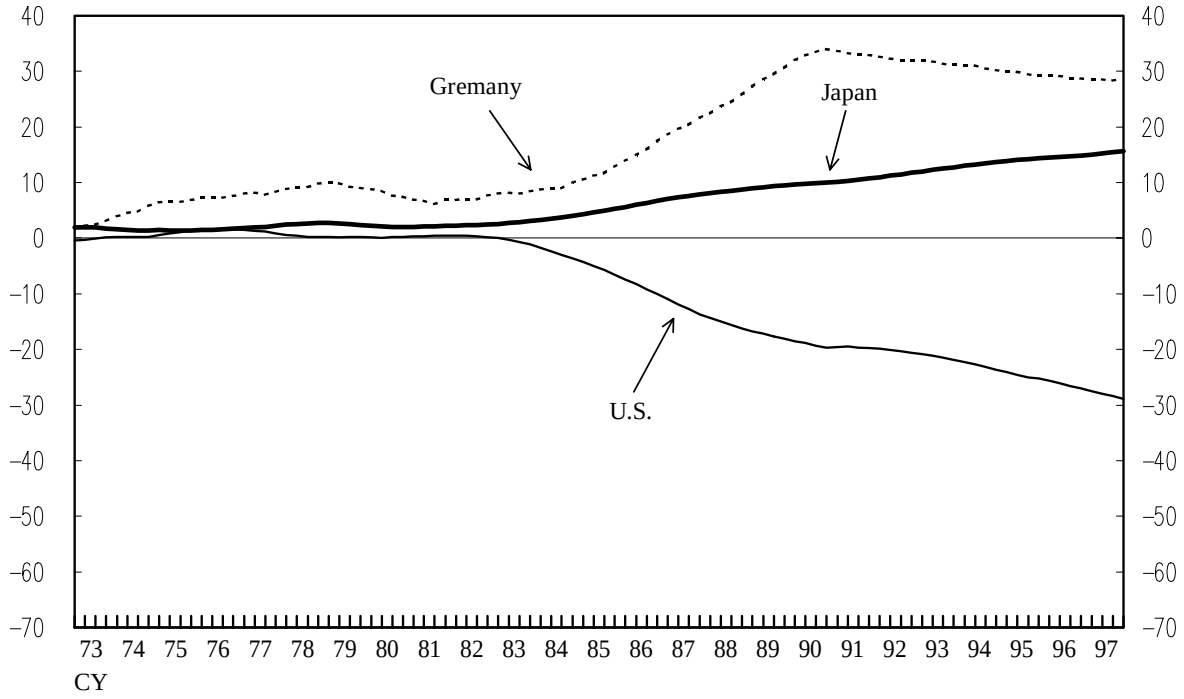
11 In general, it is difficult to calculate the real interest rate of different countries. In this section, we determine the real short-term interest rate by subtracting GDP deflator changes from one quarter earlier to two quarters later from the nominal short-term interest rate. This is equivalent to assuming that investors forecast inflation two quarters ahead based on actual inflation information. On the other hand, the real long-term interest rate is calculated by subtracting GDP deflator changes one year ahead from the nominal long-term interest rate. This is equivalent to assuming that investors forecast inflation one year ahead, with more forward-looking behaviour in the long run than in the short run.

included in the model: the country dummies, β_i, which capture domestic factors and time dummies, γ_t, which capture common shocks to all countries in one period, such as global financial

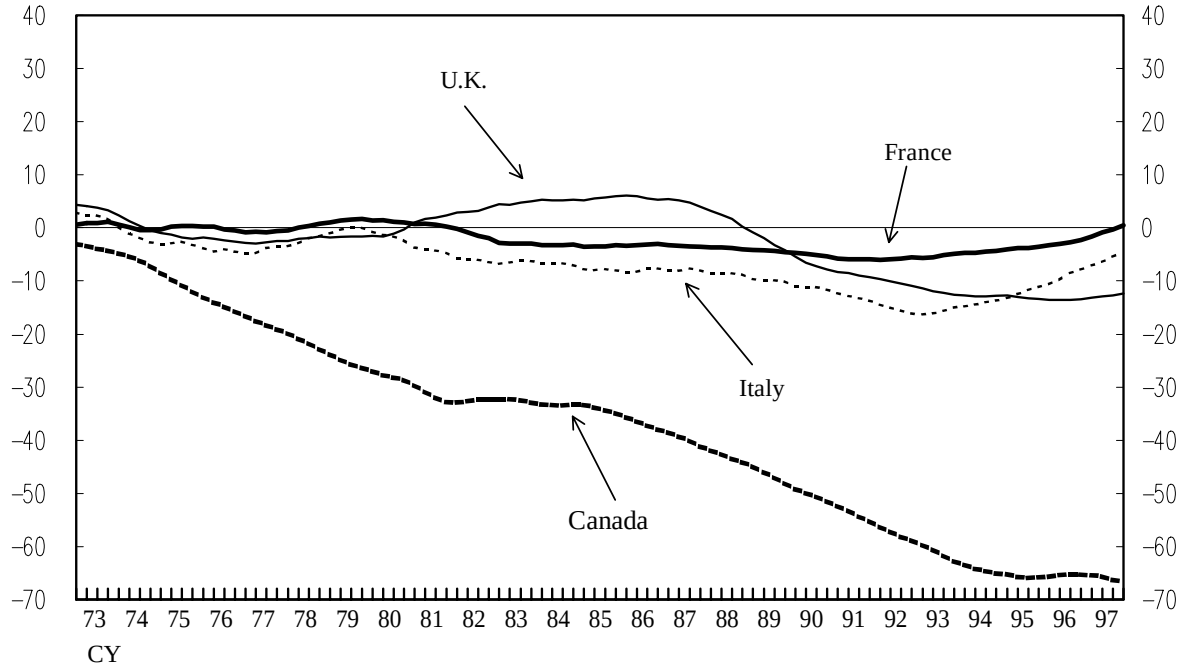
Chart 3

CA/GDP of MI-7 Countries

(1) U.S., Japan, Germany



(2) U.K., France, Italy, Canada



shocks.[12] The parameter for CA/GDP, α_2, is expected to be negative theoretically. In this empirical analysis, we estimate the above regression model for three periods using quarterly data.[13] The first period, 1973Q1–1980Q4, is characterised by acceleration of inflation, the second period, 1981Q1–1986Q4, by deceleration of inflation, and the third period, 1987Q1–1997Q4, by price stability. We also estimate the model using the rolling regression method with 10-year window to investigate how the estimated parameters change in different sample periods.

2.2.2 Estimation results and implications

The results of the empirical analyses are shown in Table 2 and Chart 4-3. In the following, we discuss the main results and the implications.

(1) The real short-term interest rate, a proxy variable for monetary policy, significantly affects the real long-term interest rate in all sample periods, which implies that domestic monetary policy also has a significant effect on it even amid the globalisation of financial markets.

Table 2
Estimation results of panel analysis
(results for three sample periods)

Sample period from 1973Q1 to 1980Q4

Explanatory variable	Dependent variable: real long-term interest rate				
	OLS	One-way fixed effect	One-way random effect	Two-way fixed effect	Two-way random effect
Constant term	0.193		0.092	–0.085	0.029
	(0.95)		(0.30)	(0.52)	(0.08)
Real short-term interest rate	0.748**	0.622**	0.691**	0.515**	0.617**
	(17.84)	(13.02)	(15.90)	(12.62)	(16.73)
CA/GDP	0.029	–0.105*	–0.002	0.016	0.016
	(1.11)	(1.91)	(0.04)	(0.35)	(0.51)
Lagrange multiplier test: One-and two-way random effect vs OLS			13.86		61.42
			(0.00)		(0.00)
Hausman test: One-way fixed vs one-way random effect			12.31		38.19
			(0.00)		(0.00)
Adjusted R-squared	0.588	0.633		0.773	
	Hypothesis test (p-values are in parentheses)				
	Likelihood ratio test: x^2			F-test	
One-way fixed effect vs OLS	32.52			5.51	
	(0.00)			(0.00)	
Two-way fixed effect vs OLS	176.35			5.80	
	(0.00)			(0.00)	
Two-way fixed effect vs one-way fixed effect	144.30			5.37	
	(0.00)			(0.00)	

[12] The country and time dummies are included in all sample periods because statistical tests reject the null hypothesis that they are equal to zero.

