CHAPTER 3

Value-at-Risk Estimation

This chapter aims at answering problems of debt management in various conditions by prolonging the burden of the debt already bonded and paid with several conditions by future sources. The results will show the maximum external debt which reduce each year. Such a maximum debt denominated in baht currency is a present value which hardly exist on payment date. It should be considered, because the present values in baht currency imply the real burden to be paid by the government pay in the same currency as that of tax collection. The maximum values of debt indicate a boundary of possible fund in baht that the government would pay. Given such results, The government can realize its real status of the external debt by tracking present circumstance to decide next step of policies.

3.1 The Conditions of the bonds and loans

The study is emphasized two types of government's securities: bonds and amortized loans, which are the major parts of all debts of the government. For bonds, the government has to pay annual interest and principal at maturity but for the loans, the government has to pay an annual interest with some amount of principal too. Generally, such securities may be issued in one or more series as may be authorized from time to time, maturity from nine moths to fifty years from date of issue. Reference terms of such securities are offered, as follows:

1) The designation, aggregate principal amount, any limitation on such principal amount and authorized denominations.

2) The currency or currencies of denomination and payment.

3) The percentage of their principal amount of securities to be issued.

4) The maturity date.

5) The interest rate (if any) and the criteria to determine it

6) The interest rate payment date (if any)

7) Any optional or mandatory redemption terms or repurchase or sinking fund provisions.

8) Whether such securities will be in form with interest coupons, registerable as to principal, or in fully registered form.

9) Other specific provisions.

We give more details of such conditions by foreign sources financing external loans which can be classified in any of the four sources, comprising:

1) Multilateral Sources are the international financial institutions which are not owned by anyone, with a main function to provide funding to members. Thailand is a member of two main multilateral, sources: IBRD and ADB. IBRD have more than 100 members, in which the United State of America holds the biggest stake. Its main mission is to rescue members' downside economies especially from war. The Asia Development Bank, known as ADB was established by most countries in Asia and a few countries outside Asia such as the USA., Canada, France, etc., with an objective to finance general members, except rich members such as Japan and those outside Asia which only adopt a preferrence of the lender. Most of ADB shares belong to Japanese. Thailand is a member of both two sources. In the past, Thai government had borrowed special funds called IDA with zero rate of interest and commitment charge, and service charge only 0.75% . These funds provide a maturity period up to 50 years, plus a grace period up to 10 years as well.

2) Bilateral Sources are any of a country financing directly to borrower including foreign governments, of Denmark, the United Kingdom government, Swisszerland, The National Bank of Belgium Federal Financial Bank,etc. Some sources backed up by Arab governments, such as OPEC Fund, Saudi Fund, providing funding to most Muslim countries. Thai government also have to rely on these sources because of the low interest rate about 3% .but we have yet received the limit funds from these sources. Moreover, Thailand's Exim Bank has been established with objective for promoting the countries' export through bilateral cooperation funds. The OECF serves as, a most source with 35.7% of total external debt, assignees interest rates at 0.25%-3.5%, without commitment charges. These include KW of Germany with 1% of that assigns the rates at 0.2% to 0.4% and Commitment charges at 0.25%-0.45%

3) Commercial Sources are the great commercial banks around the world such as HSBC Holdings of the United Kingdom, Bank of Tokyo Japan, Chase Manhattan Bank at USA, etc. Generally, these offer syndicated loans with higher interest and shorter maturity than that of ADB. Beside to high interest rates, the government also pays annually a commitment charge 0.25% of remaining principal based on opportunity of other potential borrowers.

4) Capital Markets serve as funding sources for Thai government via issues of the bonds sold both private placement and public offering. Fundings will be distributed into two currencies, Japanese Yen and US dollar, under main banners as Yankee Bond issued in USA, and Samurai Bond issued in Japan. Medium-Term Notes have portions of the total external debt in US dollar and Japanese Yen , 33% and 10% respectively. Most commercial sources and capital markets aim for high interest rate

from lending, different from others sources that will lend for economic development, export promotion or political interests.

We can entirely compare any of the sources' conditions including interest rate, maturity period, amount of finance, frequency of lending, facility of borrowing, as follows:

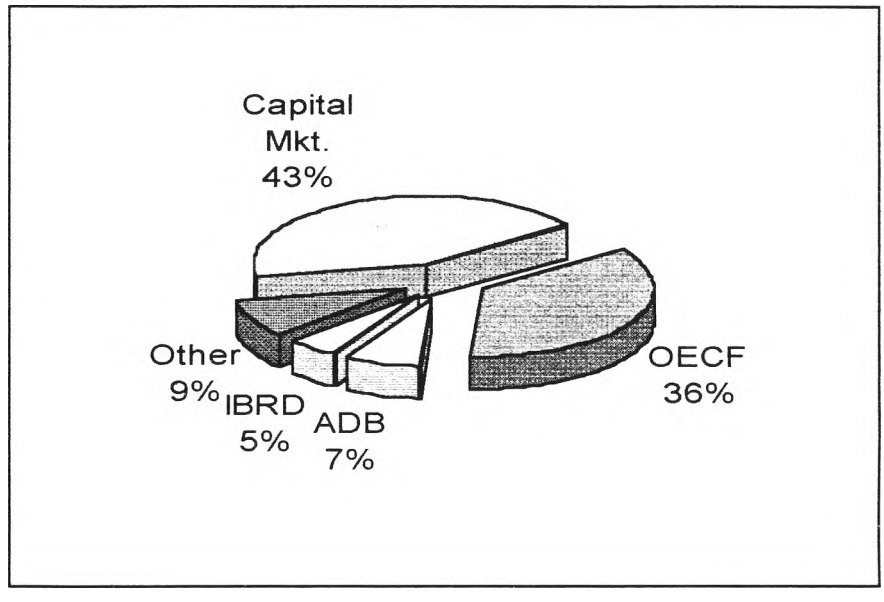

Figure 3.1 Proportion of all Outstanding Principal Debts by Source

Source: Thai government's external direct debt as of September 30, 1996 from Fiscal Policy Office, Ministry of Finance

Figure 3.1 shows the proportion of all outstanding debts by sources during 1957 and 1996. External debts from capital markets stood at 43%. It is in fact, easier to borrowed from capital markets than from other sources, as it does not require project preparation, appraisal mission and other complex steps. Others sources mostly consider borrower's ability for future payment.

Furthermore, when Thai credit improved in 1987, the government could issue more bonds, especially in 1994 for Yankee bonds and Samurai bonds shown in figure 3.2 and 3.3. Whenever Thai economic growth and political situation are stable, Thai government could borrow from capital markets with better conditions.

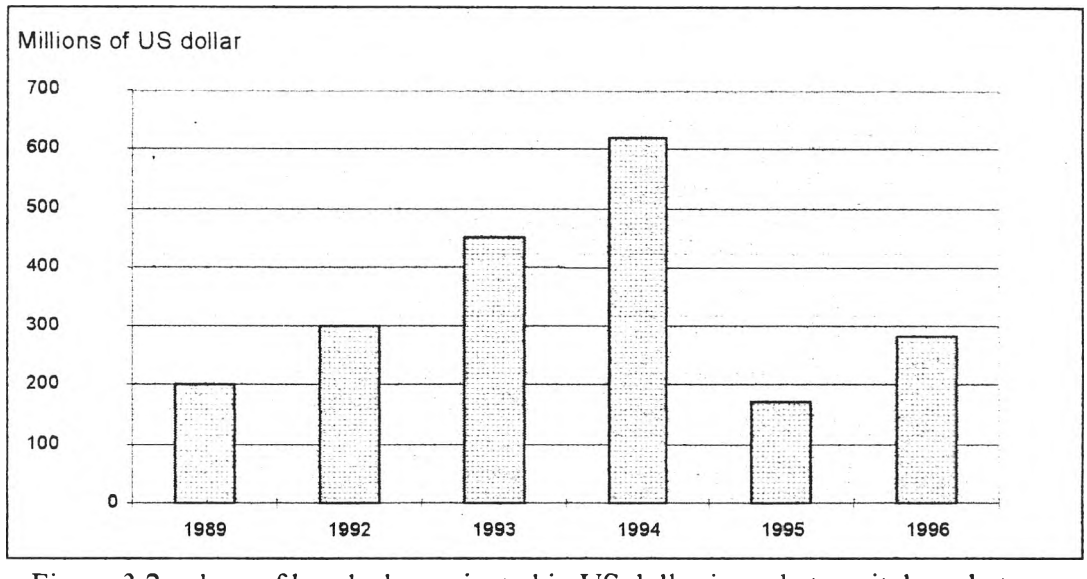

Figure 3.2 values of bonds denominated in US dollar issued at capital market

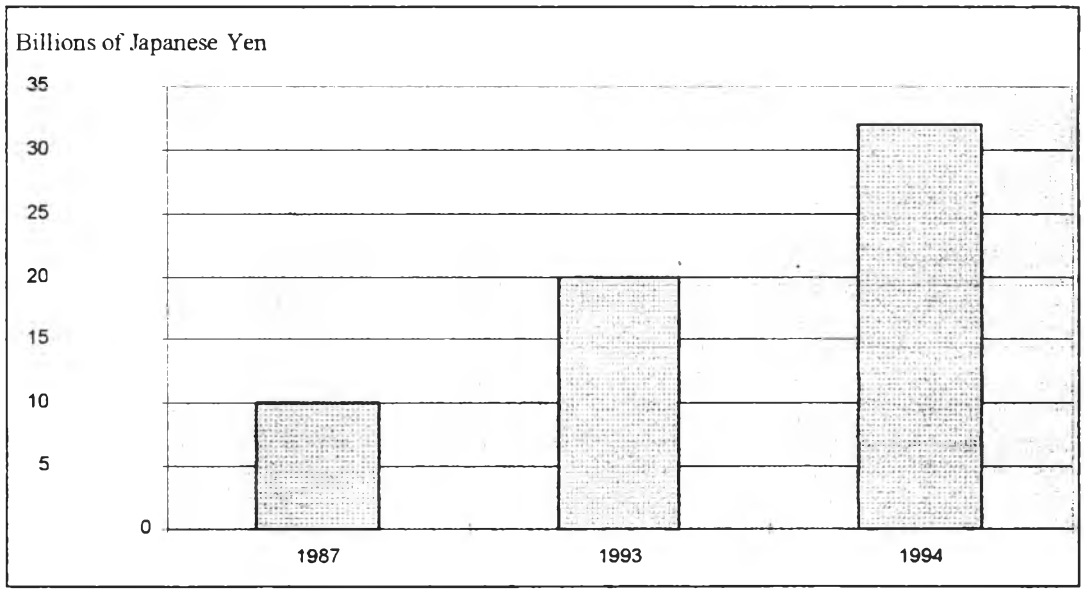

Figure 3.3 values of bonds denominated in Japanese Yen issued at capital market

However, in 1995-1996 due to shrinking growth of export causing lack of foreigner's confidence, the government decided to issue bonds with greater values in 1992 to 1994, and few years later. There are limits of borrowing from capital market, so the projects which need finance from such source should shown reality good returns. Basically, the interest rates might be higher i.e. 6-7% while the maturity periods are shorter by comparing to other sources or less than 10 years as shown in figure 3.4, 3.5

