Saukkonen, Erja

Working Paper

Default risk on Finnish government foreign currency debt

Bank of Finland Discussion Papers, No. 30/1995

Provided in Cooperation with:
Bank of Finland, Helsinki

Suggested Citation: Saukkonen, Erja (1995) : Default risk on Finnish government foreign currency debt, Bank of Finland Discussion Papers, No. 30/1995, ISBN 951-686-473-2, Bank of Finland, Helsinki,
https://nbn-resolving.de/urn:nbn:fi:bof-20140807216

This Version is available at:
https://hdl.handle.net/10419/211743

BANK OF FINLAND
DISCUSSION PAPERS

30/95

Erja Saukkonen

Financial Markets Department
31.10.1995

Default Risk on Finnish Government Foreign Currency Debt

SUOMEN PANKIN KESKUSTELUALOITTEITA • FINLANDS BANKS DISKUSSIONSUNDERLAG

Suomen Pankki
Bank of Finland
P.O.Box 160, SF-00101 HELSINKI, Finland
☎ + 358 0 1831

BANK OF FINLAND DISCUSSION PAPERS **30/95**

Erja Saukkonen

31.10.1995

Default Risk on Finnish Government Foreign Currency Debt

ISBN 951-686-473-2
ISSN 0785-3572

Suomen Pankin monistuskeskus
Helsinki 1995

Default Risk on Finnish Government Foreign Currency Debt

Bank of Finland discussion papers 30/95

Erja Saukkonen
Financial Markets Department

Abstract

This paper is a study of default risk on Finnish government debt. The objectives of the study are to estimate the size of the default risk and to shed some light to the causes of default risk, using simple regression runs. To estimate the Finnish government default risk premium, we measured the interest rate differential on Finnish government DEM- and USD-denominated bonds compared to respectively German and US government bonds over the period October 1991 - February 1995. For the sake of comparison, we also measured the interest rate differential between Finnish government FIM-denominated bonds and German government bonds. Our results indicate that for the period studied the default risk premium on the Finnish government foreign-currency denominated debt was quite small, but by no means trivial and clearly not constant. The default risk premium on DEM-denominated debt was a small fraction of the differential for FIM-denominated debt. Our results provide strong evidence that the default risk premium was mainly determined by the level and growth rate of government debt and was not related to the general economic indicators (GDP and current account).

Tiivistelmä

Työn tavoitteena on estimoida Suomen valtion velan luottoriskipreemion suuruus ja selvittää siihen vaikuttavia tekijöitä. Luottoriskipreemio lasketaan vertaamalla Suomen valtion DEM- ja USD-määräisten joukkovelkakirjojen tuottoa vastaaviin Saksan tai USA:n valtion velkakirjojen tuottoon tutkimusajanjaksolla lokakuu 1991 - helmikuu 1995. Myös Suomen valtion FIM-määräiselle velalle lasketaan korkoero Saksan DEM-määräiseen velkaan verrattuna. Tulokset osoittavat, että Suomen valtion DEM- ja USD-määräisen velan luottoriski on suuruudeltaan melko pieni ja selvästi ajassa muuttuva. DEM-määräisen velan korkoero on murto-osa FIM-määräisen velan korkoerosta. Regressioanalyysin perusteella luottoriskipreemio selittyy pääasiassa valtion velan kasvuvauhdin ja velan tason avulla, muttei liity yleisiin kansantalouden indikaattoreihin (BKT tai vaihtotase).

Contents

1 Introduction*

In the 1980s a considerable amount of attention was paid to the international debt problem. In particular Latin American countries were forced to renegotiate their debts and so research focused heavily on less developed countries. Today, many OECD-countries have also become heavily indebted, both in absolute terms and relative to GDP. In Europe, the countries with the highest government debt relative to GDP are Belgium and Italy (debt/GDP over 100 per cent), but also Finland's government debt amounts to 70 percent of GDP.

This paper focuses on the case of Finland. Finland was hit by a severe economic recession in the beginning of 1990s and the central government was forced to run significant budget deficits, which led to growing level of government debt. Especially in 1992 and 1993, when debt growth was at its highest, there was extensive discussion of the possibility that Finland might face difficulties in obtaining additional credit from abroad.

As the amount of government debt increases, one would expect that the default risk associated with government bonds would increase and thus that interest rates would rise. This raises the questions as to how much higher interest rates a country with a large government debt or rapid debt growth must pay and whether the higher rates are caused by default risk. These matters are particularly important, for instance, in the context of convergence towards a single currency within the European Monetary Union.

The first objective of this study is to estimate the size and development of default risk on Finnish foreign currency-denominated government bonds in the 1990s. There are good reasons to concentrate on this particular aspect of debt and on this particular period. First, in studying foreign currency debt, we can eliminate risk factors other than default risk such as foreign exchange risk or inflation risk. Second, the beginning of the 1990s in Finland is almost as close as possible to laboratory case where an economy experiences a sudden structural change. One cannot easily find another example where factors that may be assumed to have an effect to the default risk change so dramatically and so rapidly (see table 1 on the development of the Finnish government debt).

---

* I thank Bank of Finland and Markku Malkamäki for the opportunity to do this study. I am especially grateful to Mikko Niskanen, Jukka Vesala and Matti Virén for their valuable comments. I also thank all other people who have helped me with my work.

Table 1. **Finland's central government debt**

year*	Total debt	Share of foreign currency-denominated debt of total	Debt growth, change from previous year	Debt growth, change from previous year	Share of foreign currency-denominated new debt of total new debt
	bill. FIM	%	%	bill. FIM	%
1989	52.9	43.1	-8.9	-5.2	-
1990	57.0	43.5	7.8	4.1	48.6
1991	92.1	47.4	61.4	35.1	53.8
1992	175.3	60.7	90.4	83.2	75.4
1993	265.5	58.6	51.5	90.2	54.5
1994	319.8	55.2	20.4	54.3	38.7
1995**	357.9	50.0	-	-	-

* 31.12.
** 31.5.
(Source: State Treasury)

The second aim of this paper is to shed light on the causes of default risk. Simple econometric regressions are used to extract the variables that have an effect on interest rate differentials, which are used to quantify the default risk. The variables used are mainly macroeconomic variables (including government debt) but some technical variables were also tested.

In a study like this a closely related topic is the determination of interest rates in general and interest rate differential in particular. Careful attention must be paid to the careful formation of the interest rate differential, which includes the default risk. The long interest rate series are composed of the yields on individual bond issues and thus the differential must be understood as the difference between yields of different individual bond issues. In light of this, the determination of default risk premiums is discussed rather thoroughly in section 2. Data and method are introduced in section 3. Section 4 provides the empirical evidence and section 5 contains concluding remarks.

