

Läufer, Nikolaus K. A.

Working Paper

Seignorage pooling of EMU, pool bias and seignorage change by the Euro

Diskussionsbeiträge - Serie I, No. 323

Provided in Cooperation with:

Department of Economics, University of Konstanz

Suggested Citation: Läufer, Nikolaus K. A. (2003) : Seignorage pooling of EMU, pool bias and seignorage change by the Euro, Diskussionsbeiträge - Serie I, No. 323, Universität Konstanz, Fachbereich Wirtschaftswissenschaften, Konstanz

This Version is available at:

<https://hdl.handle.net/10419/68867>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

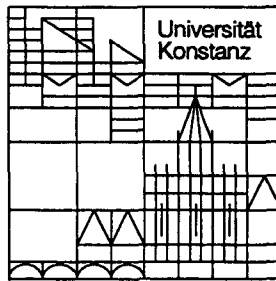
Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.



597 725 977

**Rechts-, Wirtschafts- und
Verwaltungswissenschaftliche Sektion**
Fachbereich
Wirtschaftswissenschaften

Nikolaus K. A. Läufer

**Seignorage pooling of EMU,
pool bias and
seignorage change by the Euro**

W 284 (323)

Diskussionsbeiträge

78457 Konstanz

Serie I — Nr. 323

Februar 2003

- 1. APR. 2003 Weltwirtschaft
Kiel

W 284 (323)

1/4 5. 00 100.

**Seignorage pooling of EMU, pool bias and
seignorage change by the Euro**

Nikolaus K. A. Läufer

Serie I – Nr. 323

Februar 2003

Seignorage pooling of EMU, pool bias and seignorage change by the Euro

Nikolaus K.A. Läufer

13th February 2003

Abstract

To deal with changes of capitalized seignorage due to EMU, we supply the still missing capital-theoretical framework. We show that seignorage pooling of EMU is composed of two components, a dynamic component and a static component. By its dynamic component, the pool provides insurance against seignorage losses from changes of national shares in European seignorage, while the static component is reflecting a problematic pool-bias. The seignorage model is then applied to simulate EMU-changes of capitalized seignorage in two scenarios for Germany. Estimates of changes in the literature are examined. Finally, recent (Dec. 6, 2001) decisions by the ECB with regard to seignorage-pooling are evaluated.

JEL classification: E59, F33, F36

Keywords: European Monetary Union (EMU), Euro, seignorage, seignorage pooling, seignorage change, pool bias

1 Modelling seignorage

In the macroeconomic literature¹, the notion of seignorage includes everything that the central bank provides to the state budget as a means of finance: central bank profits and additional central bank credits to the state (ΔV_s^n). Consequently, real net-seignorage, from the point of view of the state, is defined as²:

$$S_{net} = iB - i_s V_s + \frac{\Delta V_s^n}{p}. \quad (1)$$

Here,

¹see e.g. J. Sachs und F. Larrain, *Macroeconomics (A global view)*, 1995, S. 436 ff.

²Gross seignorage in this case is:

$$S_{gross} = iB + \frac{\Delta V_s^n}{p}.$$

- $S_{net}(S_{gross})$ = real seignorage, net (gross),
- i = real net interest rate on central bank earning assets,
- B = real monetary base as a measure of central bank net earning assets,
- $V_s(V_s^n)$ = real (nominal) central bank debt of the state,
- i_s = real interest rate on central bank debt of the state,
- p = price level.

If indebtedness of the state towards the central bank is avoided, as required by EMU-rules, the definition of seignorage simplifies to:

$$S_{net} = S_{gross} = iB. \quad (2)$$

This model of seignorage applies in a world where the monetary base is entirely of the inside type. Seignorage derives from indebtedness of the private public to the central bank. I call this the inside-monetary-base model (IB-model). The IB-model includes the case where part of the monetary base is created by central bank intervention in the market for foreign exchange.³

In the opposite case, the outside-monetary-base model (OB-model), the total monetary base derives, exclusively, from indebtedness of the state towards the central bank⁴:

$$B^n = V^n \quad (3)$$

Inserting (3) into (1), we obtain the seignorage definition of the optimal inflation literature:

$$S_{net} = S_{gross} = \frac{\Delta B^n}{p}. \quad (4)$$

The initial seignorage definition (1) corresponds to a mixture of pure IB- and OB-models.

The transition process to EMU has brought about various institutional changes which altered the monetary regimes of EMU-countries. In particular, indebtedness of state entities to the central bank is no longer permitted to member countries of EMU. This implies that, from the start of stage three of EMU (1.1.1999), only the IB-model is suitable.

The purpose of stage two of the transition process was to change the monetary regimes and to adjust the countries to the institutional requirements of the Maastricht Treaty. The seignorage definition that is appropriate to the times of transition and conversion before the beginning of stage

³I realize that the foreign assets acquired by the central bank do not represent private debt of the domestic public. However, there is no point in arguing about my procedure. I find this definition convenient. And I am not bound by the inventors (Gurley and Shaw) of the term "inside" and "outside" money who have introduced these terms into a closed economy framework and not into an open economy world.

⁴Of course, in this case we also have $i = i_s$.

three (1.1.1999) depends on the precise date and country. For the end of stage two, the date 31.12.1998, the appropriate choice is the IB-model. At the beginning of stage two, the more general initial seignorage definition, and a mixture of the IB- and OB-models are appropriate. However, this mixture varies from country to country.

In the following, I shall compare steady states that differ institutionally only by the introduction of the Euro⁵. Therefore, the dates of reference for a comparison are 31.12.1998 and 1.1.1999. To both of these dates, the IB-model applies.

2 A firm-theoretic approach

Central bank profits (seignorage in the IB-model) arise from the production of central bank money. Therefore, the central bank is treated as a firm that generates a flow of seignorage. The capital value of this flow is given by a standard capitalization formula⁶:

$$CS_t = \frac{S_t}{1+r} + \frac{S_{t+1}}{(1+r)^2} + \dots + \frac{S_{t+np-1}}{(1+r)^{np}}. \quad (5)$$

The meaning of the symbols in this formula is:

- CS_t = real capital value of seignorage at the beginning of period t ,
- S_t = real seignorage at the end of period t ,
- r = constant rate of time preference (of government),
- np = number of periods (length of the flow of seignorage).

Consecutive seignorage variables, S_τ , are linked recursively by growth:

$$S_{\tau+1} = (1+g_\tau)S_\tau, \quad \tau = t, t+1, t+2, \dots, \quad (6)$$

where g_τ is the growth rate of seignorage in period τ . For steady state analysis, constant growth rates are assumed, i.e. trend rates of growth are considered:

$$g_\tau = g_{\tau+1} = g_{\tau+2} \dots = g = \text{const.} \quad (7)$$

Assuming nonfinite lifetimes for central banks and EMU ($np \rightarrow \infty$), the capital value of seignorage is given by the well known Gordon-formula:

$$CS_t = S_t \frac{1}{r-g}. \quad (8)$$

In the pure IB-model, seignorage is equal to net earnings of central bank assets. By a simple transformation of the balance sheet of the central

⁵In my language, EMU starts with the introduction of the Euro.