OECF, another major source, has provided loans under attraction conditions of, interest rates 2-3%, long maturity period 20-30 years and flexible conditions about impact credits. The OECF supported by Japanese government has 33.2 percent of all debt. Since payment of some principal and a low depreciation in THB/yen exchange rate make outstanding proportion comparing with all debt from other sources equal to only 0.33% . The absolute controversy increasing in loans from KW is up to 35.72 percent of all outstanding debt from 1.08 percent of principal of all debt shown in figure 3.6

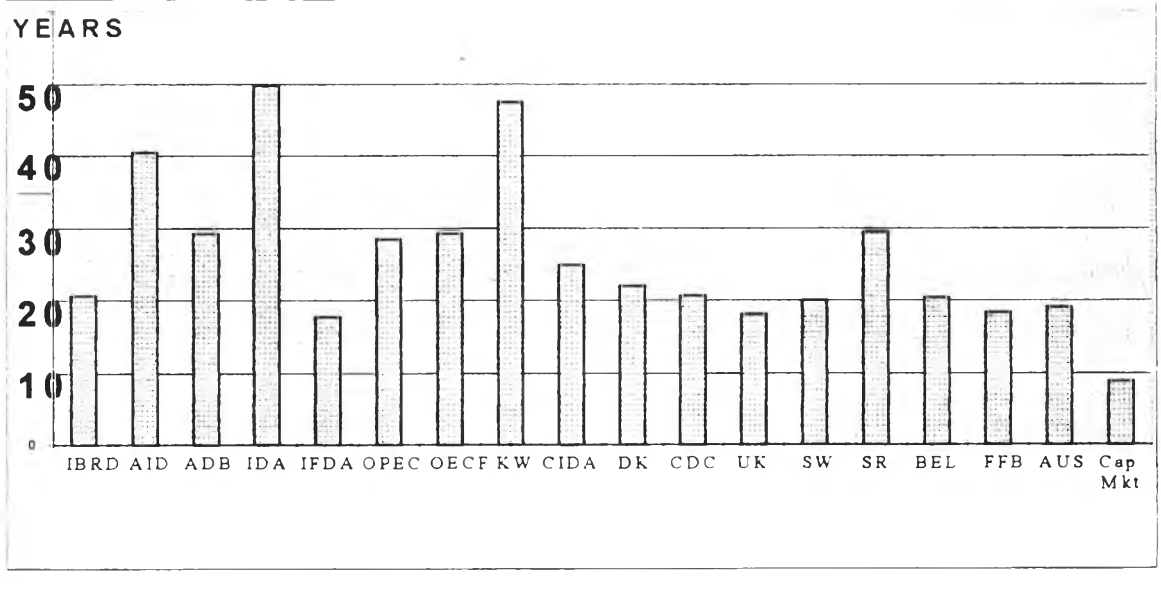

Figure 3.4 Average maturity periods of the external debt by sources

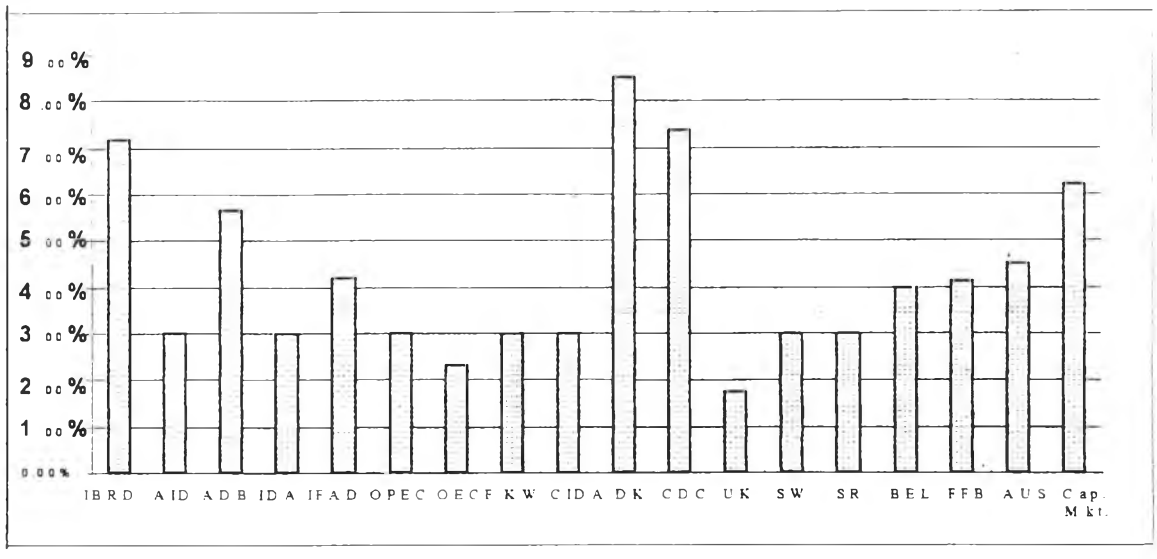

Figure 3.5 Average Interest rates of the external debt by sources

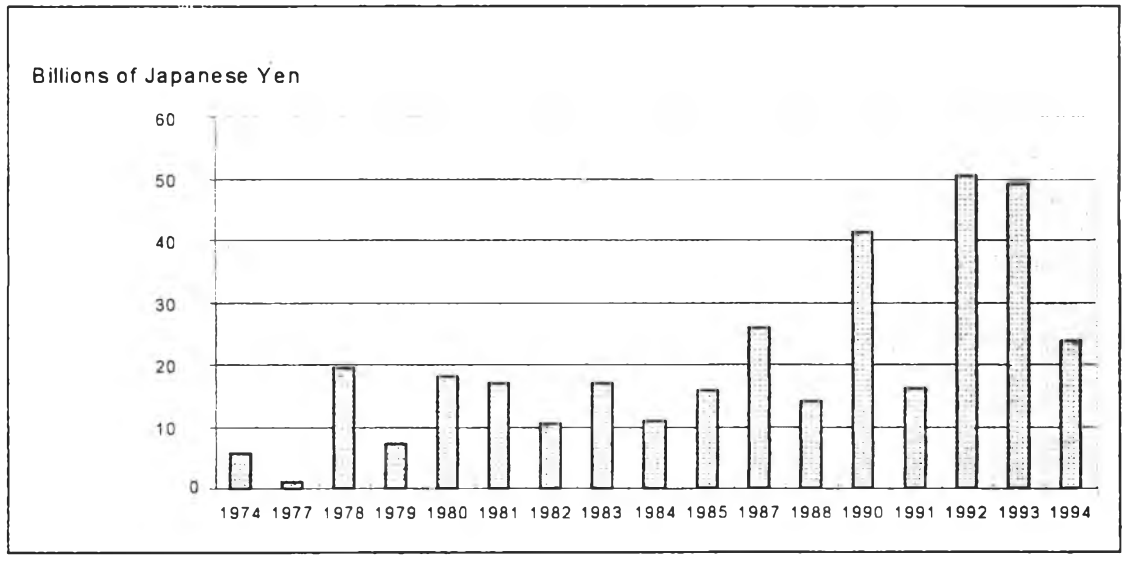

Figure 3.6 Loans from OECF

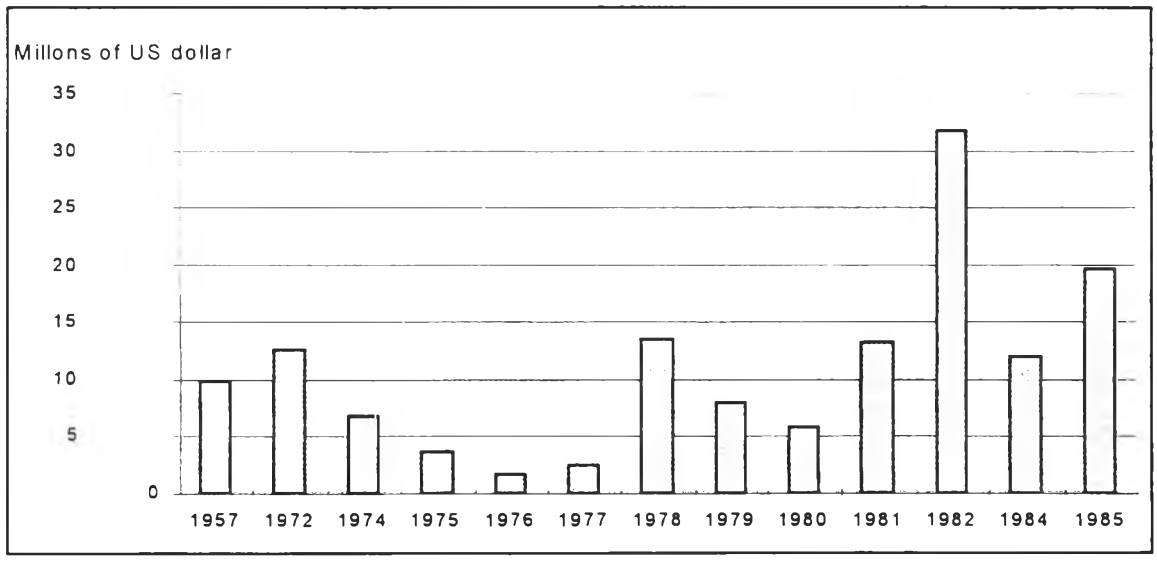

Figure 3.7 Loans from AID

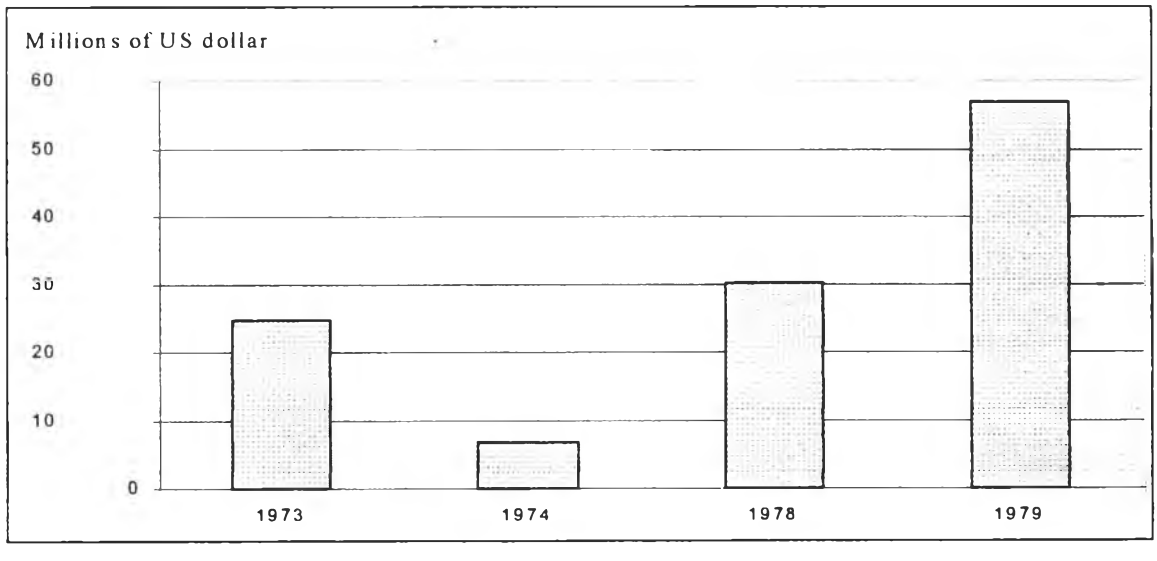

Figure 3.8 Loans from IDA

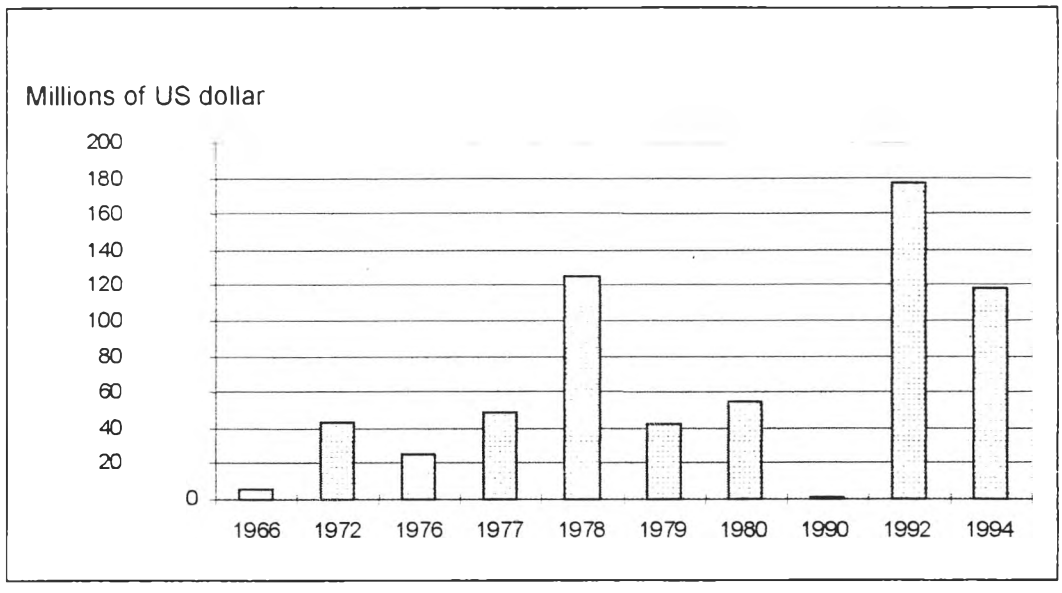

Figure 3.9 Loans from IBRD

Source: Thai government's external direct debt as of September 30, 1996 from Loan Policy Department, Ministry of Finance

Loans from other sources played a minimal role in Thailand. Although they have almost low interest rate about 2-5% and long maturity periods more than 15 years, they have purchasing obligations. Hence sometime Thai government has worried about unusual high price of goods as stipulated in a loan condition.For justification purpose Thai government has a policy of international bids for purchasing, and the best condition offered would be selected country.

When we find a good condition, loans from AID are good choice because of low interest rate about 3% and long maturity period about 40 years. Furthermore AID also finance Thai government frequently and moderately.

The best conditions offered by IDA source are interest rate about 2-3%, longest maturity period about 50 years and amount of money in each borrowing not less than other sources. Nevertheless, figure 3.7 and 3.8 show that Thai government could only borrow in the past, since the objective of such source specifies for development of society and economy of much poorer developing countries where Thailand has been exempted from this criteria for a long time. Both IBRD and ADB apply pooling system that make a similar condition to both source. The government has small burdens for repaying debts from other sources, given long maturity periods, unlike debts recently incurred from capital markets. The author would later estimate the maximum present value of all debt that might break out in the future.

Figure 3.9 shows proportion in percent of all debt created since 1957 until 1996. No bond or loan was issued during 1958-1965 and 1967-1971. Debt created during 1957-1977 had little proportion to value of all debt. Then during 1978-1984, debt created fell continuously from 4.88% to 2.7%, rose continuously during 1985-1994, especially within the last three years, 1992-1994, with great percentage up to 47.33% of bonds issued in capital markets. Such created debt had been a major part of outstanding debt of Thai government and then significantly decreased during 1995-1996 shown in figure 3.10

