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"Seigniorage in the EC: The Implications of the EMS and Financial Market Integration"

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Abstract

The paper measures the effects of the integration of European financial markets and lower inflation in the EMS on the revenue from seigniorage for the EC member countries with particular focus on the high inflation countries. Assuming that by 1992 all EC members participate fully in the EMS and reserve requirements are unified, the revenue from seigniorage will be reduced by about 2 percentage points of GDP in Greece and Portugal and 0.5-0.8 percentage points in Italy and Spain. Two different measures of seigniorage yield similar results regarding the change, but differ regarding the level.

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Summary

Seigniorage is the revenue the government obtains because the public holds zero interest-bearing debt in the form of cash and because the government can force commercial banks to hold reserves at zero interest or below market interest rates. The savings in interest payments on the stock of currency in circulation and required reserves can, from an economic point of view, be considered the implicit revenue from seigniorage. Another way to look at seigniorage is to consider the command over real resources the government obtains by issuing additional currency or by being able to impose higher reserve requirements. According to this flow concept, the revenue from seigniorage is equal to the change in the monetary base (non-interest-bearing component).

This paper calculates both measures of seigniorage for all EC member countries in order to analyze the implications for public finance of the EMS and of financial market integration in the EC. It is assumed that the EMS will lead to a general convergence of inflation rates in the EC to around 1-2 percent by 1992 and that financial market integration will lead to a general convergence in required reserved rations to the current EMS average.

These two assumptions imply that the revenue from seigniorage will decline substantially for Greece, Italy, Portugal, and Spain, which have had considerably higher revenues from seigniorage than other EC countries because of a combination of higher inflation rates and higher required reserve ratios. For Italy and Spain, whose inflation rates are only about 3-4 percentage points above those of the more stable EMS countries, most of the required adjustment will come from a reduction in reserve requirements, which might lead to a negative cash flow of seigniorage for the years up to 1992. Since these two countries pay substantial interest on reserves, however, the loss in terms of interest payments on public debt, arising when required reserves have to be substituted by other securities bearing a full market interest rate, is more limited. Most of the loss appears only toward 1992.

For Portugal and Greece, which now have double-digit inflation rates, the loss of seigniorage will reach about 2 percentage points of GDP, but since the cash flow from seigniorage is currently high, seigniorage will remain positive. Moreover, seigniorage will decline only gradually as inflation is reduced.

The EMS and financial market integration can be expected to lead to a loss of seigniorage in some countries. From an economic point of view, the loss should be minor for Italy and Spain, but could become substantial for Portugal and Greece.

I. Introduction

This note provides a quantitative estimate of the impact of the EMS and the integration of EC financial markets planned for 1992 on the revenue from seigniorage. The underlying premise is that the EMS will lead to a convergence of interest and inflation rates and that the integration of financial markets will lead to a convergence of the required reserve ratios that national central banks can impose on commercial banks in their country. All members of the European Community are treated as if they were full members of the EMS and as if the integration of financial markets was scheduled to proceed at the same pace throughout the Community. This is clearly not an exact description of reality since four members (the United Kingdom, Spain, Portugal, and Greece) are currently not participating in the exchange rate mechanism of the EMS 1/ and also since the integration of financial markets is scheduled to proceed at a slower pace for some of the countries that have only recently joined the EC. However, the results should still give an indication of the direction and the order of magnitude of the impact of the coming integration of EC financial markets coupled with a certain convergence in inflation and interest rates.

The next section discusses some issues related to the economic meaning of the term "seigniorage" and presents two alternative definitions of seigniorage. The third section presents the assumptions that form the basis for the estimates of the impact of the EMS and financial market integration on the revenue from seigniorage. The fourth section presents the results obtained by using these assumptions for the two definitions of seigniorage. Finally, the fifth section discusses to what extent the different views of seigniorage would lead to a different evaluation of the impact of financial integration in Europe on the fiscal situation of some countries.

II. The Concept of Seigniorage

Most academic discussions of seigniorage have tended to focus on the command over real resources the government can obtain by increasing the supply of fiat money, that is by printing currency in the form of bank notes and coins and using this currency to buy goods and services from the private sector. 2/ In this view the total revenue the government obtains in any given period from issuing fiat money is simply equal to the increase in currency over this period. In order to be able to compare the importance of the revenue from seigniorage across countries it is convenient to relate the (flow of) seigniorage to the (flow of) value of

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1/ The authorities of Spain have indicated their intention to join the EMS in the course of 1989.