⁶In the following, everything is in real terms.

bank⁷, net earning assets of the central bank become equal to the monetary base. Thus, seignorage equals interest-earnings of the monetary base:

$$S_t = i_t B_t, \quad (9)$$

with

- i_t = real rate of earnings of the net earning assets of the central bank (=monetary base),
- B_t = real monetary base, representing net earning assets.

To simplify, the rate of earnings is assumed to be a constant over time. The rate of growth of seignorage (S) is then equal to the rate of growth of the monetary base (B) and vice versa. Therefore, capitalized seignorage is an algebraic product of the monetary base and a variable s , here called *seignorage multiplier*:

$$CS_t = B_t \frac{i}{r-g} = sB_t, \quad (10)$$

with

$$s = \frac{i}{r-g}. \quad (11)$$

The analogy to money and credit multipliers is obvious.

In the literature⁸, a seignorage multiplier of 1 is assumed:

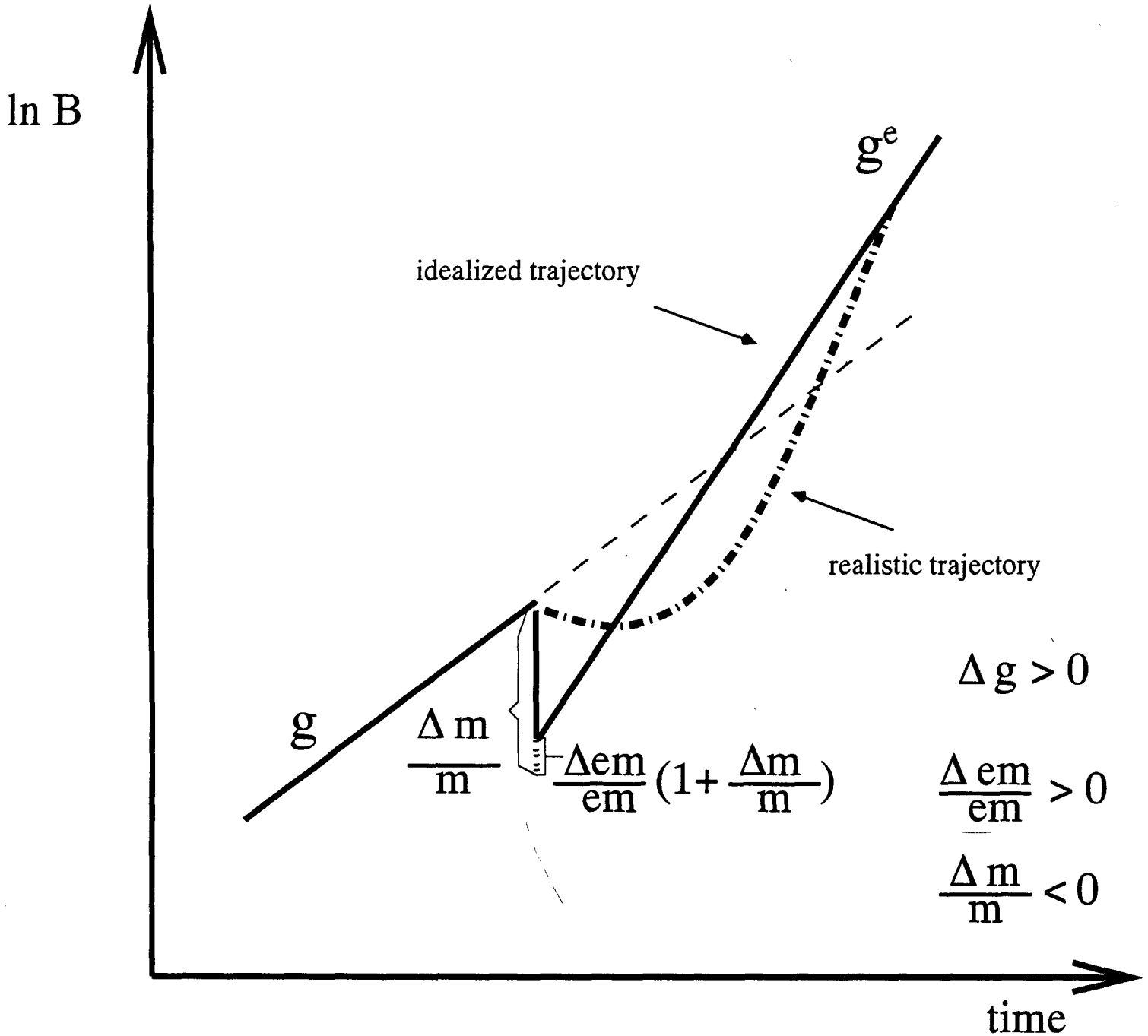
$$CS_t = B_t, \quad (12)$$

However, in general, the conditions, which justify a multiplier of 1, are not satisfied. Even in a stationary world ($g = 0$) we cannot be sure that $i = r$. An approach, that fixes the seignorage multiplier to 1, is neglecting the possibility that the multiplier itself may change by the transition to EMU. After all, the seignorage multiplier depends on three variables, all of which may change by the introduction of the Euro.

⁷These transformations include a consolidation of state issuance of coins and normal central banking activity (note issuance, credit granting etc.).

⁸see Sinn and Feist.

Monetary base with EMU-break



3 The effects of EMU on capitalized seignorage: components, pooling and net effect

3.1 Components of capitalized seignorage and their changes

The change of capitalized seignorage is given by the changes of the monetary base and the seignorage multiplier according to the following formulae⁹

$$\frac{\Delta CS}{CS} = \frac{\Delta s}{s} + \frac{\Delta s}{s} \frac{\Delta B}{B} + \frac{\Delta B}{B} \quad (14)$$

$$\Delta CS = \left[\left(1 + \frac{\Delta B}{B}\right) \frac{\Delta s}{s} + \frac{\Delta B}{B} \right] CS. \quad (15)$$

As a next step, we shall analyse the relative change of the monetary base ($\frac{\Delta B}{B}$) and of the seignorage multiplier ($\frac{\Delta s}{s}$).

