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DEREGULATION OF FINANCIAL MARKETS:
A GENERAL EQUILIBRIUM ANALYSIS
OF FINLAND*

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ABSTRACT. In the 1980's there have been substantial institutional changes in the structure and scope of the markets, the behaviour of the market participants and the monetary policy tools in many countries, including Finland. Two major changes in the Finnish financial system have been the rapid growth of the short-term money market and the deregulation of the administrative interest rate controls in the bank loan market set by the central bank. The aim of this paper is to carry out a general equilibrium analysis of these structural changes in the financial markets. The behaviour of the non-bank private sector and the banks is described by extensive use of portfolio theory. By combining these two blocks into a macroeconomic model, it is possible to make some comparisons between the old and the new financial regimes with respect to macroeconomic stability and effectiveness of policies. The deregulation of the bank loan market and the emergence of a short-term money market have made the domestic economy less dependent on shocks arising from fluctuations in exports. A shift towards a more competitive bank loan market has improved the effectiveness of monetary policy and also reduced the sensitivity of the domestic economy with respect to foreign demand shocks. The paper also shows that the deregulation of the financial markets has led to a decline in the effectiveness of fiscal policy.

KEY WORDS: Financial markets, deregulation, macroeconomic policies

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TIIVISTELMÄ. Suuria rakenteellisia muutoksia on tapahtunut 1980-luvulla rahoitusmarkkinoiden toiminnassa, markkinaosapuolien käyttäytymisessä ja rahapolitiikan keinoissa useissa teollisuusmaissa, mukaanlukien Suomessa. Kaksi keskeistä muutosta Suomen rahoitusmarkkinoilla ovat olleet lyhyen rahan markkinoiden synty ja ripeä kasvu sekä luopuminen keskuspankin harjoittamasta hallinnollisesta luottokoron säätelystä. Tarkoituksena tässä tutkielmassa on juuri tarkastella näiden rahoitusmarkkinoiden muutosten kokonaistaloudellisia vaikutuksia muodostamalla yleisen tasapainon makrotaloudelliset mallit, jotka nojautuvat keskeisesti portfolioteoriaan yleisön ja pankkien käyttäytymisen kuvaamisessa. Tulosten mukaan pankkiluottomarkkinoiden vapauttaminen ja lyhyen rahan markkinoiden synty ovat vähentäneet talouden riippuvuutta ulkoisista kysyntäshokeista, so. viennin vaihteluista. Siirtyminen kilpailullisempiin pankkiluottomarkkinoihin on myös johtanut viennin vaikutusten vähenemiseen. Tuloksia voidaan tulkita myös siten, että rahoitusmarkkinoiden deregulaatio on johtanut finanssipolitiikan vaikutusten vähenemiseen. Tämä perustuu mm. siihen, että menojen riippuvuus juoksevista tuloista on vähentynyt rahoitusmarkkinoiden säännöstelyn purkauduttua.

ASIASANAT: Rahoitusmarkkinat, deregulaatio, talouspolitiikka

Kari Alho

DEREGULATION OF FINANCIAL MARKETS: A GENERAL EQUILIBRIUM ANALYSIS OF FINLAND

1. Introduction

In the 1980's there have been substantial institutional changes both in the structure and scope of the financial markets, behaviour of the market participants and the tools of the monetary policies in industrial countries(1). There have been major steps towards deregulation of quantitative controls, a shift towards market determined interest rates and a worldwide integration within national and international financial markets. The variety of financial instruments has been enlarged to fit better with the financial needs of the market participants and to allow for a more efficient allocation of risks in the economy.

In Finland the financial markets were tightly controlled by administrative measures up to the early 1980's. Quantitative constraints, most notably credit rationing, dominated the operation of the markets. There was virtually no short-term money market and the domestic component of the base money supply consisted of direct lending by the central bank to the banks. Since then a short-term mo-

ney market has emerged, growing into a deep market of substantial size. It was first linked by arbitrage to the market for central bank finance of the banks, but has recently been transformed into a market of the standard type where the central bank indirectly through changing its position in this market influences the domestic short-term interest rate. The central bank abandoned control of the average lending rates of the banks in 1986. Deregulation of exchange controls is also under way(2).

Our aim in this paper is to carry out a general equilibrium analysis of these changes in the operations of the Finnish financial markets. Our method is to construct macroeconomic models for three financial regimes with different menus of financial instruments available to the private sector and a varying degree of deregulation of the markets and to compare the different financial regimes with each other with respect to private sector behaviour, macroeconomic stability and changes in the effectiveness of monetary policies. In order to keep the analysis within manageable limits, we concentrate on the changes in the working of the bank loan market and the short-term money market. So we do not address the interesting problem of the growing role of the securities market in this context.

In order to be able to carry out a reliable comparison between the "old" and "new" financial environments, we must introduce a firm microtheoretic arsenal into the analysis, because otherwise we could not draw any conclusions concerning the structural changes in behaviour. Our method is to utilize portfolio theory extensively because, as is well-known, portfolio allocations depend in principle in a simple way on the covariances between asset returns and

the attitudes towards risk by the agents. Accordingly, we shall describe decision-making of the non-bank private sector in a mean-variance framework and combine this with the behaviour of the banks and the central bank. By combining these blocks into a common macroeconomic model, we are then able to derive some general equilibrium properties of the deregulation in the financial markets. As will become evident, the task easily becomes quite elaborate even in our fairly concise framework. The reason for this is that we have to take into consideration not only the first moments, i.e. means, but also the second moments, i.e. uncertainty in the form of variances and covariances, in such a way as to be partly endogenous and dependent on the structure of the financial system. Basically, the system we are building is driven by two uncertainties, taken as mutually independent, namely the yield on domestic real capital and on foreign financial claims. We should remark already at the outset that the results depend quite closely on the specification of the financial system, especially the risk characteristics of the various assets and liabilities.

We should also here briefly mention the limitations of the study. Even though we assume throughout that exchange rates are fixed (in effective terms), we assume that there is a certain uncertainty related to the costs of foreign borrowing in terms of domestic currency. We do not, however, specify explicitly from which source it stems. Government behaviour and finances are not explicitly presented, but we are nevertheless able to make some inferences concerning the effects of fiscal policies. The analysis only covers the short-term macroeconomic properties of the economy. All problems concerning the supply of goods and the operation of the factor markets are discarded in our Keynesian structure.

The structure of the rest of the paper is as follows. In section 2 we define the three financial regimes we are studying. Section 3 is devoted to deriving the behavioural equations for the non-bank private sector in the different regimes, while section 4 describes the behaviour of the banks. After these preliminaries, we turn to the macroeconomic analysis of the properties of the various regimes in sections 5,6 and 7. Section 8 presents the conclusions of the study.

2. Specification of financial instruments and financial regimes to be studied

First we have to define the financial instruments which we are considering and "label" them with characteristics by which we are able to distinguish them from each other in order to be able to derive some clear-cut results. Otherwise we would run into difficulties and the results would then become too vague to be at all helpful. So, we consider decision-making in a framework covering the following items:

Goods. Real expenditure ("optimally balanced bunch" of investment and consumption) (E) which yields a random rate of return i_K.