2/ The classic reference is Auernheimer (1974); for an application to the U.S., see Barro (1982); and for an evaluation of the importance of seigniorage for a group of developing countries, see Fischer (1982).

goods and services produced by the economy. The seigniorage from the issuance of currency, as a proportion of GDP, can then be expressed by:

$$(1) \quad s1 = \frac{D(C)}{GDP}$$

where D(C) denotes the change in the stock of currency in circulation over the year and GDP is in nominal terms. Since the amounts of currency issued by the central bank can be accurately measured this component of seigniorage can be easily compared across countries.

The definition of seigniorage employed in equation (1) measures the amount of goods and services the government can buy by issuing fiat money, however, it does not take into account the true opportunity cost of issuing fiat money. Since fiat money can be viewed as a zero interest loan to the government the opportunity cost definition of the value of seigniorage is given the interest savings the government obtains by being able to issue zero interest rate securities in the form of currency. From this point of view the value of seigniorage, as a proportion of GDP, is given by:

$$(2) \quad s2 = \frac{i*C}{GDP}$$

where i denotes the average nominal interest rate the government pays on its debt. 1/ This second definition of the revenue from seigniorage is therefore based on the stock of currency, whereas the first definition is based on a flow concept, that is the change in the stock of currency.

In the academic literature these two definitions of seigniorage are usually regarded as equivalent since the change in the stock of currency is related, via a demand for money function, to the inflation rate, which in turn is assumed to determine the interest rate. 2/ Differences between the two definitions of seigniorage can then be related to shifts in the demand for money function and the real interest rate. The data for EC countries presented in the next section indicates that given the changes in the real interest rate over the last decade these two definitions of seigniorage have indeed sometimes diverged considerably. As can be seen by comparing equation (1) and (2) an increase in the real interest rate would tend to increase the second measure of seigniorage relative to the first since an increase in the real interest rate would increase the

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1/ In the empirical part of this paper it is implicitly assumed that "the" interest rate on government debt is the interest rate on long term debt. This implies that the alternative to printing money is to issue long term debt.

2/ In the customary steady state analysis the rate of expansion of money is equal to the sum of an exogenous rate of real growth and the inflation rate. The nominal interest rate is then posited to be the sum of an exogenous real rate and the inflation rate.

nominal interest rate associated with any given steady state rate of monetary expansion. Conversely, an increase in the rate of real growth of the economy would increase the first measure relative to the second since it would reduce the inflation rate and thus the interest rate resulting from a given steady state rate of monetary expansion.

Up to this point the discussion has focused on the role of the issuance of fiat money, however, most governments also impose obligatory reserve requirements on commercial banks which are usually calculated as a proportion of the total deposits held by the banks. If no interest is paid on the balances the banks are required to hold with the central bank the economic nature of these required reserves is similar to that of currency: by increasing the amount of required reserves (for example by increasing the required reserve ratio) the government obtains an asset which can be used to acquire real resources. However, a conceptual problem arises when some interest payments are made on these required reserves. The first definition of seigniorage would suggest that the revenue from seigniorage should then be given by:

$$(3) \quad sl = \frac{D(C)}{GDP} + \frac{D(RR)}{GDP} - \frac{i_r * RR}{GDP}$$

where RR denotes the total required reserves held by commercial banks with the central bank and i_r denotes the interest rate paid on these reserves. It is apparent from this equation that in the absence of interest payments on reserves the first definition of seigniorage would be equivalent to the change in reserve money (the sum of currency and required reserves) divided by nominal GDP, this is indeed the measure that has been used most often in empirical investigations. 1/ However, this definition of seigniorage might lead to a situation in which for a given period measured seigniorage is negative because interest payments on required reserves are larger than the increase in currency and required reserves. The contribution of required reserves to seigniorage according to this definition can be seen more clearly by rewriting the last two terms in equation (3) as:

$$(4) \quad sl = \frac{D(C)}{GDP} + \left[\frac{D(RR)}{RR} - i_r\right] \left[\frac{RR}{GDP}\right]$$

This equation implies that as the integration of the European financial markets planned for 1992 might force some countries to lower their required reserve ratios considerably, for these countries the contribution from required reserves to the revenue from seigniorage (according to this definition) might become negative.

1/ For a recent contribution applied to the EMS, see Giavazzi and Giovannini (1988) who do not, however, take into account interest payments on reserves.