[13] The historical movements of three variables in the model, the domestic real long-term interest rate, the real short-term interest rate and CA/GDP of the relevant G7 country, are shown in Charts 1 to 3.

Table 2 (cont.)

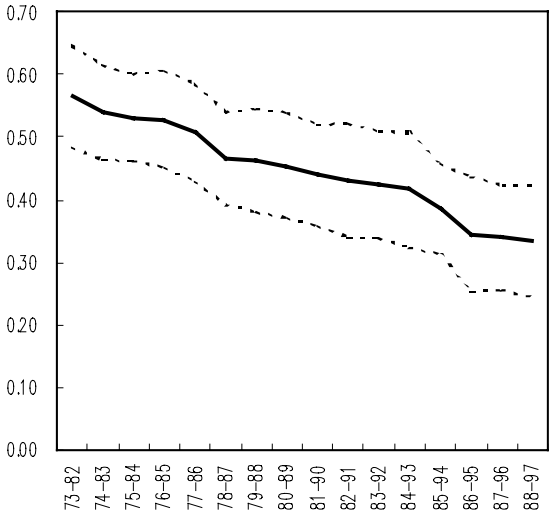
Sample period from 1981Q1 to 1986Q4					
Constant term	3.975*		4.024**	4.615**	4.390**
	(12.91)		(9.16)	(15.42)	(9.89)
Real short-term interest rate	0.415**	0.409**	0.410**	0.317**	0.342**
	(7.55)	(7.60)	(7.68)	(6.63)	(7.39)
CA/GDP	–0.035**	–0.003	–0.029	–0.005	–0.028
	(3.99)	(0.07)	(1.30)	(0.13)	(1.34)
Lagrange multiplier test: One- and two-way random effect vs OLS			55.24		85.44
			(0.00)		(0.00)
Hausman test: One-way fixed vs one-way random effect			0.39		5.02
			(0.82)		(0.08)
Adjusted R-squared	0.349	0.464		0.660	
	Hypothesis test (p-values are in parentheses)				
	Likelihood ratio test: x^2			F-test	
One-way fixed effect vs OLS	38.77			6.88	
	(0.00)			(0.00)	
Two-way fixed effect vs OLS	142.65			6.06	
	(0.00)			(0.00)	
Two-way fixed effect vs one-way fixed effect	103.88			5.06	
	(0.00)			(0.00)	
Sample period from 1987Q1 to 1997Q4					
Constant term	3.470**		3.499**	3.161**	3.447**
	(20.48)		(13.12)	(14.69)	(12.73)
Real short-term interest rate	0.340**	0.303**	0.296**	0.346**	0.314**
	(9.57)	(8.49)	(8.41)	(8.30)	(8.93)
CA/GDP	–0.024**	–0.093**	–0.043**	–0.057**	–0.040**
	(8.00)	(7.24)	(6.11)	(4.44)	(5.78)
Lagrange multiplier test: One- and two-way random effect vs OLS			94.14		127.11
			(0.00)		(0.00)
Hausman test: One-way fixed vs one-way random effect			22.76		4.89
			(0.00)		(0.09)
Adjusted R-squared	0.386	0.511		0.602	
	Hypothesis test (p-values are in parentheses)				
	Likelihood ratio test: x^2			F-test	
One-way fixed effect vs OLS	76.411			14.03	
	(0.00)			(0.00)	
Two-way fixed effect vs OLS	188.99			4.34	
	(0.00)			(0.00)	
Two-way fixed effect vs one-way fixed effect	112.58			2.63	
	(0.00)			(0.00)	

Notes: Figures in parentheses below the estimated parameters indicate t-values. ** and * indicate significance of the estimated parameters at the 1% and 5% levels respectively. In the process of model selection, the smaller the p-value of likelihood ratio- and F-tests, the more the one-way fixed effect model is likely to be preferred to either OLS or the one-way fixed effect model. In addition, the smaller the p-value of the Lagrange multiplier test, the more the one-way and two-way random effect models are likely to be chosen than OLS. And the smaller the p-value of the Hausman test, the more the one-way and two-way fixed models are likely to be chosen than one-way and two-way random effect models. The selected models are shaded.

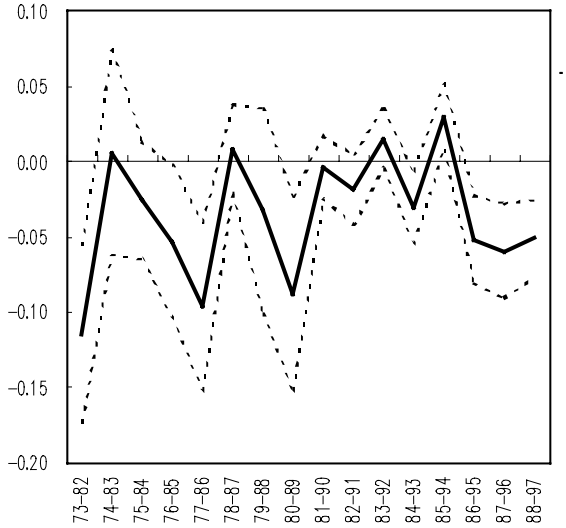
Chart 4-3

(2) Results of Rolling Regression

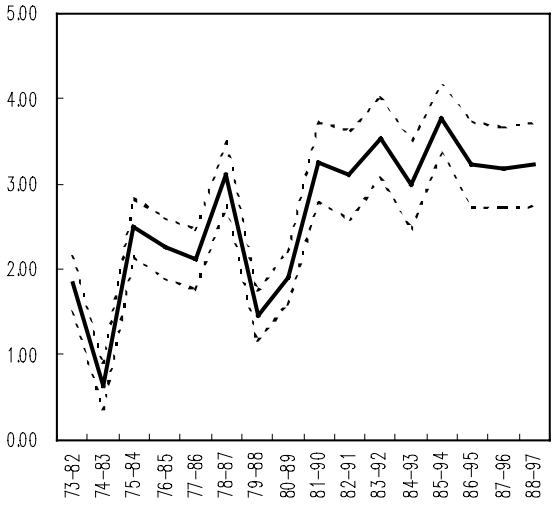
(A) Real short-term Interest Rate



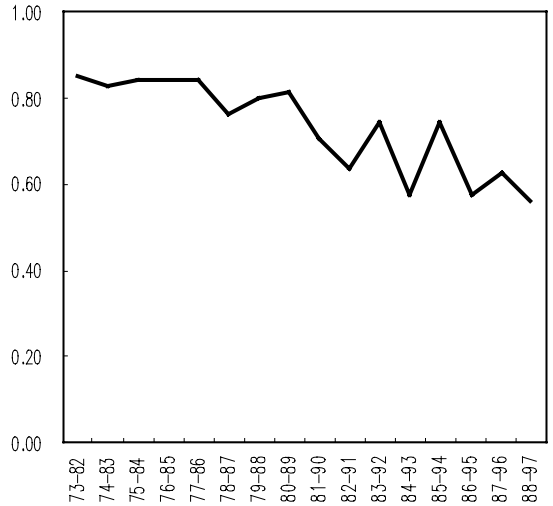
(B) CA/GDP



(C) Constant Term



(D) Adjusted R-Squared



Note:
(1) Two way fixed effect models are chosen in all sample periods. The model contains both country and time dummies in explanatory variables. Here we omit their estimation results.
(2) In the above charts, the bold lines indicate the estimated parameters of explanatory variables in the model, and dotted lines estimated parameters ± 2 × their standard deviations, which indicates a 5 percent significance level.