Domestic bank loans (L). These are assumed to have a fixed-interest rate i_L which is taken to be known and certain at the moment of decision-making for the unit period. Thus loans are in a way negotiated at the beginning of the unit period (to bear either the administrative rate in the old system or the equilibrium rate in the new system) and to be of a fixed rate type.

Bank deposits (D). These are assumed to bear a fixed and known rate of interest i_D, at which the banks are rationed.

Short-term domestic asset (M). This has during the unit period either a certain or uncertain return i_M depending on the policy rule obeyed by the central bank. In the old financial market system this instrument is identified as the central bank debt of the banks (CB), see on this more closely Alho (1988), section 2.1.

Foreign financial liability (F), the interest rate i_F of which is uncertain, e.g. because of the exchange rate risk, or because the liability is of a variable interest rate type.

Base money (cash)(H). This item is assumed to be a fixed quantity in the portfolios of the non-bank private sector because of its small size in a macroeconomic context. The supply of base money has two sources: the holdings of the short-term asset by the central bank (denoted by CB^s in the old system and by M_{cb} in the new one) and the foreign reserves (F_{cb}) of the central bank.

Our aim is to compare the following three financial regimes, which we call the "old", the "intermediate" and the "new" regime. The financial regimes are characterized by the following specification with respect to the operation of the markets, as shown in the following table.

Table 1. STRUCTURE OF MARKETS IN THE DIFFERENT FINANCIAL REGIMES

MARKET	OLD	INTERMEDIATE	NEW
Goods	Keynesian	Keynesian	Keynesian
Deposits	Banks rationed at the fixed dep.rate	as in old	as in old
Loans	Private sector rationed at the fixed loan rate	Freely floating loan rate of interest	as in intermediate
Short-term money market	The market for central bank debt of the banks	as in old	Short-term money market with non-bank private sector as one market participant
Foreign assets	The elasticity of supply of foreign funds is perfectly elastic	as in old	as in old
Cash (base money)	The supply of cash consists of the foreign reserves and the position of the central bank in the short-term money market	as in old	as in old

The goods market operates in the standard Keynesian manner in all the different regimes, i.e. the supply of goods is perfectly elastic at the fixed price level (set to unity), exports is also a fixed quantity for the home economy and imports is a simple function of aggregate income. Other common features in the model over the different regimes are the operation of the market for bank deposits, where the banks are assumed to be rationed, and the supply of the foreign financial liabilities provided by the foreigners to the domestic non-bank private sector which is perfectly elastic at the prevailing foreign rate of interest. The market for cash is omitted from the equilibrium system on the basis of Walras' law.

So we see that the structural changes in the financial markets concentrate on the short-term money market and the bank loan market. In the "old" regime there is credit rationing and the domestic component of base money supply consists of the central bank finance of the banks. In the "intermediate" financial regime we have the case where the central bank has deregulated the bank loan market and there is a freely floating domestic loan rate of interest clearing the bank loan market. In the "new" regime we have in addition to this transformed the market for central bank debt into a short-term money market with the private non-bank sector as one market participant side by side with the banks and the central bank. In the "new" financial regime we also consider as a subcase the deregulation of the exchange controls.

The above order of transformation in the financial system does not exactly correspond to the timely order of deregulation in the Finnish financial markets.

It is true that in Finland first the short-term money market grew vigorously in the early 1980's and only later in 1986 was there a suspension of the interest controls concerning average bank lending rates. However, the early period of the free funds market was characterized by tight pegging of the rates in that market to the call money rate on overnight borrowing from the central bank, and so we cannot consider that period to represent what has happened only recently in 1987, when there has been a shift to a "genuine" short-term money market with marketable instruments and an active secondary market for them. Our specification of the transformation of the financial markets should, however, have more general interest, because first the market between the public and the banks will be deregulated and then later on there is a shift into a phase with an active and deep short-term money market.

3. Behaviour of the private non-bank sector in the different regimes

Let us now turn to deriving the behaviour of the non-bank private sector in the various regimes. To make things simpler, we have bridged the difficult task of combining decision-making on real expenditure and financial behaviour by considering real goods as one of the investment objects for the private sector in addition to the financial claims. Implicitly, we are describing the behaviour of firms, and so we are omitting various aspects which are by and large typical of households.

In the **"OLD"** system borrowing from the banks by the firms is rationed at the

amount $\bar{L}$ exceeding the notional demand for loans at the fixed loan rate i_L. The flow budget constraint binding the decision making is

$$E = y + \bar{L} + F - D + W^f, \tag{1}$$

where E is the flow of real expenditure, y is national income, L is the end-of-period stock of bank loans, F is the end-of-period stock of foreign debts to the private sector, D is the stock of bank deposits at the end of the period and W^f is the stock of net financial wealth (except cash) at the beginning of the period, i.e. it consists of deposits less domestic and foreign loans. A bar is used to indicate an exogenous financial flow for the sector. In order to simplify the analysis we assume that all interest payments and the return on new real investments are received only in the next period, when bank profits and the profits on the central bank are paid back to the non-bank private sector. We assume that the current profits of the banks and the central bank are roughly the same as those in the previous period and therefore the current income of the non-bank private sector is equal to the national income. These assumptions allow us to omit the various interest payments from the private sector income and therefore simplify the analysis.

In the following we have specified in a most simple way the demand for bank deposits to be a function of just income and the deposit rate. Deposit holdings are determined in the first stage of the decision-making and they are not an element of the optimizing model describing private sector behaviour. So we assume that the stock demand for deposits is a simple function of income y and the deposit rate i_D,

(2) $$D^d = dy + fi_D,\ d \text{ and } f > 0,\ 0 < d < 1 .$$

We now consider decision-making with respect to the rest of the assets. The profit π from these allocations in the unit period is

(3) $$\pi = i_K E - i_L \bar{L} - i_F F .$$

The uncertainties which have an effect on the behaviour of the private sector are related to the yields on real investments and the cost of foreign funds in the manner described above. As mentioned, we assume that these disturbances are statistically independent from each other, since foreign nominal shocks and domestic real shocks may be presumed to be uncorrelated with each other. This assumption greatly facilitates the derivations below. We also simplify matters by assuming that there is no uncertainty related to income, i.e. the yield on existing capital. All uncertainty is related to new investments and their financing.

In general, we use the notation where the covariance between rates of return i_x and i_y is denoted by σ_{xy} and the variance of i_x by $\sigma_{xx} = (\sigma_x)^2$. In the mean-variance framework the objective function of a single investor is

(4) $$U(E(\pi), V(\pi)),\ U_1 > 0,\ U_2 < 0,$$

where $E(\pi)$ is the expectation and $V(\pi)$ the variance of the profit. In the following we assume the non-bank private sector behaviour to show constant relative risk aversion, i.e. that we have

(5) $$-2WU_2/U_1 = a > 0, \text{ constant},$$

where W is the net wealth of the agent, supposed to be predetermined and a/2 is the coefficient of the relative risk aversion. Now we are able to derive in this framework the following optimal decision rules:

(6a) $$E = -\frac{W}{a}\left(\frac{Ei_K - Ei_F}{\sigma_{KK} + \sigma_{FF}}\right) + \frac{\sigma_{FF}}{\sigma_{KK} + \sigma_{FF}}(\tilde{y} + \bar{L})$$