3.1.1 The relative change of the monetary base ($\frac{\Delta B}{B}$)

Describing the German¹⁰ monetary base by the German market share (m) in the European monetary base:

$$B = m \sum_{l=1}^z B_l, \quad (16)$$

$$m \stackrel{def}{=} \frac{B}{\sum_{l=1}^z B_l}, \quad (17)$$

⁹In this paper, all differences are defined as:

$$\Delta x = (x^e - x), \quad (13)$$

where $x^e(x)$ stands for values after (before) the transition to EMU. In addition, it is assumed, that changes caused by the transition to EMU (introduction of the Euro) occur as a jump. Market shares and permanent growth rates jump from the old to the new equilibrium values. In figure 1 "Monetary base with EMU-break" the continuous line represents an idealized trajectory, while the dashed line represents the real course of the monetary base observable for Germany. The idealized line is supposed to approximate the realistic line.

The axes of figure 1 have no explicit scales. Therefore, the change in the rate of growth of the monetary base cannot be read from figure 1. The optically significant rise in the slope is also consistent with a very small numerical rise in the rate of growth.

¹⁰As far as the model is concerned, the word "Germany" is just a dummy word for the country under consideration. Variables and parameters which refer to Germany are written without index, except if they appear under a summation sign as in (16).

and describing the European monetary base¹¹ by the European market share (em) in the world monetary base (B^w):

$$\sum_{l=1}^z B_l = em B^w, \quad (18)$$

$$em \stackrel{def}{=} \frac{B}{\sum_{l=1}^z B_l}, \quad (19)$$

we have:

$$B = m em B^w. \quad (20)$$

For the relative change of the German monetary base caused by the Euro, we then obtain:

$$\begin{aligned} \frac{\Delta B}{B} &= \frac{\Delta m}{m} + \frac{\Delta em}{em} + \frac{\Delta B^w}{B^w} \\ &+ \frac{\Delta m}{m} \frac{\Delta em}{em} + \frac{\Delta m}{m} \frac{\Delta B^w}{B^w} + \frac{\Delta em}{em} \frac{\Delta B^w}{B^w} \\ &+ \frac{\Delta m}{m} \frac{\Delta em}{em} \frac{\Delta B^w}{B^w}. \end{aligned} \quad (21)$$

In a linear approximation, there would be no cross product terms. Exact values for changes will later be helpful in finding certain important properties of the seignorage change.

The relative change of the German monetary base involves several factors:

1. factor: the relative change of the German market share in the European monetary base ($\frac{\Delta m}{m}$). This variable parameter catches the loss of the German monopoly position in the supply of a currency of the quality of the DM.
2. factor: the relative change of the European market share in the world monetary base ($\frac{\Delta em}{em}$). It is related to the quality of the Euro relative to other currencies in the world against which the Euro competes for the role as an international money.
3. factor: the relative change of the world monetary base ($\frac{\Delta B^w}{B^w}$).¹²

As shown by the cross product terms in (21), these factors also interact.

¹¹ z is the number of EMU-countries.

¹²Changes in the world monetary base may be autonomous or induced by changes of the European monetary base.

3.1.2 The relative change of the seignorage-multiplier ($\frac{\Delta s}{s}$)

From the definition of the seignorage multiplier s , we derive the following formula for its change:

$$\Delta s = \frac{\partial s}{\partial i} \Delta i + \frac{\partial s}{\partial r} (\Delta r - \Delta g). \quad (22)$$

We shall assume, that the introduction of EMU does not alter the rate of time preference and that the earnings rate of the net earning assets of the central bank does not change significantly either:

$$\Delta i = \Delta r = 0. \quad (23)$$

For the relative change of the seignorage multiplier, we then obtain:

$$\frac{\Delta s}{s} = \frac{1}{(r-g)} \Delta g. \quad (24)$$

In the following, Δg will be treated as a parameter.

Finally, we must deal with the pooling of seignorage under EMU.

3.2 The pooling of seignorage under EMU

Capitalized net payments to Germany from the seignorage pool are given by

$$P = \rho \sum_{l=1}^z CS_l^e - CS^e \quad (25)$$

$$= \rho \sum_{l=1}^z B_l^e s_l^e - B^e s^e \quad (26)$$

$$= (\bar{s}^e \sum_{l=1}^z B_l^e) (\rho - \frac{s^e}{\bar{s}^e} m^e). \quad (27)$$

Here, ρ is Germany's pool share, which is equal to its capital share in the ECB. \bar{s}^e , the average seignorage multiplier for EMU is defined by

$$\bar{s}^e = \frac{\sum_{l=1}^z s_l^e B_l^e}{\sum_{l=1}^z B_l^e}. \quad (28)$$

The total pooling effect is decomposable into a dynamic (first) and a static (second) component. The following decomposition of the pooling-factor $(\rho - \frac{s^e}{\bar{s}^e} m^e)$ serves as an intermediary step¹³:

$$(\rho - \frac{s^e}{\bar{s}^e} m^e) = (\rho - \frac{s}{\bar{s}} m) + [(\rho - \frac{s^e}{\bar{s}^e} m^e) - (\rho - \frac{s}{\bar{s}} m)] \quad (29)$$

$$= \underbrace{(\rho - \frac{s}{\bar{s}} m)}_{\text{static component}} - \underbrace{(\frac{s^e}{\bar{s}^e} m^e - \frac{s}{\bar{s}} m)}_{\text{dynamic component}}. \quad (30)$$

¹³Obviously, this decomposition has the same structure as $x^e = x + \Delta x^e$.

For the dynamic component of the pooling-factor we find¹⁴:

$$-\left(\frac{s^e}{s^e}m^e - \frac{s}{\bar{s}}m\right) = -\frac{s}{\bar{s}}m \frac{\left(\frac{\Delta s}{s} + \frac{\Delta m}{m} + \frac{\Delta s}{s} \frac{\Delta m}{m} - \frac{\Delta \bar{s}}{\bar{s}}\right)}{\left(1 + \frac{\Delta \bar{s}}{\bar{s}}\right)}. \quad (31)$$

For the total pooling-effect, this implies:

$$P = \underbrace{\left(\bar{s}^e \sum B^e\right)\left(\rho - \frac{sm}{\bar{s}}\right)}_{\text{static component}} - \underbrace{\left(\bar{s}^e \sum B^e\right)\left[\frac{s}{\bar{s}}m \frac{\left(\frac{\Delta s}{s} + \frac{\Delta m}{m} + \frac{\Delta s}{s} \frac{\Delta m}{m} - \frac{\Delta \bar{s}}{\bar{s}}\right)}{1 + \frac{\Delta \bar{s}}{\bar{s}}}\right]}_{\text{dynamic component}}. \quad (32)$$