However, the later the sample period, the smaller the estimated parameter of the real short-term interest rate, α_1. Thus, the influence of monetary policy on the real long-term interest rate has been decreasing year by year.

(2) From the late 1980s, the parameter for CA/GDP, α_2, has had a significant effect on the real long-term interest rate. This implies that the risk premium stemming from imperfect substitution between domestic and foreign assets has pushed down the real long-term interest rate of the

country which holds net foreign assets, and pushed up that of the country which holds net foreign liabilities.[14]

In other words, this risk premium implies that the more foreign assets domestic investors have, the higher the returns they require for compensation for risks involved in holding such assets.

Note that the parameter for CA/GDP is significant only in the sample periods after the late 1980s. This is because the current account imbalances in G7 countries were so small in the 1970s and early 1980s that the effect of CA/GDP could not be extracted by empirical analysis, although the mechanism of home bias had possibly worked even in those periods. On the other hand, as current account imbalances increased after the late 1980s, the phenomenon of home bias has become statistically significant.

(3) There seems to be little difference between the determinants of real long-term interest rates in Japan and the other G7 countries. This can be confirmed by decomposing the sum of squared residuals of the model into the part contributed by each country. Although the weight contributed by Japan is higher than those of other countries except for the United Kingdom in sample period 1, it is almost the same as them or rather lower in sample periods 2 and 3, as shown in Table 3. These facts suggest that the determinants of Japan's real long-term interest rate are not necessarily much different from those in other G7 countries.

The fact that Japan's real long-term interest rate is relatively lower than those of G7 countries in the later periods is consistently explained by the following two factors: the low real short-term interest rate, brought about by the Bank of Japan's extremely easy monetary policy, and the large positive CA/GDP, which has held down Japan's real long-term interest rate until now.

Table 3
Analysis of sum of squared residuals of the model

Sample period	US	JP	DE	UK	FR	IT	CA	Sum of the squared residuals	R-squared
(1) Contribution of each country									
1973Q1–1980Q4	0.84	4.46	1.83	7.04	0.81	2.33	1.28	18.59	81.41
1981Q1–1986Q4	2.39	4.05	2.43	5.29	3.77	3.02	6.55	27.50	72.50
1987Q1–1997Q4	2.49	2.69	3.11	5.46	4.03	12.10	3.14	33.02	66.98
Sample period	US	JP	DE	UK	FR	IT	CA	SUM	
(2) Country weight									
1973Q1–1980Q4	4.54	23.98	9.86	37.85	4.37	12.53	6.87	100.00	
1981Q1–1986Q4	8.68	14.73	8.82	19.24	13.72	10.98	23.82	100.00	
1987Q1–1997Q4	7.53	8.16	9.42	16.53	12.22	36.64	9.51	100.00	

Note: The contributions of each country to the sum of squared residuals of the model in (1) are multiplied by 100.

[14] The risk premium imposed on holding foreign assets may include some sovereign risk of the country issuing these foreign bonds. In this analysis, we tried to use the ratio of financial liability of general government to nominal GDP, as a proxy for sovereign risk, as the explanatory variable. However, we did not find evidence that the variable has a significant effect on the real long-term interest rate.

3. Effects of the global financial crisis on Japanese financial markets in autumn 1998

Generally speaking, domestic short-term interest rates are likely to be under the control of the central bank even given the globalisation of financial markets. However, can we say that the domestic short-term financial market is well controlled by the central bank in the event of global financial stress?

In autumn 1998, we observe that either a deterioration in the creditworthiness of Japanese financial institutions in the eyes of market participants or a credit contraction with a drying-up of dollar liquidity led to an increase in the Japan premium imposed on dollar fundings amid the global financial crisis. As a result, Japanese short-term interest rates were exposed to upward pressure.

Below, we review the behaviour of Japanese financial institutions and arbitrage relationships among some financial markets in autumn 1998 (Section 3.1), and consider the Bank of Japan's control over the domestic short-term financial market (Section 3.2).

3.1 The Japan premium, market interest rates and the behaviour of financial institutions

The Japan premium[15] (Chart 5), which reflects the differences in dollar funding costs of Japanese and foreign financial institutions, increased by 1 percentage point in autumn 1997, when the Hokkaido Takushoku Bank and Yamaichi Securities went bankrupt. Afterwards, although it decreased to 0.2 points temporarily in May 1998, it began to quickly increase again and reached 0.91 points at the beginning of November.[16]

According to market participants, the reason for the increase in the Japan premium in 1998 was the same as in 1997 in that the creditworthiness of Japanese financial institutions had deteriorated, that is, solvency risk had heightened.[17] However, the surge in autumn 1998 was probably affected by greater dollar liquidity risk,[18] which led to Japanese financial institutions finding it difficult to raise dollar funds. Reasons were both a credit contraction and a drying-up of dollar liquidity in global financial markets that were caused by the Russian debt crisis – the depreciation of the Russian rouble and subsequent debt moratorium – and the near-collapse of LTCM.

Faced with such a difficult financial situation, Japanese financial institutions tried to procure yen funds in domestic and global financial markets and to convert them into dollar funds through yen/dollar swap transactions.[19] Consequently, this added to the demand for yen funds, which were necessary for yen/dollar swap transactions. This, together with a rise in the risk premium attaching to yen fundings of Japanese financial institutions, increased upward pressure on yen interest rates. The risk premium for raising yen funds, as given by the difference between the euroyen TIBOR and the risk-free yen treasury bill rate, widened from October to the beginning of November, as shown in Chart 6.

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15 In this section, we define the Japan premium as three-month dollar TIBOR minus three-month dollar LIBOR.

16 When Cosmo Credit Cooperative, Kizu Credit Cooperative and Hyogo Bank went bankrupt and the illegal transactions in the New York branch of Daiwa Bank were exposed in 1995, the creditworthiness of Japanese financial institutions deteriorated and the Japan premium increased. For details of the Japan premium in autumn 1997, see Bank of Japan (1998).