2 Default risk on government bonds

2.1 The different risks related to bond investments

A key feature of all asset pricing theories is that an investor sets a return he or she requires. The required expected rate of return on a bond investment can be separated into two main components: the riskless rate of return and risk premiums that compensate for possible uncertainties. This is highlighted in table 2.

Table 2. **The required rate of return on a bond investment**

Riskless return
Inflation risk premium
Interest rate risk premium
Exchange rate risk premium
Liquidity risk premium
Default risk premium

The riskless return is based on the time value of money. According to Fisher's parity it can be divided into a real expected return and an expected inflation component. Risk premiums are required to compensate for various risk factors associated with the investment. For example, the inflation risk premium is the premium for unexpected changes in the rate of inflation.

When analyzing a single risk factor, the others must be eliminated to the extent possible. For example, the interest rate differential between two bonds denominated in different currencies contains more than one element. The major explanatory factor may be either the exchange rate risk itself or other factors that indirectly lead to the exchange rate risk (see Hukkinen and Koskela 1995)[1].

[1] In the paper by Hukkinen and Koskela (1995) the factors explaining the interest differential between Finnish government bonds FIM-denominated and German government bonds DEM-denominated were exchange rate deterioration, inflation difference, short interest rate difference, interest rate volatilities and difference in budget deficits. The three first factors all refer to the exchange rate change or exchange rate expectations through parity conditions.

2.2 Default risk on government bonds

Default risk refers to the risk that a debt instrument will default, meaning that the issuer will break his commitment (ie default on interest or principal payments). In most available studies on the default premium, the emphasis has been on corporate default risk. In these studies government bonds have been considered "risk free" assets and so have been used for comparative purposes. This is because governments have the right to tax and may in the last instance inflate their home currency-denominated debt by issuing money. However, when government debt is denominated in foreign currency or the amount of debt is very high relative to the size of the economy, these methods may no longer be sufficient and can be considered as ineffective to settle the debt problem. Consequently, governments too may have to pay a default premium, at least when compared to other less risky governments.

Naturally the default risk related to governments differs from that related to companies. Risks associated with a foreign country (direct or indirect investments) are characterized by country risk[2], and country risk analysis aims to identify cases where a foreign country is unable to meet its commitments. In this paper the default risk on a government bond and country risk are considered synonymous and thus the potential factors that lead to default risk premium are those that are evaluated in country risk analysis. Country risk definitions vary, but all of them include the cross-country aspect and the fact that the debtor is sovereign[3] (eg Krayenbuehl 1985, Nagy 1984 or Friedman 1983). The components of country risk are sovereign risk, political risk and economic risk[4]. In this paper we focus on the economic risk associated with Finnish government bonds.

Country risk can materialize in various ways. Particularly in analyzing the default risk of a country like Finland we cannot presume that "default" would mean "absolute default" (the debtor will not or can not pay) or repudiation (the debtor does not recognize the debt). That would be the most extreme form of default risk materialization. Very few countries have chosen absolute default or repudiation, since that would probably lead to a severe international isolation. The less aggressive and more common cases are reschedulings and renegotiations, where the loan terms are renegotiated. Considering the default risk on Finnish government (and governments of other OECD-countries), the most extreme form of risk realization would be renegotiation. We believe that Finland would not under any circumstances "absolutely default" or repudiate its debt and that the existence of a extremely small

---

[2] The term sovereign risk is often used as equivalent of country risk. Here, sovereign risk is understood as one part of country risk.

[3] Sovereignty and sovereign risk refer to the fact that a government is independent of other governments. Thus there is no higher courts and no possibility of taking legal action against defaulted governments.

[4] Economic risk refers to country's *ability* to meet its foreign obligations. The major factors in economic risk are the amount of foreign debt and the capability to earn or in other ways obtain (e.g. by issuing new debt) foreign currency. Political risk covers different political and social risk factors and refers to the government's *will* to meet its obligations.

possibility of renegotiation, however, is enough to generate a default risk premium on Finnish government debt.

2.3 Studying government bond default risk

Several previous studies on the government default risk premium should be mentioned. Loenning (1994), Giovannini and Piga (1992), Alesina et al. (1992) and Cottarelli and Mecagni (1990) have discussed the size and the measurement of the government default risk premium and the reasons for its existence. Our method of measuring default risk (ie forming interest rate differential) reminds in principle mostly that of Loenning, but we broaden the cross-section approach of Loenning to time-series analysis.

In estimating the size of the default premium, the key issue is how to isolate that part of the interest rate differential which represents the default premium. How can the other risk factors be eliminated and what should be used as an object of comparison? In this study, the premiums for exchange rate risk and inflation rate risk were eliminated by comparing yields on bonds denominated in the same currency. In other words, those two risks are present in equal amount in the interest rate levels of the comparison securities but not in the differential. Comparing the bonds with equal maturities eliminated the interest rate risk.

Elimination of the liquidity risk requires that the bonds to be compared be equivalent in regard to those factors which influence liquidity (eg date of issue, amount of issue, coupon). Finding precisely equivalent bonds is however difficult because of the restricted universe of bonds available in the market. Also quantifying and correcting for the effects of such differences in differential would be practically impossible. Thus we solved the problem of liquidity risk elimination by using the average of several differentials as our object of examination. In contrast to examining the differential based on the yield difference for a single pair of bonds, we believe that the average of the several differentials (thus reflecting yield differences for several pairs of bonds) to some extent eliminates the effect of a potential liquidity risk factor. Thus the average differential provides a reasonable view of the size and development of Finnish government default risk. In addition, the use of an average can be justified by the fact that the correlations between the average differential and individual bonds differentials were very high (correlation coefficients with only a few exceptions were over 0.9).

For the comparison, we selected German government bonds for the Finnish DEM-denominated bonds and US Treasuries for the Finnish USD-denominated bonds[5]. The technical details are presented in the next section.

---

[5] Cottarelli and Mecagni (1990) and Alesina et al. (1992) compared government bonds to private sector bonds. Giovannini (1992) used a World Bank bond as the object of comparison. Loenning (1994) used differentials between government bonds yields in the same currency, as in this study.

3 The data and hypotheses

3.1 The data and measurement of interest rate differential

The data used in this study is based on secondary market quotes on foreign currency-denominated bonds issued by the Finnish government (Republic of Finland). The foreign-currency share of the Finnish government's total debt was 50 per cent in July 1995. The most important denominations were DEM (28 %), FRF (14 %), ECU (13 %), JPY (12 %), GBP (11 %) and USD (9 %)[6]. The amount of foreign debt was FIM 179,0 billion.