Regarding the rapid increase in external debts during the current crisis, we wondered whether or not the government can manage it. Although we know how much debt in foreign currencies now, it's hard to guess how much it would be increased in the future, especially in these circumstances of the current economic downturn. So, under this severe situation, we should know the present status of the debt , and how we can minimize it.

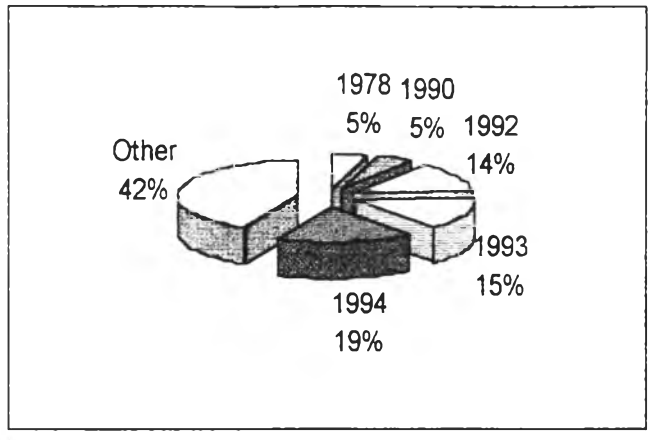

Figure 3.10 The proportions of all debt issued in each year

Source: Thai government's external direct debt as of September 30, 1996 from Fiscal Policy Office, Ministry of Finance

3.2 The Maximum Present Values of the External Direct Debt

In the study for estimating the maximum present values of the external debt at year-end, we assume 2 scenarios; 1. a case of low fluctuated exchange rate or stable exchange rate by using a scenario since 25/09/1995 until 31/12/1995 to calculate a variance of the price return and 2. the case of high fluctuated exchange rate or unstable exchange rate by using the scenario since 02/07/1997 until 08/09/1997 to calculate the variance of the price return also.

Since 1996, the present values of the debt has decreased annually because such total debt is a burden of issuing bonds and loans in the past and still outstanding as of September 30,1996. Hence after that, it should be assumed that the government will not incur more debts, but repay all outstanding debts in coming years. However, effects of depreciation and fluctuation of the baht values increase the present

value which should reduce as time goes by as shown in table 3.1 as an annual decrease in the expected values of the external debt . For example, at exchange rate on date 31/12/1996, we have the expected present value of the external debt about 148 billion baht and then it fall to 120 billion baht on date 31/12/1997.

However, when we consider the maximum present value of the external debt with a year holding period on date 31/12/1996 about 162.8 billion baht and on date 31/12/1997 about 164.4 billion baht. This implied that although the debt in foreign currency decreases annually, the debt in baht currency increase as table 3.1. Comparing the percentage of the maximum present value with holding period on a daily, monthly and year by basis to the expected value in a result of the longer holding period, the value at risk will be higher.

Table 3.1 shows that as the government can control the fluctuation of exchange rate, the maximum present values of the external debt on a daily, monthly and yearly basis were more than the expected present values of that 0.4% - 0.5%, 2% - 3%, and 7% - 10% respectively. In other word, values at risk were 0.4% - 0.5%, 2% - 3%, 7% - 10% of the expected value respectively under floating system, however, extreme fluctuation of exchange rates made such values at risk to be 2%, 11-12%, and 36%-45% respectively. Then, we shall consider bunching and covariance of each risk vertices in order to find out causes of this fluctuation.