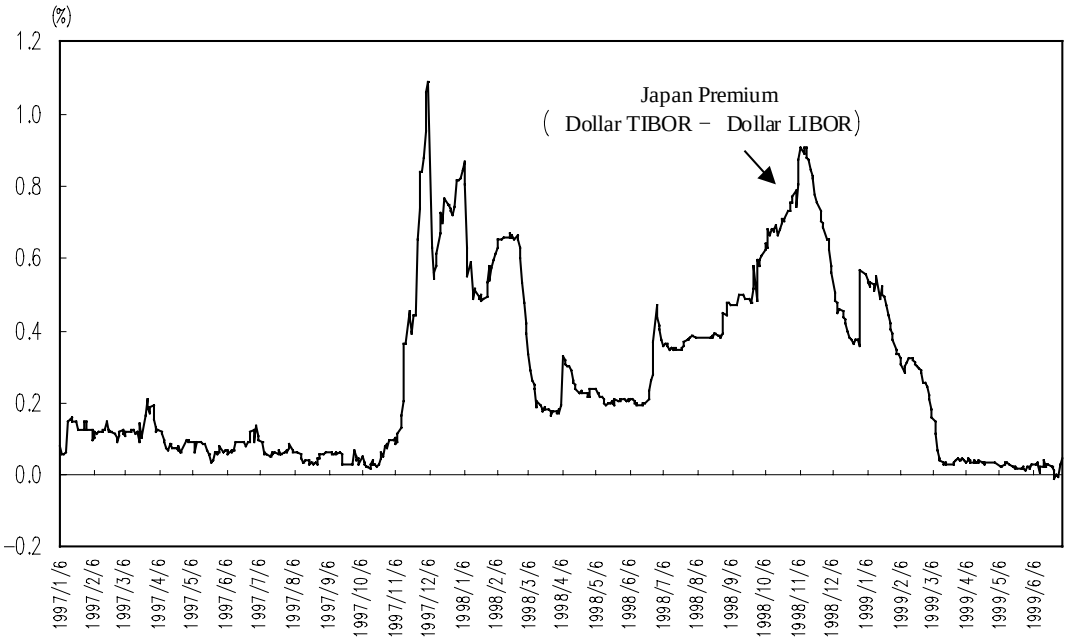
17 In 1998, the failure of LTCB, whose bankruptcy was rumoured in June and which was temporarily nationalised in October, and uncertainty over the passing of laws for the revitalisation of the financial system increased concerns about the soundness of Japanese financial institutions and the entire Japanese financial system.

18 Conceptually, the Japan premium is equal to the premium on the default risk of Japanese financial institutions compared with that of foreign financial institutions. The default risk is the sum of solvency risk and liquidity risk. However, it is quite difficult to directly observe solvency and liquidity risk.

19 In this case, transactions in which Japanese financial institutions receive dollars and foreign financial institutions yen at the start date, and Japanese financial institutions receive yen and foreign financial institutions dollars at the predetermined forward exchange rate on the end date of the transactions.

Chart 5

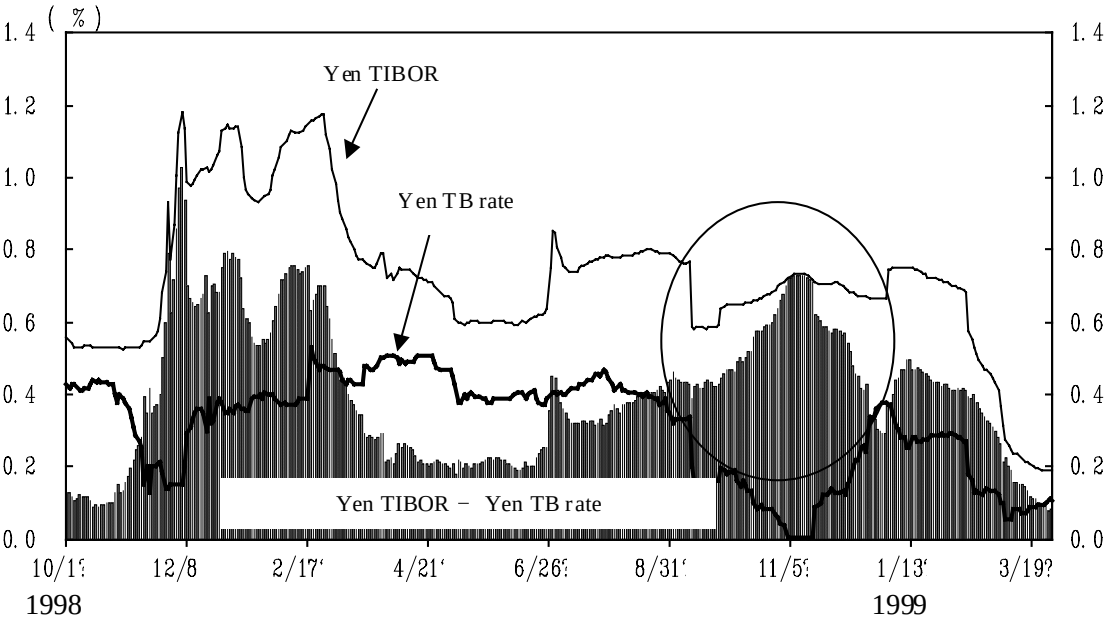
Japan Premium



Note:
3-month Dollar TIBOR and 3-month Dollar LIBOR.

Chart 6

Short-term Interest Rates



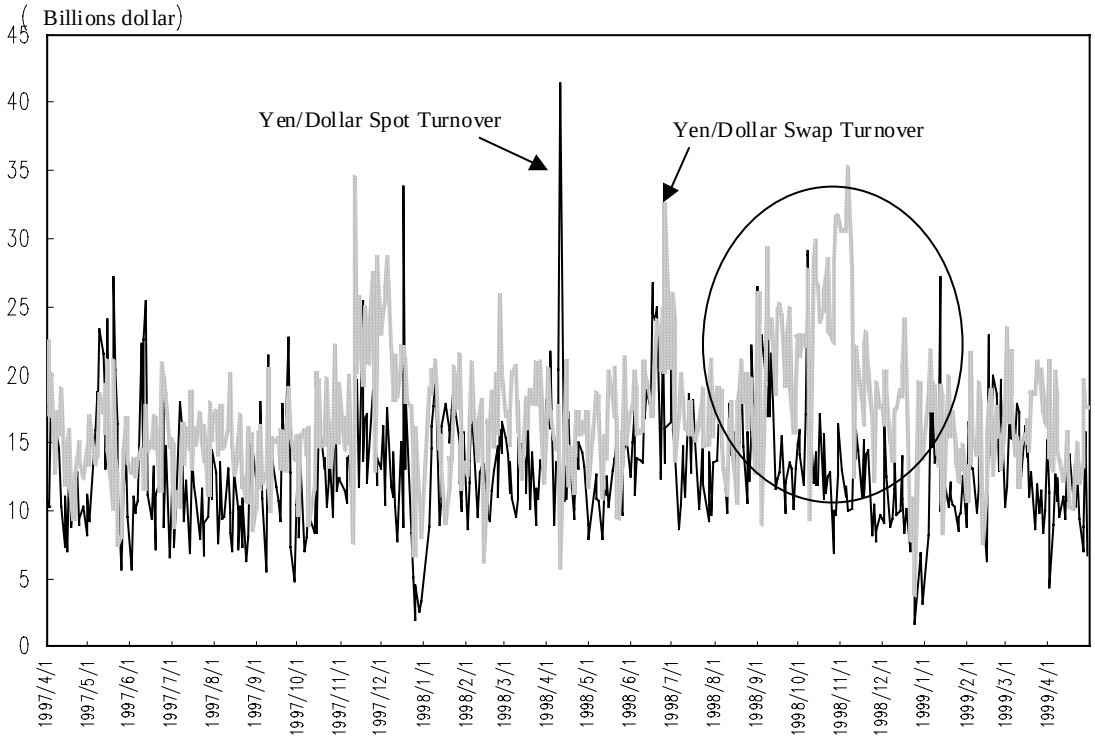
Note:
3-month Yen TIBOR and 3-month Dollar LIBOR.