(6b) $$F = -\frac{W}{a}\left(\frac{Ei_K - Ei_F}{\sigma_{KK} + \sigma_{FF}}\right) - \frac{\sigma_{KK}}{\sigma_{KK} + \sigma_{FF}}(\tilde{y} + \bar{L})$$

Here by $\tilde{y}$ is denoted the variable $y(1-d)-fi_D+W^f$. The total net wealth W consists of the real wealth added to the net financial wealth. We find that the administrative domestic loan rate does not at all have an effect on the desired real expenditure and its financing by foreign borrowing. On the other hand, the deposit rate has an effect on both real expenditure and foreign borrowing. The higher the "overall" uncertainty in the system, i.e. the sum $\sigma_{KK} + \sigma_{FF}$, the less the interest differential between the yield on real investment and the foreign rate of interest has an effect on the private sector behaviour. On the other hand, it is the relation between the real and financial uncertainty which determines to which degree sources of finance, i.e. income and exogenous bank lending flow, are used for real investments and to reduce foreign borrowing. The higher the ratio σ_{FF}/σ_{KK}

is, the higher the propensity to spend exogenous sources of finance on real expenditure. If there is no financial risk, i.e. if σ_{FF} is zero, all income is used to acquire foreign assets (or reduce foreign liabilities) and none at all to finance real expenditures. We also see that an increase in the variance σ_{FF}, which can be a result of deliberate policies by the central bank in the currency market, decreases the offset coefficient in (6b).

INTERMEDIATE regime. As explained above, in this case the bank loan market has been deregulated. The private sector now behaves as a price taker in the bank loan market instead of as a quantity taker as before. Otherwise the institutional framework is similar to that above. Remember that above we made the assumption that domestic loans are of a fixed interest type and therefore are not a new source of uncertainty. It is fairly straightforward to derive the following behavioural equations for the private sector agents:

$$E = -\frac{W}{a}\left(\sigma_{KK}^{-1}\left(Ei_K - i_L\right)\right) \tag{7a}$$

$$L = -\frac{W}{a}\left(\sigma_{KK}^{-1}\left(Ei_K - i_L\right) - \sigma_{FF}^{-1}\left(i_L - Ei_F\right)\right) - \tilde{y} \tag{7b}$$

$$F = -\frac{W}{a}\left(\sigma_{FF}^{-1}\left(i_L - Ei_F\right)\right) . \tag{7c}$$

Here we reach the result that the real expenditures do not at all depend on the foreign interest rate. This property crucially depends on our basic assumption of no correlation between yields on domestic real investments and the foreign

interest rate. On the other hand, we find that the real expenditures react more vigorously to the relevant financial rate than was the case above in the "old" system and similarly the reactions to changes in the respective yield on real investment are now larger. The reason for these results is that now the firms have to take into account only the uncertainty related to real investment as the domestic loan rate is here supposed to be fixed and known for the decision period. It is also important to see that in this case changes in income do not have any effect on desired real expenditures, which only depend on the interest differential between the real investment and the relevant financial rate of interest. The reason for this is that income, taken to be known at the moment the investment decision is made, is a perfect substitute for the other certain source of finance, i.e. domestic loans.

NEW regime. Let us finally turn to the most complicated case where we introduce the domestic short-term money market with one financial instrument for the private sector. We assume that this instrument (M) has potentially (see, however, section 7.1. below) an uncertain return just like the foreign rate. As this instrument is now available also to the private sector, we have to take into account the covariation of the domestic short-term rate with the rate on real investments and the foreign rate. These covariances may either be caused by the very characteristics of the assets and by the financial market behaviour of the agents, or because of the behaviour of the central bank. One possibility is that the domestic and foreign short-term rates have to covary because of the close substitutability between these assets and the operations of the central bank which are directed towards the goal of maintaining its reserves. This goal requires a policy which at least to some extent links the domestic rate of

interest to the foreign. Especially, the deregulation of the foreign capital flows leads to this kind of a situation. This is considered in section 7.2.

For these reasons, the analysis carried out below is quite a complicated one in this "new" financial regime. We return to this in section 7 and present here first the behaviour of the non-bank private sector.

In this case the budget constraint for the private sector is

$$E + M_p = \tilde{y} + L + F, \tag{8}$$

where M_p is the stock of the domestic short-term asset held by the non-bank private sector at the end of the unit period considered here, the return on which is i_M. The financial wealth W^f is now transformed to consist also of the stock of the M asset in the beginning of the period.

From the first order necessary and sufficient conditions we can derive the following set of demand functions for the non-bank private sector. The demand for foreign loans is then solved as a residual from the budget constraint (8).

$$(9) \qquad B \begin{bmatrix} E \\ L \\ M_p \end{bmatrix} = (W/a) \begin{bmatrix} Ei_K - Ei_F \\ i_L - Ei_F \\ Ei_M - Ei_F \end{bmatrix} + \begin{bmatrix} b_1 \\ b_2 \\ b_3 \end{bmatrix} \tilde{y} \ ,$$

where the matrix B consists of the following covariance and variance terms

$$(10a) \qquad B = \begin{bmatrix} \sigma_{KK} + \sigma_{FF} & -\sigma_{FF} & (\sigma_{FF} + \sigma_{KM} - \sigma_{MF}) \\ \sigma_{FF} & -\sigma_{FF} & (\sigma_{FF} - \sigma_{MF}) \\ (\sigma_{FF} + \sigma_{KM} - \sigma_{MF}) & (-\sigma_{FF} + \sigma_{MF}) & (\sigma_{MM} + \sigma_{FF} - 2\sigma_{MF}) \end{bmatrix},$$

and the vector $b = (b_1, b_2, b_3)'$ has the following elements

$$(10b) \qquad b_1 = \sigma_{FF},\ b_2 = \sigma_{FF},\ b_3 = \sigma_{FF} - \sigma_{MF}\ .$$

It would be straightforward but tedious to derive from (9) and (10) the desired demands and their properties analogously with that above even if we could take the covariances σ_{MF} and σ_{KM} as given. We do not, however, directly need the solution of (9), as we are going to see in section 7.

The above individual behavioural equations can be aggregated into market demand functions as quite simple aggregation is possible here with uniform expectations and covariances. The terms where the individual wealth W is multiplied by the inverse of the coefficient of relative risk aversion is taken to be a constant sum in aggregation. Therefore, we can directly interprete the above derivations as market demand functions and we can use the same symbols as above to denote market variables. The income terms can also be aggregated in a simple way.

4. Behaviour of the banks and the central bank

As can be seen from section 2, the behaviour of the banks remains essentially the same in all the regimes which we consider. Banks supply loans and finance these by deposits and by borrowing from the short-term money market, which we identify in the "old" and "intermediate" systems with the market for central bank debt of the banks (symbol CB) and in the "new" system with the domestic short-term money market, the market M (see section 2.1. in Alho (1988) on this). We also have to specify the behaviour of the central bank in the short-term money market, as this essentially influences the loan supply behaviour of the banks, because i.a. the risks facing the banks depend also on the policy rule of the central bank.