The yield differential was calculated for the DEM- and USD-denominated bonds. The period of calculation was restricted by data availability, and the calculations were done for 10/1991–2/1995. The period is sufficiently long for studying the development of the differential during the years of economic turmoil in Finland. End of month data was used. The secondary market yield data was taken from the Bloomberg information system[7].

There were several reasons for studying both DEM- and USD-denominated differentials in this study. Firstly, both German and US government bonds may be considered as "benchmark bonds" among other governments, indicating that Germany and USA are strong "benchmark" economies. Representative of this is the fact that USD and DEM are often referred to as "flight-to-quality" currencies. Secondly, the selection of DEM- and USD-denominations was based on the availability of Finnish DEM- and USD-denominated bonds. Data was available for an adequately long period and for a adequate amounts of various issues[8]. Furthermore, by using two different denominations we were able to see if the default risk is analogous irrespective of currency denomination.

The differential was formed as an arithmetic average of individual yield differentials (see appendix 1 for the individual bond issues). The average differential was formulated in two stages: firstly, the yield differentials were calculated for individual Finnish bonds and then these differentials were used to construct the arithmetic average, which is the dependent variable in this study.

In the first stage, when selecting the object of comparison (German or US government bond) for a particular Finnish bond, the primary criterion was that the maturity and coupon be as close as possible to those of the Finnish bond. Then, of the acceptable bonds, we selected the one with the lowest average yield in the period. The bond with the lowest yield, but otherwise the same technical characteristics can

---

[6] Figures extracted from the publication Republic of Finland, Government Borrowing, Ministry of Finance. The currency composition is reported after swaps and does not represent the currency composition of original issues.

[7] Bloomberg Generic prices used in this study are formed by Bloomberg. The Bloomberg Generic is the average of prices set by different market parties. Bloomberg Generic excludes erroneous high and low quotes.

[8] Also the fact that Loenning (1994) had used DEM differentials and that the share of DEM-denomination in Finland's foreign debt was substantial argued on behalf of using DEM.

be argued to be "the most riskless" bond. In the second stage, we computed the arithmetic average of the individual yield differentials.

3.2 Hypotheses on the determinants of default risk

In the second part of the empirical section, regressions were done in order to select the variables that might explain the default risk on Finnish government bonds. Our hypotheses were based on previous studies of government default risk and on the general literature on country risk analysis[9].

We believe that a large proportion of default risk should be explained by five types of factors. The first is the size of the government debt and how it changes over time. We intend to test both government debt and budget deficits as explanatory variables. In addition, we test both backward- and forward-oriented debt variables, since it may be assumed that investors look at both historical debt and debt growth data and that they are able to rationally anticipate the forthcoming development.

The second type consists of factors that indicate the general economic development of the issuing country. We assume that, *ceteris paribus*, growth of GDP and improvement of the current account would tend to narrow the yield differential.

The third type of variable to be tested is the average of country ratings by Moody's and Standard and Poor's. Both agencies have lowered their ratings for Finland twice during this decade[10].

The fourth factor type is related to overall uncertainty in the world economy. When investors experience financial uncertainty or turmoil they usually shift their investments to safer economies like the USA or Germany. The demand increases for bonds issued by safe economies and decreases for bonds issued by peripheral countries like Finland and thus widen the yield differential. In the spirit of Hukkinen and Koskela (1995) we use the volatility of short-term interest rates in the USA and Germany as indicators of global uncertainty.

We also tested two technical variables as explanatory factors. Since the differential could not be constructed for a fixed maturity, we tested the average remaining maturity as an explanatory variable. We assume that a longer maturity should imply higher differential. The second technical factor is the level of interest rates. We assume that an investor either requires a constant differential in real terms (differential after expected inflation) or a constant relative yield differential (ie always a certain proportion of the yield level). Both assumptions lead to a hypothesis where a higher yield level results in a higher differential.

The summary of the hypotheses is presented in table 3.

---

[9] See the above-mentioned four studies and the references therein. As examples of country risk literature, one should mention e.g. Ciarrapico (1992), Heffernan (1986), Krayenbuehl (1985) and Nagy (1984).

[10] The ratings were changed as follows: Moody's 10/90 (from Aaa to Aa1) and 1/92 (from Aa1 to Aa2); Standard and Poor's 3/92 (from AAA to AA+) and 3/93 (from AA+ to AA-).

Table 3. **Summary of hypotheses**

Factor	Assumed impact on yield differential
government debt	
total government debt level/change	+
budget deficit level/ change	+
general economic indicators	
GDP level/ change	–
current account level/change	–
rating	–
the world economy	
volatility of	
German/ US short interest rates	+
technical factors	
maturity	+
level of interest rates	+

4 Empirical results

4.1 Overview of magnitude and historical variation in the interest rate differentials

For the Finnish DEM-denominated government bonds, the interest rate differential (henceforth "the DEM differential") has averaged 27.8 bp[11] over the period 10/1991-2/1995. For USD-denominated bonds the differential has averaged 48.4 bp (henceforth "USD differential"). See table 4 for statistical details.

Table 4. **Statistical diagnosis of interest rate differentials**

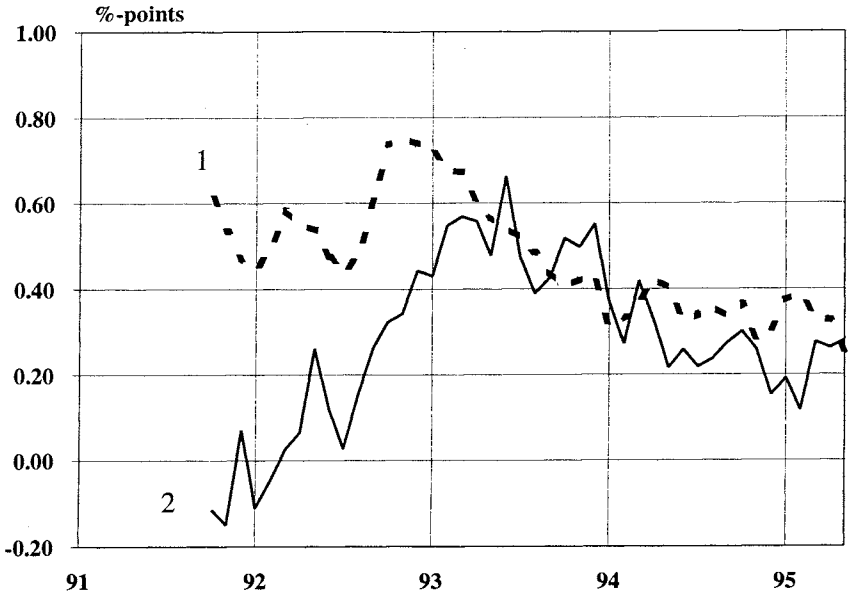
	Differential on the DEM-denominated Finnish government bonds 10/91-2/95	Differential on the USD-denominated Finnish government bonds 10/91-2/95
Mean	27.8 bp	48.4 bp
Standard Deviation	20.4 bp	13.2 bp
High	66.2 bp	75.2 bp
Low	-15.0 bp	28.2 bp

When making comparisons between the DEM and the USD differential, one must take into account that the differential series were constructed for non-constant and unequal maturities[12]. In the following we characterize the development of Finnish government default risk in DEM- and USD-denominated currency debt using some stylized facts. See figure 1.