The reason Japanese financial institutions engaged in a lot of yen/dollar swap transactions at that time is that such transactions were easier than uncollateralised direct dollar fundings. This implies that whereas the supply side of dollar funds bears the counterparty's default risk in uncollateralised

transactions, in yen/dollar swap transactions, in which foreign financial institutions receive yen as collateral, there is relatively less risk. Therefore, yen/dollar swap transactions provided a good opportunity to raise dollar funds for Japanese financial institutions with relatively low credit ratings, which could hardly raise dollar funds without collateral.[20]

Chart 7

Yen/Dollar Spot and Yen/Dollar Swap Turnover



If Japanese financial institutions could have raised dollar funds smoothly through yen/dollar swap transactions, the liquidity risk portion of the Japan premium would have been eliminated, although the solvency risk portion would have partially remained. However, when the global financial crisis occurred in autumn 1998, the suppliers of dollar funds, especially foreign financial institutions, tended to restrict yen/dollar swap transactions with Japanese financial institutions.[21] Hence, the difficulty faced by Japanese financial institutions in procuring foreign currency was not eased immediately.

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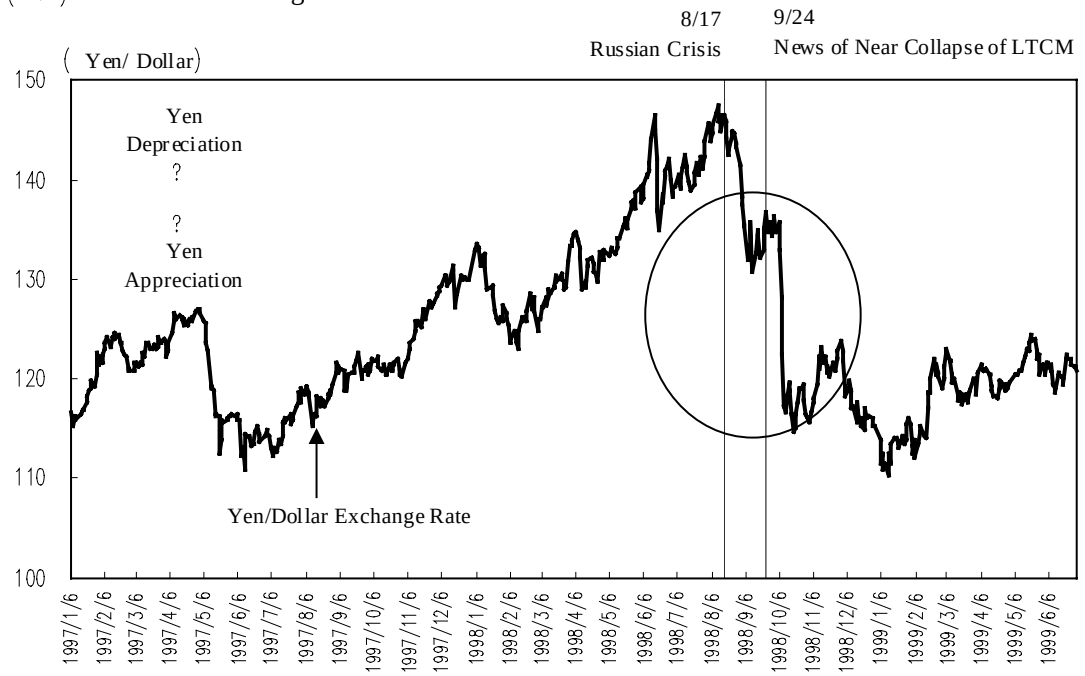
[20] Chart 7 shows that yen/dollar swap turnover was more than yen/dollar spot turnover in autumn 1997 and autumn 1998, as Hanajiri (1999) pointed out in his paper.

[21] Some possible factors explaining the behaviour of foreign financial institutions are as follows: first, profits of many foreign financial institutions had deteriorated and their risk-taking capacity had weakened due to global financial shocks in autumn 1998. In addition, they experienced large volatility in the yen/dollar spot exchange rate, as shown in Chart 8, and had few opportunities to invest yen funds (obtained through yen/dollar exchange swap transactions with Japanese financial institutions) in risk-free assets (since there were insufficient risk-free assets, i.e. yen treasury and financing bills) in Japan's short-term financial market (Hanajiri (1999)).