The banks do not participate in the foreign capital markets in such a way as to have an open position in foreign currencies against the domestic currency. This is not allowed by the exchange controls carried out the Bank of Finland. So, in a way the net foreign debt of the banks can be added to that of the private sector, and this is what we have done here. So, the balance sheet of the banks is

$$L = D + CB \text{ (or } M_b) \quad . \tag{11}$$

For simplicity, we abstract from cash reserve requirements of the banks and cash reserve policy by the central bank in this paper. We now have to specify the uncertainty related both to the volume of the deposits of a single bank and to

the short-term interest rate i_M. We assume that the individual bank operates on the assumption that its lending policies do not have an effect on the level of the rate of interest in the short-term money market. In oligopolistic banking markets this is perhaps not the best way to describe market behaviour, but we may justify this with the following reasoning. The bank i under consideration thinks that either because the outflow of funds from the system is a minor factor or that the competing banks react by also expanding their lending, the overall position for the banks as a whole in the market for the central bank debt of the banks (or the short-term money market) does not depend on the lending policies of the bank i. Therefore the short-term money market rate (or the rate on the central bank debt) should not depend to any great extent on the lending policy of an individual bank. One further factor behind this assumption is that a major source of uncertainty of this rate is related to the measures taken by the central bank itself (see below for more on this).

The expected value and variance of a bank's profit π_{bi} can now be presented on the above assumptions of a certain lending rate and keeping the loan supply L_i as the decision variable of a representative bank i.

$$\pi_{bi} = i_L L_i - i_M(L_i - D_i) - i_D D_i \tag{12a}$$

$$E(\pi_{bi}) = (i_L - Ei_M)L_i - (i_D - Ei_M)ED_i \tag{12b}$$

$$V(\pi_{bi}) = \sigma_{MM} L_i^2 - 2\, L_i(ED_i)\sigma_{MM} + \text{terms not depending on } L_i \,. \tag{12c}$$

In the following we have carried out the analysis under the assumption of risk averting bank behaviour and the banks are taken to show identical absolute risk

aversion. Constant absolute risk aversion has been quite a common way to describe bank behaviour under uncertainty starting with Parkin (1970). The coefficient of absolute risk aversion is denoted by b/2. We also take into account that the marginal revenue from lending is a decreasing function of the volume of loans because the banks typically have market power in the loan market. We are going to make some inferences with respect to this parameter below. So we specify that the loan rate depends on lending policy of bank i in the following manner,

$$(13) \qquad i_L = i(L) \ , \ di_L/dL_i = i'(L)(dL/dL_i),$$

where L is the aggregate loan supply and the derivative $dL/dL_i \geq 0$ depends on the degree of competition in the bank loan market. This parameter is taken to be a constant below. With perfect competition we have $dL/dL_i = 0$, but with Cournot oligopoly or a monopoly we have $dL/dL_i = 1$. The consistent conjectures equilibrium would in the case of identical banks and constant marginal cost correspond to the Bertrand oligopoly under which assumption dL/dL_i would also be zero (see on this Dixit (1986) and Rantala (1988)). The optimal aggregated bank loan supply and demand for central bank debt (or in the new regime borrowing from the short-term money market) can now be easily derived to be

$$(14a) \qquad L^s = \frac{i_L - Ei_M}{n^{-1}(g + b\sigma_{MM})} + \frac{b\sigma_{MM}}{g + b\sigma_{MM}} ED \quad \text{and}$$

$$(14b) \qquad CB^d (\text{or } M_b^d) = L^s - D, \text{ where } g = -i'(L)(dL/dL_i) \geq 0 \text{ and}$$

n is the number of banks operating in the loan market.

In order to be precise, we should let the derivative i'(L) to be regime specific, because it is the inverse of the reaction of the loan demand to the loan rate of interest. However, to simplify matters, we have taken it to be a constant in the different regimes.

Let us finally turn to central bank policy, because it has an effect on the variance σ_{MM}. We specify the central bank policy rule in three different ways: it sets either a horizontal or a flat supply curve for the central bank debt of the banks or it uses some kind of a reaction function (see on this more closely section 7.2 below). In the first case the short-term rate is pegged and thus we have as a prototype case - if also the private sector believes that the rate is fixed - that σ_{MM} is zero. In the second case of a flat supply curve or a fixed quantity of central bank finance the uncertainty related to the short-term rate is as large as it can be (if we exclude negatively sloping supply curves for central bank debt). We assume that irrespective of our assumption of non-stochastic deposit demand (as aggregate income is certain), from the banks' point of view there is uncertainty related to total volume of deposits. From (14b) by setting it equal to the exogenous supply CB^S we can derive the result that σ_{MM} is now equal to $(n^{-1}g)^2\sigma_{DD}$, where σ_{DD} is the uncertainty related to the level of the bank deposits. This is taken to be an exogenous source of uncertainty in the system. Note that with perfect competition σ_{MM} decreases to zero. This is so because with more competition, i_M is more and more tied to the domestic loan rate i_L, which is certain in our system. The last case with a reaction function of the central bank is analyzed in more detail in section 7.2. It

is true that the central bank policy also has an income effect on private sector incomes through a change in the profits from seigniorage. In the following we have, however, treated this effect in the manner explained above on page 9, which is not quite valid, but may be justified because of the fairly small macroeconomic role of seignorage in the Finnish conditions.

5. Analysis of macroeconomic equilibrium in the "old" regime

5.1. The case of a pegged rate in the market for central bank debt of the banks

In this case the endogenous part of the macroeconomic model consists of only the equilibrium condition for the goods market (the bank loan supply function can be substituted into the goods market equilibrium condition),

(15)
$$\begin{aligned} &\text{goods} && y + (i_F F)_{-1} - E_{old} + x - N = 0 \\ &\text{loans} && L - L^S = 0 \\ &\text{central bank debt} && i_M - \bar{i}_M = 0, \end{aligned}$$

where $\bar{i}_M$ is the pegged discount rate of the central bank and in the goods market equilibrium condition x is exports, taken to be a fixed exogenous variable in the system and N is imports. The sum of the national income y and the interest payments on the stock of foreign debt are equal to the net domestic product. We

assume that the interest payments on the foreign debt are based on last period's stock and interest rate. For imports we specify a simple function,

(16) $$N = m\,y,\quad m > 0.$$

The only endogenous variable now is income y. The exogenous variables are the expected shocks in the yield on real investments and the foreign interest rate. We substitute E from (6a) and L^s from (14a) into the equilibrium conditions for the goods market and the central bank debt. Now we have the case where $\sigma_{MM} = 0$. We assume that there are rational expectations with respect to the rate on the central bank debt so that in all regimes $Ei_M = i_M$. This is one of our linear, or first order, perfect foresight assumptions in the model. A second assumption of this kind is that related to the loan rate of interest, the equilibrium value of which we assume to be known with no uncertainty to the market participants. In order to keep the analysis within manageable limits, we concentrate below on the multipliers related to exports x and to central bank policy, which in the present case means changes in the discount rate. Thus we omit here the effects of the changes in the (expected) values of the yield on real capital and the foreign rate of interest.

It is fairly straightforward to derive the following multipliers identified by the symbol "∞" to denote the infinite elasticity in the supply curve for central bank debt

(17a) $$\left(\frac{dy}{dx}\right)^{OLD}_{\infty} = (1-(1-d)\sigma_{RR}+m)^{-1} \quad \text{and}$$

$$(17b) \qquad (dy/d\bar{i}_M)^{OLD}_{\infty} = -\sigma_{RR} ng^{-1}(1-(1-d)\sigma_{RR}+m)^{-1},$$

where $\sigma_{RR} = \sigma_{FF}(\sigma_{FF}+\sigma_{KK})^{-1}$.