[11] Bp= basis point. 1 bp is one-hundredth of one percentage point.

[12] In both currencies the average maturity shortens with time. Furthermore, there is also a maturity difference between the two denominations. The maturity of the DEM differential has been approximately two years longer than that of USD differential.

Figure 1. **Interest rate differentials on Finnish government bonds**



1 USD-denomination
2 DEM-denomination

The main features of DEM and USD differentials are similar. Both differentials started to widen at the same time (7/1992) and both had a similar strong narrowing trend after a turning point.

The dissimilarities between DEM and USD differentials include the timing of the turning point, differential levels before 1993 and differing volatilities. The widening of differentials started simultaneously in both currencies, but the USD differential peaked much earlier. The USD differential peaked at year-change 1992/1993, while the DEM-differential peaked at 6/1993. In 1994 both differentials converged to the same level. The level of differential was higher for USD-denominated bonds before 1993. At the end of 1991 the DEM differential amounted about 0 bp[13] and the USD differential to about 50 bp, and the peak was approximately 10 bp higher for the USD differential. The lower variance of the USD-differential may be explained by the general competitiveness of the USD market.

[13] We had some observation points where Finnish DEM-denominated Eurobonds had a lower yield than German government bonds in the German domestic market thus implying a negative differential. Also, for example, Belgian DEM-denominated Eurobonds yielded less than German ones at that time. The negative yield differential may be explained by the differences between German domestic and Euro-DEM markets and German financing needs caused by unification. According to various dealers, the demand in the Euro-DEM market might have been higher eg because of smaller minimum trade amounts, which attract private individuals. Also other features of the Euro-market (eg anonymity) may have caused the negative differential.

4.2 The determinants of default risk

The hypotheses were tested in linear models. In the regressions we found three explanatory variables worth noting: government debt level and change and the interest rate level. We present the differential determination simply as follows:

yield differential = constant + a government debt growth + b* debt level + c* interest rate level*

The summary of the estimations is presented in table 5; the details and certain other regression statistics are left to appendix 2.

Table 5. **Results of the estimations**

	con-stant	government debt growth***	government debt level****	interest rate level*****
DEM differential*	**1.32**	**5.79**	**0.00064**	**-0.20**
t- value	6.50	6.23	2.13	9.28
P- value	0.0000	0.0000	0.0396	0.0000
R^2 adj. 0.81				
USD differential**	**0.45**	**5.41**	**0.00010**	**-0.03**
t- value	5.73	8.10	0.48	-4.16
P- value	0.0000	0.0000	0.6310	-0.0002
R^2 adj. 0.81				

DEM and USD models estimated by OLS- method,
In USD model t-values corrected by Newey-West- method.

* Yield on Finnish DEM-denominated government bonds minus Yield on German government bonds (percentage points; 40 bp = 0.40).

** Yield on Finnish USD-denominated government bonds minus Yield on USA government bonds (percentage points).

*** 9 month (from 5 previous months to 3 months forward) moving average of government debt level changes from previous month (%; 10 % = 0.10).

**** Government debt level (FIM bill.).

***** Level of German or US government bond yields (%).

The regressions provided strong evidence for the assumption that default risk and government debt are strongly related. We also tested budget deficit as an explanatory variable, but it was not as powerful as government debt level change[14]. We noticed

[14] In cross-country studies it is necessary to use a relative government debt variable (debt/GDP). GDP is however available only quarterly, which was considered as disadvantage when explaining monthly data.

that both debt level and debt growth[15] were significant explanatory variables, with growth being the stronger one. Thus, for example, the sharp increase in both differentials after July 1992 is explained by the simultaneous period of strongest debt growth.

Besides government debt growth and level, the only other significant variable was the interest rate level. Our expectation was that the interest rate level should have a positive coefficient. The regressions revealed strong evidence of the opposite. In all models, the coefficient was negative. In DEM models, the coefficient of interest rate level was -0.20 and in USD-model -0.03. These estimates indicate that the lower interest rate level causes the wider spread.

The negative coefficient for the interest rate level may have its origin in the asymmetric inertia of the interest rate movements. To clarify this we ran correlations between yield level changes for the Finnish government foreign currency-denominated bonds and changes in the respective German government and US government bonds. The correlations were higher for positive changes than for negative ones[16]. This phenomenon might be explained by assuming that the German and US government bond markets are the dominant markets and that investors are more risk averse when investing in bonds issues by peripheral governments such as that of Finland. When the German or US interest rate level decreases, there is a lag before the Finnish DEM- or USD-denominated interest rate level follows, thus widening the differential. When the change in German or US interest rate level is upwards, the Finnish interest rate level reacts immediately.

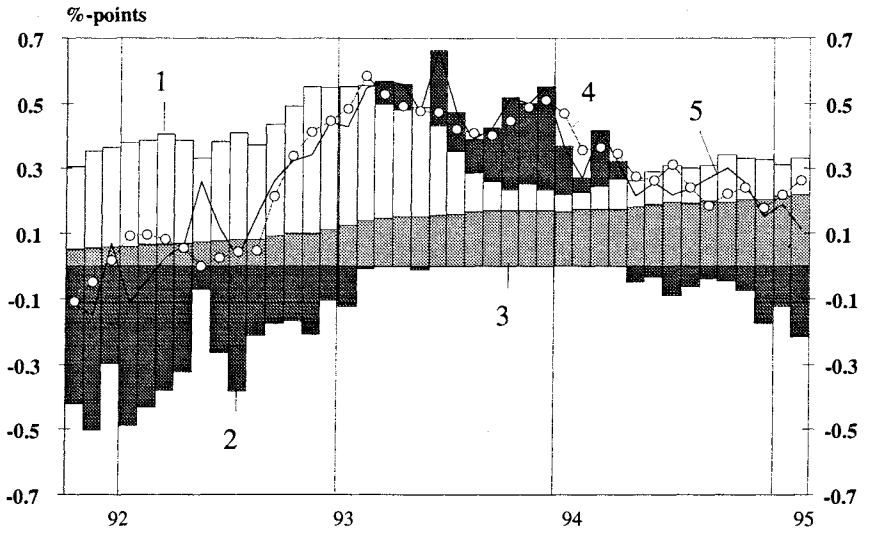
The following figure 2 illustrates our estimation results for the DEM differential.