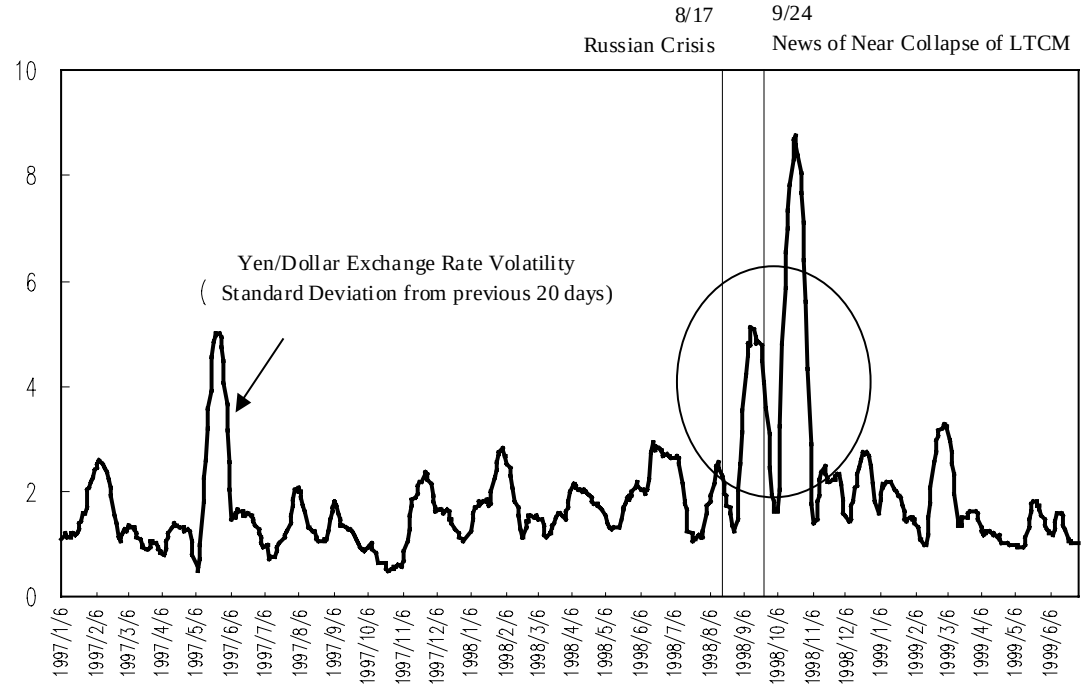
Chart 8

Yen/Dollar Exchange Rate and Volatility

(1) Yen/Dollar Exchange rate



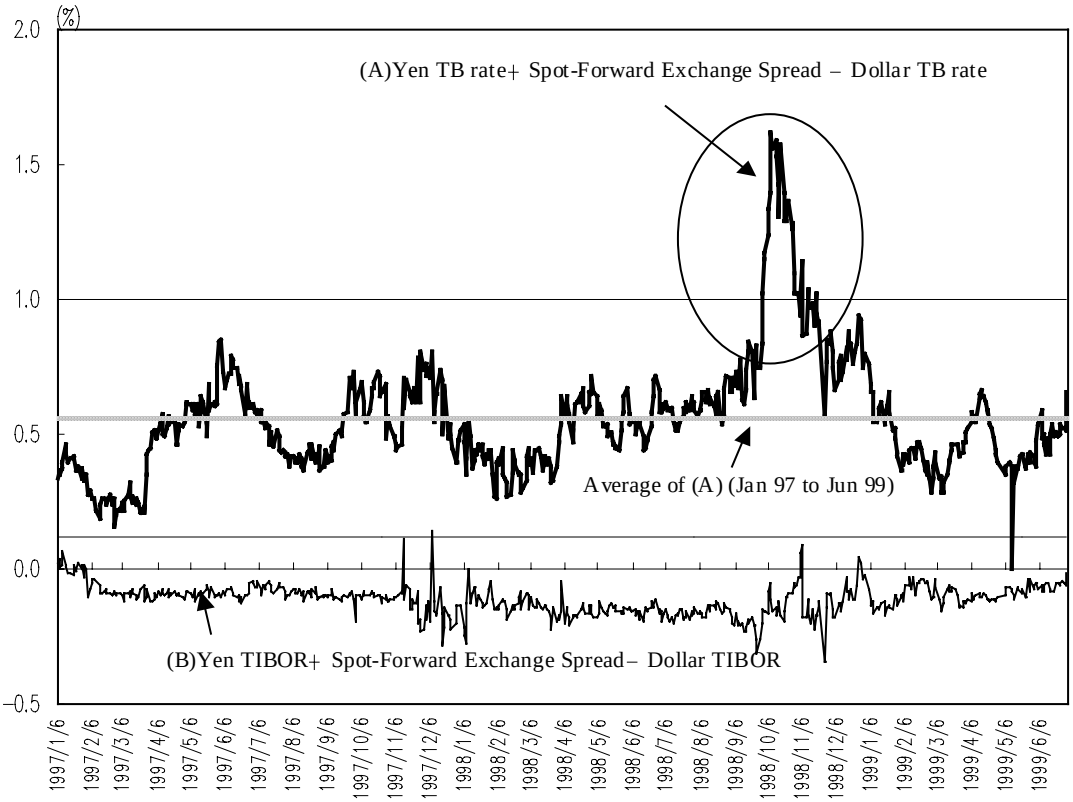
(2) Yen/Dollar Exchange Rate Volatility



With the quantitative restriction, prices do not work efficiently to clear the markets. In autumn 1998, as foreign financial institutions restricted yen/dollar swap transactions, a distortion of arbitrage transactions between domestic and foreign interest rates was observed in short-term financial markets. As shown in Chart 9, the arbitrage relation between yen and the dollar risk-free rates, that is, yen and

Chart 9

Arbitrage Relation between Yen/Dollar Markets



Notes:
(1) The lines above and below the average (A) "Yen TB rate+ Spot-Forward Exchange Spread− Dollar TB rate" are the average ±2 × standard deviation.
(2) The Yen TB rate, Dollar TB rate, Yen TIBOR, and Dollar TIBOR are 3-month terms.

dollar treasury bill rates, adjusted by the spot and forward exchange rate spread, was not maintained, a phenomenon which was not observed in autumn 1997.[22]

In the same way, the spread between the cost for foreign financial institutions of converting from dollar to yen funds and the yen treasury bill rate, whose mean value is around 0.15% on average, decreased remarkably or went below zero from the end of September to December 1998.[23] This suggests the strong risk-averting stance of foreign financial institutions and the existence of quantitative restrictions on yen/dollar swap transactions.[24]

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[22] According to Chart 9, on the other hand, the arbitrage relation between yen and dollar TIBOR adjusted by the yen/dollar spot and forward exchange spread was maintained in this period.

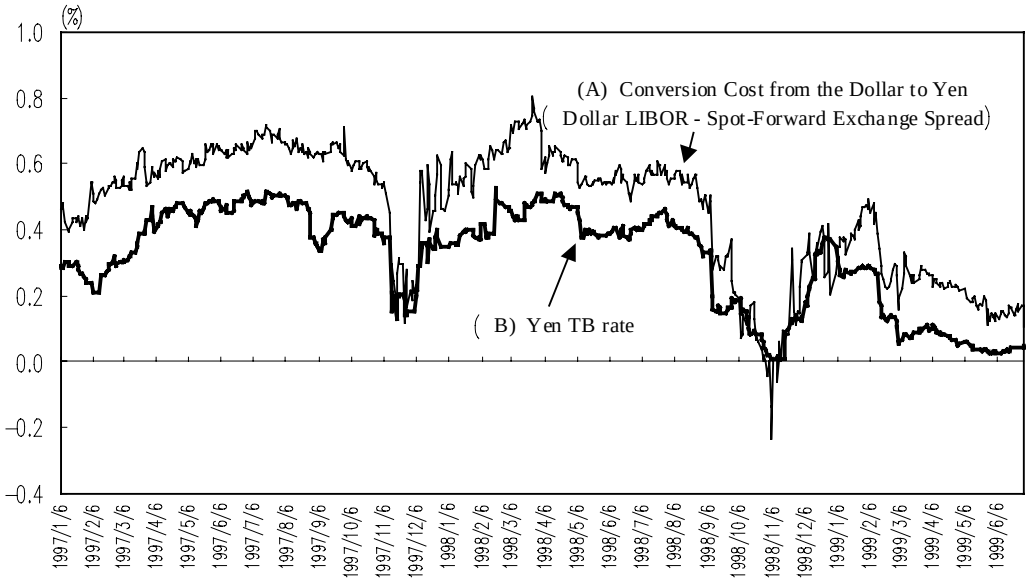
[23] In autumn 1997, we can also observe an increase in the gap between the cost for foreign financial institutions of converting from yen to dollar funds and the yen treasury bill rate. However, the narrowing of this gap in autumn 1998 was more pronounced and longer than in autumn 1997.

[24] Reasons for the arbitrage distortion in Charts 9 and 10 are that the yen treasury bill rate was too low to decline in the face of a zero bound and that a deterioration in the creditworthiness of Japanese financial institutions was reflected in the yen treasury bill rate. However, periods in which the yen treasury bill rate was zero were few during the arbitrage distortion period. In addition, although one private rating company, Moody's Investors Service, lowered its rating on yen bonds

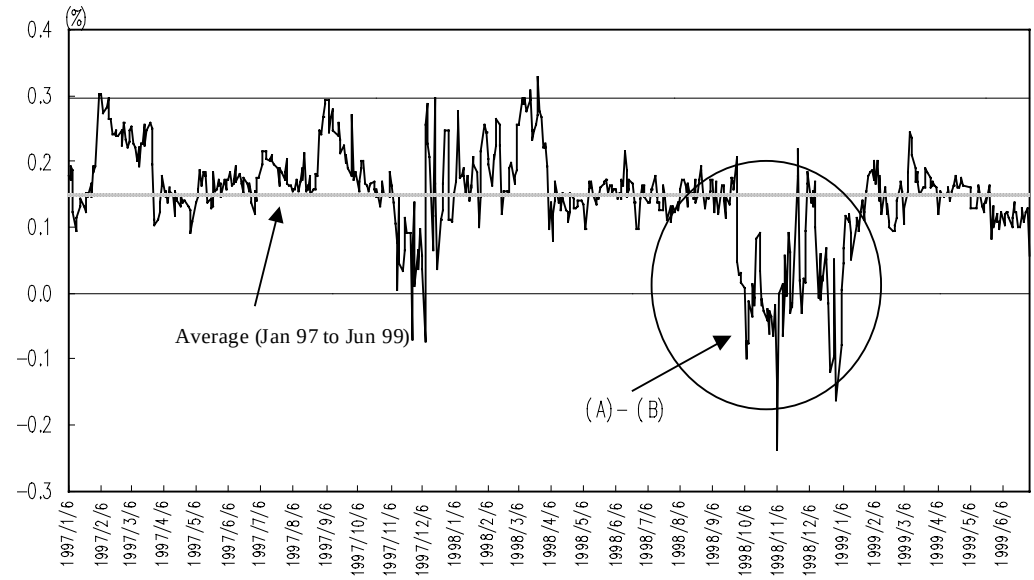
Chart 10

Conversion Costs of Foreign Financial Institutions from the Dollar to Yen and the Yen TB Rate

(1) Conversion Cost of Foreign Financial Institutions from the Dollar to Yen, and the Yen TB Rate.



