

Seigniorage in Selected Acceding Countries: Current Situation and Future Prospects on the Road towards Monetary Integration

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I Introduction

This paper examines the seigniorage income of six acceding countries – the Czech Republic, Estonia, Hungary, Poland, Slovakia and Slovenia – in the period from 1998 to 2002, comparing it with that of the euro area. Furthermore, the paper discusses whether the selected countries could raise their seigniorage revenues by following an expansive monetary policy course; it also examines how the prospective joining of the euro area could affect the seigniorage revenues of these countries.

This paper is structured as follows: After defining seigniorage and the monetary base in section 2, section 3 examines the components and the counterparts of the monetary base in the selected acceding countries. In section 4, we calculate the seigniorage revenues of the selected acceding countries for the period from 1998 to 2002. After assessing the future development of seigniorage in acceding countries, we address the question whether these countries could gain more seigniorage if they raised their inflation rate. Section 5 presents a simulation on how euro area membership would probably influence the seigniorage revenues of the selected countries. Finally, section 6 concludes.

2 Definition of Seigniorage and Monetary Base

2.1 Definition of Seigniorage

As central banks are solely responsible for money issuance and have the power to demand that commercial banks hold balances with the central bank, seigniorage is the monopoly profit of central banks. There are several definitions of seigniorage. The most widespread definition in the earlier literature (e.g. Fischer, 1980) uses *monetary seigniorage*, which is the increment of the monetary base over a defined period (usually a year). According to this definition, the increment of the monetary base could be regarded as profit of the central bank after deducting the costs that arise from the creation of the monetary base, e.g. the interest the central bank pays on the balances of commercial banks. Whenever the monetary base contracts, the central bank would be considered as suffering a loss. This concept does not correspond to the current, generally accepted accounting rules, as these consider the components of the monetary base repayable liabilities. An increase in repayable liabilities can be regarded as profit only in unlawful pyramid schemes. The ambition of all countries in this survey is to join the euro area. In this case, the national banknotes will be exchanged for euro banknotes; this process can be seen as the central bank paying back the monetary base to the general public. In a more permissive sense, monetary seigniorage could be regarded as profit if the counterpart of the increase in the monetary base were unmarketable government debt. This is, however, not the case in the countries under investigation. Central bank legislation in these countries prohibits direct financing of the government by the central bank.

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The recent literature (e.g. Kun, 1996; Holub, 2001; Tymoczko, 2001; Schobert 2001; Hochreiter and Rovelli, 2002) prefers the concept of *fiscal seigniorage*, which refers to the yield on the counterparts of the monetary base after deduction of costs. Halpern and Neményi (2002), however, calculate monetary seigniorage. A comprehensive survey of the literature can be found in Lange (1995) and a transparent description of all concepts in Hochreiter and Rovelli (2002).

The European System of Central Banks (ESCB) uses the terms *seigniorage* and *monetary income* as synonyms, the use of the term “monetary income” being more frequent. According to Article 32.1 of the Statute of the European System of Central Banks and of the European Central Bank, monetary income is “the income accruing to the national central banks in the performance of the ESCB’s monetary policy function.” This definition is closely related to the concept of fiscal seigniorage because issuing money and requiring commercial banks to hold reserves with the central bank are monetary policy functions. There is a difference, however: Monetary policy functions include interventions that may be very costly and may decrease the central bank’s profit. For the majority of the economies under review, a monetary policy intervention that is likely to be costly is sterilization in response to high foreign capital inflows.

We do not consider seigniorage and monetary income synonyms: seigniorage is a part of monetary income. According to the above definition, the only costs that reduce seigniorage are the printing costs of banknotes, the minting costs of coins (if issued by the central bank) and the interest paid on required reserves. Therefore, seigniorage must be positive except in extreme cases when, for example, the counterpart of the monetary base is in foreign assets and the rate of appreciation of the home currency is higher than the yield on foreign assets.

Another question is how expensive it is to sustain a chosen monetary regime.¹⁾ Obviously, central banks utilize their profit and reserves first to cover their costs for sustaining the monetary regime, but if this does not suffice, the government must subsidize these central banks. If intervention proves to be profitable in the end, it yields an income which is not part of seigniorage.

There is also a practical reason why we did not include the costs or profit of interventions in our investigations. Central banks are often hesitant in disclosing the costs of their interventions, and even if some information is given, it might not contain all costs because (though not typically) the central bank and the government might apply a division of labor in executing interventions and bearing the costs.

There are, however, considerations which would justify the inclusion of interventions in the definition of seigniorage. As this study will show, exchange rate movements have a considerable effect on seigniorage in the acceding countries: seigniorage decreases as the currency appreciates. Interventions often aim to prevent the acceding countries’ currencies from excessive appreciation. This means that a lack of interventions would reduce seigniorage. Although the motive behind an intervention has nothing to do with seigniorage expectations,

¹ Schobert (2001) points out that the Estonian and Slovenian monetary regimes were much cheaper to sustain in the period under investigation than those of the other acceding countries.

it would be interesting to investigate the effect of interventions on seigniorage. Such an investigation, however, would go beyond the scope of this study.

It should be noted that central banks make profits that are neither part of seigniorage nor of monetary income. Such profits may derive from managing reserves that are not a counterpart of the monetary base; furthermore, central banks may provide services to banks, to the government or to the general public, which also yield profit. This paper does not deal with this type of profit. Hochreiter and Rovelli (2002) include the yield on those reserves which had been accumulated as retained seigniorage in seigniorage revenue. We do not follow this calculation in this paper.

2.2 Definition of the Monetary Base

According to common definition, the monetary base is the sum of cash outside the central bank and the reserves of commercial banks held at the central bank. We use this definition in this study, but the following remarks are deemed necessary to justify this definition to some extent.

Central banks in the acceding countries often issue *securities denominated in domestic currency to sterilize excess liquidity* (e.g. money market bills in Poland). These securities are usually purchased by commercial banks and/or by the general public.¹⁾ Some national definitions consider this instrument part of the monetary base. We do not share this view for two reasons. First, the central bank has to pay market interest on these instruments, i.e. no seigniorage revenue arises out of their issue. Second, excess liquidity may be sterilized by selling government papers from the central bank's portfolio or by agreeing with the Treasury that it issues government papers in excess of the government's financing needs for sterilization. If central bank securities were treated as part of the monetary base, the monetary base would fluctuate depending on which method is used for sterilization.