Under the second definition of seigniorage the contribution of required reserves would be valued differently since according to this definition required reserves always allow the government to save on interest payments it would otherwise have to make on its public debt; this is expressed in the formula for the total revenue from seigniorage under the second definition:

$$(5) \quad s2 = \frac{i*C}{GDP} + [i - i_r] \left[\frac{RR}{GDP}\right]$$

This expression shows that the imposition of required reserves always increases seigniorage as long as the interest rate on government debt, i, exceeds the interest rate paid on reserves, i_r. 1/ This holds irrespective of the change in the amount of reserves commercial banks are required to hold.

The economic meaning of the two definitions of seigniorage can be illustrated by comparing the government to a firm. The first definition would then correspond to the cash flow and the second definition would correspond to the earnings of the firm. It is not clear a priori which definition of seigniorage is more appropriate for an evaluation of the fiscal impact of financial integration in the EC. On the one hand, government revenues and expenditures are usually measured on a basis that is closer to the definition of cash flows and governments might therefore be more interested in the contribution of seigniorage to cash flow. Moreover, the cash flow definition is equal to the increase in public debt that would occur if--at a given fiscal deficit--no monetary financing had been available. On the other hand, if government revenues and expenditures were evaluated in terms of opportunity costs the second definition of seigniorage would yield a more accurate measurement of the fiscal importance of seigniorage.

Some difficulties might arise, however, in implementing the opportunity cost definition of seigniorage since in some countries the use of the interest rate on public debt to measure the opportunity cost of seigniorage can be criticized on the ground that in these countries the existence of high reserve requirements leads to a higher average level for all interest rates, this would imply that the second definition of seigniorage might in some cases yield an upward biased estimate. However, many countries with high reserve requirements also have capital controls which are designed to lower domestic interest rates, this would point towards a bias in the opposite direction. Moreover, in some countries the central bank has many more financial links with the banking system which include extending credit at reduced rates to certain sectors of the economy, rediscounting of certain financial instruments, etc. The aim of

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1/ For example, in Greece banks have to hold 38 percent of their total deposits in treasury bills; this so-called secondary reserve requirement was not included for the calculation of seigniorage in the empirical part of the paper.

these operations is usually not to affect seigniorage, but to allocate credit across sectors and to implement monetary control. From a theoretical point of view all these operations affect seigniorage to the extent that these operations are not conducted at market rates. However, for the purpose of the present study these operations are not taken into account under the implicit assumption that the net cost of, for example, rediscounting at below market interest rate is just the cost of implementing monetary control, which arises even in the absence of any considerations of seigniorage.

The interpretation of both definitions of seigniorage is difficult in those EC member countries where the bulk of the banking system is owned by the public sector. 1/ It is apparent that this implies that an increase in reserve requirements, which represent a tax on deposits, will have an additional effect on public revenues since it will depress the profits of the banking system which go to the government. 2/ This effect, which might lead to considerably lower estimates of the revenue from seigniorage for some countries, has not been taken into account in this study since data on bank profits is not available on a consistent basis across countries.

III. Assumptions About the Impact of the EMS and 1992

This section estimates the impact of financial integration on the revenue from seigniorage by calculating the two measures of seigniorage given by equations (4) and (5) for 11 EC countries and the U.S. and Japan for comparison. 3/ The results are shown in Tables 1 and 2, which contain data from 1972 to 1987 and projections for 1988-92. The figures up to 1987 are based on actual data from IFS and national sources whereas the figures for the period 1988-92 are the outcome of simulations which are based on a number of simple assumptions about the demand for currency, the time path of nominal GDP, inflation, interest rates, and required reserves. The assumptions used for the projections are:

First, it was assumed that the demand for currency is equal to a constant fraction of GDP and is therefore not affected by inflation or the interest rate. This can be justified by the observation that the ratio of currency to GDP has actually decreased over the last decade in almost all

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1/ This is the case for example in Italy and Portugal.

2/ See Siegel (1981) for a discussion of the importance of this point in measuring the revenue from seigniorage. In Portugal banks have reported a negative interest rate margin for four years up to 1986. In 1985, for example, this negative interest margin (the excess of interest paid on deposits over the interest received on credits and other financial instruments) was equivalent to about 2.3 percent of GNP (see Banco de Portugal, Annual Report 1986, page 151).