---

[15] We operationalized the debt growth (change from previous month) with 9 month moving average. The models were not sensitive to the length of the MA , that was tested by making the regressions with MA:s with different lengths. Also the foreign debt (as percentage of total debt) and its growth were tested, but they did not result in better models.

[16] The observations were separated according to the interest rate level changes in the German and US bonds. The correlation coefficients were calculated separately for positive and negative German and US changes. The correlation between positive German DEM interest rate level changes and Finnish changes was 0.83 and between negative German changes and Finnish changes the correlation was 0.71. The correlation for positive US Treasury interest rate level changes was 0.98 and for negative changes 0.93.

Figure 2. **Decomposition of DEM differential**



1 Debt change
2 Constant + interest rate level + error
3 Debt level
4 Estimated
5 Realized

The significant explanatory variables were government debt level and change and the interest rate level. All the other variables tested proved to be insignificant with the exception of rating, which had small significance in DEM models. The small significance of rating may be explained by the fact that ratings changed altogether only four times and that the latest downgrading by Standard and Poor's happened after the USD differential had peaked. The insignificance of general economic indicators (GDP, current account) may imply that changes therein are considered to be more closely related to transitory business fluctuations and thus not to government default risk. The insignificance of international volatility is contrary to the results of Hukkinen and Koskela (1995). We may conclude that international uncertainty has a greater effect on the exchange rate risk of peripheral countries than on their default risk. Also, the tested variable maturity had no significance in our models. This may be due to the fact that maturity was decreasing linearly and thus was not powerful in the context of volatile differentials.

The regressions revealed differences between DEM and USD differentials. As reported above, the estimated models differ in respect to certain properties (eg parameter values). Autocorrelation was also more problematic with USD data. From these regression results and figure 1 we see that the USD and DEM differentials are not equal. We believe this may be caused by market-specific factors. The bond markets may not be totally integrated. The differentials relate to bonds traded in four different markets. The DEM differential was the differential between Finnish bonds in the international DEM market and German government bonds in the German domestic market. The USD differential was the differential between Finnish bonds

in the international USD market and US government bonds in the US domestic market. These markets (international DEM, international USD, German domestic, US domestic) may differ in their trade practices and investor segments. For instance, the minimum trade lots may differ or the investors may differ in their institutional position or nationality. And even though it might seem that markets are integrated when one looks at the interest rate levels and changes in these four markets, more detailed study of the differentials might reveal something that would otherwise remain hidden in those studies that aim at other questions. Furthermore, there might be some dissimilarities between the German and US governments and their assessed degree of risk (degree of "risklessness").

4.3 The foreign currency debt differential and a Finnish markka differential

We also compared the Finnish government foreign currency debt differential to the home currency debt differential. The home currency debt differential (which we call "the long FIM differential") has been calculated as the difference between Finnish government FIM-denominated bond yields and German government DEM-denominated bond yields[17]. These differentials are presented in figure 3.

Figure 3. **Finnish FIM- and DEM-denominated interest rate differentials vs Germany**

1 FIM-denomination
2 DEM-denomination (default risk)

[17] Here our method for calculating the interest rate spread is less precise. The Finnish long bond yield level is the yield of the longest FIM bond available at each point. For the German bond, we use the yield on 10-year German government bond. "The long FIM differential" is the difference between these two interest rate levels, and thus the difference is not necessarily determined for bonds of equal maturity.

We see that the long FIM differential and the Finnish government DEM differential do not have much in common. The long FIM differential has averaged 290 bp in 10/1991 - 2/1995 and peaked at roughly 600 bp. The DEM differential peaked at 66.7 bp and averaged 27.8 bp. Thus the DEM differential (ie default risk on the government DEM-denominated debt) amounts to approximately 10 per cent of the long FIM differential. The difference between the long FIM differential and the Finnish government DEM differential is mainly due to exchange rate risk, and we could as well call it the devaluation premium and say that the devaluation premium has amounted to 262 bp on average with respect to Germany. This is only a rough estimate which assumes that default risk on domestic debt is equal in size to the foreign currency debt. This assumption is not necessarily true, since for instance the possibility of inflating the debt is available only for domestic debt.

5 Concluding remarks

In this study, we examined the default risk on the Finnish government debt by comparing Finnish government DEM- and USD-denominated bonds with German and US government bonds, thus eliminating the exchange risk. The estimated differential on Finnish government DEM-denominated bonds amounted on average to 27.8 bp and that of USD-denominated bonds 48.4 bp in the period 10/1991–2/1995. Our results are in line with previous studies[18] and indicate, that there exists a quite small but significant default premium.

Our regressions revealed a strong relationship between government debt and default risk. Only three factors were significant as explanatory variables: government debt level, change in government debt level and interest rate level; naturally, the government debt level and change are related to each other. Government debt had the expected effect on default risk (debt growth strongly increases the differential), but the effect of the interest rate level on the differential was negative, against our expectations. We also observed differences between DEM and USD differentials. These we feel may be caused by differences between the respective bond markets. Our results provide a rather one-dimensional government debt-oriented world of default risk determination. However, we studied very unusual period, when Finnish government debt rose rapidly virtually from nil to a high level. In a less dramatic period one might find more determinants[19]. On the other hand, also other studies (eg Loenning 1994) have shown that factors like GDP growth are not relevant explanatory variables for default risk.

We also compared the default risk on DEM-denominated debt to the total interest rate differential on Finnish government domestic FIM-denominated debt. We found the default risk to be quite a small fraction (approximately 10 per cent) of the total differential on FIM-denominated debt, but it is by no means trivial[20]. The small share of default risk in the total home currency differential indicates that most of the cost paid for home currency debt is due to exchange rate risk. Thus from a government debt-servicing point of view, attention should be paid to exchange rate risk costs in the servicing of government debt.

Our results stress the importance of fiscal discipline since the default risk premium is determined mainly by government debt and changes therein. Other economic indicators, such as GDP or current account, were not related to default risk. We suggest that even in a single currency Europe the Finnish government would have to pay a higher default risk premium if fiscal policy were not prudent. We may

---

[18] See above mentioned studies.