Apart from serving as the calculation base of seigniorage, the monetary base can play an important role in the analytical work of central banks. It is one of the most easily accessible monetary aggregates and can provide information on the state of the economy. In order to draw conclusions, however, seasonal changes, changes in the behavior of cash management and cash holding, and changes in the rates of required reserves have to be taken into account as well.

According to the concept applied by the ESCB, *coins* are usually²⁾ issued by the national governments and are not part of the monetary base. With respect to coins, the ESCB follows the concept of monetary seigniorage: The face value of coins is credited to the government when the coins are purchased by the central bank, which puts them into circulation. The monopoly profit of coin issuing – the difference between the minting cost and face value – is at the government's free disposal like any other revenue. (According to Article 106 of the Treaty Establishing the European Community, the ECB has the right to approve the volume of coins that can be issued by particular governments.)

1 Money market bills issued by Narodowy Bank Polski, the Polish central bank, can be purchased by commercial banks and by the Banking Guarantee Fund.

2 With the exception of Austria, where the mint is a 100% subsidiary of the national central bank.

However, in the acceding countries under review (with the exception of Slovenia) coins are issued by the central banks and are part of the monetary base. This difference somewhat weakens the comparability between data on the acceding countries and euro area member countries, but the distortion is fairly negligible. According to data extracted from the annual reports of Magyar Nemzeti Bank and Narodowy Bank Polski and to data obtained from the central banks of other countries,¹⁾ coins make up 1% to 3% of the currency in circulation. The share is lowest in Estonia (1%) and Slovakia (1.5%), while in the other countries analyzed it comes to 3%.

3 The Monetary Base of the Acceding Countries

3.1 Components of the Monetary Base

Table 1 compares the monetary base of the acceding countries and that of the euro area in the period from 1998 to 2002.

Table 1

Monetary Base					
	1998	1999	2000	2001	2002
	<i>Annual average, % of nominal GDP</i>				
Czech Republic	12.7	11.1	11.1	10.3	9.5
Estonia	11.4	12.1	12.7	11.0	10.3
Hungary	10.6	11.1	11.0	9.5	9.5
Poland	9.0	8.8	6.8	6.6	7.4
Slovakia	12.5	11.7	11.4	10.9	10.9
Slovenia	4.2	4.6	4.5	4.3	4.5
Acceding countries' weighted average	9.9	9.5	8.4	7.9	8.3
Euro area	7.3	7.2	7.2	6.8	6.3

Source: National central banks, ECB, Eurostat, own calculations.
Note: Euro area 1998: year-end value, not year-average value. The AC's weighted average includes only the six countries above.

As table 1 shows, the monetary base differs widely in the selected countries. To understand this behavior, let us investigate separately the components of the monetary base of the countries. We find that the two components develop differently. While currency holdings depend on individual decisions and on the habits of the economic subjects (which are influenced by macroeconomic developments and by the state of development of the individual country's banking system), the magnitude of reserves rather depends on the central bank's mandatory reserve regulations and on the behavior of commercial banks' liabilities, which are the calculation base of reserves.

Let us have a look at the *currency holdings* first. As table 2 shows, currency holdings in relation to nominal GDP are rather stable in each acceding country over the observation period, but there are substantial differences among countries.²⁾ Czech households (and commercial banks) keep more than three times as much currency in relation to GDP than Slovenian households (and banks). The weighted average of currency holdings in relation to GDP for the six acceding countries analyzed is higher than that of the euro area; the difference is, however, not striking. While currency holdings in the euro area are diminishing, no definite trend can be determined for the acceding countries. The decrease of the currency stock relative to nominal GDP in the euro area in 2001 and 2002

¹ Thanks to Barta Vit (Česká národní banka), Martti Ranveer (Eesti Pank), Robert Pazitny (Narodná banka Slovenska).

² Currency holdings increased at end-1999 because of the Y2K effect, but this rise is smoothed by the annual averages.

is attributable to the replacement of national denominations by euro banknotes. Euro area citizens may have changed their savings habits; they no longer have to keep denominations of other euro area countries when traveling to another country, and Deutsche mark banknotes, which had been used as “quasi-legal tender” outside the euro area before, were not replaced by euro banknotes but rather by the U.S. dollar or put to bank accounts.

Table 2

Currency Holdings					
	1998	1999	2000	2001	2002
	Annual average, % of nominal GDP				
Czech Republic	7.6	8.3	9.3	9.0	8.4
Estonia	7.3	7.5	7.7	7.4	7.3
Hungary	6.6	7.0	6.9	6.7	7.1
Poland	5.9	6.0	5.3	5.2	5.8
Slovakia	7.6	7.1	7.3	7.9	8.4
Slovenia	2.4	2.6	2.6	2.4	2.5
Acceding countries' weighted average	6.2	6.4	6.2	6.1	6.5
Euro area	5.8	5.5	5.5	5.0	4.5

Source: National central banks, ECB, Eurostat, own calculations.
Note: Euro area 1998: year-end value, not year-average value. The AC's weighted average includes only the six countries above.

To understand the currency holding habits of the population of different countries, we examined the per capita currency holdings in the acceding countries and in the euro area. As we can see in table 3, per capita currency holdings in purchasing power parity euro increased in the acceding countries during the period in question. This may be connected to the initial increase of the population's purchasing power in the acceding countries given the recovery after the transformation crisis and because of the diminishing opportunity costs of cash holding as inflation, and hence nominal interest rates, went down in these countries. The differences between the currency holding habits in the individual countries, however, remained, while currency holdings decreased in the euro area.

Table 3

Currency outside the Central Bank					
	1998	1999	2000	2001	2002
	Per capita, EUR converted at purchasing power parity, annual average				
Czech Republic	930	1,045	1,226	1,256	1,232
Estonia	592	612	688	729	779
Hungary	646	725	762	796	898
Poland	459	496	464	488	562
Slovakia	781	740	790	908	1,037
Slovenia	330	374	395	395	435
Euro area	1,178	1,166	1,214	1,125	1,037

Source: Eurostat.
Note 1: Euro area 1998: year-end value, not year-average value.
Note 2: Available data calculate the purchasing power parity of the acceding countries in relation to the European Union average and not to the euro area. We regard the purchasing power of the EU-15 equal to that of the euro area.