Both multipliers rise in (absolute) value as the ratio σ_{RR} rises, i.e as the real uncertainty is reduced in relation to the financial uncertainty. If there is no financial uncertainty at all in the system ($\sigma_{FF} = 0$), the central bank would have no power at all to influence the real economy by discretionary measures in the discount rate. This is due to the fact that in this case the real expenditure would not depend at all on the flow of bank lending; see (6a).

5.2. The case of a fixed supply of central bank finance to the banks

In this case the equation system of the model is of the following kind

$$(18) \qquad \begin{array}{ll} \text{goods} & y + (i_F F)_{-1} - E_{old} - x + my = 0 \\ \text{loans} & -L + L^s = 0 \\ \text{central bank debt} & -CB^d + CB^s = 0. \end{array}$$

Now we have income y and the rate on central bank debt i_M as endogenous variables. We can derive the following results concerning effects of changes in the autonomous demand (exports x) and in the supply of central bank debt of the banks (the multipliers now have the subscript 0 to denote the zero elasticity of the supply curve of the central bank debt with respect to i_M,

i.e. the supply curve is vertical),

$$(19a) \qquad (dy/dx)^{OLD}_{0} = (1+m-\sigma_{RR}(1-d(1+e)))^{-1} \qquad \text{and}$$

$$(19b) \qquad (dy/dCB^{s})^{OLD}_{0} = \sigma_{RR}(1+m-\sigma_{RR}(1-d(1+e)))^{-1} \quad ,$$

where $e = -g(g+b\sigma_{MM})^{-1}$.

It is fairly easy to see that both these multipliers are positive. It is also fairly easy to see that under the present system of a fixed supply of central bank debt to the banks the multiplier (19a) related to exports is higher than (17a) in the case of a fixed discount rate. The intuition behind this result is the fact that in the present case there is an automatic crowding-in from the monetary side to a rise in exports. Assume that exports rise, which causes an initial rise in income. This causes a rise in the demand for deposits by the public, and therefore the demand for central bank debt by the banks diminishes. This causes a reduction in the central bank rate, which again leads to a rise in the supply of loans by the banks, which is also raised directly because of the rise in deposits. These have an expansive effect on the domestic expenditure. In the case of a fixed discount rate in section 5.1. there exists no effect of this kind.

So we reach the conclusion that the change by the central bank in 1983, when it abolished its old quota system for central bank finance by the banks with rising

supply curves and replaced this by a call money market system and a policy of discount rate pegging and reduced the variance in this rate, should have led to reduced fluctuations in the domestic economy caused by exports. It is also interesting to see that in the old regime both the multipliers in (17) and (19) are not affected by the risk aversion of the non-bank private sector, while in the present case (19) the risk aversion by the banks has an effect on the outcome of the system. This is, of course, due to the fact that now σ_{MM} is positive. The higher the bank risk aversion is, the smaller both the multipliers (19a) and (19b) become.

6. Macroeconomic equilibrium in the "intermediate" regime

In this case there has been a deregulation of the bank loan market, so that the central bank has abandoned its administrative control of the loan rate of interest and the bank loan rate adjusts freely to clear the bank loan market. There is no more credit rationing in a macroeconomic sense.

6.1. The case of a pegged central bank discount rate

On the basis of what has been derived above, the system consists of the following equilibrium conditions

$$
\begin{array}{lll}
\text{goods} & y + (i_F F)_{-1} - E_{int} - x + my = 0 & \\
(20) \quad \text{loans} & - L^d_{int} + L^s = 0 & \\
\text{central bank debt} & i_M - \bar{i}_M = 0 &
\end{array}
$$

By substituting into this system the private sector behaviour from (7a and b) and bank behaviour from (14a) we can derive the following multipliers

$$
(21a) \quad (dy/dx)^{INT}_{\infty} = \frac{(W/a)(\sigma^{-1}_{KK} + \sigma^{-1}_{FF}) + (n^{-1}g)^{-1}}{(W/a)(\sigma^{-1}_{KK}(d+m) + \sigma^{-1}_{FF}(1+m)) + (n^{-1}g)^{-1}(1+m)} \quad \text{and}
$$

$$
(21b) \quad (dy/d\bar{i}_M)^{INT}_{\infty} = \frac{-(W/a)\sigma^{-1}_{KK}(n^{-1}g)^{-1}}{(W/a)(\sigma^{-1}_{KK}(d+m) + \sigma^{-1}_{FF}(1+m)) + (n^{-1}g)^{-1}(1+m)} \; .
$$

Once again we find that a necessary condition for monetary policies to have leverage with respect to output is the same as above, i.e. that there is financial uncertainty in the system, σ_{FF} is positive. If $\sigma_{FF} = 0$, the loan rate i_L does not at all react to a change in the central bank discount rate, because the financial market behaviour becomes extremely sensitive to the interest differential between the domestic and foreign interest rate (see (7b)). The domestic loan rate would in this case solely depend on the foreign rate.

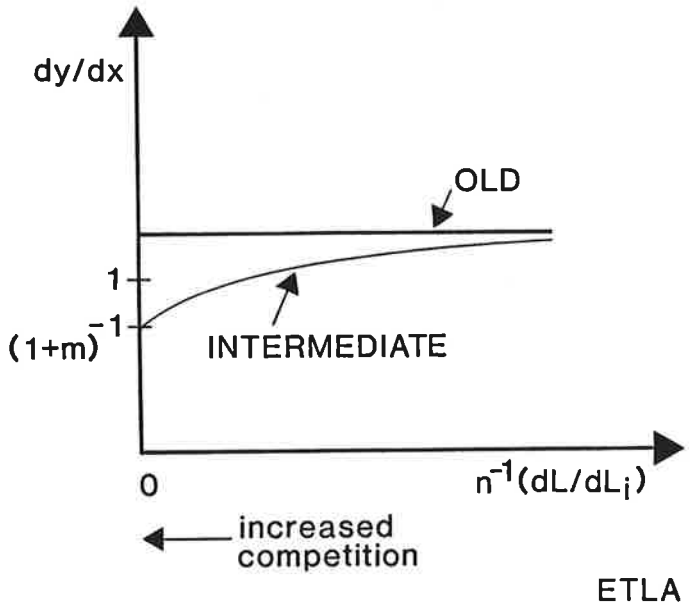
In general, we find that it is fairly difficult to make comparisons of the multipliers in (17a) and (21a) between the old and intermediate cases,

because in (21) we have also the aggregative wealth W as one term. Therefore we take another route in the comparison and examine the multipliers as a function of the parameter $n^{-1}(dL/dL_i)$, which may be considered as a measure of the degree of competition in the bank loan market. With perfect competition, as the number of banks rises to infinity, this parameter is equal to zero, the same holds for Bertrand oligopoly, with a Cournot oligopoly it is n^{-1} and with monopoly unity. Perfect competition can be only analyzed as a limit case, because with $n^{-1}g = 0$ our loan supply equation in (14a) breaks down when $\sigma_{MM} = 0$, as is now the case. For mathematical convenience we also let $n^{-1}(dL/dL_i)$ rise to infinity, because this helps us in deriving some comparisons between the regimes.