[19] Alesina et al. (1992) found in their cross-section data of the highly indebted countries that default risk was positively correlated with debt level and growth, but this was not the case for countries with stable (although high) debt levels.

[20] If we assume that the average of the DEM and USD differentials is a good estimate of the default premium on the total debt, we find that Finland is paying 38.1 bp for the default premium, and this causes a yearly cost of FIM 1.33 billion, at the present level of government debt. (The average of 27.8 bp and 48.4 bp is 38.1 bp. At the end of the July, the Finland's government debt was FIM 349 bill. and 38.1 bp x FIM 349 bill. is FIM 1.33 bill.)

conclude that at the moment the Finnish government hardly has a credit access problem, as the size of the default premium is still quite small, but the results clearly illustrate that the debt price may change (since the premium is not constant).

References

Alesina, Alberto, De Broeck, Mark, Prati, Alessandro and Tabellini, Guido 1992. Default risk on government debt in OECD countries. *Economic Policy* October 1992, 428–463.

Ciarrapico, Anna Micaela 1992. *Country risk: a theoretical framework of analysis.* Darmouth.

Cottarelli, Carlo & Mecani, Mauro 1990. *The risk premium on Italian government debt, 1979-88.* IMF working paper April 1990.

Fabozzi, Frank J. & Fong Gifford 1994. *Advanced fixed income portfolio management. The state of art.* Chigago, Cambridge.

Giovanni, Alberto and Piga, Gustavo 1992. Understanding the high interest rates on Italian government securities. *CEPR Discussion Paper* No. 720, October 1992.

Heffernan, Slelagh A.1986. Sovereign risk analysis. London.

Hukkinen, Juhana ja Koskela, Erkki 1995. Voidaanko Suomen pitkien korkojen tasoa selittää talouden perustekijöillä, vai onko kyse jostain muusta? *Suomen Pankin keskustelunaloitteita* 8/95.

Krayenbuehl, Thomas E. 1985. *Country risk. Assesment and monitoring.* Cambridge.

Loenning, Ingunn 1994. *Default premia on European government debt.* Memorandum from department of Economics, University of Oslo 16/ 1994.

Nagy, Pancras 1984. *Country Risk.* Euromoney.

Appendix 1. Government bonds used in interest rate differentials

Finnish government DEM bonds					German government bonds				
	Maturity date	Issue date*	Coupon	Issue bill. DEM		Maturity date	Issue date	Coupon	Issue bill. DEM
FINL7.75 11/97	20.11.1997	20.11.1992	7.750	1.00	OBL7.25 10/97	20.10.1997	19.10.1992	7.250	7.00
FINL8.5 7/98	31.07.1998	31.07.1991	8.500	0.50	DBR6.75 8/98	20.08.1998	05.09.1988	6.750	4.00
FINL8.675 12/98	11.12.1998	11.12.1991	8.675	0.30	DBR6.375 12/98	21.12.1998	06.12.1988	6.375	4.00
FINL7.5 1/00	27.01.2000	27.01.1993	7.500	3.00	DBR7.125 12/99	20.12.1999	11.09.1989	7.125	4.00
FINL5.5 2/01	09.02.2001	09.02.1994	5.500	2.00	DBR9 1/01	22.01.2001	22.01.1992	9.000	10.00
FINL8.25 6/02	25.06.2002	25.06.1992	8.250	2.00	DBR8 7/02	22.07.2002	14.07.1992	8.000	15.00
Finnish government USD bonds					US government bonds				
	Maturity date	Issue date*	Coupon	Issue bill. USD		Maturity date	Issue date	Coupon	Issue bill. USD
FINL9 5/96	30.05.1996	30.05.1989	9.000	0.85	T9.375 4/96	15.04.1996	17.04.1989	9.375	7.78
FINL7.625 9/96	18.09.1996	18.09.1986	7.625	0.10	T7 9/96	30.09.1996	30.09.1991	7.000	10.10
FINL 10/96	21.10.1996	21.10.1986	8.375	0.07	T8 10/96	15.10.1996	16.10.1989	8.000	7.99
FINL 12/96	15.12.1996	15.12.1986	7.800	0.10	T7.25 11/96	15.11.1996	15.11.1986	7.250	20.26
FINL7.25 4/97	28.04.1997	28.04.1992	7.250	0.50	T8.5 4/95	15.04.1997	16.04.1990	8.500	7.86
FINL6.75 11/97	24.11.1997	24.11.1992	6.750	3.00	T8.875 11/97	15.11.1997	15.11.1987	8.875	9.80

* Issue date — first settlement date
FINL, DBR, OBL and T — codes used in Bloomberg system to identify individual bonds
FINL — Finnish government international bonds
DBR, OBL — German government bonds
T — US government bonds

Appendix 2a. The variables

DEMDIFF	Yield on Finnish government DEM-denominated bond minus yield on German government bonds (%-points; 7.85 - 7.55 = 0.30)
USDDIFF	Yield on Finnish government USD-denominated bonds minus yield on US government bonds (%-points)
GOVD	Finland's government debt (bill. FIM)
GOVDZ	9 month MA of government monthly debt changes (%; 4 % = 0.04) monthly change = ((debt level$_t$ - debt level$_{t-1}$) /debt level$_{t-1}$) (9 months: 5 months backward and 3 months forward)
GDP	GDP level (bill. FIM)
GDPZ	GDP change compared to average level for previous six months (%)
CURA	Current account level (mill. FIM)
CURAZ	Current account change compared to average level for previous six months (%)
RATING	log((rating of Moody's + rating of Standard and Poor's) / 2) [investment grade ratings scored from 1 to 10, lowest to highest]
USAVOLA	Historical volatility of 3-month interest rates in USA, 3 month MA (historical volatility = variance for previous 22 days / average interest rate) level)
GERVOLA	Historical volatility of 3-month interest rates in Germany, 3 month MA (historical volatility = variance for previous 22 days / average interest rate)
UMATU	Average time to maturity of US government bonds used in comparisons (years operationalized as Excel serial numbers)
DMATU	The average time to maturity of German government bonds used in comparisons (years operationalized as Excel serial numbers)
DLEVEL	Yield level of German government bonds used in comparisons (%)
ULEVEL	Yield level of US government bonds used in comparisons (%)

Appendix 2b. The Regressions

1 / DEM

Dependent Variable DEMDIFF - Estimation by Least Squares
Monthly Data From 1991:10 To 1995:02