Required reserves of commercial banks at the central bank, the second part of base money, serve several goals. They increase the security of the banking system because required reserves of a particular bank can be released if the bank is in difficulties, and thus any spillover effect of the crisis of one bank can be contained. Furthermore, reserve holdings raise the efficiency and reliability of interbank transfers because they have to be kept on commercial banks' current

accounts with the central bank and reserve requirements have to be met on a monthly or fortnightly average only. They may help to mop up excess liquidity, may increase the official reserves of the country if commercial banks take out foreign exchange loans in order to meet the reserve requirement and the foreign exchange is converted at the central bank, and they may offer seigniorage revenue if the reserves are not remunerated at market interest rates. The banking systems of the acceding countries are (or at least were until lately) more fragile than the euro area banking system, and required reserves were partly needed to accumulate bank reserves that justified higher reserve requirements than in the euro area. Higher required reserves, however, have a negative side effect. They decrease the cross-border competitiveness of the domestic banking system vis-à-vis banks abroad. This disadvantage is more pronounced the more capital controls are eased. As in the countries under review enterprises are allowed to borrow from abroad, and best debtors can thus be lured away from the domestic banking system, it is understandable that the countries concerned have been easing their reserve requirements. In fact, the official explanation for reducing the reserve requirement often contains the intention to increase the competitiveness of the domestic banking sector and the intention to move, gradually, to mandatory reserve rates compatible with those of the euro area. Table 4 clearly reflects the decreasing trend of bank reserves as a percentage of GDP.

Table 4

Commercial Banks' Reserve Holdings at the Central Bank

	1998	1999	2000	2001	2002
	<i>Annual average, % of nominal GDP</i>				
Czech Republic	5.1	2.7	1.8	1.3	1.1
Estonia	4.1	4.6	5.0	3.5	3.0
Hungary	4.0	4.1	4.2	2.8	2.4
Poland	3.2	2.8	1.5	1.4	1.7
Slovakia	4.9	4.6	4.2	3.1	2.5
Slovenia	2.0	2.2	2.1	2.1	2.2
Acceding countries' weighted average	3.7	3.1	2.2	1.8	1.8
Euro area	1.5	1.7	1.7	1.8	1.8

Source: National central banks, ECB, Eurostat, own calculations.

Note: Euro area 1998: year-end value, not year-average value. The AC's weighted average includes only the six countries above.

In the Czech Republic, the reserve requirement was reduced from 9.5% to 7.5% in August 1998, to 5% in January 1999 and to 2% in October of the same year. Estonia has the highest reserve requirements, as under its currency board arrangement, the central bank cannot practice its "lender of last resort" function. The higher reserve requirement (13% of the eligible commercial bank liabilities) helps to partly compensate for this increased fragility. Until July 2000, 3 percentage points of the reserve requirement were called "additional" requirement and were remunerated differently than the other part. Since January 2001, 25% and since July of that year 50% of the reserve requirement may be met with high-quality foreign assets, which is clearly visible in the table in the decreasing trend in holdings at the central bank. In Hungary, the reserve requirement was reduced in several steps from the initial 12% to 5% by August 2002. Liabilities with a maturity of over two years were exempted from the reserve requirement in 2000. In Poland, the fragmented reserve requirement (20% on demand deposits, 11% on time deposits and 5% on foreign exchange deposits) was replaced by a 5% flat rate in September 1999. Taking into account

that 10% of the reserve requirement could be met with vault cash, the effective reserve ratio was reduced from 10.6% to 4.5%.¹⁾ In Slovakia, the requirement was reduced from the initial 9% to 4% by 2002. Slovenia was the only country where reserve requirements were not reduced during most of the observed period. Instead, the reserve requirement was fragmented, ranging from 12% on sight deposits to 0% on deposits with a maturity of more than one year, which results in an average reserve ratio of 5.6%. With a view to convergence with ECB instruments, however, three ratios (0%, 2% and 7%) have been applied since August 2002, and it is no longer possible to meet the reserve requirement by purchasing 60-day tolar bills issued by Banka Slovenije.²⁾

3.2 Counterparts of the Monetary Base

Central banks' balance sheet totals may surpass considerably the size of the monetary base because of their capital and reserves and because of other functions central banks may perform aside from their primary functions of issuing money, preserving price stability and ensuring the stability of the country's financial system.

Table 5

Central Bank Assets			
	Foreign currency assets	Claims on government in local currency	Claims on domestic banks in local currency
	% of monetary base, 2000		
Czech Republic	278.12	0.00	8.81
Estonia	130.77	0.00	0.00
Hungary	361.39	42.89	5.71
Poland	240.94	33.42	13.01
Slovakia	351.05	8.14	10.61
Slovenia	175.27	0.00	33.53
Euro area	78.92	11.63 ¹⁾	54.24

Source: National central banks, ECB, own calculations.

¹⁾ General government debt denominated in euro.

The national central banks of the Eurosystem are required to earmark the assets generated in connection with the creation of the monetary base,³⁾ but this is not the case for the central banks of the acceding countries. Without onsite information we cannot perform the task of earmarking the assets linked to the creation of the monetary base in the acceding countries. Table 5 displays those assets of the central banks of the acceding countries under review which may serve as the *counterparts of the monetary base*; this means fixed assets, intangibles and accruals are not taken into account because they are not considered possible channels of money creation. Up to the size of the monetary base, the assets included in table 5 can be considered actual counterparts of the monetary base. By comparison, the table also shows the corresponding data from the consolidated euro area balance sheet.

1 In order to comply with ECB rules, the reserve ratio was lowered to 4.5% for all types of deposits (i.e. demand deposits, time deposits and foreign currency deposits) in February 2002, but vault cash was no longer deductible. The reserve ratio was further lowered to 3.5% for all types of deposits as of the end of October 2003.

2 Source: Annual reports and information from the websites of the respective national central banks retrieved on November 10, 2003.

3 See Article 32.2 of the Statute of the European System of Central Banks and of the European Central Bank.

As table 5 indicates, *foreign assets* dominate the asset side of the balance sheet of central banks in the acceding countries. The ratio of foreign assets to the monetary base is substantially higher in the acceding countries than in the euro area, coming to above 100%, as the acceding countries' foreign assets exceed their monetary base. Three acceding countries' central banks have no claims on their governments, and the share of claims on domestic banks in local currency is substantially lower than in the euro area. All central banks (with the exception of Eesti Pank, which is a currency board regime) basically have the same monetary policy instruments in place as the ESCB, but repos are used for money creation to a much smaller extent than in the euro area.