Let us first concentrate on the multipliers (17a) and (21a) related to a change in exports. Above in the old regime this multiplier does not depend at all on the situation in the bank loan market, so the multiplier is a constant in figure 1. In the intermediate regime the multiplier rises as $n^{-1}(dL/dL_i)$ rises and its lowest value is $(1+m)^{-1}$ (which is smaller than unity), which is reached with perfect competition in the loan market. So we find that **increased competition in the bank loan market leads to a reduced sensitivity of the economy with respect to external demand shocks.** The reason for this is that as competition rises, the loan rate is more and more tied to the central bank rate, which is now pegged. (If there is no financial uncertainty in the system, the multiplier does not at all depend on the degree of competition. As can be easily observed, in this case the multipliers in the old and intermediate regimes are the same, $(1+m)^{-1}$.)

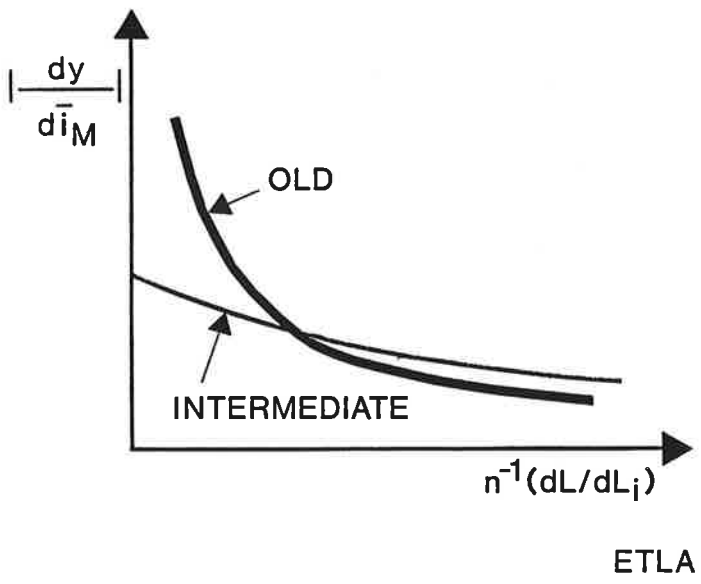
In general, it is fairly easy to derive the result that with any ratio of the financial and real uncertainty, σ_{FF}/σ_{KK}, the multiplier (21a) in the intermediate regime approaches the multiplier (17a) in the old regime as a limit value as the parameter $n^{-1}(dL/dL_i)$ rises to infinity, see figure 1. Therefore we can definitely reach the conclusion that **deregulation of the bank loan market leads to a reduced sensitivity of the domestic economy (i.e. real income) with respect to the shocks rising from the export demand.** One reason for this is the fact that abandoning credit rationing leads to a reduced dependence of expenditure on income, as was explained above in section 2. However, the situation is not so simple since in the intermediate regime a rise in exports causes a reduction in the bank loan rate, which gives a boost to expenditure. Our result shows that this expansive link is weaker than that in the old regime running directly from exports to income and to expenditure.

Figure 1. The dependence of the export multiplier on the degree of competition in the bank loan market.



Let us next turn to analyze the effectiveness of monetary policy in the two financial regimes. In the intermediate regime the multiplier (21b) rises as there is increased competition, see figure 2. The reason for this is that with increased competition, the loan supply and thereby the loan rate reacts more vigorously to the change in the discount rate. **So we find that increased competition in the bank loan market is conducive to the effectiveness of monetary policy.** In the old regime the multiplier of monetary policy rises to infinity with perfect competition, and the situation is of the kind depicted in figure 2. We are not able to reach a uniform comparison between the two regimes with respect to the effectiveness of monetary policy.

Figure 2. The effectiveness of monetary policy as a function of competitiveness in the bank loan market



6.2. The intermediate regime with a fixed supply of central bank finance.

Let us now turn to the other case within this regime, where the central bank sets a vertical supply curve of central bank finance to the banks. In this case the model consists of the following equations:

(22)

goods	$y + (i_F F)_{-1} - E_{int} - x + my = 0$	
loans	$-L^d_{int} + L^s = 0$	
central bank debt	$- CB^d + CB^s = 0$	

A straightforward derivation where the elements in the first row of the inverse of the Jacobian of the model are calculated gives the following impact effects of exports x and discretionary monetary policies,

$$(23a) \qquad (dy/dx)^{INT}_{0} = (1 + m - \sigma_{RR})^{-1} \quad \text{and}$$

$$(23b) \qquad (dy/dCB^s)^{INT}_{0} = \sigma_{FF}((1+m)\sigma_{KK} + m\sigma_{FF})^{-1} .$$

Note that in this case both the multipliers do not depend at all on the degree of competition in the bank loan market. It is also easy to see that (23a) is greater than the limit value of (21a) as $n^{-1}(dL/dL_i)$ approaches

infinity. So we once again find that interest rate pegging is conducive to stability of the home economy with respect to fluctuations in exports. A direct comparison to the corresponding multiplier (19a) in the "old" regime shows that now in the "intermediate" regime the export multiplier is greater than in the "old" regime. Now, as exports rise, both i_L and i_M go down and these lead to increased fluctuations in the domestic economy. However, as the actual policy of the central bank has been targeting domestic interest rates rather than domestic credit, we may draw the conclusion that in practice deregulation of the bank loan market has led to stabilization of the domestic economy with respect to export shocks.

A direct comparison of (23b) with the corresponding multiplier (19b) in the "old" regime reveals that now monetary policy has more power to affect the domestic economy. This shows that now the link running from a change in the base money supply through a change in the loan rate of interest to expenditure is stronger than the corresponding link running through credit rationing in the old regime.

7. Analysis of the macroeconomic equilibrium in the "new" regime

Let us now proceed to put the pieces together to form the macroeconomic model in the "new" case. Now the model consists of the equilibrium conditions for the goods, loans and the domestic short-term money market. Cash is a residual and

foreign loans is always in equilibrium as the foreign interest rate is given to the domestic agents. The endogenous market clearing variables are now income y, loan rate i_L and the short-term rate i_M. So we have

$$
\begin{array}{lll}
\text{goods} & y + (i_F F)_{-1} - E^d_{new} - x + N = 0 \\
\text{loans} & -L^d_{new} + L^s = 0 \\
\text{short-term money market} & M_p^d - M_b^d + M_{cb} = 0.
\end{array} \qquad (24)
$$

Here M_{cb} is the stock of the short-term asset held by the central bank. Let us as above first consider the case where the central bank pegs the domestic short-term interest rate through interventions.