The dynamic component compensates (neutralizes) seignorage changes, that follow from changes in the national market share $\Delta\left(\frac{s}{\bar{s}}m\right)$ in EMU-seignorage. If such compensation is considered to be the purpose of the seignorage pool, then the static component forms a pool bias. With an unbiased pool, any decline of the German (national) market share in the EMU-seignorage cake would be completely compensated.¹⁵ With a positively biased seignorage pool, net-payments from the pool would be possible also with an increase in national market share. We shall later show that the static component is neither positive nor zero for Germany, but negative. Therefore, a sufficiently strong decline of the German market share in EMU-seignorage is required, in order to see net-payments flow from the pool to Germany. For Germany, actual market shares in monetary base have declined under EMU already to such a degree that net-payments to Germany are likely to be observed for the year 2002.¹⁶

The pooling volume $(\bar{s}^e \sum_{l=1}^z B_l^e)$ can be rewritten as follows:

$$\bar{s}^e \sum_{l=1}^z B_l^e = \bar{s}^e em^e B^{w,e} \quad (33)$$

$$= \bar{s}emB^w \left(1 + \frac{\Delta \bar{s}}{\bar{s}}\right) \left(1 + \frac{\Delta em}{em}\right) \left(1 + \frac{\Delta B^w}{B^w}\right). \quad (34)$$

3.3 The net change of seignorage

3.3.1 An overview of the components

The factors, contributing to a change of seignorage due to EMU, are listed in table 1.

¹⁴The dynamic component is structured like the righthand side of $-\Delta x^e = -(x^e - x)$, where $x = \frac{s}{\bar{s}}m$ is Germany's last market share in EMU-seignorage prior to EMU.

¹⁵As shown in figure 2, the German market share in the monetary base, m , has almost continuously declined since the start of EMU as predicted by Lauer (1997).

¹⁶See figure 2 below.

Table 1: **Effects of EMU on capital. seignorage**

row	effects	math. expression	German values
1.	seignorage multiplier effect: (permanent growth effects etc.)	$sB \frac{\Delta s}{s} (i, r, g)$	positive
2.	world monetary base effect: (changes of the world monetary base)	$sB \frac{\Delta B^w}{B^w}$	positive
3.	international market share effect: (changes of European market shares ($\frac{\Delta em}{em}$) in the world monetary base, role of Euro as international money; quality of the Euro)	$sB \frac{\Delta em}{em}$	positive
4.	national market share effect: (changes of the German share in the European monetary base market ($\frac{\Delta m}{m}$); end of German DM-monopoly)	$sB \frac{\Delta m}{m}$	negative
5.	interactions: a) b) c) d) e) f) g) h) i) j) k)	$sB \frac{\Delta s}{s} \frac{\Delta m}{m}$ $sB \frac{\Delta s}{s} \frac{\Delta em}{em}$ $sB \frac{\Delta s}{s} \frac{\Delta B^w}{B^w}$ $sB \frac{\Delta m}{m} \frac{\Delta em}{em}$ $sB \frac{\Delta m}{m} \frac{\Delta B^w}{B^w}$ $sB \frac{\Delta em}{em} \frac{\Delta B^w}{B^w}$ $sB \frac{\Delta s}{s} \frac{\Delta m}{m} \frac{\Delta em}{em}$ $sB \frac{\Delta s}{s} \frac{\Delta m}{m} \frac{\Delta B^w}{B^w}$ $sB \frac{\Delta s}{s} \frac{\Delta em}{em} \frac{\Delta em}{em}$ $sB \frac{\Delta m}{m} \frac{\Delta em}{em} \frac{\Delta B^w}{B^w}$ $sB \frac{\Delta s}{s} \frac{\Delta m}{m} \frac{\Delta em}{em} \frac{\Delta B^w}{B^w}$	negative positive positive negative negative positive negative negative positive negative negative

Table 1: - ctd-

row	effects	math. expression	German values
6.	pooling-effect: dynamic component	$-(\bar{s}^e \sum B^e) \left[\frac{\frac{s}{s} m \left(\frac{\Delta s}{s} + \frac{\Delta m}{m} + \frac{\Delta s}{s} \frac{\Delta m}{m} - \frac{\Delta \bar{s}}{\bar{s}} \right)}{1 + \frac{\Delta \bar{s}}{\bar{s}}} \right]$?
7.	pooling-effect: static component (pool bias)	$(\bar{s}^e \sum B^e) \left[\rho - \frac{s}{s} m \right]$	negative
8.	total change under pooling (8.=1.+2.+3.+4. +5.+6.+7.)	$sB \left[\left(1 + \frac{\Delta \bar{s}}{\bar{s}} \right) \left(1 + \frac{\Delta em}{em} \right) \left(1 + \frac{\Delta B^w}{B^w} \right) - 1 \right]$ $+ \underbrace{(\bar{s}^e \sum B^e) \left[\rho - \frac{s}{s} m \right]}_{\text{pool bias}}$ $= (\bar{s} \sum B) \left[\left(1 + \frac{\Delta \bar{s}}{\bar{s}} \right) \left(1 + \frac{\Delta em}{em} \right) \left(1 + \frac{\Delta B^w}{B^w} \right) - 1 \right] \frac{s}{s} m$ $+ \underbrace{(\bar{s}^e \sum B^e) \left[\rho - \frac{s}{s} m \right]}_{\text{pool bias}}$ $= (\bar{s} \sum B) \left[\rho \left(1 + \frac{\Delta \bar{s}}{\bar{s}} \right) \left(1 + \frac{\Delta em}{em} \right) \left(1 + \frac{\Delta B^w}{B^w} \right) - \frac{s}{s} m \right]$ $= \rho \bar{s}^e \sum B^e - sB$ $= \rho \bar{s}^e em^e B^{w,e} - sB$?
	where	$\bar{s}^e \sum B^e = \bar{s}^e em^e B^{w,e}$ $= (\bar{s} \sum B) \left(1 + \frac{\Delta \bar{s}}{\bar{s}} \right) \left(1 + \frac{\Delta em}{em} \right) \left(1 + \frac{\Delta B^w}{B^w} \right)$	

Assumptions: $\Delta em^e > 0$, $\Delta s > 0$, for Germany: $\rho < \frac{s^e}{s^e} m$, $\Delta m < 0$.