4 The Size of Seigniorage Revenues in the Acceding Countries

4.1 Measurement of Seigniorage Revenues

In this study, we assume that in the *acceding countries* money creation is effected exclusively through the foreign exchange channel. This simplifying assumption is justified by the fact that money creation is performed through this channel to an overwhelming extent. Accordingly, the quantity of seigniorage is the yield, or interest income, on the central bank's foreign assets equivalent to the size of the monetary base, minus the interest paid on the commercial banks' required reserves.

We have information about the currency composition of the foreign reserves from the annual report of Česká národní banka and from the website of Národná banka Slovenska. The other central banks in the region do not reveal their reserve allocation policy. The reserve allocation policy of the Czech and Slovak central banks is very similar; therefore, we assume that the other central banks in the acceding countries also follow a similar policy. We take it that 75% of the reserves of the six central banks under consideration are held in euro-denominated and 25% in U.S. dollar-denominated government bonds.

Because of the long-term character of these investments, we use the secondary market yields on long-term government papers.

Central banks' balance sheets are compiled in domestic currency; therefore, the depreciation or appreciation of the domestic currency against the euro and the U.S. dollar has to be taken into account as well.

In this study, we calculated seigniorage in the following steps. First, we took the long-term U.S. and euro¹⁾ government bond yields for the five years under investigation.²⁾ We then adjusted U.S. yields for the depreciation of the euro against the U.S. dollar and computed the three-quarter euro/one-quarter U.S. dollar government bond basket. Subsequently, we adjusted the yield of

1 For 1998 we employed German government bond yields.

2 For reasons of simplicity, the annual average yield-to-maturity ratio of long-term government bonds was taken as the basis for the calculation. However, in actual practice, the total performance of central banks' actual asset portfolios during the investigated time periods formed the basis of seigniorage income. With regard to the Eurosystem, the transitional institutional rules for measuring monetary income implied that the benchmark for monetary income pooling and reallocation from its start in 1999 was the main refinancing operation (MRO) rate on a daily basis; since 2003 the sum of the actual (nominal) interest income on monetary policy instruments and the interest income resulting from applying the MRO rate on the difference between the monetary base and the total refinancing volume (consisting mainly of foreign assets and euro government bonds) have been taken for monetary income pooling.

the basket for the change of value of the individual countries' currencies against the euro. For 1998, we used the ECU instead of the euro.

To measure *euro area* seigniorage, we had to form a different basket, since euro-denominated government bonds held by the Eurosystem account for less than three quarters of the monetary base. For this exercise, we assume that money creation as reflected in commercial banks' required reserve deposits with the euro area central banks is effected through the repo channel and that the counterpart of the currency holdings is a basket composed of a 30% repo, 60% U.S. dollar-denominated bond and 10% euro-denominated bond portfolio. We arrived at this portfolio by assuming, roughly, that those euro area assets in excess of the level of the counterparts of the monetary base consist exclusively of foreign assets.

Table 3 of the annex presents the data used for calculating the *interest rates*; table 6 displays the computed interest rates.

Table 6

Interest Rates Used in the Calculation of Seigniorage					
	1998	1999	2000	2001	2002
	%				
Czech Republic	5.4	9.2	5.9	1.2	-6.4
Estonia	5.7	5.2	9.7	5.8	3.5
Hungary	20.2	11.3	12.8	4.4	-2.1
Poland	10.6	15.4	4.0	-3.2	8.7
Slovakia	9.9	18.2	5.9	7.6	2.0
Slovenia	8.7	10.3	16.1	12.1	7.8
Euro area (currency)	5.6	7.6	15.1	6.8	0.9

Source: National central banks, Eurostat, own calculations.

Though we assumed that all acceding country central banks use the same portfolio, the interest rates turned out to be substantially different, which is traceable to the exchange rate movements in the individual countries. In 1998 and in 1999, all the countries under review experienced a nominal depreciation against the euro, with Hungary and the Slovak Republic recording the most pronounced depreciation in 1998 and 1999, respectively. Depreciation entails high interest rates. In 2000, however, the currencies of three countries appreciated, and only Hungary and Slovenia recorded a depreciation of their national currencies. The Hungarian forint joined the club of appreciating currencies in 2001, followed by the Slovak koruna in 2002. The appreciation of the Polish zloty in 2001 and that of the Hungarian forint and the Czech koruna in 2002 was so high that the applied interest rates were negative in the respective years. The euro area interest rate used for the currency part of the monetary base was extremely high in 2000 because of the sharp appreciation of the U.S. dollar against the euro and substantially lower in 2002 as the U.S. dollar depreciated in that year.

Table 7 shows the *seigniorage on the currency holdings* of the acceding countries and of the euro area as a percentage of GDP. Among the acceding countries, Hungary recorded the highest seigniorage on currency holdings (1998 and 2000), as the country's currency holdings are high and interest rates went up as the forint devalued. In 1999, revenue on currency holdings was highest in Slovakia due to the pronounced depreciation of the koruna. Seigniorage revenues on currency holdings in Poland in 2001 and in Hungary and the Czech

Republic in 2002 are negative because their currencies appreciated. Seigniorage revenue on currency holdings in Estonia grew almost twofold from 1999 to 2000. The main reason behind this increase is the higher yield on the above-described model portfolio given the appreciation of the U.S. dollar against the euro. This effect was not mitigated by the appreciation of the domestic currency in the case of Estonia. Seigniorage on the currency holdings of the acceding countries does not differ substantially from that in the euro area. For 2000, however, euro area seigniorage turns out to be almost as high as the highest acceding country value because of the appreciation of the U.S. dollar.

Table 7

Seigniorage on Currency Holdings

	1998	1999	2000	2001	2002
	% of nominal GDP				
Czech Republic	0.4	0.8	0.5	0.1	-0.5
Estonia	0.4	0.4	0.7	0.4	0.3
Hungary	1.3	0.8	0.9	0.3	-0.2
Poland	0.6	0.9	0.2	-0.2	0.5
Slovakia	0.8	1.3	0.4	0.6	0.2
Slovenia	0.2	0.3	0.4	0.3	0.2
Euro area	0.3	0.4	0.8	0.3	0.0

Source: National central banks, ECB, Eurostat, own calculations.