3/ The BLEU is treated as one country for the purpose of this study.

Table 1. Seigniorage in EC, 1982-92 1/

(Cash flow definition of seigniorage)

	Average 1979-81	1982	1983	1984	1985	1986	1987	Projections 1988	1989	1990	1991	1992
Portugal	5.29	5.86	2.70	0.63	1.07	1.62	2.74	1.18	0.88	0.60	0.33	0.08
Greece	2.28	3.39	-0.02	3.48	0.56	0.22	2.99	0.77	0.58	0.40	0.20	0.00
Italy	1.37	1.45	1.49	1.39	1.81	0.60	0.63	-0.43	-0.46	-0.50	-0.56	-0.63
Spain	1.32	1.87	2.01	7.51	0.59	0.88	1.18	-0.47	-0.56	-0.66	-0.78	-0.91
France	0.64	1.32	0.52	0.83	0.06	-0.25	0.33	0.71	0.73	0.75	0.78	0.81
Denmark	0.31	0.08	0.22	0.31	4.58	-2.39	-1.09	0.84	0.88	0.92	0.96	1.01
Belgium	0.22	0.00	0.32	0.06	-0.08	0.38	0.21	1.01	1.07	1.13	1.21	1.28
United Kingdom	0.19	0.19	0.12	-0.45	0.22	0.33	0.06	1.04	1.07	1.10	1.11	1.12
Ireland	0.10	0.20	0.52	0.16	0.24	0.08	0.56	-0.07	0.00	0.06	0.12	0.30
Netherlands	0.07	0.48	0.78	0.41	0.28	0.26	0.73	0.84	0.92	1.01	1.11	1.22
Germany	0.00	0.48	0.50	0.35	0.30	0.56	0.83	0.44	0.47	0.49	0.52	0.53
For Comparison												
Japan	0.50	0.54	0.48	0.75	0.34	0.73	1.10					
U.S.	0.32	0.34	0.32	0.33	0.51	0.80	0.26					

1/ In percent of GDP.

Table 2. Seigniorage in EC 1/

(Opportunity cost definition of seigniorage)

	Average 1979-81	1982	1983	1984	1985	1986	1987	Projections 1988	1989	1990	1991	1992
Portugal	3.83	4.35	4.56	4.28	3.51	2.70	2.36	1.97	1.60	1.26	0.94	0.64
Greece	3.30	2.43	2.26	2.11	2.14	1.92	2.42	2.05.	1.70	1.35	1.02	0.70
Italy	2.12	2.64	2.19	1.72	1.48	1.07	0.93	0.85	0.76	0.67	0.57	0.47
Spain	1.77	1.83	2.43	1.52	0.89	0.80	1.39	1.24	1.08	0.92	0.75	0.59
Belgium	1.27	1.31	1.12	1.06	0.87	0.64	0.63	0.64	1.64	0.63	0.61	0.59
Ireland	1.23	1.12	0.95	0.92	0.80	0.71	0.75	0.67	0.60	0.52	0.45	0.49
France	0.87	1.12	0.96	0.91	0.75	0.52	0.58	0.56	0.54	0.50	0.46	0.41
Germany	0.87	0.85	0.76	0.74	0.65	0.56	0.58	0.57	0.55	0.54	0.52	0.51
United Kingdom	0.75	0.61	0.48	0.40	0.38	0.37	0.33	0.37	0.39	0.40	0.39	0.37
Netherlands	0.69	0.69	0.64	0.62	0.55	0.47	0.52	0.54	0.55	0.57	0.57	0.58
Denmark	0.68	0.70	0.48	0.46	0.92	0.51	0.38	0.41	0.42	0.41	0.39	0.35
For Comparison												
Japan	0.78	0.75	0.70	0.65	0.60	0.48	0.43					
U.S.	0.70	0.75	0.63	0.69	0.60	0.47	0.51					

1/ In percent of GDP

countries although inflation rates have fallen considerably over the same period. There is therefore no reason to believe that a further fall in inflation will increase the demand for currency by an appreciable amount. Accordingly, for all countries it was assumed that the currency to GDP ratio would be constant up to 1992 at the level observed in 1987. Given that there are now some differences in the currency to GDP ratios this assumption implies that some differences in payment habits will continue to exist. 1/