Usable Observations	41	Degrees of Freedom	32
Centered R**2	0.856767	R Bar **2	0.820959
Uncentered R**2	0.950453	T x R**2	38.969
Mean of Dependent Variable		0.2776016260	
Std Error of Dependent Variable		0.2043866872	
Standard Error of Estimate		0.0864826605	
Sum of Squared Residuals		0.2393360180	
Regression F(8,32)		23.9265	
Significance Level of F		0.00000000	
Durbin-Watson Statistic		1.913400	
Q(10-0)		4.789619	
Significance Level of Q		0.90478120	

Variable	Coeff	Std Error	T-Stat	Signif
1. Constant	2.573109458	1.198302287	2.14730	0.03944756
2. GOVDZ	5.619894144	1.091340445	5.14953	0.00001286
3. GOVD	0.000509513	0.000639928	0.79620	0.43178081
4. RATING	-0.873590286	0.480736448	-1.81719	0.07856337
5. CURA	-0.000010145	0.000012988	-0.78113	0.44046415
6. GDPZ	0.004012867	0.004226013	0.94956	0.34945110
7. GERVOLA	3.466194538	7.026428507	0.49331	0.62516349
8. DMATU	0.000185533	0.000138621	1.33842	0.19019303
9. DLEVEL	-0.175663237	0.023567380	-7.45366	0.00000002

2 / DEM

Dependent Variable DEMDIFF - Estimation by Least Squares
Monthly Data From 1991:10 To 1995:02

Usable Observations	41	Degrees of Freedom	35
Centered R**2	0.851376	R Bar **2	0.830144
Uncentered R**2	0.948589	T x R**2	38.892
Mean of Dependent Variable		0.2776016260	
Std Error of Dependent Variable		0.2043866872	
Standard Error of Estimate		0.0842350129	
Sum of Squared Residuals		0.2483438092	
Regression F(5,35)		40.0988	
Significance Level of F		0.00000000	
Durbin-Watson Statistic		1.901456	
Q(10-0)		6.951726	
Significance Level of Q		0.72999432	

Variable	Coeff	Std Error	T-Stat	Signif
1. Constant	2.656262237	1.142188517	2.32559	0.02596053
2. GOVDZ	5.608707354	1.036811784	5.40957	0.00000464
3. GOVD	0.000565161	0.000597733	0.94551	0.35088181
4. RATING	-0.904462730	0.460740641	-1.96306	0.05762468
5. DMATU	0.000171792	0.000126589	1.35708	0.18344271
6. DLEVEL	-0.174101843	0.022783554	-7.64156	0.00000001

3 / DEM, REPORTED IN TEXT

Dependent Variable DEMDIFF - Estimation by Least Squares
Monthly Data From 1991:10 To 1995:02

Usable Observations	41	Degrees of Freedom	37
Centered R**2	0.819738	R Bar **2	0.805123
Uncentered R**2	0.937645	T x R**2	38.443
Mean of Dependent Variable		0.2776016260	
Std Error of Dependent Variable		0.2043866872	
Standard Error of Estimate		0.0902263570	
Sum of Squared Residuals		0.3012094334	
Regression F(3,37)		56.0857	
Significance Level of F		0.00000000	
Durbin-Watson Statistic		1.401998	
Q(10-0)		12.400966	
Significance Level of Q		0.25911710	

Variable	Coeff	Std Error	T-Stat	Signif
1. Constant	1.323359939	0.203746743	6.49512	0.00000013
2. GOVD	0.000644045	0.000301848	2.13367	0.03956452
3. GOVDZ	5.785625439	0.928756134	6.22943	0.00000031
4. DLEVEL	-0.201867960	0.021742936	-9.28430	0.00000000

4 / USD

Dependent Variable USDDIFF - Estimation by Least Squares
Monthly Data From 1991:10 To 1995:02

Usable Observations	41	Degrees of Freedom	35
Centered R**2	0.825768	R Bar **2	0.800878
Uncentered R**2	0.988231	T x R**2	40.517
Mean of Dependent Variable		0.4844512195	
Std Error of Dependent Variable		0.1320105932	
Standard Error of Estimate		0.0589072220	
Sum of Squared Residuals		0.1214521281	
Regression F(5,35)		33.1763	
Significance Level of F		0.00000000	
Durbin-Watson Statistic		1.030408	
Q(10-0)		31.143408	
Significance Level of Q		0.00055557	

Variable	Coeff	Std Error	T-Stat	Signif
1. Constant	-0.202546574	0.887685229	-0.22817	0.82083892
2. GOVDZ	5.200316972	0.746601686	6.96532	0.00000004
3. GOVD	0.000486820	0.000969871	0.50194	0.61885057
4. RATING	0.247188112	0.321240449	0.76948	0.44677063
5. UMATU	0.000049903	0.000238998	0.20880	0.83581372
6. ULEVEL	-0.034098944	0.018656854	-1.82769	0.07613167

5 / USD

Dependent Variable USDDIFF - Estimation by Least Squares
Monthly Data From 1991:10 To 1995:02

Usable Observations	41	Degrees of Freedom	37
Centered R**2	0.822543	R Bar **2	0.808155
Uncentered R**2	0.988013	T x R**2	40.509
Mean of Dependent Variable		0.4844512195	
Std Error of Dependent Variable		0.1320105932	
Standard Error of Estimate		0.0578207811	
Sum of Squared Residuals		0.1236999808	
Regression F(3,37)		57.1672	
Significance Level of F		0.00000000	
Durbin-Watson Statistic		1.009308	
Q(10-0)		25.060165	
Significance Level of Q		0.00523262	

Variable	Coeff	Std Error	T-Stat	Signif
1. Constant	0.447472070	0.081291227	5.50456	0.00000294
2. GOVDZ	5.441602734	0.594669387	9.15064	0.00000000
3. GOVD	0.000105192	0.000160547	0.65521	0.51638578
4. ULEVEL	-0.033758856	0.009575224	-3.52565	0.00114537

6 / USD, REPORTED IN TEXT

OLS ESTIMATION
41 OBSERVATIONS DEPENDENT VARIABLE = USDDIFF
NOTE..SAMPLE RANGE SET TO: 1, 41
USING HETEROSKEDASTICITY-CONSISTENT COVARIANCE MATRIX
AND AUTOCORRELATION-CONSISTENT MATRIX WITH ORDER= 2
BY NEWEY-WEST CORRECTION METHOD
R-SQUARE = .8208 R-SQUARE ADJUSTED = .8062
VARIANCE OF THE ESTIMATE-SIGMA**2 = .33770E-02
STANDARD ERROR OF THE ESTIMATE-SIGMA = .58112E-01
SUM OF SQUARED ERRORS-SSE = .12495
MEAN OF DEPENDENT VARIABLE = .48445
LOG OF THE LIKELIHOOD FUNCTION = 60.5887