When calculating the *seigniorage on bank reserves* held at the central bank, we have to take into account the interest central banks pay to commercial banks. Narodowy Bank Polski paid no interest on deposits during the observation period, and Česká národní banka began to remunerate deposits in July 2001 only with the two-week repo rate. In the other countries, central banks paid (and still pay) interest on reserves, but rates are lower than market interest rates. In the second half of 2000, Magyar Nemzeti Bank paid 0.5% more interest on required reserves which had to be accumulated because of foreign exchange deposits in commercial banks, but this preferential rate was abolished in 2001. The interest Eesti Pank paid on required reserves increased substantially over the period because interest payment was extended to the whole volume of required reserves in July 1999. Until then, only “additional” reserves had been remunerated. The interest rate applied corresponds to the deposit interest rate of the ECB (and that of the Deutsche Bundesbank in 1998). In the euro area, the interest rate for commercial banks’ required reserves corresponds to the repo rate. As we assumed that commercial banks’ reserves are created through the repo channel, no seigniorage arises on required reserves in the euro area.

The influence of excess reserves on seigniorage is neglected in this paper. Excess reserves are usually not remunerated, and interest is paid on required reserves only. This treatment prompts commercial banks to pursue a tight liquidity management: Excess reserves make up merely 1% to 4% of total reserves.

The average interest rates on commercial banks’ reserves with the central bank are presented in table 4 of the annex. The seigniorage on bank deposits as a percentage of GDP is displayed in table 8.

Table 8 demonstrates that seigniorage on bank deposits follows a mixed, but in the majority of cases decreasing trend. The sharpest reduction is visible in Poland, given the sharp decrease of the reserve ratio in fall 1999 and the appre-

Table 8

Seigniorage on Commercial Bank Deposits with the Central Bank					
	1998	1999	2000	2001	2002
	% of nominal GDP				
Czech Republic	0.3	0.2	0.1	0.0	-0.1
Estonia	0.2	0.2	0.3	0.1	0.0
Hungary	0.4	0.1	0.3	0.0	-0.2
Poland	0.3	0.4	0.1	0.0	0.1
Slovakia	0.4	0.8	0.2	0.2	0.0
Slovenia	0.2	0.2	0.3	0.2	0.1
Euro area	0.0	0.0	0.0	0.0	0.0

Source: National central banks, ECB, Eurostat, own calculations.

ciation of the zloty in 2000. Seigniorage on bank deposits increased sharply in Hungary from 1999 to 2000. The reason was, on the one hand, that – in line with the decreasing domestic interest rate – Magyar Nemzeti Bank paid lower interest on commercial banks' mandatory reserve deposits and on the other hand, that the yield the model portfolio (three-quarter euro, one-quarter U.S. dollar bonds) offered was amplified by the depreciation of the forint. However, the appreciation of the forint in 2001 and 2002 mopped up this revenue, and seigniorage on bank deposits turned negative in 2002, as in the Czech Republic, which had already posted a loss in 2001. Poland, in turn, recorded negative seigniorage in 2001, which changed its sign in 2002.

Adding up the two components of seigniorage, we get the *total seigniorage revenue* of the countries under review, which is presented in table 9.

Table 9

Total Seigniorage Revenue					
	1998	1999	2000	2001	2002
	% of nominal GDP				
Czech Republic	0.7	1.0	0.7	0.1	-0.6
Estonia	0.6	0.6	1.0	0.5	0.3
Hungary	1.7	0.9	1.2	0.3	-0.3
Poland	1.0	1.4	0.3	-0.2	0.6
Slovakia	1.2	2.1	0.6	0.8	0.2
Slovenia	0.4	0.5	0.7	0.5	0.3
Euro area	0.3	0.4	0.9	0.4	0.1

Source: National central banks, ECB, Eurostat, own calculations.

As table 9 shows, total seigniorage revenue is usually higher in the acceding countries than in the euro area. The year 2000, when this value was higher in the euro area, can be treated as exceptional because of the steep appreciation of the U.S. dollar versus the euro. Only Slovenia posted smaller values in 1998 and 1999, mainly because of its low currency stock. The main reason why seigniorage is lower in the euro area is the lack of seigniorage on bank reserves.

We carried out *sensitivity analyses* regarding the effect of exchange rate changes on the size of total seigniorage revenue. In the first analysis we disregarded the exchange rate movements between the euro and the U.S. dollar. The U.S. dollar was appreciating against the euro in the observation period until 2001. This appreciation manifested itself in higher yields on U.S. dollar assets held against the monetary base. Therefore, if no exchange rate movements had taken place, seigniorage would have been smaller. In 2002, however, the dollar depreciated and without this depreciation seigniorage would have been higher.

In the second analysis we disregarded the exchange rate movements of the domestic currencies of the acceding countries as well. Slovenia shows lower seigniorage revenues than the euro area in all years but 2002, as the devaluation of the tolar no longer increases the yield of the foreign exchange portfolio in this simulation. Hungary shows extremely small values in 1998 and 1999, because in these years the nominal interest rate on commercial banks' required reserves was higher than the yield on the counterpart of the monetary base and therefore, if devaluation is not taken into account, negative seigniorage (loss) is realized on commercial bank deposits. If exchange rates had been stable, negative seigniorage values would not have occurred and seigniorage revenues would have been more stable. In the euro area, for example, seigniorage revenues would have fluctuated between 0.19% and 0.29% of GDP if the exchange rate of the euro against the U.S. dollar had been stable against the fluctuation of 0.05% and 0.88% of GDP. All in all, in most cases more than half of the seigniorage revenue can be attributed to exchange rate changes. Tables 5 and 6 in the annex present the results of the sensitivity analyses.

It should be noted that the seigniorage revenues calculated in this exercise have little to do with the *actual profit* (or the share of the actual profit) the central banks transfer to the Treasury each year. As mentioned above, central banks usually manage (foreign) assets that are much higher than the monetary base, and income on assets above the level of the counterparts of the monetary base is usually not identified separately. (One exception is the euro area, where reserves are labeled.) Open market operations may also influence profits substantially. But even if we neglected or tried to filter out these effects, a difference between seigniorage and transferred profit would remain. The reason lies in the accounting practices and profit distribution rules of the respective central banks.

In Hungary, Poland and Slovenia, foreign exchange gains have to be transferred to the foreign exchange reserves – either directly to the asset side or onto a revaluation account on the liabilities side. Any such gains may only be used to cover foreign exchange losses. As a general rule, unrealized gains must not be recognized as income and have to be put on a revaluation account. There is no information about the maturity structure of bonds, and even if we had such information, we could not gauge the effect the active portfolio management of central banks' treasurers has on the proportion of realized and unrealized gains. Unrealized losses, however, appear on the profit and loss accounts if they surpass prior, unrealized gains. The application of accounting rules will most probably help smooth out central banks' profits over the years.