The effects listed are:

1. the seignorage multiplier effect. (It represents, among other things, the permanent growth effect of the Euro, should there really be one.)
2. the world monetary base effect. (It catches both autonomous changes in the world monetary base and induced changes in the world monetary base implied by changes of the EMU-base.)
3. the international market share effect. (It reflects the role, that the Euro will play as an international money and will depend on the quality of the Euro relative to other currencies.)
4. the national market share effect. (It captures the effect of the end of the German DM-monopoly.)
5. a series of interaction terms due to nonlinearity of the seignorage multiplier model.¹⁷
6. the dynamic pooling effect. (This component represents the compensation, coming from the seignorage pool, for losses from changes of the German market share in European seignorage ($\frac{\$}{\text{€}}m$).
7. the static pooling effect. (This component expresses a bias of the seignorage pool, that traces back to the difference between the seignorage market share ($\frac{\$}{\text{€}}m$) and the share in the ECB capital (ρ).¹⁸)

From this list, two observations emerge. Firstly, the single effects do not have a common sign. Without further information, nothing can be said about the sign of the total effect. Only a numerical analysis can help. Secondly, the claim of Sinn and Feist, that only seignorage pooling causes seignorage losses, cannot be maintained. On the contrary and in general, the size of net payments into the pool bears no information about the net-change of seignorage.¹⁹

¹⁷These terms should not be dropped as long as the nonlinearity of the seignorage pool is maintained.

¹⁸If $\frac{\$}{\text{€}} = 1$, the seignorage market share is equal to the monetary base market share.

¹⁹Until now, we have neglected the possibility that the rate of (expected) inflation might change, by the introduction of the Euro. This is consistent with policy intentions under EMU and the outcome of the convergence process which implies a normative expectation of an inflation rate below 2%.

For the sake of completeness, I shall now consider the seignorage changes following from an increase in the expected rate of inflation. In such a case, nominal interest rates would rise by the Fisher-effect. The rise in nominal interest rates would reduce the real demand for money in Europe. With an unchanged money multiplier, the implicit demand for real monetary base in Euroland, $\sum_{i=1}^z B_i^e$, would decline. This would reduce a likely positive Δem . As a result of this, Δem might even become negative.

An increase in expected inflation, caused by the introduction of the Euro, would have the following effects on the components listed in table 1. (Here, I am assuming that the decline of the EMU-wide monetary base is distributed proportionally among the EMU-countries. Thus, the change in market shares Δm is unaffected or constant by assumption.)

3.3.2 On the dependence of effects

How do the effects change by a variation of the parameters, especially of the "market share" parameters Δm and $\Delta \frac{s}{sm}$?

A ceteris-paribus-variation in Δm leaves unaltered both the sum of the first six effects and the sum of the first seven effects. This means, a variation in the change of the national market share in the monetary base (Δm), caused by EMU, does not affect a country's net change of seignorage by EMU. The same holds for a variation in the change of the national market share in total EMU-seignorage, $\Delta \frac{s}{sm}$.

There is a simple explanation for these results. Whatever Germany, or any other country in Euroland, is loosing in seignorage due to a fall in its market share, it will recover by paying equally less into the EMU seignorage pool. The dynamic component of the total pooling effect (component 6 in the tabular survey of components) compensates the seignorage effects of variations in the seignorage market share ($\frac{s}{sm}$) that arise from changes in either m or s or both. However, changes in the share $\frac{s}{sm}$ that derive from changes in \bar{s} do not induce compensations. They represent transmissions of changes in \bar{s} to the individual country considered.²⁰

-
1. the positive multiplier effect might change. (If the rise in the rate of real growth should also be reduced by the higher expected inflation, the increase of the seignorage multiplier would be lower.)
 2. the positive world monetary base effect would change if the reduction of the EMU base is also lowering the world monetary base.
 3. the positive international market share effect could possibly change. (The reduction of EMU's-share in the world monetary base would reduce an otherwise positive Δem which might even become negative by the reduction.)
 4. the negative national market share effect would remain unchanged.
 5. a) interaction terms not containing Δem would remain constant; b) interaction terms with Δem would be lowered in absolute value.
 6. the absolute value of the dynamic pooling component would be smaller.
 7. the value of the pool bias (absolute value of the static pool component) would be smaller. ($\sum_{i=1}^z B_i^e$, the monetary base for EMU after the introduction of the Euro, is lowered and is a multiplicative factor in the term expressing the pool bias.)
 8. an increase (decline) of total seignorage would be smaller (larger). (It is assumed that only Δem and ΔB^w change (fall), while i , $\Delta \bar{s}$ and $\Delta \bar{s}^e$ remain constant. Then the answer given follows from the formulas for the total change.)

²⁰If $\frac{\Delta s}{s} = \frac{\Delta \bar{s}}{\bar{s}} \neq 0$ and $\frac{\Delta m}{m} = 0$, then the dynamic component assumes a value of zero. The pool compensation for the change $\frac{\Delta s}{s}$ and the transmission of $\frac{\Delta \bar{s}}{\bar{s}}$ neutralize each other.

Reaction of the effects to an increase of parameter values

row	parameter	effects							sum of 1.-7.
		1.	2.	3.	4.	5	6.	7.	
1.	i	+	+	+	-	?	+	-	-
2.	r	-	-	-	+	?	-	+	+
3.	g	+	+	+	-	?	+	-	-
4.	Δm	+	+	+	+	+	-	0	0
5.	Δem	+	+	+	0	?	+	-	+
6.	$\frac{\Delta B^w}{B^w}$	+	+	0	0	+	+	-	+

In rows 1,2 and 3, we consider effects on s while holding constant $\frac{\Delta s}{s}$, $\frac{\Delta \bar{s}}{\bar{s}}$ and \bar{s} .

The sign in brackets of the last column was determined using realistic numerical parameter values for the FRG.

So far, we have simply rediscovered "well known" effects of the pooling of production results by firms that share a single market.

De facto, the seignorage-pool of EMU is an insurance against seignorage losses by changes of national market shares in EMU-seignorage caused by changes in either s or m . But, pooling will provide a further advantage. It eliminates the incentive for the central banks of EMU-countries, to compete and chase for market shares for national-fiscal reasons. This effect is certainly most welcome because it harmonizes monetary policy in EMU.

If we look at the seignorage pool as an insurance scheme against seignorage losses by changes of national market shares in seignorage (changes of $\frac{s}{\bar{s}}m$ due to variations of m and s and as the channel of transmission for the distributive effects of variations in \bar{s}), then, without changes of s , m and \bar{s} (i.e. with a constant $\frac{s}{\bar{s}}m$), there should be no payments into or out of the seignorage pool. If payments into the pool are required nevertheless, then we have a (negative) bias of the pool. This bias is captured by the nonzero (negative) static component.

4 An application: the seignorage change for Germany

4.1 Numerical results for two scenarios

For a numerical simulation, two scenarios will be considered, an optimistic and a pessimistic one. In these scenarios, it is assumed that $\frac{s}{\bar{s}} \equiv 1$, such that market shares for seignorage are equal to market shares for monetary base. In the optimistic scenario the real long run rate of growth of the monetary base²¹ (g) rises by a 1/4 % and the market share of EMU (em)

²¹In judging these assumptions on the rate of growth of the real monetary base and the change of that rate, it should be taken into account that they need not be identical with the rates and their changes for GDP. After all, the velocity of money may change systematically over time. A real rate of growth of 2,84% would be too high for GDP.