Table 3.1 The expected present value and the maximum present value of the external direct debt with a day, a month and a year holding period.

date	debt (Billions of Baht)	maximum debt(a day) (Billions of Baht)	maximum debt(a month) (Billions of Baht)	maximum debt(a year) (Billions of Baht)
12/29/95	142.09	142.66	144.81	151.83
12/31/96	148.20	148.96	152.02	162.83
12/31/97	120.44	123.16	133.86	164.43
12/31/98	104.14	106.48	115.67	142.21
12/31/99	92.64	94.72	102.90	126.56
12/31/00	85.34	87.26	94.83	116.52
12/31/01	76.94	78.68	85.54	105.09
12/31/02	64.66	66.12	71.84	88.29
12/31/03	57.83	59.14	64.24	79.00
12/31/04	48.67	49.77	54.06	66.61
12/31/05	40.50	41.43	45.03	55.65
12/31/06	33.19	33.96	36.97	45.94
12/31/07	30.69	31.40	34.17	42.45
12/31/08	28.04	28.68	31.21	38.78
12/31/09	25.20	25.78	28.05	34.83
12/31/10	23.01	23.54	25.60	31.74
12/31/11	21.02	21.50	23.36	28.95
12/31/12	19.20	19.64	21.34	26.41
12/31/13	10.63	10.89	11.92	15.06
12/31/14	8.88	9.10	9.95	12.57
12/31/15	7.14	7.31	8.00	10.08
12/31/16	5.47	5.61	6.13	7.71
12/31/17	4.08	4.17	4.55	5.70
12/31/18	3.00	3.07	3.34	4.16
12/31/19	2.25	2.30	2.50	3.10
12/31/20	1.51	1.54	1.68	2.07

3.3 Bunching and Diversification

Firstly, we can calculate the maximum present value of the external debt denominated in any of the foreign currencies and covariance and correlation of price returns among them as shown in table 3.2, table 3.3 - 3.14 and figure 3.10

Table 3.2 show the most weights of the external consisting of two main currencies , US dollar and Japanese Yen. By the end of this year, we expect that the government will have the present values of the external debt denominated in such two currencies about 75 billion baht and 43 billion baht respectively . Figure 3.10 shows the portions of the most external debt bunching in such two currencies. Since 1995 until 2004, the percentage of present values in baht of the debt denominated in US dollar is more than that in Japanese Yen. Existing debt denominated in Japanese Yen is until 2022,that in US dollar until 2029 and Canadian Dollar and Deutsche Mark, until 2032. But if we calculate the present value of such last two currencies, we will find that their values are very small.

It would be interesting to know if bunching of such debt almost weighted in two main currencies is the correct diversification.We should firstly consider covariances, variance and correlation of price returns of exchange rate risk vertices shown in table 3.3.3 to 3.3.14, the top of which show variance and covariance, the bottom of which show correlation with respectively holding period one day, one month and one year.

The cluster of such tables clearly implies the relationship of baht value and foreign currencies value borrowed by Thai government and moreover can compare annually the relation ship of exchange rates of baht against US dollar and that of baht against Yen. Such relationships show that The baht/dollar rate fluctuates more than the

baht/Yen in three scenarios:from December 1995 to September 1997, as well as yearly records in 1994 and 1996.

Then, change in a monetary policy from exchange rate pegged to dollar to floating makes the extreme fluctuations of exchange rates of baht against all foreign currencies where the variance of return of exchange rate of baht against US dollar rises up to 1,251% but less than the increase of baht against yen up to 23,429%. Such percentages are measured by comparing the scenario in 1996 to the scenario of unstable exchange rate (July-September, 1997). In addition, this indicates that, in 1995, the price return of THB/Yen relates contrarily to that of THB/US dollar. So having the debt denominated in such two major currencies that is the good diversification making decrease in the risk of the debt denominated in baht currency. And then in 1996, with the similar direction of covariance of such two price returns, the diversification is better off but less than that in 1995 resulting smaller magnitude of covariance of the two price returns.

Moreover, on the scenario of unstable exchange rate, all variances and covariance have positive signs and much bigger sizes, especially THB/Yen showing the relationships in the same direction and the extreme fluctuation.This implies that mean when baht values extremely depreciate to US dollar values, baht values also incline to severely depreciate to not only Japanese Yen but also all currencies borrowed as well. In other words, the existing external debt or the issuing external debt in whichever currency the government issues a new loan or bond denominated can not be diversified to reduce the existing risk.

However, if the government needs an additional external borrowing. The findings will show the criteria for currency denomination of bonds and loans to minimize risks. If the government can keep baht value stable, we will talk later about

how much decreases in value at risk, the maximum present value of the debt and how to issue loans in such scenario.

Table 3.2 The bunching percentage of the maximum present value of the external debt denominated in any foreign currencies with a year holding period

date	AS	SF	DK	FF	pd	SR	CS	DM	yn	US
29 12 95	0.26%	0.01%	0.40%	0.07%	0.16%	0.23%	0.19%	0.60%	28.44%	69.64%
31 12 96	0.25%	0.00%	0.38%	0.06%	0.17%	0.22%	0.19%	0.57%	25.79%	72.37%
31 12 97	0.32%	0.00%	0.48%	0.08%	0.21%	0.29%	0.29%	0.73%	35.41%	62.18%
31 12 98	0.35%	0.00%	0.52%	0.09%	0.20%	0.26%	0.33%	0.80%	40.06%	57.40%
31 12 99	0.37%	0.00%	0.53%	0.09%	0.18%	0.20%	0.37%	0.84%	40.82%	56.60%
31 12 00	0.38%	0.00%	0.52%	0.09%	0.14%	0.11%	0.39%	0.85%	36.21%	61.30%
31 12 01	0.40%	0.00%	0.51%	0.10%	0.11%	0.00%	0.42%	0.87%	33.81%	63.79%
31/12/02	0.44%	0.00%	0.52%	0.11%	0.06%	0.00%	0.49%	0.94%	37.98%	59.46%
31 12 03	0.46%	0.00%	0.49%	0.11%	0.00%	0.00%	0.53%	0.93%	39.83%	57.65%
31/12/04	0.50%	0.00%	0.45%	0.12%	0.00%	0.00%	0.61%	0.97%	44.40%	52.94%
31/12/05	0.54%	0.00%	0.43%	0.13%	0.00%	0.00%	0.72%	0.98%	49.67%	47.53%
31 12 06	0.59%	0.00%	0.38%	0.14%	0.00%	0.00%	0.85%	1.01%	56.05%	40.99%
31 12 07	0.56%	0.00%	0.31%	0.13%	0.00%	0.00%	0.89%	0.87%	55.45%	41.79%
31/12/08	0.52%	0.00%	0.24%	0.11%	0.00%	0.00%	0.95%	0.70%	54.75%	42.74%
31 12 09	0.47%	0.00%	0.14%	0.09%	0.00%	0.00%	1.02%	0.48%	53.90%	43.90%
31 12 10	0.40%	0.00%	0.00%	0.06%	0.00%	0.00%	1.08%	0.41%	51.33%	46.72%
31 12 11	0.30%	0.00%	0.00%	0.06%	0.00%	0.00%	1.14%	0.36%	48.51%	49.64%
31/12/12	0.17%	0.00%	0.00%	0.05%	0.00%	0.00%	1.20%	0.29%	45.46%	52.83%
31/12/13	0.00%	0.00%	0.00%	0.06%	0.00%	0.00%	2.09%	0.33%	68.92%	28.60%
31/12/14	0.00%	0.00%	0.00%	0.04%	0.00%	0.00%	2.39%	0.38%	68.08%	29.11%
31/12/15	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	2.84%	0.46%	67.16%	29.54%
31/12/16	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	3.51%	0.58%	65.51%	30.40%
31/12/17	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	4.46%	0.75%	61.08%	33.72%
31/12/18	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	5.69%	0.97%	53.89%	39.45%
31/12/19	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	7.07%	1.23%	47.18%	44.51%
31/12/20	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	9.76%	1.75%	32.35%	56.15%
31/12/21	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	12.31%	2.28%	23.09%	62.32%
31/12/22	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	17.41%	3.35%	0.00%	79.24%
31/12/23	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	19.11%	3.86%	0.00%	77.03%
31/12/24	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	20.84%	4.49%	0.00%	74.67%
31/12/25	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	22.21%	5.21%	0.00%	72.58%
31/12/26	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	23.61%	6.27%	0.00%	70.12%
31/12/27	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	26.74%	8.72%	0.00%	64.54%
31/12/28	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	34.15%	12.05%	0.00%	53.80%
31/12/29	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	71.08%	28.92%	0.00%	0.00%
31/12/30	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	70.98%	29.02%	0.00%	0.00%
31/12/31	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	70.87%	29.13%	0.00%	0.00%