Even if profits are realized, there are restrictions to transferring profits to the Treasury. In Estonia, for example, 25% of the profit can be transferred to the Treasury, provided the reserves of the Eesti Pank reach 2% of GDP and 5% of M2. Magyar Nemzeti Bank's profit transfer to the Treasury is equal to the average profit of the second, third and fourth preceding year, provided the profit of the year under review and retained earnings suffice.

4.2 Further Evolution of Seigniorage in the Acceding Countries

All acceding countries under review are on the road to joining the EU and are pursuing the final goal of joining the Eurosystem. They are already economically and financially integrated with the EU; their banking systems are to a large

extent foreign-owned, mainly by banks from the euro area (Reininger et al., 2002). Because of this high-level integration, it is expected that these countries converge their reserve requirements to those of the Eurosystem even before actually joining it, although legally they are obliged to harmonize mandatory reserve rates fully only when they join the euro area. Maybe they will keep a higher reserve ratio in order to preserve ample official foreign exchange reserves, but the implicit taxation of the banking system will be further reduced and will finally disappear: The interest rates the central banks pay on reserves will converge to market rates. Therefore, as in the Eurosystem, seigniorage revenue on commercial bank reserves will disappear.

As mentioned before, the repo channel was hardly used for money creation in the acceding countries in the years under investigation because commercial banks in the region had ample liquidity even without using this option. This was for three reasons. First, in order to restrict domestic demand and to reduce inflation, domestic interest rates were kept at a relatively high level and therefore it was rewarding for commercial banks to borrow money from abroad instead of using repos to obtain funds from the central bank. Second, some transnational banks centralized their treasury activities in the country of their headquarters, using the repo facility of that country and disbursing the funds among the subsidiary banks. Aside from organizational considerations, this practice had another advantage, namely that intrabank loans may serve as a convenient vehicle of profit transfer between a parent bank and its subsidiaries. As inflation in the acceding countries is abating, interest rates are also being reduced and using repos will become less disadvantageous. The second reason, however, will sustain or even gain momentum, as the banking system is becoming even more integrated into the network of transnational banks through the privatization of remaining state-owned banks. Third, capital inflow (FDI and portfolio investment of nonbanks) drove up the resources of commercial banks even if banks did not make use of the repo facility. Anyway, as a consequence of these three factors – and in particular because of changes in the first factor – the use of repos is expected to go up, which will reduce seigniorage because repos incur lower yields for central banks than long-term bonds.

The currencies of most acceding countries appreciated in recent years. It is expected that appreciation will slow down in the coming years for the following reasons. First, as euro area membership becomes a realistic option, the acceding countries have to consider that joining ERM II with an excessively appreciated currency would negatively influence their competitiveness in the long run. Second, inflation in most countries has already been reduced to a level where the weapon of exchange rate appreciation is not needed for further disinflation. Therefore, it is expected that these countries will follow an exchange rate policy which impedes, or at least slows down, appreciation. This means that in the coming years, no significant further upward movements are expected in the nominal exchange rate of the acceding countries' domestic currencies that would have a large-scale impact on seigniorage revenue.

As far as currency-holding habits are concerned, we have seen above that currency holdings in relation to GDP are higher in the acceding countries than in the euro area, but per capita currency holdings in purchasing power parity euro are smaller. Increasing purchasing power, as experienced in the acceding

countries, points towards a rise in currency holdings, which can be offset by the increasing availability of banking services and the spreading of financial innovation. We expect that currency holding habits will be neutral to seigniorage revenue in relation to GDP in the coming years.

All in all, we expect that seigniorage revenue will decrease somewhat in the acceding countries in the coming years.

The question arises whether the acceding countries could or should stop this decrease to improve their fiscal stance, as suggested by the “optimal inflation rate” literature. Obviously, an expansive monetary policy would – ceteris paribus – result in higher inflation, higher nominal interest rates and a (higher) nominal depreciation of the currency, which would entail higher seigniorage revenue. On the other hand, as table 10 shows, government debt is higher than the monetary base in all the countries under review (with the exception of Estonia). More than the gain on seigniorage would be spent on higher debt service, all other things being equal, if an expansive monetary policy were pursued.

Table 10

Government Debt less Monetary Base in the Acceding Countries

	1998	1999	2000	2001	2002
	% of nominal GDP				
Czech Republic	1.0	3.2	5.5	13.0	17.4
Estonia	- 5.3	- 5.6	- 7.7	- 6.3	- 4.6
Hungary	51.5	50.1	44.5	43.9	48.0
Poland	33.9	33.9	30.4	30.7	34.4
Slovakia	n.a.	32.1	35.5	37.2	33.4
Slovenia	n.a.	21.8	23.1	23.2	23.3

Source: National central banks, ECB, Eurostat, own calculations.

5 Seigniorage in the Acceding Countries after Joining the Euro Area

In this part we investigate how the prospective entry into the Eurosystem will affect the seigniorage revenues of the acceding countries. It should be noted that accession to the euro area will occur as the last step after EU accession and participation in ERM II and that it will require the fulfillment of the Maastricht convergence criteria.

In this analysis, we use the *rules of the protocol on the Statute of the ESCB and of the ECB*, under which the monetary income (seigniorage revenue) of the Eurosystem is to be distributed according to the respective national central bank’s share in the ECB’s paid-up capital, which in turn is determined as a weighted average of the respective country’s share in population (50% weight) and in GDP (50% weight).¹ Actually, we should take average GDP over the five

¹ While the pooled monetary income has always been distributed according to the capital key, from 1999 to 2007 smoothing mechanisms are applied in line with the transitional provisions of the Statute of the ESCB. From 1999 to 2001, the smoothing mechanism was based on the exclusion of the national banknotes in circulation from the monetary base, as euro cash had not been introduced yet (see ECB Decision of 3 November 1998 as amended by Decision of 14 December 2000 ECB/2000/19). Since the euro cash changeover on January 1, 2002, the smoothing mechanism has primarily aimed to equalize historical differences in the banknote circulation. “Historical differences” are identified by discrepancies between the actual national banknote circulation of a national central bank (NCB) before the euro cash changeover and the NCB’s “ideal” part in the total Eurosystem banknote circulation according to its share in the paid-up ECB capital (see ECB Decision ECB/2001/16, in particular Article 4). Since 2002, the smoothing effects have been declining year by year.

years preceding the penultimate year and the population of the penultimate year into account,¹⁾ but we simplify the compilation by taking year 2002 data only.