7.1. The case with a fixed domestic short-term rate

Let us assume as a starting point that this is a true case of interest rate fixity, so that we can also set the covariances σ_{KM} and σ_{MF} equal to zero. In effect this means that there are now two certain assets L and M in the portfolios of the private sector, and as can easily be seen from (10a) above, in this case the portfolio framework breaks down. We can only solve from it the demand for the composite asset M-L. Accordingly, we have to replace the portfolio allocation between M and L with an arbitrage relation, which states that these two certain rates of interest, i.e. i_L and i_M, have to be equal to each other. So in this case the system (24) can be presented in the following simple form,

$$\text{goods} \qquad y + (i_F F)_{-1} - E_{new} - x + my = 0$$

(25) $$\text{loans} \qquad i_L - i_M = 0$$

$$\text{short-term money market} \qquad i_M - \bar{i}_M = 0$$

In this case it is a very simple task to derive the multipliers and we get the following results:

(26a) $$(dy/dx)^{NEW}_{\infty} = (1+m)^{-1} \qquad \text{and}$$

(26b) $$(dy/d\bar{i}_M)^{NEW}_{\infty} = -\sigma_{KK}^{-1}(1+m)^{-1} .$$

In this case, in contrast with those above, we see that the financial uncertainty (σ_{FF}) does not at all affect the effectiveness of monetary policy. Exports do not give rise to increased expenditure, because they do not affect the financial rates and again, as above in the intermediate case, real expenditure does not depend on income.

7.2. The general case in the "new" regime

Let us now turn to the general case where we analyze the equation system in (24) and substitute in this equation system the above behavioural equations of the private sector E^d, L^d and $M_p{}^d$ and those of the banks L^s and $M_b{}^d$. Let us first write (24) in the following form

$$E_{new} = y - x + my - (i_F F)_{-1}$$

(24)' $$L^d_{new} = L^s$$

$$M_p{}^d = M_b{}^d - M_{cb}$$

Now we can substitute on the left hand side the demand functions derived above in (10a). On the right-hand side of (24)' we substitute the behavioural equations for the banks. (We omit now the interest payments abroad from the following notations). It is possible with some algebraic manipulation to write this equation system so that on the left-hand side we have as a common factor the matrix B^{-1} (defined above in (10a)), i.e. we are able to derive the following system

(27) $$B^{-1} C \begin{bmatrix} y \\ i_L \\ i_M \end{bmatrix} = \begin{bmatrix} -x \\ 0 \\ -M_{cb} \end{bmatrix} - (W/a)\, D \begin{bmatrix} Ei_K \\ Ei_F \end{bmatrix},$$

where the matrix C consists of the following elements

(28)
$$\begin{aligned} c_{11} &= -(1+m)\sigma_{KK} - m\sigma_{FF} + d(h-1)(\sigma_{KM} - \sigma_{MF}) \\ c_{12} &= -c(\sigma_{KM} - \sigma_{MF}) = -c_{13} \\ c_{21} &= -m\sigma_{FF} + \sigma_{MF}(h-1)d \\ c_{22} &= W/a + c\sigma_{MF} \\ c_{23} &= -c\sigma_{MF} \\ c_{31} &= \sigma_{MF}(m+d(h-1)) - \sigma_{KM}(1+m) - \sigma_{MM}d(h-1) - m\sigma_{FF} \\ c_{32} &= -c(\sigma_{MM} - \sigma_{MF}) \quad \text{and} \end{aligned}$$

$$c_{33} = W/a + c(\sigma_{MM} - \sigma_{MF}), \text{ where } h = 1 + e \text{ and } c = n(g+b\sigma_{MM})^{-1}.$$

As we now solve for the vector of the endogenous variables, we multiply the right-hand side of the system in (27) by the matrix $C^{-1}B$. The matrix D in (27) consists of elements of the inverse matrix B^{-1}, so that when multiplying it by B it is simplified to a great extent. We have now the following system

$$(29) \qquad \begin{bmatrix} \dot{y} \\ \dot{i}_L \\ \dot{i}_M \end{bmatrix} = C^{-1}\left(B \begin{bmatrix} -x \\ 0 \\ -M_{cb} \end{bmatrix} + (W/a) \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix} Ei_K + (W/a) \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} Ei_F \right).$$

We are able to derive after some cumbersome calculations the following expressions for the impact effect of a change in exports and a "discretionary" change in monetary policy, i.e. in M_{cb}

$$(30a) \quad (dy/dx)^{NEW}_{0} = \frac{(\sigma_{KK} + \sigma_{FF})(W/a + c\sigma_{MM}) - c(\sigma_{KM} - \sigma_{MF})^2}{\bar{C}} \quad \text{and}$$

$$(30b) \quad (dy/d\bar{M}_{cb})^{NEW}_{0} = \frac{\sigma_{FF}(W/a + c\sigma_{MM}) + (\sigma_{KM} - \sigma_{MF})(W/a + c\sigma_{MF})}{\bar{C}},$$

where the denominator $\bar{C}$ is the following slightly modified determinant of the matrix C

$$(30c)\quad \bar{C} = ((1+m)\sigma_{KK} + m\sigma_{FF})(W/a+c\sigma_{MM}) - (\sigma_{MF} - \sigma_{KM})((W/a)d(h-1)+c(m\sigma_{MF} - \sigma_{KM}(1+m))) .$$

As can be seen from these expressions, it is fairly tedious to solve the system and analyze its properties. There is an additional difficulty as the multipliers include the terms σ_{MF} and σ_{KM}, which are in a way endogenous uncertainty elements of the model in contrast with σ_{FF} and σ_{KK}, which we have taken to be "exogenous" sources of uncertainty. This causes a difficult problem which can in principle be solved in two ways. First, let us assume that the i_K and i_F processes are martingales so that $Ei_K = (i_K)_{-1}$ and $Ei_F = (i_F)_{-1}$ respectively. From (29) we can solve i_M and on the basis of this solution we could write the condition that the covariance σ_{MK} is the element c^{31} of the inverse matrix C^{-1} multiplied by the first order autocorrelation of i_K, and similarly we can specify σ_{MF}. From these we could then solve as an "equilibrium values of uncertainties" σ_{KM} and σ_{MF}. This would be something we could call a "second order rational expectations" solution of the system. This would, however, be quite a tedious approach to finding a solution for a nonlinear equation system which evidently can be solved only with the aid of numerical methods.

So, we have chosen another kind of approach to solve this problem. So far we have not integrated the behaviour of the central bank into the model. Let us now suppose that the monetary policy rule of the central bank is the following,

$$(31)\quad M_{cb} = \bar{M}_{cb} + ki_K + fi_F ,$$

where $\bar{M}_{cb}$ is the discretionary component of central bank intervention and

the latter terms represent the rule component of policy, with k and f being fixed parameters. We omit the problem of observability and assume implicitly that the shocks are revealed for the policy maker so that (31) is feasible also in practice. The aim of the central bank is to influence the short-term money market in such a way as to achieve a desired behaviour of the short-term rate with respect to the shocks i_K and i_F. So, we assume that the central bank fixes the parameters k and f in (31) in such a way that the resulting solution of the short-term rate in the full system (29) is the following,

$$(32) \qquad i_M = i_M^o(M_{cb}) + h_1 i_K + h_2 i_F .$$

Here the first term represents the "constant" factors in the determination of the short-term rate, and the parameters h_1 and h_2 represent the desired dependence of the short rate on the exogenous shocks. From this we can solve for the required covariance terms,

$$(33) \qquad \sigma_{KM} = h_1\sigma_{KK},\ \sigma_{MF} = h_2\sigma_{FF} \quad \text{and}$$

solve for the variance of the short-term rate:

$$(34) \qquad \sigma_{MM} = h_1^2\sigma_{KK} + h_2^2\sigma_{FF} .$$

The idea in this construction is that in this way we are able to fix the endogenous uncertainties σ_{KM} and σ_{MF} to be of a similar type, in fact, as the exogenous uncertainties mentioned above, but now chosen by the policy maker. This same problem and its solution can also, of course, be included in the two regimes considered above. The difference between them and the present case lies

in the fact that here these covariance terms have an effect also on the behaviour of the private sector whereas above in the old and intermediate regimes they do not.