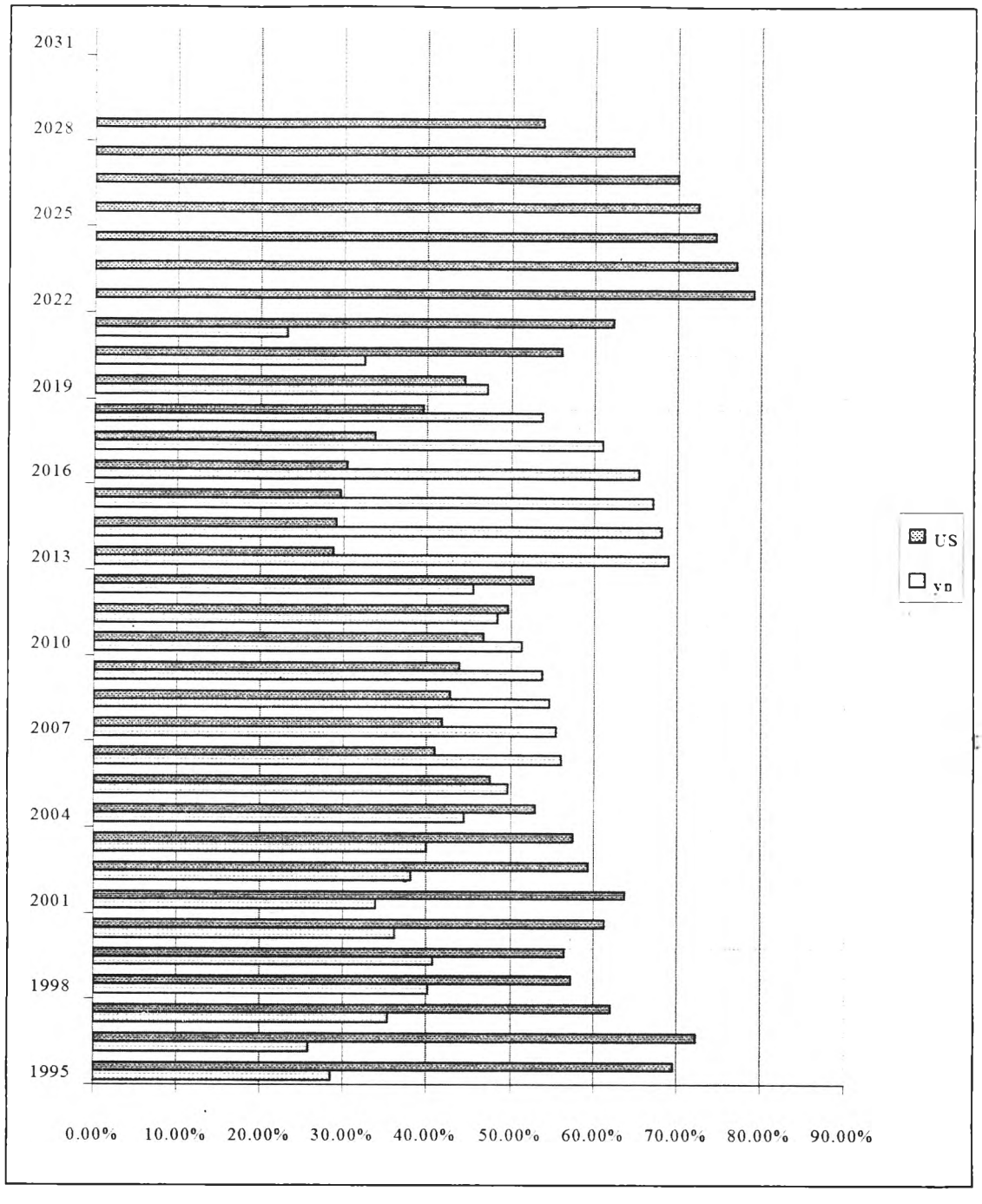

Figure 3.1 The bunching percent of the maximum present value of the external debt denominated in two major foreign currencies, US dollar and Japanese Yen, with a year holding period

Table 3.3 The covariance and correlation of daily price return (dp/p) of any exchange rate risk vertices during September to November 1995

	AS	CS	SF	DM	DK	BF	PD	Y	SR	US
AS	2.27E-05	-4.8E-06	1.61E-05	1.53E-05	1.7E-05	7.43E-06	4.1E-06	-1.1E-06	-7.6E-07	-7.6E-07
CS	-4.8E-06	1.53E-05	-6.6E-06	-4.7E-06	-4E-06	1.37E-06	1.81E-06	-3.3E-06	1.96E-06	1.96E-06
SF	1.61E-05	-6.6E-06	3.02E-05	2.26E-05	2.03E-05	5.19E-06	8.53E-06	-2.6E-06	-8.2E-07	-8.2E-07
DM	1.53E-05	-4.7E-06	2.26E-05	2.19E-05	1.98E-05	3.51E-06	7.43E-06	-2.2E-06	-6.4E-07	-6.3E-07
DK	1.7E-05	-4E-06	2.03E-05	1.98E-05	2.34E-05	2.56E-06	8.05E-06	-2.6E-06	-4.4E-07	-4.6E-07
BF	7.43E-06	1.37E-06	5.19E-06	3.51E-06	2.56E-06	1.89E-05	2.97E-06	4.12E-06	6.47E-07	6.74E-07
PD	4.1E-06	1.81E-06	8.53E-06	7.43E-06	8.05E-06	2.97E-06	1.39E-05	-1.9E-06	5.48E-07	5.57E-07
Y	-1.1E-06	-3.3E-06	-2.6E-06	-2.2E-06	-2.6E-06	4.12E-06	-1.9E-06	2.55E-05	-1.3E-06	-1.3E-06
SR	-7.6E-07	1.96E-06	-8.2E-07	-6.4E-07	-4.4E-07	6.47E-07	5.48E-07	-1.3E-06	9.82E-07	9.71E-07
US	-7.6E-07	1.96E-06	-8.2E-07	-6.3E-07	-4.6E-07	6.74E-07	5.57E-07	-1.3E-06	9.71E-07	9.64E-07

	AS	CS	SF	DM	DK	BF	PD	Y	SR	US
AS	1	-0.25648	0.6135	0.684735	0.73838	0.35858	0.230875	-0.04731	-0.16132	-0.16182
CS	-0.25648	1	-0.30871	-0.25494	-0.21206	0.080274	0.124468	-0.16534	0.504886	0.510808
SF	0.6135	-0.30871	1	0.876794	0.761843	0.217302	0.416884	-0.0951	-0.15037	-0.15149
DM	0.684735	-0.25494	0.876794	1	0.872188	0.172531	0.425846	-0.09512	-0.1373	-0.13594
DK	0.73838	-0.21206	0.761843	0.872188	1	0.121699	0.446275	-0.10698	-0.09143	-0.09709
BF	0.35858	0.080274	0.217302	0.172531	0.121699	1	0.18313	0.187739	0.150159	0.157921
PD	0.230875	0.124468	0.416884	0.425846	0.446275	0.18313	1	-0.1037	0.148377	0.152324
Y	-0.04731	-0.16534	-0.0951	-0.09512	-0.10698	0.187739	-0.1037	1	-0.25893	-0.25533
SR	-0.16132	0.504886	-0.15037	-0.1373	-0.09143	0.150159	0.148377	-0.25893	1	0.998276
US	-0.16182	0.510808	-0.15149	-0.13594	-0.09709	0.157921	0.152324	-0.25533	0.998276	1

Table 3.4 The covariance and correlation of monthly price return (dp/p) of any exchange rate risk vertices during September to November 1995

	asm	cSm	sfm	dmm	dkm	bfm	pdm	ynm	srm	usm
asm	0.000632	-0.00022	0.000508	0.000487	0.000521	0.000188	8.22E-05	7.36E-05	-3.7E-05	-3.8E-05
cSm	-0.00022	0.00046	-0.00029	-0.00021	-0.0002	-3.3E-05	3.5E-05	-0.00018	6.92E-05	6.91E-05
sfm	0.000508	-0.00029	0.000951	0.000716	0.000644	0.00022	0.000248	8.01E-05	-5.1E-05	-5.1E-05
dmm	0.000487	-0.00021	0.000716	0.000672	0.000611	0.000173	0.000211	6.21E-05	-3.7E-05	-3.7E-05
dkm	0.000521	-0.0002	0.000644	0.000611	0.000693	0.000158	0.000196	4.97E-05	-4.1E-05	-4.2E-05
bfm	0.000188	-3.3E-05	0.00022	0.000173	0.000158	0.000398	0.000104	8.22E-05	1.19E-05	1.14E-05
pdm	8.22E-05	3.5E-05	0.000248	0.000211	0.000196	0.000104	0.000317	-3.8E-05	3.17E-06	2.75E-06
ym	7.36E-05	-0.00018	8.01E-05	6.21E-05	4.97E-05	8.22E-05	-3.8E-05	0.000657	-5.2E-05	-5.2E-05
srm	-3.7E-05	6.92E-05	-5.1E-05	-3.7E-05	-4.1E-05	1.19E-05	3.17E-06	-5.2E-05	2.54E-05	2.52E-05
usm	-3.8E-05	6.91E-05	-5.1E-05	-3.7E-05	-4.2E-05	1.14E-05	2.75E-06	-5.2E-05	2.52E-05	2.5E-05

	asm	cSm	sfm	dmm	dkm	bfm	pdm	ynm	srm	usm
asm	1	-0.4072	0.654805	0.746878	0.786207	0.374429	0.183771	0.114167	-0.29473	-0.29967
cSm	-0.4072	1	-0.43963	-0.37574	-0.36015	-0.07701	0.091826	-0.3258	0.640569	0.644991
sfm	0.654805	-0.43963	1	0.8955	0.792495	0.358221	0.45281	0.101342	-0.32716	-0.33228
dmm	0.746878	-0.37574	0.8955	1	0.895001	0.333652	0.458404	0.093393	-0.27949	-0.28308
dkm	0.786207	-0.36015	0.792495	0.895001	1	0.30075	0.418827	0.073585	-0.31064	-0.31721
bfm	0.374429	-0.07701	0.358221	0.333652	0.30075	1	0.293076	0.160708	0.118247	0.114015
pdm	0.183771	0.091826	0.45281	0.458404	0.418827	0.293076	1	-0.08315	0.03538	0.030928
ym	0.114167	-0.3258	0.101342	0.093393	0.073585	0.160708	-0.08315	1	-0.40167	-0.40815
srm	-0.29473	0.640569	-0.32716	-0.27949	-0.31064	0.118247	0.03538	-0.40167	1	0.998402
usm	-0.29967	0.644991	-0.33228	-0.28308	-0.31721	0.114015	0.030928	-0.40815	0.998402	1