Table 2: parameter values

real rate of earnings of the earning assets (i) (extrapolation based on observations for 1990-2000)	3 %
real rate of time preference (r) (assumption)	5%
real trend rate of growth (g) (extrapolation based on the observations for the years 1960-2001)	2,84 %
German share in ECB-capital (ρ) in a Europe of 11 countries (Euroland) (data of Maastricht treaties)	30,56%
Euro-caused change of the world monetary base ($\frac{\Delta B^w}{B^w}$) (assumption)	0
$\frac{s}{s}$ (assumption)	1
s (calculated from the prior assumptions)	1,39
monetary base values from february 1999 (They are used as final B-values (of 31.12.1998) ($\neq B^e$) <i>prior</i> to the EMU-break): 1. for Germany 2. for EMU	Bill. of Euro: 158,5 430,9
The monetary base values <i>after</i> the EMU-break, the B^e -values, are calculated by means of the formula $B^e = B + \Delta B$ and they vary between scenarios.	calculated

in the world market for monetary base rises by 5 %. In the pessimistic scenario, instead, both changes are zero. The values of other parameters are specified in table 2.

In both scenarios, the change of the German share in the market for monetary base, Δm as caused by the transition to EMU, is varied. There is a zero variation and a non-zero-variation, a real decline.²² What can we observe?

1. The sum of all 7 effects is independent of the change in market share m .²³ Capitalized seignorage is changing independently of the degree to which German market shares in the European market for monetary base are assumed to decline. This is the consequence of seignorage pooling under EMU.

2. The static component of the seignorage pooling effect is constant. It is independent of the degree to which German market shares decline.

3. Contrary to the static component, the dynamic component is varying with the degree of decline of German market shares.

4. If its market share falls below 30,56 %, Germany will become a net recipient of payments from the seignorage pool.

5. As these numbers show, seignorage pooling in EMU is biased against Germany. Under unbiased pooling of seignorage, Germany would be compensated completely for any, even a small change in its market share m . However, Germany will receive positive net-payments (6th+7th component) from the seignorage pool not before its market share, which was 0,37 before EMU, has dropped to below 0,3056.²⁴ Germany will be compensated by the seignorage pool only with a decline in market share larger than 0,0644. In addition, the compensation will only cover that part of the decline, which is exceeding this critical value of 0,0644.

²²The assumption of a decline is consistent with actual developments of the German market shares under EMU, as shown in the lower part of figure 2.

²³See the last line of the first scenario survey.

²⁴In these calculations, I assume an EMU that includes Greece, but not Denmark, Sweden and Great-Britain.

1. scenario survey

	Scenario			
	optimistic		pessimistic	
properties	in decimals			
Δg	0,0025		0	
Δem	0,05		0	
m^e	0,368	0,294	0,368	0,303
Δm	0	-0,0739	0	-0,065
effects of EMU	in Bill. Euro			
1. multiplier-component	25,48	25,48	0	0
2. world monetary base growth-component	0	0	0	0
3. international market share-component	11,01	11,01	0	0
4. national market share-component	0	-44,21	0	-38,80
5. sum of interaction components	1,27	-6,31	0	0
sum: 1.+2.+3.+4.+5.. components	37,76	-14,04	0	-38,80
6. dynamic pool-component	0	51,80	0	38,80
7. static pool-component (pool bias)	-43,67	-43,67	-37,27	-37,27
sum: 6.+7. comp. = total pool-component	-43,67	8,13	-37,27	1,53
8. sum: 1.+2.+3.+4.+5.+6. component	-5,91	-5,91	-37,27	-37,27

6. The economic value of the pool bias is given by the static component of the pooling effect.

7. According to my calculations, the pool bias is costing Germany roughly 44 Bill. Euro in the optimistic scenario and roughly 37 Mrd. Euro in the pessimistic scenario. These values, are not far from those of Sinn and Feist.

8. In the pessimistic scenario, the static component of pooling is given by:

$$\bar{s} \left(\sum_{l=1}^z B_l \right) \left(\rho - \frac{s}{\bar{s}} m \right). \quad (35)$$

In this formula, all variables refer to the time before EMU. Under the assumption $\frac{s}{\bar{s}} = 1$, this is proportional to the formula that Sinn and Feist are using, the factor of proportionality being \bar{s} .

2. scenario survey

	scenario	
	optimistic	pessimistic
properties		
	in percent	
rise of the real rate of growth	1/4	0
rise of the European market share	5	0
effect of EMU		
	in Bill. Euro	
pool-bias (pooling-costs)	44	37
net-seignorage-loss	6	37

9. In the pessimistic scenario, the components which have been neglected by Sinn and Feist (4th and 6th component), are perfectly compensating, something I have once called a compensation of errors.²⁵ The compensation is between the national market share component and the dynamic pool component. The compensation is a direct consequence of seignorage pooling.

10. In the optimistic scenario, the net seignorage loss of Germany is far below the pool bias (compare 6 Bill. with roughly 44 Bill. Euro)²⁶. In the pessimistic scenario, the seignorage loss is equal to the pool bias of 37,3 Bill. Euro. It should be noted that the pool bias is not varying with the change in the market share, but with other parameters. However, all other parameters are held constant within a particular scenario.

11. In the pessimistic scenario, Germany is losing an amount equal to the static component of the pooling effect, i.e. equal to the pool bias.

12. The scenarios are illustrating the basic insight, that there is a fundamental difference between the change of net seignorage, the net payment into the seignorage pool and the pool bias.²⁷

²⁵See Läufer (1997).

²⁶See also the 2nd scenario survey.

²⁷If one of these items is estimated by another one, one is likely to commit an error similar to the approximation of the course of the Rhine by the course of the Danube.

4.2 The effects of recent decisions of the ECB-council.

On December, 6, 2001, the ECB has produced a somewhat cryptic decision²⁸ with respect to seignorage pooling, a decision that, according to my calculations, is eliminating at most 10% of the existing pool bias.²⁹ If this number is applied to the static pool component of either 37 or 44 Bill. of Euro, then the reduction of the pool bias is roughly 4 Bill. Euro.

3. Scenario-survey

	Scenario	
	optimistic	pessimistic
properties	in percent	
rise of the rate of real growth	1/4	0
rise of the European market share	5	0
effects of EMU	in Bill. Euro	
change of net-seignorage after the ECB-correction	-2	-33
Remaining pool-bias (pooling-costs)	40	33
change of net-seignorage without pool-bias	38	0

4.3 The real size of seignorage change

It is now possible to specify the size of the seignorage change for the Germany. I have presented two scenarios (see the third scenario survey).

²⁸I am referring to decision ECB/2001/16 in connection with decision ECB/2001/15.