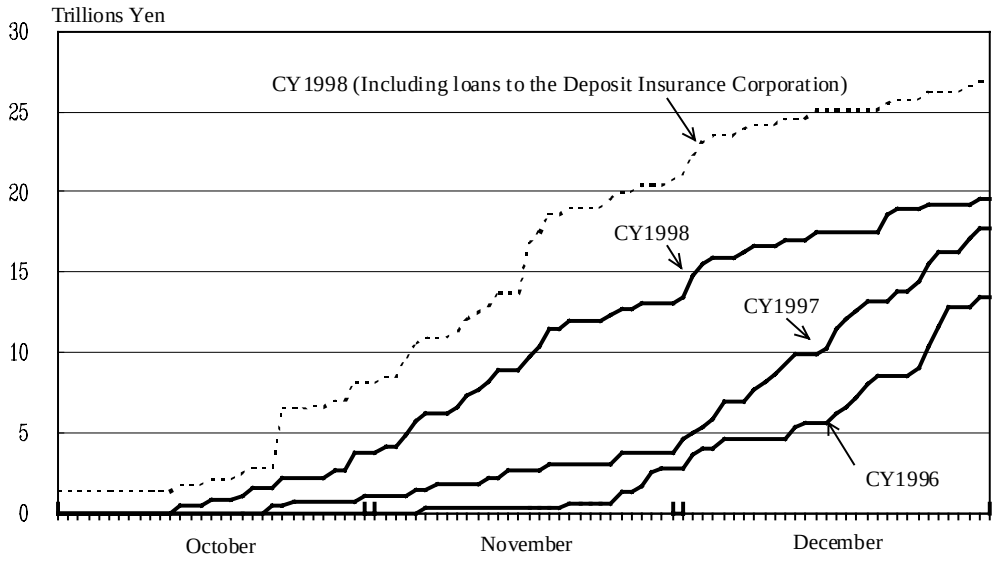
(2) (A) − (B)



Notes:
(1) The lines above and below the average (A) "Conversion Cost of foreign financial institutions from the Dollar to Yen" minus (B) "Yen TB rate" in the lower panel are average series ± 2 × standard deviation.
(2) 3-month Yen TB rate and 3-month Dollar LIBOR.

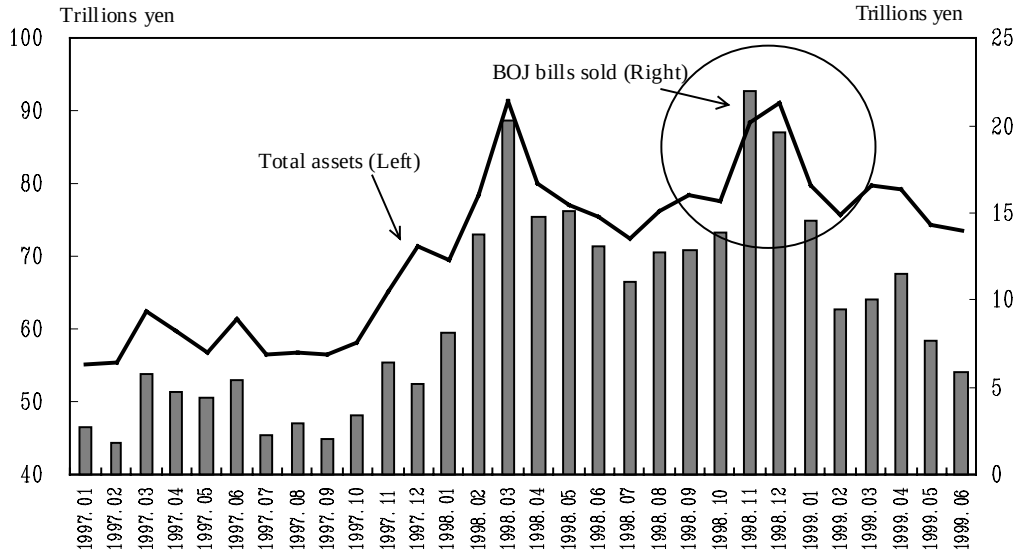
issued and secured by the Japanese government from Aaa to Aa1 on 17 November 1998, distortion of the arbitrage relation had already been observed. Hence, we believe that this analysis are not affected by such factors.

Injection of Yen Funds beyond the End of the Calendar Year



Note:
The injection of yen includes loans except for the special loans provided under Article 38 of the Bank of Japan Law of 1997 (Article 25 of the former Bank of Japan Law), outright purchases of bills and some money market operations, such as purchases of TBs/FBs under repurchase agreement, JGB repo operations, purchases of JGB under repurchase agreements and purchases of CPs under repurchase agreement.

BOJ Bills Sold and Total Assets of the Bank of Japan



Note:
BOJ bills sold and total assets of the Bank of Japan as of the end of each month.

3.2 Monetary policy operations of the Bank of Japan and their effects

In response to this tough financial situation, the Bank of Japan conducted money market operations by injecting ample yen funds using instruments with relatively long maturities (beyond the end of the calendar year) in order to mitigate the upward pressure on short-term yen interest rates. Simultaneously, the Bank absorbed excess yen funds by selling bills with short maturities in an attempt to prevent the overnight call rate, Japan's interbank rate, from decreasing excessively (Chart 11; Bank of Japan (1999)). These money market operations had the following effects.

First, the injection of ample yen funds for conversion into dollar funds had a direct effect in mitigating upward pressure on the short-term yen interest rates caused by the procurement of yen funds.

Second, the injection of ample yen funds implies that the Bank of Japan supplied these funds for Japanese financial institutions to convert into dollars. In this way, the Bank of Japan supported Japanese financial institutions' dollar financing. At this time, in fact, because foreign financial institutions restricted quantities in yen/dollar swap transactions, the difficulty of Japanese financial institutions in raising dollars was not completely eased. However, if it had not been for the Bank of Japan's money market operations, the Japanese financial situation might have been more confused.

Third, market participants complained that Japanese markets for risk-free yen assets, such as treasury bills and financing bills, were so small that foreign financial institutions were forced to restrict yen/dollar swap transactions (see footnote 21). In reality, excessive demand for treasury bills is evidenced by the fact that the treasury bill rate fell to zero at the beginning of November 1998. In this respect, the operations of the Bank of Japan to absorb excess yen by BOJ bill sales contributed to providing risk-free yen assets to the market, and consequently led to the activation of yen/dollar swap transactions. In fact, most of the buyers of these bills were foreign financial institutions (Shirakawa (1999)).

Lastly, the easing of dollar procurement by Japanese financial institutions, described above, seemed to reduce the default risk of Japanese financial institutions and the Japan premium. These effects also worked to reduce the short-term yen interest rate by decreasing the risk premium on yen funds.

From the above discussions, the money market operations of the Bank of Japan in autumn 1998, that is, the aggressive injection of yen and BOJ bill sales, had some effect in mitigating upward pressure on yen interest rates induced by both the drying-up of dollar liquidity and the malfunction of swap transactions. Nonetheless, it could not mitigate the increase in the Japan premium stemming from solvency risk.

In addition, global financial markets regaining stability after the interest rate reductions by the Federal Reserve and increased confidence in Japan's financial system following the enactment of financial legislation enabled the short-term yen interest rate to decrease after mid-November.

4. Concluding remarks

In this paper, we analysed both the determinants of real interest rates in G7 countries and the impact of the global market crisis in autumn 1998 on Japan's short-term financial market, in order to examine the effectiveness of monetary policy amid the globalisation of financial markets.