Table 3.5 The covariance and correlation of yearly price return (dp/p) of any exchange rate risk vertices during September to November 1995

	asy	cSy	sfy	dmy	dky	bfy	pdy	yy	sry	usy
asy	0.008233	-0.00327	0.006353	0.006486	0.007136	0.002994	0.001244	0.000728	-0.0006	-0.00059
cSy	-0.00327	0.005308	-0.0038	-0.00319	-0.00314	-0.00114	0.000118	-0.0018	0.000835	0.000824
sfy	0.006353	-0.0038	0.012095	0.009396	0.008305	0.003299	0.003168	0.000198	-0.00076	-0.00076
dmy	0.006486	-0.00319	0.009396	0.009375	0.008574	0.002992	0.002823	0.000452	-0.00056	-0.00056
dky	0.007136	-0.00314	0.008305	0.008574	0.009657	0.00229	0.002703	-5.9E-05	-0.00061	-0.0006
bfy	0.002994	-0.00114	0.003299	0.002992	0.00229	0.005016	0.000857	0.001637	-3.4E-05	-3.8E-05
pdy	0.001244	0.000118	0.003168	0.002823	0.002703	0.000857	0.003437	-0.00107	-2.3E-05	-2.5E-05
yy	0.000728	-0.0018	0.000198	0.000452	-5.9E-05	0.001637	-0.00107	0.00835	-0.00062	-0.00063
sry	-0.0006	0.000835	-0.00076	-0.00056	-0.00061	-3.4E-05	-2.3E-05	-0.00062	0.000306	0.000302
usy	-0.00059	0.000824	-0.00076	-0.00056	-0.0006	-3.8E-05	-2.5E-05	-0.00063	0.000302	0.000299

	asy	cSy	sfy	dmy	dky	bfy	pdy	yy	sry	usy
asy	1	-0.49535	0.63664	0.738331	0.800367	0.465907	0.233937	0.087758	-0.37844	-0.3753
cSy	-0.49535	1	-0.47394	-0.45248	-0.43847	-0.22188	0.02772	-0.26968	0.65532	0.654495
sfy	0.63664	-0.47394	1	0.882347	0.768446	0.423494	0.491382	0.019671	-0.39345	-0.40052
dmy	0.738331	-0.45248	0.882347	1	0.90118	0.436293	0.497323	0.051054	-0.33085	-0.33246
dky	0.800367	-0.43847	0.768446	0.90118	1	0.329044	0.46915	-0.00661	-0.35556	-0.35609
bfy	0.465907	-0.22188	0.423494	0.436293	0.329044	1	0.206387	0.252923	-0.02782	-0.03127
pdy	0.233937	0.02772	0.491382	0.497323	0.46915	0.206387	1	-0.19928	-0.0229	-0.02452
yy	0.087758	-0.26968	0.019671	0.051054	-0.00661	0.252923	-0.19928	1	-0.38666	-0.39864
sry	-0.37844	0.65532	-0.39345	-0.33085	-0.35556	-0.02782	-0.0229	-0.38666	1	0.998347
usy	-0.3753	0.654495	-0.40052	-0.33246	-0.35609	-0.03127	-0.02452	-0.39864	0.998347	1

Table 3.6 The covariance and correlation of daily price return (dp/p) of any exchange rate risk vertices during September 1995 to November 1996

	AS	C$	SF	DM	DK	BF	PD	Y	SR	US
AS	1.83E-05	-2.1E-06	1.31E-05	1.15E-05	1.39E-05	9.54E-06	3.76E-06	1.33E-06	-7.6E-07	-5.7E-07
CS	-2.1E-06	5.97E-06	-2.8E-06	-2E-06	-1.4E-06	-3.4E-07	4.7E-07	-1.6E-06	9.85E-07	9.05E-07
SF	1.31E-05	-2.8E-06	2.82E-05	2.01E-05	1.52E-05	5.73E-06	7.48E-06	-2E-07	2.52E-07	-4.9E-07
DM	1.15E-05	-2E-06	2.01E-05	1.83E-05	1.35E-05	4.19E-06	7.08E-06	-1.4E-06	3.93E-07	-1E-07
DK	1.39E-05	-1.4E-06	1.52E-05	1.35E-05	1.69E-05	6.96E-06	5.51E-06	4.63E-07	-5.3E-07	-3.1E-07
BF	9.54E-06	-3.4E-07	5.73E-06	4.19E-06	6.96E-06	1.64E-05	1.8E-06	4.42E-06	-5.9E-07	-4.4E-07
PD	3.76E-06	4.7E-07	7.48E-06	7.08E-06	5.51E-06	1.8E-06	1.48E-05	-1.2E-06	2.75E-07	5.8E-07
Y	1.33E-06	-1.6E-06	-2E-07	-1.4E-06	4.63E-07	4.42E-06	-1.2E-06	1.85E-05	-1.3E-06	-1.3E-06
SR	-7.6E-07	9.85E-07	2.52E-07	3.93E-07	-5.3E-07	-5.9E-07	2.75E-07	-1.3E-06	1.44E-06	7.28E-07
US	-5.7E-07	9.05E-07	-4.9E-07	-1E-07	-3.1E-07	-4.4E-07	5.8E-07	-1.3E-06	7.28E-07	7.82E-07

	AS	C$	SF	DM	DK	BF	PD	Y	SR	US
AS	1	-0.19751	0.577007	0.627679	0.790571	0.552148	0.228648	0.072312	-0.14843	-0.15053
CS	-0.19751	1	-0.21604	-0.19213	-0.14303	-0.03469	0.049985	-0.15477	0.335847	0.418922
SF	0.577007	-0.21604	1	0.8879	0.698972	0.267049	0.366302	-0.00874	0.039518	-0.10495
DM	0.627679	-0.19213	0.8879	1	0.7691	0.242672	0.430682	-0.07558	0.076549	-0.0273
DK	0.790571	-0.14303	0.698972	0.7691	1	0.419125	0.348621	0.0262	-0.10824	-0.08512
BF	0.552148	-0.03469	0.267049	0.242672	0.419125	1	0.115963	0.253943	-0.12098	-0.12239
PD	0.228648	0.049985	0.366302	0.430682	0.348621	0.115963	1	-0.07194	0.05955	0.170604
Y	0.072312	-0.15477	-0.00874	-0.07558	0.0262	0.253943	-0.07194	1	-0.2424	-0.3436
SR	-0.14843	0.335847	0.039518	0.076549	-0.10824	-0.12098	0.05955	-0.2424	1	0.685468
US	-0.15053	0.418922	-0.10495	-0.0273	-0.08512	-0.12239	0.170604	-0.3436	0.685468	1

Table 3.7 The covariance and correlation of monthly price return (dp/p) of any exchange rate risk vertices during September 1995 to November 1996

	asm	c$m	sfm	dmm	dkm	bfm	pdm	ynm	srm	usm
asm	0.00036	2.29E-06	0.000258	0.000225	0.000292	0.000167	6.89E-05	8.16E-06	-9.2E-06	2.59E-06
c$m	2.29E-06	0.000125	-1.5E-05	-1.7E-05	1.98E-05	1.56E-05	3.79E-05	-4E-05	2.54E-05	2.58E-05
sfm	0.000258	-1.5E-05	0.000679	0.00046	0.000324	0.000118	0.000111	2.31E-05	2.22E-05	2.26E-06
dmm	0.000225	-1.7E-05	0.00046	0.000415	0.000283	7.75E-05	0.000123	-1.5E-05	1.51E-05	6.16E-06
dkm	0.000292	1.98E-05	0.000324	0.000283	0.0004	0.000173	0.000148	1.97E-05	-2.1E-06	1.1E-05
bfm	0.000167	1.56E-05	0.000118	7.75E-05	0.000173	0.000368	4.05E-05	0.000145	-1.2E-05	-4E-06
pdm	6.89E-05	3.79E-05	0.000111	0.000123	0.000148	4.05E-05	0.000308	-4.8E-05	1.47E-05	1.99E-05
ym	8.16E-06	-4E-05	2.31E-05	-1.5E-05	1.97E-05	0.000145	-4.8E-05	0.000462	-3.4E-05	-3.7E-05
srm	-9.2E-06	2.54E-05	2.22E-05	1.51E-05	-2.1E-06	-1.2E-05	1.47E-05	-3.4E-05	3.65E-05	1.91E-05
usm	2.59E-06	2.58E-05	2.26E-06	6.16E-06	1.1E-05	-4E-06	1.99E-05	-3.7E-05	1.91E-05	2.05E-05

	asm	c$m	sfm	dmm	dkm	bfm	pdm	ynm	srm	usm
asm	1	0.01078	0.520837	0.581176	0.770222	0.457571	0.206877	0.019998	-0.08006	0.030105
c$m	0.01078	1	-0.05312	-0.0764	0.088519	0.072733	0.192991	-0.1672	0.37633	0.509993
sfm	0.520837	-0.05312	1	0.86649	0.62195	0.2352	0.243047	0.041167	0.141354	0.019176
dmm	0.581176	-0.0764	0.86649	1	0.694678	0.198361	0.344496	-0.0332	0.123003	0.066735
dkm	0.770222	0.088519	0.62195	0.694678	1	0.450625	0.422454	0.045864	-0.01776	0.121005
bfm	0.457571	0.072733	0.2352	0.198361	0.450625	1	0.12035	0.35247	-0.10701	-0.04572
pdm	0.206877	0.192991	0.243047	0.344496	0.422454	0.12035	1	-0.12668	0.13928	0.25042
ym	0.019998	-0.1672	0.041167	-0.0332	0.045864	0.35247	-0.12668	1	-0.25907	-0.38103
srm	-0.08006	0.37633	0.141354	0.123003	-0.01776	-0.10701	0.13928	-0.25907	1	0.697815
usm	0.030105	0.509993	0.019176	0.066735	0.121005	-0.04572	0.25042	-0.38103	0.697815	1