Second, it was assumed that by 1992 all countries will have converged to a rate of growth of nominal GDP of 5 percent. This rate of growth of nominal GDP can be thought of as the result of an inflation rate of about 1-2 percent and a real growth rate of about 3-4 percent; this is approximately equal to the average already achieved in the EMS. Each country was assumed to converge to this level in five equal steps between 1988 and 1992. These projections for nominal GDP together with the first assumption were then used to obtain projections for the demand for currency. For all current EMS members this assumption seems very reasonable since even the high inflation EMS members have currently growth rates of nominal GDP of less than 8 percent. For the two EC members which still have double digit inflation rates (Portugal and Greece) this target seems to require a rapid disinflation, but the required fall in the inflation rate would not exceed that experienced by Italy between a period of similar length (in Italy the inflation rate fell from 16.2 percent in 1982 to 5.5 percent in 1987).

Third, regarding interest rates on government debt it was assumed that they would converge with the same pattern to a level of 5 percent. This is also approximately equal to the present level in some low inflation countries and would allow for a real interest rate of about 3-4 percent. Interest payments on required reserves were assumed to be phased out over the same period since reserves are not remunerated at present in any of the low inflation countries.

Fourth, the ratio of reserves to GDP was assumed to converge by 1992 to 4 percent, which is approximately equal to the present average for the EMS of 4.24 percent. This assumption could be based on the argument that the integration of financial markets will lead to similar financial institutions everywhere so that the deposit to GDP ratios would become similar, coupled with the pressure for convergence in required reserve ratios this would lead to convergence in the ratio of reserves to GDP.

1/ On average the EC countries with higher inflation rates are also those with a financial system that is regarded as less well developed. The assumption of a constant cash to GDP ratio therefore implies that the positive effect of a decline in inflation on the demand for real balances is counterbalanced by the negative effect of financial integration which should make other means of payments more attractive.

IV. Results

Given these assumptions both measures of seigniorage can be calculated for the years 1988-92. The first (cash flow) definition of seigniorage in equation (4) can be rewritten as:

$$(6) \quad sl = \frac{D(C)}{C}\frac{C}{GDP} + \left[\frac{D(RR)}{RR} - i_r\right]\left[\frac{RR}{GDP}\right]$$

which shows that the contribution of currency to seigniorage is given by the product of the currency to GDP ratio (a constant by the first assumption) and the growth rate of the stock of currency (equal to the growth rate of nominal GDP also by the first assumption), which is assumed to go linearly to 5 percent. A similar reasoning shows that the contribution of reserves to seigniorage also goes linearly to a value that is equal to 5 percent times the reserve to GDP ratio.

The second (opportunity cost) definition of the revenue from seigniorage relies only on the ratios of currency and reserves to GDP and the two interest rates (see equation (5) above). The projected changes in this measure of seigniorage are therefore determined by the assumptions about the reserve to GDP ratio and the two interest rates (on debt and on reserves). For some countries data of the effective interest rate paid on reserves was difficult to obtain since in some countries (typically those with high interest rates) different interest rates are paid on different proportions of the total of required reserves. 1/ It is apparent from equation (5) that reserves that can be held in the form of government securities do not contribute to this definition of seigniorage.

Table 1 displays the cash flow measure of seigniorage, the EC countries in this table are ordered by the importance of seigniorage in 1979-81, which goes from 5.29 percent of GDP for Portugal to 0 percent for Germany. This table shows that there is a group of four countries which did have considerable cash flows from seigniorage during the early 1980s, which for Italy coincided with the early years of the EMS. However, it is also apparent that the cash flow measure of seigniorage is not a very reliable indicator if it is based only on data from a single year. For example the data for Greece suggests that seigniorage was about 3.4 percent of GDP in both 1982 and 1984, but turned negative (0.2 percent of GDP) in 1983, another example would be Germany, where the cash flow from seigniorage was zero in 1979-81, but almost 1/2 of 1 percent in 1982. However, even taking into account the limited reliability of this measure of seigniorage it appears that there has been already considerable adjustment in the group of four countries that use seigniorage most intensively if one compares the 1979-81 to 1986-87. In Portugal and

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1/ In Spain interest is paid on a proportion of the total reserves, in Italy interest is paid on all reserves, but a higher interest rate applies to reserves held against certificates of deposit.

Greece the use of seigniorage appears to have declined by about 2 percentage points of GDP and in Italy seigniorage declined from 1.5 percent of GDP to about 0.6 percent of GDP; less adjustment is apparent in Spain. It is interesting to note that due to the recent increase in demand for monetary base in Germany seigniorage (according to the cash flow definition) has been more important in that country than in Italy in 1986-87.