²⁹Though the new ECB-regulation is quite complicated and difficult to penetrate, it is easy to estimate an upper bound of the bias reduction using capital-theoretic or finance-mathematical methods. For the time, for which, largely, only a partial compensation of the bias is provided by the regulation, we can assume a full compensation and we can relate it to the bias for the whole period for which EMU is existing.

In the optimistic scenario, Germany is suffering at best no loss of seignorage under the new pooling rules.

In the optimistic case, Germany would receive roughly 38 Bill. Euro more of seignorage if there were no pool bias.

In the pessimistic scenario, Germany is losing an amount equal to the static component of the pooling effect, i.e. equal to the pool bias. In this scenario and after the incomplete correction of the pool, Germany is still suffering a loss of roughly 34 Bill. Euro.

In the pessimistic case, Germany would neither be winning nor losing seignorage if there were no remaining pooling bias.³⁰

4.4 A critique of Sinn and Feist

Under the assumption $\frac{\bar{s}}{\bar{s}^e} = 1$ and apart from a factor of proportionality (\bar{s}^e), the formula for the static pooling effect corresponds to the formula used by Sinn and Feist to calculate seignorage changes.³¹ This correspondence should not obscure the fundamental problems of the Sinn and Feist approach. Firstly, they have no capital theoretic foundation for their approach. Choosing, implicitly, a seignorage multiplier of 1, is highly arbitrary.³² Secondly, Sinn and Feist identify seignorage losses with the total pooling component. ("Without pooling no seignorage losses.") This theoretical confusion causes them to neglect some other possibly important components of seignorage change. In the pessimistic scenario, some of these components are zero. Neglecting them, is then no additional restriction. However, Sinn and Feist also neglect the national market share component which, realistically, is non-zero for Germany even in the pessimistic scenario. This may be called "error number one". Thirdly, in order to calculate total seignorage losses, they use a formula which corresponds to the static component of the total pooling effect, provided $\bar{s}^e = 1$ and $\frac{\bar{s}}{\bar{s}^e} = 1$. Consequently, they confuse the pool bias with the total pooling effect and neglect the non-zero dynamic pooling component. This may be called "error number two". In the pessimistic scenario, the neglected non-zero components are summing up to zero. Thus, the numbers of Sinn and Feist are reasonable only in the pessimistic scenario and only because of two compensating errors.

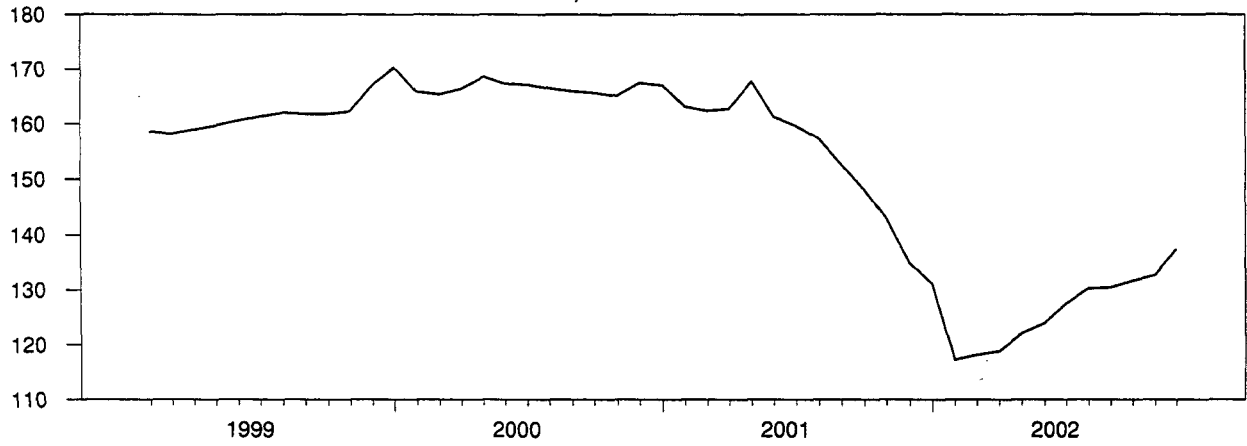
³⁰Please note, I am not saying "without the seignorage pool". Of course, eliminating the seignorage pool, would not only eliminate the pool bias but also the pool benefits mentioned above.

³¹In the pessimistic scenario we have $\bar{s}^e = \bar{s}$. If I would neglect the factor of proportionality (\bar{s}^e) of the pooling bias and would use the same monetary base data as Sinn and Feist, my numbers for the seignorage change in the pessimistic scenario would exactly equal those of Sinn and Feist.

³²Curiously, it also amounts to predicting, implicitly, an untimely death of EMU. A seignorage multiplier larger than 1 for an infinite series of seignorage flows may be reduced to 1 by cutting off the endless flow beyond a certain point in time.