Table 3.8 The covariance and correlation of yearly price return (dp/p) of any exchange rate risk vertices during September 1995 to November 1996

	asy	c$y	sfy	dmy	dky	bfy	pdy	yy	sry	usy
asy	0.00509	3.03E-06	0.003274	0.003101	0.003967	0.001729	0.001195	0.000315	-0.00032	-0.00014
c$y	3.03E-06	0.001316	-0.0006	-0.00055	-6.1E-05	0.000266	-0.00014	-1E-05	0.000267	0.000214
sfy	0.003274	-0.0006	0.006924	0.004831	0.00337	0.00093	0.001523	-0.00026	3.28E-05	-7.1E-05
dmy	0.003101	-0.00055	0.004831	0.004777	0.003395	0.00065	0.001954	-0.00057	8.27E-06	-1.7E-06
dky	0.003967	-6.1E-05	0.00337	0.003395	0.004525	0.001467	0.00188	-5.7E-05	-0.00012	8.76E-07
bfy	0.001729	0.000266	0.00093	0.00065	0.001467	0.003886	0.00022	0.002618	-0.00017	-0.00012
pdy	0.001195	-0.00014	0.001523	0.001954	0.00188	0.00022	0.003031	-1.4E-05	2.55E-06	2.47E-05
yy	0.000315	-1E-05	-0.00026	-0.00057	-5.7E-05	0.002618	-1.4E-05	0.006938	-0.00056	-0.00046
sry	-0.00032	0.000267	3.28E-05	8.27E-06	-0.00012	-0.00017	2.55E-06	-0.00056	0.000537	0.000278
usy	-0.00014	0.000214	-7.1E-05	-1.7E-06	8.76E-07	-0.00012	2.47E-05	-0.00046	0.000278	0.000243

	asy	c$y	sfy	dmy	dky	bfy	pdy	yy	sry	usy
asy	1	0.001172	0.551571	0.62888	0.82676	0.388782	0.304185	0.052997	-0.19347	-0.1215
c$y	0.001172	1	-0.19799	-0.21894	-0.02514	0.117564	-0.07016	-0.00337	0.317294	0.378171
sfy	0.551571	-0.19799	1	0.840015	0.60205	0.17935	0.332424	-0.0371	0.016997	-0.05477
dmy	0.62888	-0.21894	0.840015	1	0.730237	0.15091	0.513431	-0.09893	0.005165	-0.00156
dky	0.82676	-0.02514	0.60205	0.730237	1	0.34993	0.507714	-0.01012	-0.07795	0.000836
bfy	0.388782	0.117564	0.17935	0.15091	0.34993	1	0.064174	0.504175	-0.11454	-0.1265
pdy	0.304185	-0.07016	0.332424	0.513431	0.507714	0.064174	1	-0.00306	0.001997	0.028825
yy	0.052997	-0.00337	-0.0371	-0.09893	-0.01012	0.504175	-0.00306	1	-0.2913	-0.35383
sry	-0.19347	0.317294	0.016997	0.005165	-0.07795	-0.11454	0.001997	-0.2913	1	0.769944
usy	-0.1215	0.378171	-0.05477	-0.00156	0.000836	-0.1265	0.028825	-0.35383	0.769944	1

Table 3.9 The covariance and correlation of daily price return (dp/p) of any exchange rate risk vertices during September 1995 to June 1997

	AS	C$	SF	DM	DK	BF	PD	Y	SR	US
AS	0.000123	9.98E-05	0.00012	0.000118	0.000118	0.000112	0.000113	6.06E-05	0.000102	0.000101
C$	9.98E-05	0.00011	0.000101	0.0001	9.97E-05	0.000101	0.000108	6.02E-05	0.000104	0.000103
SF	0.00012	0.000101	0.000135	0.000126	0.00012	0.000109	0.000117	5.93E-05	0.000103	0.000102
DM	0.000118	0.0001	0.000126	0.000124	0.000119	0.000108	0.000115	5.77E-05	0.000102	0.000102
DK	0.000118	9.97E-05	0.00012	0.000119	0.000121	0.000109	0.000113	6E-05	0.000101	0.000101
BF	0.000112	0.000101	0.000109	0.000108	0.000109	0.000122	0.000109	6.62E-05	0.000102	0.000102
PD	0.000113	0.000108	0.000117	0.000115	0.000113	0.000109	0.000128	6.35E-05	0.000108	0.000107
Y	6.06E-05	6.02E-05	5.93E-05	5.77E-05	6E-05	6.62E-05	6.35E-05	0.000169	6.13E-05	5.91E-05
SR	0.000102	0.000104	0.000103	0.000102	0.000101	0.000102	0.000108	6.13E-05	0.000105	0.000104
US	0.000101	0.000103	0.000102	0.000102	0.000101	0.000102	0.000107	5.91E-05	0.000104	0.000103

	AS	C$	SF	DM	DK	BF	PD	Y	SR	US
AS	1	0.857658	0.930233	0.95648	0.968235	0.912954	0.895919	0.42036	0.896249	0.900641
C$	0.857658	1	0.825444	0.854201	0.863139	0.873234	0.903456	0.440119	0.966114	0.969134
SF	0.930233	0.825444	1	0.973449	0.942438	0.848953	0.886657	0.392482	0.865118	0.866253
DM	0.95648	0.854201	0.973449	1	0.971197	0.873722	0.91114	0.397428	0.897493	0.898903
DK	0.968235	0.863139	0.942438	0.971197	1	0.898076	0.904996	0.419613	0.900302	0.904856
BF	0.912954	0.873234	0.848953	0.873722	0.898076	1	0.869998	0.459748	0.903697	0.90669
PD	0.895919	0.903456	0.886657	0.91114	0.904996	0.869998	1	0.430337	0.927694	0.932945
Y	0.42036	0.440119	0.392482	0.397428	0.419613	0.459748	0.430337	1	0.460244	0.447024
SR	0.896249	0.966114	0.865118	0.897493	0.900302	0.903697	0.927694	0.460244	1	0.996975
US	0.900641	0.969134	0.866253	0.898903	0.904856	0.90669	0.932945	0.447024	0.996975	1

Table 3.10 The covariance and correlation of monthly price return (dp/p) of any exchange rate risk vertices during September 1995 to June 1997

	asm	c$m	sfm	dmm	dkm	bfm	pdm	ynm	srm	usm
asm	0.002129	0.001822	0.002201	0.002062	0.002063	0.001981	0.002092	0.001194	0.001896	0.001886
c$m	0.001822	0.00231	0.001933	0.001895	0.00185	0.001906	0.002249	0.001494	0.002179	0.002156
sfm	0.002201	0.001933	0.002629	0.002364	0.002229	0.002021	0.002274	0.00111	0.002014	0.001995
dmm	0.002062	0.001895	0.002364	0.002263	0.002137	0.001949	0.002222	0.00109	0.001979	0.001959
dkm	0.002063	0.00185	0.002229	0.002137	0.002182	0.001929	0.00212	0.001207	0.0019	0.001891
bfm	0.001981	0.001906	0.002021	0.001949	0.001929	0.002326	0.002094	0.001422	0.002012	0.002005
pdm	0.002092	0.002249	0.002274	0.002222	0.00212	0.002094	0.00269	0.001514	0.002269	0.002255
ym	0.001194	0.001494	0.00111	0.00109	0.001207	0.001422	0.001514	0.004289	0.001532	0.001488
srm	0.001896	0.002179	0.002014	0.001979	0.0019	0.002012	0.002269	0.001532	0.002238	0.002205
usm	0.001886	0.002156	0.001995	0.001959	0.001891	0.002005	0.002255	0.001488	0.002205	0.002185

	asm	c$m	sfm	dmm	dkm	bfm	pdm	ynm	srm	usm
asm	1	0.821403	0.930231	0.939474	0.957043	0.890367	0.874254	0.395178	0.86855	0.874195
c$m	0.821403	1	0.784635	0.828759	0.824177	0.822288	0.902402	0.474793	0.958078	0.959492
sfm	0.930231	0.784635	1	0.969235	0.93047	0.817517	0.855123	0.330414	0.830319	0.832135
dmm	0.939474	0.828759	0.969235	1	0.961551	0.849496	0.900668	0.349949	0.879283	0.880742
dkm	0.957043	0.824177	0.93047	0.961551	1	0.856196	0.875253	0.394421	0.859673	0.865962
bfm	0.890367	0.822288	0.817517	0.849496	0.856196	1	0.837194	0.450257	0.881721	0.88915
pdm	0.874254	0.902402	0.855123	0.900668	0.875253	0.837194	1	0.445867	0.924915	0.930036
ym	0.395178	0.474793	0.330414	0.349949	0.394421	0.450257	0.445867	1	0.494384	0.486004
srm	0.86855	0.958078	0.830319	0.879283	0.859673	0.881721	0.924915	0.494384	1	0.997073
usm	0.874195	0.959492	0.832135	0.880742	0.865962	0.88915	0.930036	0.486004	0.997073	1

Table 3.11 The covariance and correlation of yearly price return (dp/p) of any exchange rate risk vertices during September 1995 to June 1997

	asy	c$y	sfy	dmy	dky	bfy	pdy	yy	sry	usy
asy	0.020899	0.015102	0.020203	0.018483	0.01961	0.019635	0.017778	0.014537	0.016618	0.016516
c$y	0.015102	0.019867	0.015287	0.015508	0.015468	0.01658	0.018854	0.015072	0.018735	0.018417
sfy	0.020203	0.015287	0.02292	0.019777	0.019657	0.018186	0.017591	0.013227	0.016057	0.015806
dmy	0.018483	0.015508	0.019777	0.019019	0.018881	0.01785	0.018027	0.013078	0.016416	0.016213
dky	0.01961	0.015468	0.019657	0.018881	0.020657	0.018875	0.017695	0.014457	0.016252	0.016194
bfy	0.019635	0.01658	0.018186	0.01785	0.018875	0.023644	0.019115	0.016235	0.018583	0.018521
pdy	0.017778	0.018854	0.017591	0.018027	0.017695	0.019115	0.022868	0.015426	0.019466	0.019253
yy	0.014537	0.015072	0.013227	0.013078	0.014457	0.016235	0.015426	0.049997	0.017026	0.016256
sry	0.016618	0.018735	0.016057	0.016416	0.016252	0.018583	0.019466	0.017026	0.019935	0.019576
usy	0.016516	0.018417	0.015806	0.016213	0.016194	0.018521	0.019253	0.016256	0.019576	0.019376

	asy	c$y	sfy	dmy	dky	bfy	pdy	yy	sry	usy
asy	1	0.741125	0.923092	0.927072	0.943818	0.883291	0.813196	0.449719	0.814135	0.820769
c$y	0.741125	1	0.716398	0.797815	0.763558	0.764967	0.884518	0.478238	0.941398	0.938709
sfy	0.923092	0.716398	1	0.947252	0.903417	0.781213	0.768377	0.390748	0.75121	0.750045
dmy	0.927072	0.797815	0.947252	1	0.952571	0.841742	0.864403	0.424106	0.843098	0.844593
dky	0.943818	0.763558	0.903417	0.952571	1	0.854051	0.814161	0.449863	0.800872	0.809454
bfy	0.883291	0.764967	0.781213	0.841742	0.854051	1	0.822044	0.472202	0.855948	0.865294
pdy	0.813196	0.884518	0.768377	0.864403	0.814161	0.822044	1	0.456198	0.911713	0.914658
yy	0.449719	0.478238	0.390748	0.424106	0.449863	0.472202	0.456198	1	0.539303	0.522305
sry	0.814135	0.941398	0.75121	0.843098	0.800872	0.855948	0.911713	0.539303	1	0.99606
usy	0.820769	0.938709	0.750045	0.844593	0.809454	0.865294	0.914658	0.522305	0.99606	1