From the empirical analysis of the determinants of real interest rates in G7 countries in Section 2, we found that monetary policy has a significant effect on domestic real long-term interest rates, and that the risk premium stemming from the imperfect substitution between domestic and foreign assets also had a significant impact from the late 1980s. The latter indicates a home bias whereby domestic investors require higher returns for holding foreign assets. In addition, the determinants of Japan's real long-term interest rate are not much different from those in other countries. All this implies that the real interest rates of different countries have not yet been equalised, and that monetary policy still has a significant effect on the domestic economy through its influence on the real long-term interest rates despite the globalisation of financial markets.

However, it should be noted that the estimation results show that the direct effects of monetary policy on real long-term interest rates have been gradually weakening over time. In this respect, it is worthwhile to explore the effects of monetary policy on real long-term interest rates further, including indirect effects through the risk premium.[25]

In Section 3, we considered the effects of the global financial crisis in autumn 1998 on Japan's short-term financial market. The increase in the Japan premium and upward pressure on short-term yen interest rates were aggravated by the contraction in dollar lending and swap transactions by foreign financial institutions, not to mention the erosion of Japanese financial institutions' creditworthiness. These phenomena of credit contraction and the drying-up of dollar liquidity were observed in the distortion of the arbitrage relation between Japanese and US short-term financial markets.

To tackle this situation, the Bank of Japan injected ample yen funds using instruments with relatively long maturities (beyond the end of the calendar year) on one hand, and absorbed excess yen funds through BOJ bill sales to prevent the overnight call rate from excessively decreasing on the other. These money market operations are likely to have contributed to mitigating upward pressures on the short-term interest rate through the direct effect of the supply of yen funds and the indirect effect of prompting Japanese financial institutions to convert yen into dollars, which consequently reduced the Japan premium and risk premium on yen funds.

[25] According to the results of rolling regression, the adjusted-R squared falls from about 0.8 to 0.6 as in later sample periods. This suggests that the explanatory power of the real short-term interest rate and CA/GDP with respect to the real long-term interest rate has been weakening. In this paper, we did not investigate further, however, it is important to consider those factors amid the globalisation of financial markets.

Appendix

Determinants of the real interest rates in MI-7 countries

Data	Content	Source
Real long-term interest rate	The real long-term interest rate is the nominal long-term interest rate minus inflation one year ahead. $r^{L}_{i,t} = i^{L}_{i,t} - [(P_{i,t+4} / P_{i,t}) - 1)]$ where $r^{L}_{i,t}$ is the real long-term interest rate of country *i* in period *t*, $i^{L}_{i,t}$ the nominal long-term interest rate and $P_{i,t}$ the GDP deflator.	OECD, "National Accounts", etc.
Real short-term interest rate	The real short-term interest rate is the nominal short-term interest rate minus actual inflation from one quarter back to two quarters ahead. $r^{S}_{i,t} = i^{S}_{i,t} - [(P_{i,t+2} / P_{i,t-1})^{4/3} - 1)]$ where $r^{S}_{i,t}$ is the real interest rate of country *i* in period *t*, $i^{S}_{i,t}$ the nominal short-term interest rate and $P_{i,t}$ the GDP deflator.	OECD, "National Accounts", etc.
Nominal long-term interest rate	United States: 10-year treasury notes. Japan: 10-year government bonds. Germany: 10-year government bonds (before 1985Q4, government bonds with maturity of 7–15 years). United Kingdom: 20-year government bonds. France: public and semi-public bonds. Italy: 10-year government bonds. Canada: over 10-year government bonds.	OECD, "Main Economic Indicators", etc.
Nominal short-term interest rate	United States: three-month CD. Japan: three-month CD. (before 1979Q2, two-month bill rate) Germany: three-month interbank rate. United Kingdom: three-month interbank rate. France: three-month PIBOR. Italy: three-month interbank deposit rate. Canada: 90-day deposit rate.	OECD, "Main Economic Indicators", etc.
Accumulated ratio of current accounts to nominal GDP	The accumulated ratio of each term's current accounts to nominal GDP from 1970Q1.	IMF, "International Financial Statistics", OECD, "Main Economic Indicators", etc.

Effects of the global financial crisis on Japanese financial markets in autumn 1998

Data	Content	Source
TIBOR (Tokyo interbank offered rate)	Three-month euroyen TIBOR, three-month euro dollar TIBOR.	Japanese Bankers' Association
LIBOR (London interbank offered rate)	Three-month euroyen LIBOR, three-month euro dollar LIBOR.	The British Bankers' Association
Spot and forward exchange spread	Three-month yen/dollar spot and forward exchange spread.	The Nihon Keizai Shinbun
Yen treasury bill rate	Three-month yen treasury bill.	Japan Bond Trading Co. Ltd
Dollar treasury bill rate	Three-month dollar treasury bill.	US Department of Commerce
Yen/dollar spot turnover, Yen/dollar swap turnover	yen/dollar spot and yen/dollar swap turnover in yen/ dollar exchange markets.	Bank of Japan, "Financial and Economic Statistics Monthly"

Bibliography

Bank of Japan (1998): "Annual Review of Monetary and Economic Developments in Fiscal 1997". *Bank of Japan Annual Review*, pp. 57-154.

Bank of Japan (1999): "Tsuuka Oyobi Kinyuu No Chousetsu Ni Kansuru Houkokusho (Report on Money and Market Operations)". June (in Japanese).

Barro R and X Sala-i-Martin (1990): "World Real Interest Rates". *NBER Macroeconomics Annual*, pp. 15-74.

Frankel J (1993): "Quantifying International Capital Mobility in the 1980s", in Frankel, J., *On Exchange Rates*, MIT Press.

French, K and J Poterba (1991): "Investor Diversification and International Equity Markets". *American Economic Review*, 81, pp. 222-6, May.

Fukao, M (1990): "Jissen Zeminaru Kokusaikinyuu (International Economics and Finance)". *Toyo-keizai Sinposha*, (in Japanese).

Hanajiri, T (1999): "Three Japan Premiums in Autumn 1997 and Autumn 1998 – Why did Premiums differ between markets?" *Financial Market Department Working Paper E-series 99-E-1*, August.

Ishi, K (1996): "Jishitsukinri No Ketteiyouin Oyobi Kakkoku-Hikaku Ni Tsuite (The Determinants of Real Interest Rate and Its Comparison among Countries)". *IMES Discussion Paper J-Series 96-J-18*, Institute for Monetary and Economic Studies, Bank of Japan, (in Japanese).

Kang, J and R Stultz (1995): "Why is there a Home Bias? An Analysis of Foreign Portfolio Equity Ownership in Japan". *NBER Working Paper*, No. 5166.

Kawai, M (1994): "Kinyuu Nyumon (Introduction to International Economics and Finance)". *Todai Shuppankai*, (in Japanese).

Mishkin, F (1984): "Are Real Interest Rates Equal Across Countries? An Empirical Investigation of International Parity Conditions". *Journal of Finance 39*, pp. 1345-57, December.

Shirakawa, M (1999): "Nihon No Kokusaisijyou No Kinoukoujyou Ni Mukete (Suggestions for the Improvement of the JGB Market)". *Nihon Ginko Geppo (Bank of Japan Monthly Bulletin)*, June (in Japanese).

Shiratsuka, S and H Nakamura (1998): "Kokusai-Bunsantoushi Niokeru Homu-baiasu-pazuru Wo Meguru Shoronten (The Home Bias Puzzle in International Investment Diversification)". *Monetary and Economic Studies*, 17(2), Institute for Monetary and Economic Studies, Bank of Japan, (in Japanese).

Tesar, L and I Werner (1992):: "Home Bias and the Globalisation of Securities Markets". *NBER Working Paper*, No. 4218.