To facilitate the investigation, we make the following *assumptions*. We assume that the incumbent members of the euro area are the 12 current euro area members, i.e. our analysis does not include those current ESCB member countries that are not members of the euro area, i.e. Denmark, Sweden and the U.K. Moreover, we assume that all profits resulting from seigniorage will be transferred to the national central banks of the euro area.

In order to investigate just the effect of joining the euro area, this exercise assumes that, already before the adoption of the euro, money creation in the acceding countries is effected through the same channels and in the same proportions as in the euro area today. Next, we assume that interest rates will be the same in the acceding countries and in the Eurosystem even before the acceding countries join, i.e. the yield on claims on the government and on domestic banks in local currency will be the same in the acceding countries and in the euro area.²⁾ Moreover, we assume that seigniorage arises on currency holdings only, as explained above. In a first step, we use the data on the year 2002 currency stock. Tymoczko (2001) uses the same method to appraise the effect of Eurosystem membership on Poland's seigniorage.

Table 11

**Key Ratios for Estimating the Effect of Euro Adoption
on the Seigniorage Revenues of the Acceding Countries, 2002 data**

	Currency holdings share	Nominal GDP	Population	ECB capital share (key to seigniorage distribution)	ECB capital share in % of currency holdings share
	%				
Czech Republic	1.8	1.0	2.7	1.9	102.6
Estonia	0.1	0.1	0.4	0.2	155.8
Hungary	1.4	0.9	2.7	1.8	126.9
Poland	3.4	2.7	10.3	6.5	191.8
Slovakia	0.6	0.3	1.4	0.9	144.1
Slovenia	0.2	0.3	0.5	0.4	243.5
Euro area	92.4	94.7	81.9	88.3	95.5
Total	100.0	100.0	100.0	100.0	

Source: National central banks, ECB, Eurostat, own calculations.

According to the *results* presented in table 11, all acceding countries receive a smaller share of the combined seigniorage revenue of the acceding countries and the euro area if seigniorage is distributed according to the share of currency holdings, i.e. if the countries do not join the euro area. This is because the acceding countries account for a relatively high share in the population of the "enlarged" euro area. Though their share in GDP is much smaller, this is more than offset by their population. The largest winner of seigniorage distribution would be Slovenia; it would receive almost two and a half times more seigniorage if it joined the euro area because its share in the combined currency holdings is much smaller than its share in the combined GDP and combined population

1 See Article 29.1 of the Statute of the European System of Central Banks and of the European Central Bank.

2 In fact, interest rates will probably be somewhat higher, but they will converge as the countries approach the adoption of the euro.

of the “enlarged” euro area. Poland would almost double its seigniorage revenue because of its large population. By contrast, if the acceding countries joined the euro area, this would not be beneficial – from the viewpoint of seigniorage – for the existing members, as they would receive about 4.5% less than before.

We carried out the *same exercise with 1998–2001 data*. The results are similar, but the gain of the acceding countries – and the loss of the incumbent euro area member states, respectively – was higher in the earlier years. This is because the nominal rise of currency holdings is higher in the acceding countries than in the euro area, as nominal GDP is rising at a faster pace. Another reason is the nominal drop of currency holdings relative to nominal GDP in the euro area in 2001 to 2002 because of the euro cash changeover. Both factors implied that the share of the acceding countries in their combined total currency holdings with the euro area went up in the period from 1998 to 2002. This uptrend, in turn, reduced the difference between the acceding countries’ share in the currency holdings of the enlarged euro area and the acceding countries’ share in the ECB’s capital of the enlarged euro area, with the latter being taken as the key to distribute the total seigniorage revenue of the enlarged Eurosystem. Based on 1998 data, the loss of seigniorage for the incumbent euro area members would be 7.3%, based on 1999 data 6.9%, on 2000 data 6.4% and on 2001 data 5.7% (see annex table 7).

If this tendency continues until the acceding countries join the euro area, their gain (and consequently the loss to the incumbent members) will be smaller. Moreover, if the euro takes over the dominant role of the U.S. dollar as “quasi-legal tender” in various parts of the world, currency holdings may expand rapidly in the present euro area. This, in turn, would increase the loss of seigniorage to the current members when the acceding countries join the euro area.

If we *ease the assumption* that money creation will be effected through the same channels and in the same proportion as in the present euro area by the time the acceding countries join and assume that the foreign exchange channel remains more pronounced in the acceding countries up to their adoption of the euro, their gain will be less than indicated in the table and the loss of the present euro area will also be smaller. This results from the fact that the yield on (long-term) foreign assets will usually be higher than the (short-term) repo rate. By assessing the impact of joining the euro area on the monetary income of the central banks in the acceding countries we must take into account that interventions in the case of the euro are much less likely than in the case of smaller currencies. Although an intervention by the Eurosystem, which would reduce the monetary income of the euro area, cannot be excluded theoretically, it will most probably impose less of a burden on the acceding countries’ central banks than interventions in their individual national currencies. This may increase the monetary income of the new members without decreasing that of the current members.

Csajbók and Csermely (2002) use a different approach in assessing the effect of euro adoption on the seigniorage revenue of Hungary. Their conclusion is that Hungary would lose seigniorage revenue of a magnitude of 0.2% of GDP if it introduced the euro around 2007.¹⁾ Their calculations cannot be

1 As of November 2003 Hungary’s official goal has been joining the euro area in 2008.

reproduced because neither the underlying assumptions nor the method of calculation are given, but according to their reasoning, if Hungary did not join the euro area, a large part of the counterpart of the Hungarian monetary base would be short-term forint-denominated assets with a yield 150 to 300 basis points higher than that of euro-denominated assets.

This reasoning is rather questionable. As explained above, we also estimate that repos will play an increasingly important role in money creation in the acceding countries in the coming years, but the precondition of this shift is a decrease in domestic interest rates. If the yield difference remains as high as envisaged by Csajbók and Csermely, such a shift will not materialize. Moreover, the authors calculate the loss of seigniorage as a “national cost” of joining the euro area. It would be more appropriate to take into account that falling interest rates reduce the interest burden of government debt, which will surpass any potential loss of seigniorage even if such a loss really occurs as a result of joining the euro area. In addition, Csajbók and Csermely assume that the total seigniorage revenue of the Eurosystem remains constant, regardless of whether one or more countries join the euro area. As table 11 shows, their assumption does not hold. The cake of euro area seigniorage is not constant, as every new member puts in the yield on its currency holdings.