VARIABLE NAME	ESTIMATED COEFFICIENT	STANDARD ERROR	T-RATIO 37 DF	SIGNIF
GOVDZ	5.4126	.6680	8.102	0.00000
GOVD	.99585E-04	.2056E-03	.4843	0.63103
ULEVEL	-.33839E-01	.8131E-02	-4.162	0.00018
CONSTANT	.45040	.7862E-01	5.729	0.00000

BANK OF FINLAND DISCUSSION PAPERS

ISSN 0785-3572

1/95 Olavi Rantala **Valuuttakurssimuutosten vaikutus yritysten kannattavuuteen** (Effects of Exchange Rate Changes on Corporate Profitability). 1995. 51 p. ISBN 951-686-439-2. (KT)

2/95 Liselotte Høj **Fundamental Equilibrium Exchange Rate — A Case Study of the Finnish Markka**. 1995. 30 p. ISBN 951-686-440-6. (TU)

3/95 Jean-Marie Viaene — Itzhak Zilcha **Multiple Uncertainty, Forward-Futures Markets and International Trade**. 1995. 23 p. ISBN 951-686-441-4. (TU)

4/95 Jorma Hilpinen **Analysis on the Errors and Omissions in the Finnish Balance of Payments: Restless Capital Movements, Floating Exchange Rate and Errors Since 1991**. 1995. 31 p. ISBN 951-686-442-2. (TP)

5/95 Juhana Hukkinen — Matti Virén **Assessing the Performance of a Macroeconomic Model**. 1995. 48 p. ISBN 951-686-443-0. (TU)

6/95 Tuomas Saarenheimo **Credit Crunch Caused Investment Slump? An Empirical Analysis Using Finnish Data**. 1995. 26 p. ISBN 951-686-444-9. (KT)

7/95 Sinimaaria Ranki **On the Role of the Single Currency ECU**. 1995. 37 p. ISBN 951-686-445-7. (TU)

8/95 Juhana Hukkinen — Erkki Koskela **Voidaanko Suomen pitkien korkojen tasoa selittää talouden perustekijöillä, vai onko kyse jostain muusta?** (Can the Level of Long-Term Interest Rates in Finland Be Explained by Economic Fundamentals, or Must an Explanation be Sought Somewhere Else? 1995. 27 p. ISBN 951-686-446-5. (KT)

9/95 Kari Takala — Matti Virén **Testing Nonlinear Dynamics, Long Memory and Chaotic Behaviour with Macroeconomic Data**. 1995. 55 p. ISBN 951-686-448-1. (TU)

10/95 Lauri Kajanoja **Aggregate Investment and Corporate Indebtedness: Some Empirical Evidence from Finland**. 1995. 28 p. ISBN 951-686-449-X. (KT)

11/95 Kari Takala **The Interest Rate Sensitivity of Output in Finland**. 1995. 49 p. ISBN 951-686-450-3. (KT)

12/95 Timo Tyrväinen **Wage Determination in the Long Run, Real Wage Resistance and Unemployment: Multivariate Analysis of Cointegrating Relations in 10 OECD Economies**. 1995. 94 p. ISBN 951-686-451-1. (KT)

13/95 Eddie George **Inflation Targeting in the UK Monetary Policy Framework**. 1995. 12 p. ISBN 951-686-452-X. (TIE)

14/95 Risto Murto **The Banking Crisis, Banking Policy Regimes and the Value of a Bank**. 1995. 27 p. ISBN 951-686-453-8. (TU)

15/95 Kari Takala **Permanent Income Hypothesis and Saving in Finland**. 1995. 53 p. ISBN 951-686-454-6. (KT)

16/95 Heikki Koskenkylä — Jaana Rantama **Pankkien korkomarginaalit ja korkokatteet Pohjoismaissa** (Banks' Interest Rate Margins and Net Interest Income in the Nordic Countries). 1995. 27 p. ISBN 951-686-455-4. (RM)

17/95 Mika Kuismanen **Exchange Rates and Import Prices in Finland: Estimation of Exchange Rate Pass-Through**. 1995. 33 p. ISBN 951-686-458-9. (KT)

18/95 Johnny Åkerholm – Timo Hämäläinen – Mika Kuismanen **Employment and the Structure of the Finnish Economy. A Model for Evaluating Scenarios**. 1995. 56 p. ISBN 951-686-460-0. (KT)

19/95 Kaare G. Andersen **Inflation Targeting: Analyzing Indicators of Inflation in Finland**. 1995. 32 p. ISBN 951-686-461-9. (KT)

20/95 Kari Takala **The Consumption Function Revisited: An Error-Correction Model for Finnish Consumption**. 1995. 44 p. ISBN 951-686-462-7. (KT)

21/95 Jouni Timonen **Nominal Income as an Intermediate Target for Monetary Policy**. 1995. 56 p. ISBN 951-686-463-5. (RP)

22/95 Maaria Kettunen **Korkojen aikarakenne, inflaatio-odotukset ja inflaatio** (Term Structure of Interest Rates, Inflation Expectations and Inflation). 1995. 81 p. ISBN 951-686-464-3. (RP)

23/95 Dan Kovenock – Casper G. de Vries **Fiat Exchange in Finite Economies**. 1995. 27 p. ISBN 951-686-465-1. (TU)

24/95 Antti Ripatti **Leading Inflation Indicators in Finland: Pairwise Analysis of Granger-Causality and Cointegration**. 1995. 45 p. ISBN 951-686-466-X. (RP)

25/95 Jorma Hilpinen **Compilation of Early Warning Indicators for Foreign Trade Employing a Cut-Off Survey**. 1995. 17 p. ISBN 951-686-467-8. (TP)

26/95 Vappu Ikonen **Suomen Pankin kotimainen luotonanto 1868–1992** (The Bank of Finland's Domestic Lending, 1868–1992). 1995. 131 p. ISBN 951-686-468-6. (TU)

27/95 Kaare Guttorm Andersen – Hanna-Leena Männistö **Output Gaps and the Government Budget Balance: The Case of Finland**. 1995. 27 p. ISBN 951-686-470-8. (KT)

28/95 Kari Takala – Matti Virén **Bankruptcies, Indebtedness and the Credit Crunch**. 1995. 28 p. ISBN 951-686-471-6. (TU)

29/95 Tuomas Saarenheimo **The Equilibrium Exchange Rate for the Finnish Markka**. 1995. 27 p. ISBN 951-686-472-4. (KT)

30/95 Erja Saukkonen **Default Risk on Finnish Government Foreign Currency Debt**. 1995. 29 p. ISBN 951-686-473-2. (RM)