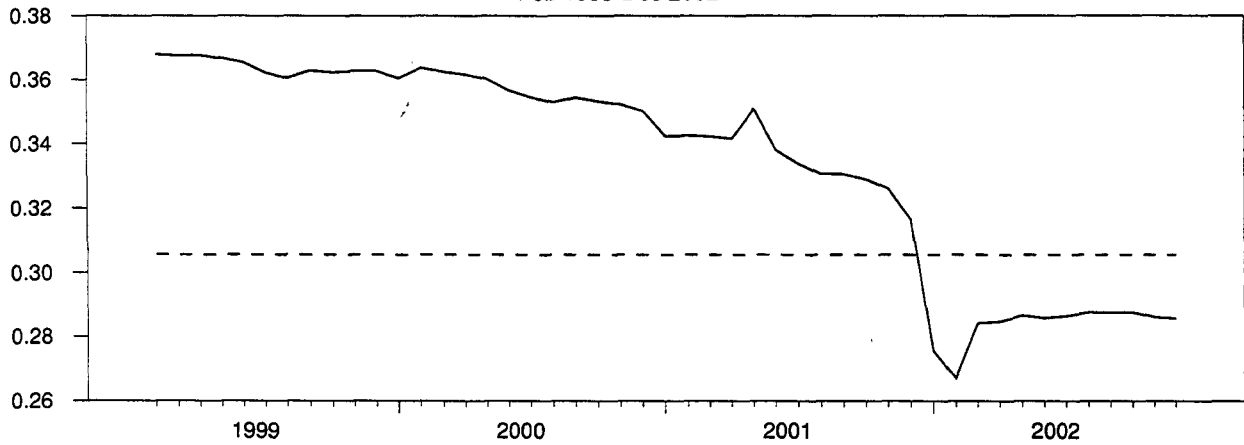
Monetary base of the FRG

in Mrd. Euro, Feb 1999-Dec 2002



German share in the European market for monetary base

Feb 1999-Dec 2002



When Sinn and Feist calculated their numbers, the neglected components were not yet observable. In the meantime, we have observations on the changes of national market shares.³³ German market shares have declined as predicted by Läufer (1997). In fact, they have declined to such a degree that, since the beginning of year 2002, German market shares lie below the German pool share.³⁴ Consequently, the dynamic pooling effect has become so strongly positive that Germany is likely to be a net-recipient of the seignorage-pool for 2002. This dramatic development, Läufer (1997) had described as "easily possible". By the criteria and procedures of Sinn and Feist (which consist essentially in identifying net-payments into the seignorage-pool as seignorage losses³⁵), Germany by now has become a seignorage "winner". Provided the decline of German market shares is not reversed, Germany will remain a "winner" also in the future if judged by the misleading standards of Sinn and Feist. The interpretation of the German position along the lines of Sinn and Feist is of course completely unacceptable, for two reasons: firstly, net payments to Germany are merely a compensation for lost market shares. Secondly, the compensation is insufficient because of the huge negative pool bias against Germany.

The negative pool bias against Germany means that German net-payments into the pool are systematically too high and pool net-out-payments to Germany are systematically too low. A pool without bias would be preferable for Germany since market share losses would be fully compensated by out-payments from the pool to Germany.³⁶ But, a biased pool is still better than no seignorage pool at all. With a biased pool, German losses of market shares are at least partially compensated.

In order to avoid the pool bias completely, total EMU-seignorage has to be distributed not according to ρ , the capital shares in the ECB, but according to $\frac{s}{s}m$, the countries' market shares in EMU-seignorage shortly prior to the start of EMU.

³³See figure 2.

³⁴The dashed line in the lower part of figure 2 represents Germany's pool share.

³⁵This amounts to measuring, in theory, the seignorage loss by the total pooling component. Of course, the practice of Sinn and Feist has differed from this theory as we have seen before, when we noted that they neglected the dynamic pool component and measured the total seignorage pooling component by a formula that, under certain specified conditions ($\bar{s}^e = 1$ and $\frac{s}{s} = 1$), matches our pool bias formula. Therefore, the procedure of Sinn and Feist may also be described as a strange mixture of false theory and a practice that, under certain conditions observed for Germany, deviates from their false theory in a self-correcting way. After the dramatic market share changes, these conditions for self-healing do no longer prevail. Consistently sticking to their theory (seignorage losses=net-payments into the pool) and with the new market shares, Sinn and Feist could and would no longer measure net-payments into the seignorage pool by something that is mimicking the static pool component.

³⁶Symmetrically, with an unbiased pool no EMU-country can profit from increases in its share in the EMU-monetary base market.

5 Summary and conclusion

In a model for capitalized seignorage change due to EMU, including seignorage pooling as present under EMU, we have introduced the concept of a pool bias. A negative pool bias against a country means that net-payments of that country into the pool are systematically too high and net payments from the pool to the country are systematically too low. A loss by the pooling bias does not exclude that net seignorage of a country (seignorage remaining after the pooling) is increasing due to EMU. Furthermore, a pool bias against a country does not require that a country, permanently or on average, pays into the pool. A country, with a negative pool bias, may receive permanently net payments from the pool but, systematically, not enough. The sum of the pool biases over the countries participating in the EMU-pool is zero.³⁷ To a negative pool bias of a single country corresponds a positive average of the pool biases for the other countries participating in the pool.

Apart from biases, seignorage pooling is offering advantages: it provides security against fluctuations in seignorage market shares and it is harmonizing monetary policy. Technically, these advantages may be obtained at zero cost. Therefore, the price of pooling, in form of a remaining pool bias of at least 33 Bill. Euro, is still too high for Germany. It is also unjust, since other Euroland countries on average are receiving the pooling benefits at a negative price. Other EMU-countries are getting pooling with cream, while Germany is getting an oversalted pooling.

The ECB has tried to correct the pool bias. However with only partial success. At most 10% of the bias has been eliminated. Without further corrections, the Germans remain sitting on a capitalized loss by the pooling bias of³⁸ roughly 450 Euro per capita. In order to eliminate the pool biases, it is necessary and sufficient to distribute according to the market shares in EMU-seignorage immediately prior to the start of EMU (Euro). In order to eliminate the pool biases, it is not necessary to change the countries' capital shares in the ECB, however it is necessary not to distribute seignorage according to existing capital shares.

If Germany continues to base its claims for compensation of seignorage losses on visible net-payments into the EMU-seignorage pool, as suggested by Sinn and Feist, these claims will evaporate. Simply, because German net payments into the seignorage pool will vanish, foreseeably already in 2002, and will be replaced by net payments to Germany out of the pool, unless there is a radical inversion of the development of German market shares observable in the EMU-market for monetary base since the beginning of EMU. Furthermore, sticking to the procedure of Sinn and Feist would be counterproductive in an additional sense. Certainly, other countries will

³⁷provided denominators of seignorage multipliers do not vary over countries, i.e. identical discount rates for capitalization and equal rates of growth for seignorage are assumed.

³⁸Depending on the scenario, at least 414 or 485 Euro per capita.

pick up the reasoning of Sinn and Feist and will ask for compensations from Germany as soon as the seignorage pool makes net payments to Germany. These claims would extend the disadvantages that Germany is already suffering from the pool bias. If Germany wants to secure its present claims and also wants to avoid that its position worsens further, then it must base its claims for compensation of seignorage losses on the concept of a pool bias as developed in the present paper and not on the misconceptions of Sinn and Feist.

References

- [1] Deutsche Bundesbank, Monthly Report, January 2003.
- [2] Läufer, Nikolaus K.A., 1997, Die Seignorage-Kosten des Euro für Deutschland, Eine Kritik an Sinn und Feist, Discussion papers of the Sonderforschungsbereich 178 "Internationalisierung der Wirtschaft", Serie II- Nr. 349, July 1997, downloadable from the internet via <http://www.uni-konstanz.de/FuF/wiwi/laufer/seignorage/seignorage-main.html>
- [3] Läufer, Nikolaus K.A., 2001, The Seignorage Costs of the Euro for Germany, A Critique of Sinn and Feist, in: Beiträge zur Mikro- und Makroökonomik, Festschrift for Hans Jürgen Ramser, Hrg. S.K. Berninghaus u. M. Bräulke, Springer Verlag.
- [4] Sinn, Hans-Werner und Holger Feist, 1997, Eurowinner and Eurolosers: The Distribution of Seignorage-Wealth in EMU, European Journal of Political Economy 13, 665-689.
- [5] Sinn, Hans-Werner und Holger Feist, 2000, Seignorage Wealth in the Eurosystem: Eurowinners and Eurolosers revisited, CESifo Working Paper No. 353.