Let us now concentrate on a special case of this general specification in the "new" regime. Let us assume that there has at the same time been a deregulation of the foreign capital flows, which is reflected in our system in the requirement that the central bank has to obey a policy rule linking the domestic short-term interest rate to that in the foreign financial markets, because otherwise the foreign reserves of the central bank would be depleted. We have now

$$h_1 = 0,\ h_2 > 0 \text{ (and } h_2 \leq 1). \tag{35}$$

From this we can derive the following expressions for the multipliers, where we have used the superscript "for" to denote foreign reserves oriented monetary policy,

$$(dy/dx)^{NEW,for} = \bar{C}^{-1}(\sigma_{KK}(W/a+ch_2^2\sigma_{FF}) + (W/a)\sigma_{FF}) \text{ and} \tag{36a}$$

$$(dy/d\bar{M}_{cb})^{NEW,for} = \bar{C}^{-1}\sigma_{FF}(W/a)(1-h_2)\ . \tag{36b}$$

Once again we find that financial uncertainty is necessary for monetary policy to be able to have an effect on domestic output. A further necessary condition

is that it is possible to even out the fluctuations of the foreign rate of interest in the manner that h_2 is less than unity. If it is exactly unity, open market operations by the central bank have no power at all on income. There are two ways in which this situation may arise. First, the behaviour of the market agents is such as to lead to a close substitutability of the domestic and foreign assets. Secondly, if the behaviour of the central bank is oriented towards maintaining its reserves on an adequate level, a close correlation arises between the domestic and foreign short-term rates of interest.

Once again, the export multiplier depends on the degree of competition in the bank loan market. We are able to make the following inferences concerning this multiplier. **As the parameter h_2 rises towards unity, the export multiplier is reduced.** This is due to the fact that while the domestic rates depends more on the foreign, a rise in exports causes a smaller reduction in domestic rates of interest. As the degree of competition rises, the multiplier converges for all values of the parameter h_2 towards its lowest value, which is again $(1+m)^{-1}$, the same as the lower bound in the intermediate regime with interest rate pegging. **This is the lowest value the export multiplier can reach with unchanged monetary policies and the means for achieving it are deregulation of the domestic financial markets and increased competition in the bank loan market.** Under perfect competition, the domestic rates of interest are independent of the domestic real economy as now $i_L = i_M$ and i_M depends only on the foreign rate and real expenditure does not either depend on income. We should also make a comparison between the new and old regimes. If we compare the export multiplier (19a) and the limit value of (36a) as the degree of competition is reduced, i.e. as $n^{-1}(dL/dL_i)$ goes to "infinity", we find that in the new regime the export mul-

tiplier is certainly lower than in the old regime if the banks are risk neutral, or close to risk neutrality. After the degree of competition reaches a certain point, the new regime is more stable than the old with respect to export shocks.

8. Conclusions

We may briefly summarize the main results of the paper. By constructing models for three different financial regimes, and basing them on explicit use of portfolio theory, we were able to derive some definite comparative results concerning macroeconomic stability and effects of macroeconomic policies between the different financial regimes. It is true that the real side of our model is very simple and the supply side and price formation is very rudimentary. It would be an interesting exercise to combine the operation of the factor markets and supply shocks to the model, even though it may be that in this way the model would be enlarged too much so that it would not be any more analytically tractable. One major finding of the paper is that deregulation of the financial market has led to reduced sensitivity of the domestic economy with respect to foreign demand shocks. This is i.a. due to the fact that real expenditure are no longer (so) liquidity constrained and that the reduction in the loan rate of interest, to which exports give rise to, does not produce effects which were so large as to compensate for this.

In our model we have not explicitly considered fiscal policy. We are, however, able to interpret the multipliers related to exports to be also related to a change in public expenditure if we assume that the government deficit is solely

financed by foreign borrowing. Assuming a proportional tax function with slope t, $0 < t < 1$, we have to replace in the above formulas the parameter m with (m+t) and d with (1-t)d in order to achieve the multiplier with respect to government expenditure. So we are able to make the inference that also the effectiveness of fiscal policy should have decreased in the process of deregulation of the Finnish financial markets. We could also consider taxation of capital income. In this case in the above formulas we should replace the coefficient of risk aversion a by a(1-t) and carry out the inferences concerning the tax rate t on capital income. In general, a rise in capital income taxation means a higher risk sharing on the part of the government and therefore an increased sensitivity of private sector behaviour with respect to changes in the expectations concerning yields and costs on financial and real assets.

We could also carry out the analysis with a classical formulation of the operation of the goods market. An intermediate case would be introduction of variable price level and price expectations (see on these formulations in a general equilibrium flow-of-funds macroeconomic model by Tobin (1982) and Alho (1988), chapter 3). It would also be interesting to carry out the analysis under flexible exchange rates.

Above we made some inferences concerning the degree of competitiveness in the bank loan market. We reached the conclusion that increased competition should lead to reduced sensitivity with respect to fluctuations in exports and also in government expenditure and increased effectiveness of monetary policy. The reason for these reactions was in the fact that increased competition leads to a more sensitive loan rate of interest with respect to the measures by the central

bank. Empirical evidence indicates, on the other hand, that there is imperfect competition in the Finnish bank loan market, see Rantala (1988).

In the new financial regime the operations of the central bank are likely to be directed towards maintaining its foreign reserves on an adequate level. This is due to the fact that the private sector is better able to make portfolio adjustments on the asset side between the domestic and foreign financial markets, as the liberalized exchange regulation gives more room for this kind of financial arbitrage(3). As shown above, in this case, if the domestic short-term interest rate is fully tied to the foreign, discretionary monetary policies no longer have any power over the domestic economy. Only fiscal policies have power, even though this is also likely to be smaller than in the old financial regime with interest controls and liquidity constraints binding the behaviour of the private sector behaviour. Thus we found a result which is in contrast with the conventional wisdom of the Mundell-Fleming analysis, which states that with perfectly elastic foreign capital flows fiscal policy has the largest effect on the domestic economy, as there is no financial crowding out in this case. Here we have developed a different approach with two domestic rates of interest and considered only the case where the budget deficit is financed in an expansive way from abroad and combined with the analysis also the changes in the demand for real expenditure, which deregulation and changes in bank competition give rise to as the situation in the financial markets changes.

FOOTNOTES

(1) On changes in central bank policy, see Kneeshaw and Van den Bergh (1989).

(2) For further details on these developments see e.g. Johansson and Solttila (1988) and Halttunen and Suvanto (1988).

(3) It should be remarked that in our model we have not considered investment by foreigners in the domestic financial market. Recently, foreigners have invested quite substantial amounts in the Finnish financial markets through the forward market for foreign exchange, so it would be interesting to add this term into the equilibrium condition for the domestic money market in (24). This would lead to a still closer link between the domestic and and foreign rate of interest and could be treated as a special case under section 7.2.

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