6 Conclusions

In the acceding countries, seigniorage in relation to nominal GDP is usually higher than in the euro area. This ratio is expected to decrease somewhat until these countries adopt the euro. After that, the seigniorage of the acceding countries' central banks will go up due to the ECB's distribution rules. Consequently, the current members will be entitled to a somewhat smaller share of seigniorage than today. Moreover, as a result of euro adoption, the central bank profits of the acceding countries will no longer be dampened by possibly costly intervention or sterilization measures for the national currencies.

But looking at the acceding countries' decision of joining the euro area from a broader perspective, considerations of seigniorage distribution or central bank profits play a minor role, if any. Synergy effects as well as a further facilitation of trade, tourism and capital movements will provide gains to both new and current Member States that will be more significant than the gain or loss of a few percentage points of seigniorage revenue.

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SEIGNIORAGE IN SELECTED ACCEDING COUNTRIES:
CURRENT SITUATION AND FUTURE PROSPECTS ON THE
ROAD TOWARDS MONETARY INTEGRATION

Annex

Table 1

Currency outside the Central Bank					
	1998	1999	2000	2001	2002
	<i>EUR million, converted at purchasing power parity, annual average</i>				
Czech Republic	3,829	4,298	5,191	5,742	6,215
Estonia	342	364	428	465	502
Hungary	2,761	3,146	3,473	3,891	4,924
Poland	8,270	8,727	9,462	10,627	11,539
Slovakia	1,511	1,350	1,593	1,835	2,113
Slovenia	445	508	525	531	595
Acceding countries' total	17,158	18,393	20,671	23,091	25,889
Euro area	342,194	339,670	354,533	341,900	315,658

Source: National central banks, ECB, own calculations.

Note: Euro area 1998: year-end value, not year-average value.

Table 2

Commercial Banks' Reserves Held at the Central Bank					
	1998	1999	2000	2001	2002
	<i>Annual average, EUR million</i>				
Czech Republic	2,604	1,382	1,010	813	832
Estonia	190	225	280	222	210
Hungary	1,698	1,843	2,115	1,609	1,653
Poland	4,475	4,128	2,645	2,944	3,353
Slovakia	977	890	910	714	639
Slovenia	372	431	437	454	507
Acceding countries' total	10,315	8,899	7,398	6,756	7,193
Euro area	87,299	103,232	112,383	124,408	130,650

Source: National central banks, ECB, own calculations.

Table 3

Data for the Calculation of Interest Rates on the Monetary Base					
	1998	1999	2000	2001	2002
	<i>%</i>				
Long-term euro-denominated government bond yield	4.7	4.7	5.4	5.0	4.9
Long-term U.S. government bond yield	5.3	5.6	6.0	5.0	4.6
Depreciation of the euro against the U.S. dollar	1.4	4.6	15.4	3.1	-5.3
Yield on the ¾ EUR / ¼ USD portfolio in euro	5.2	6.1	9.7	5.8	3.5
Yield on the basket portfolio in euro (basket: 30% repo, 10% EUR, 60% USD)	5.6	7.6	15.1	6.8	0.9
	<i>Change of value of local currencies against the euro (value > 1 = depreciation)</i>				
Czech Republic	1.00	1.03	0.97	0.96	0.90
Estonia	1.00	0.99	1.00	1.00	1.00
Hungary	1.14	1.05	1.03	0.99	0.95
Poland	1.05	1.09	0.95	0.91	1.05
Slovakia	1.04	1.11	0.97	1.02	0.99
Slovenia	1.03	1.04	1.06	1.06	1.04

Source: National central banks, Eurostat, own calculations.

SEIGNIORAGE IN SELECTED ACCEDING COUNTRIES:
CURRENT SITUATION AND FUTURE PROSPECTS ON THE
ROAD TOWARDS MONETARY INTEGRATION

Table 4

Average Interest Rates on Bank Deposits

	1998	1999	2000	2001	2002
	%				
Czech Republic	0.0	0.0	0.0	2.4	3.2
Estonia	0.5	1.6	3.5	3.3	2.2
Hungary	10.9	9.0	5.6	4.0	4.5
Poland	0.0	0.0	0.0	0.0	0.0
Slovakia	1.5	1.5	1.5	1.5	1.5
Slovenia	1.0	1.0	1.0	1.0	1.0
Euro area	3.3	2.7	4.0	4.3	3.2

Source: National central banks, ECB, own calculations.

Table 5

Simulation: Total Seigniorage Revenue

without EUR/USD Exchange Rate Changes

	1998	1999	2000	2001	2002
	% of nominal GDP				
Czech Republic	0.6	0.9	0.2	0.0	-0.5
Estonia	0.6	0.4	0.5	0.4	0.4
Hungary	1.7	0.7	0.7	0.2	-0.2
Poland	0.9	1.2	0.0	-0.3	0.8
Slovakia	1.1	1.9	0.2	0.7	0.3
Slovenia	0.3	0.4	0.5	0.5	0.4
Euro area	0.3	0.3	0.3	0.2	0.2

Source: National central banks, ECB, Eurostat, own calculations.

Table 6

Simulation: Total Seigniorage Revenue

without Exchange Rate Changes

	1998	1999	2000	2001	2002
	% of nominal GDP				
Czech Republic	0.6	0.5	0.6	0.5	0.4
Estonia	0.5	0.5	0.5	0.4	0.4
Hungary	0.1	0.2	0.4	0.4	0.4
Poland	0.4	0.4	0.4	0.3	0.4
Slovakia	0.5	0.5	0.6	0.5	0.5
Slovenia	0.2	0.2	0.2	0.2	0.2
Euro area	0.3	0.3	0.3	0.2	0.2

Source: National central banks, ECB, Eurostat, own calculations.

Table 7

Ratio of Seigniorage Based on ECB Capital Share

to Seigniorage Based on Currency Holdings Share

	1998	1999	2000	2001	2002
	ratio				
Czech Republic	1.733	1.527	1.294	1.157	1.026
Estonia	2.526	2.351	1.978	1.786	1.558
Hungary	2.308	2.023	1.886	1.664	1.269
Poland	2.840	2.672	2.579	2.255	1.918
Slovakia	2.168	2.386	2.090	1.762	1.441
Slovenia	3.441	3.022	2.976	2.875	2.435
Euro area	0.927	0.931	0.936	0.943	0.955

Source: National central banks, ECB, Eurostat, own calculations.