Table 3.12 The covariance and correlation of daily price return (dp/p) of any exchange rate risk vertices during July to Sept 1997

	AS	CS	SF	DM	DK	BF	PD	Y	SR	US
AS	0.000204	0.000169	0.000189	0.000205	0.000207	0.000182	0.000198	4.56E-05	0.000165	0.000165
CS	0.000169	0.000201	0.000176	0.000176	0.000179	0.0002	0.00021	6.71E-05	0.00019	0.00019
SF	0.000189	0.000176	0.000196	0.000197	0.000199	0.000179	0.000202	5.41E-05	0.00017	0.000171
DM	0.000205	0.000176	0.000197	0.000211	0.000212	0.000185	0.000203	4.59E-05	0.000171	0.000171
DK	0.000207	0.000179	0.000199	0.000212	0.000222	0.000197	0.00021	4.95E-05	0.000174	0.000174
BF	0.000182	0.0002	0.000179	0.000185	0.000197	0.000248	0.00022	8.36E-05	0.000191	0.000191
PD	0.000198	0.00021	0.000202	0.000203	0.00021	0.00022	0.000254	9.27E-05	0.000201	0.000201
Y	4.56E-05	6.71E-05	5.41E-05	4.59E-05	4.95E-05	8.36E-05	9.27E-05	0.000255	6.54E-05	6.58E-05
SR	0.000165	0.00019	0.00017	0.000171	0.000174	0.000191	0.000201	6.54E-05	0.000184	0.000184
US	0.000165	0.00019	0.000171	0.000171	0.000174	0.000191	0.000201	6.58E-05	0.000184	0.000184

	AS	CS	SF	DM	DK	BF	PD	Y	SR	US
AS	1	0.833734	0.942556	0.98754	0.971409	0.809292	0.867169	0.199793	0.850329	0.850745
CS	0.833734	1	0.887121	0.855697	0.848486	0.895731	0.931212	0.296649	0.991557	0.991226
SF	0.942556	0.887121	1	0.966705	0.954493	0.810651	0.904821	0.241838	0.897274	0.897792
DM	0.98754	0.855697	0.966705	1	0.978463	0.811788	0.87664	0.198072	0.86874	0.869109
DK	0.971409	0.848486	0.954493	0.978463	1	0.839534	0.883432	0.207694	0.860056	0.85986
BF	0.809292	0.895731	0.810651	0.811788	0.839534	1	0.877417	0.332739	0.893647	0.893418
PD	0.867169	0.931212	0.904821	0.87664	0.883432	0.877417	1	0.36388	0.929586	0.929967
Y	0.199793	0.296649	0.241838	0.198072	0.207694	0.332739	0.36388	1	0.301864	0.303539
SR	0.850329	0.991557	0.897274	0.86874	0.860056	0.893647	0.929586	0.301864	1	0.999962
US	0.850745	0.991226	0.897792	0.869109	0.85986	0.893418	0.929967	0.303539	0.999962	1

Table 3.13 The covariance and correlation of monthly price return (dp/p) of any exchange rate risk vertices during July to Sept 1997

	asm	cSm	sfm	dmm	dkm	bfm	pdm	ynm	srm	usm
asm	0.004821	0.004447	0.004554	0.00494	0.004964	0.00493	0.004881	0.000564	0.004317	0.004323
cSm	0.004447	0.005356	0.004598	0.00472	0.004667	0.005337	0.005337	0.001104	0.005121	0.005126
sfm	0.004554	0.004598	0.004898	0.004868	0.004924	0.004829	0.005064	0.000786	0.004429	0.004436
dmm	0.00494	0.00472	0.004868	0.005205	0.005203	0.005062	0.005138	0.000527	0.004551	0.004557
dkm	0.004964	0.004667	0.004924	0.005203	0.005413	0.005281	0.005171	0.000524	0.004492	0.004496
bfm	0.00493	0.005337	0.004829	0.005062	0.005281	0.006658	0.005596	0.001166	0.005139	0.005144
pdm	0.004881	0.005337	0.005064	0.005138	0.005171	0.005596	0.006037	0.001469	0.005126	0.005132
ym	0.000564	0.001104	0.000786	0.000527	0.000524	0.001166	0.001469	0.00635	0.001112	0.001111
srm	0.004317	0.005121	0.004429	0.004551	0.004492	0.005139	0.005126	0.001112	0.004959	0.004965
usm	0.004323	0.005126	0.004436	0.004557	0.004496	0.005144	0.005132	0.001111	0.004965	0.004971

	asm	cSm	sfm	dmm	dkm	bfm	pdm	ynm	srm	usm
asm	1	0.875093	0.937035	0.98614	0.97176	0.870054	0.90466	0.101996	0.882937	0.882962
cSm	0.875093	1	0.897692	0.893948	0.866743	0.89373	0.938595	0.18931	0.993603	0.993327
sfm	0.937035	0.897692	1	0.964031	0.956203	0.845597	0.931269	0.140871	0.898684	0.899041
dmm	0.98614	0.893948	0.964031	1	0.980299	0.859857	0.916616	0.091705	0.895905	0.895894
dkm	0.97176	0.866743	0.956203	0.980299	1	0.879641	0.904611	0.089464	0.86703	0.866735
bfm	0.870054	0.89373	0.845597	0.859857	0.879641	1	0.882719	0.179311	0.894356	0.894177
pdm	0.90466	0.938595	0.931269	0.916616	0.904611	0.882719	1	0.237214	0.936858	0.93686
ym	0.101996	0.18931	0.140871	0.091705	0.089464	0.179311	0.237214	1	0.198114	0.197793
srm	0.882937	0.993603	0.898684	0.895905	0.86703	0.894356	0.936858	0.198114	1	0.999974
usm	0.882962	0.993327	0.899041	0.895894	0.866735	0.894177	0.93686	0.197793	0.999974	1

Table 3.14 The covariance and correlation of yearly price return (dp/p) of any exchange rate risk vertices during July to Sept 1997

	asy	cSy	sfy	dmy	dky	bfy	pdy	yy	sry	usy
asy	0.048818	0.047745	0.051366	0.051291	0.051586	0.050636	0.054961	0.011593	0.045056	0.045121
cSy	0.047745	0.05912	0.053143	0.05134	0.051139	0.05895	0.060491	0.016149	0.055181	0.055228
sfy	0.051366	0.053143	0.061545	0.05636	0.05673	0.055229	0.062406	0.01423	0.049708	0.049796
dmy	0.051291	0.05134	0.05636	0.055716	0.05524	0.052883	0.058914	0.01011	0.048059	0.048129
dky	0.051586	0.051139	0.05673	0.05524	0.057792	0.056521	0.059582	0.010903	0.047837	0.047873
bfy	0.050636	0.05895	0.055229	0.052883	0.056521	0.07439	0.062943	0.019217	0.055587	0.055642
pdy	0.054961	0.060491	0.062406	0.058914	0.059582	0.062943	0.071536	0.019425	0.056586	0.056651
yy	0.011593	0.016149	0.01423	0.01011	0.010903	0.019217	0.019425	0.076046	0.017373	0.017376
sry	0.045056	0.055181	0.049708	0.048059	0.047837	0.055587	0.056586	0.017373	0.05228	0.052341
usy	0.045121	0.055228	0.049796	0.048129	0.047873	0.055642	0.056651	0.017376	0.052341	0.052406

	asy	c$y	sfy	dmy	dky	bfy	pdy	yy	sry	usy
asy	1	0.888734	0.937099	0.983463	0.971201	0.840264	0.93003	0.190264	0.891857	0.892075
c$y	0.888734	1	0.881006	0.894544	0.874877	0.888919	0.930159	0.240852	0.992561	0.992215
sfy	0.937099	0.881006	1	0.962464	0.951221	0.816236	0.940521	0.207999	0.876317	0.876825
dmy	0.983463	0.894544	0.962464	1	0.973481	0.821437	0.933186	0.155323	0.890473	0.890693
dky	0.971201	0.874877	0.951221	0.973481	1	0.862027	0.926651	0.164465	0.870291	0.869887
bfy	0.840264	0.888919	0.816236	0.821437	0.862027	1	0.862834	0.255501	0.891361	0.891162
pdy	0.93003	0.930159	0.940521	0.933186	0.926651	0.862834	1	0.263369	0.9253	0.925251
yy	0.190264	0.240852	0.207999	0.155323	0.164465	0.255501	0.263369	1	0.275526	0.275255
sry	0.891857	0.992561	0.876317	0.890473	0.870291	0.891361	0.9253	0.275526	1	0.99997
usy	0.892075	0.992215	0.876825	0.890693	0.869887	0.891162	0.925251	0.275255	0.99997	1