The impact of the integration of European financial markets can be seen from the projections for 1988-92. In Portugal and Greece seigniorage declines by more than 2 percentage points of GDP comparing 1992 to 1987, the magnitude of this adjustment is even larger than that experienced by these countries over the last seven to eight years. For Italy and Spain the cash flow from seigniorage becomes negative for the entire period of five years up to 1992. The reason for this result is that these two countries have relatively high reserve requirement ratios, which they are assumed to have to reduce to the EC average due to the integration of the European financial markets. In Portugal and Greece a similar effect is operating, but in these two countries, which are not members of the EMS, inflation rates and the ratios of currency to GDP are high enough to offset the negative impact of the required reduction in reserve requirements. However, although the cash flow from seigniorage stays positive in these two countries the absolute adjustment is larger in Portugal and Greece than in Italy and Spain (more than 2 percentage points versus 1-1.5 percentage points) because the former two countries have the additional negative effect on seigniorage coming from the reduction in inflation rates.

The impact of the EMS and the integration of European financial markets on the cash flow from seigniorage may be summarized as follows: the reduction in inflation required from countries like Portugal and Greece if they wish to join the EMS in the future will reduce the cash flow from seigniorage coming from the currency component of the monetary base. The reduction in reserve requirements that may be necessary because of financial market integration will lead to a negative cash flow from this component since it implies that in countries like Italy and Spain public debt of between 5.7 and 7.8 percent of GDP that has up to now been held by bank at below market rates will have to be substituted by ordinary public debt bearing full market rates. For Italy and Spain this effect is strong enough to lead to an overall negative cash flow from seigniorage. 1/

1/ Evidently a symmetric effect is operating for those countries that currently do not impose significant reserve requirements. Table 1 shows therefore that the U.K., Belgium, Netherlands, and Denmark would experience a positive cash flow of about 1 percent of GDP up to 1992 because in these countries the ratio of bank reserves to GDP would have to rise in order to get to the EC average of 4 percent. Therefore, Table 1 appears to suggest that the upper and lower groups of countries trade

Table 2 displays the opportunity cost measure of seigniorage, which shows that the same group of four countries that had the highest measure of seigniorage in Table 1 again appear to make the most intensive use of seigniorage; however, the ordering among the remaining countries is somewhat different. It is also apparent by comparing Tables 1 and 2 that the opportunity cost measure of seigniorage is more stable, this is due to the fact that interest rates and the stock of currency and reserves are considerably more stable than changes in currency and reserves. Table 2 confirms only partially the considerable adjustment in the group of high seigniorage countries that had appeared in Table 1 as having taken place between 1979-81 and 1987. For Portugal and Italy a considerable reduction in seigniorage (2 and 1.5 percentage points of GDP respectively) is still apparent, but almost no reduction appears to have taken place in Spain and Greece.

The effects of the EMS and financial market integration can again be seen from the projections for 1988-92. Using the opportunity cost measure of seigniorage no negative entries appear in that part of the table since the savings in interest payments on currency and reserves are always positive irrespective of the actual changes in the stocks of currency and reserves. This table therefore suggests that the revenue from seigniorage will converge for all EC countries to a narrow range (0.37 to 0.70 percent of GDP), whose width is essentially determined by the differences in the currency to GDP ratios that are assumed to persist until 1992. For the high seigniorage country this implies that seigniorage will have to decline to about one third to one half of the current level. The largest absolute adjustment, about two percentage points of GDP, is still projected for Portugal. The absolute adjustment required by countries which already have single digit inflation rates, like Italy and Spain is lower, about 0.5 and 0.8 percentage points of GDP respectively.

V. Interpretation of the Results and Summary

The implications of the EMS and financial market integration in Europe on the revenue from seigniorage have been analyzed in this study under the hypothesis that the EMS would lead to a general convergence of inflation rates in the EC to around 1-2 percent by 1992 and that financial market integration would lead to a general convergence in required *reserved ratios to the current EMS average.*

These two assumptions imply that the revenue from seigniorage will be substantially reduced for a group of four countries (Greece, Italy, Portugal, and Spain) that have had considerable higher revenues from

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1/ (Cont'd from page 10) places: during the early 1980s, seigniorage was more important in the first five countries than in the other six, during the period up to 1992 the opposite is true.

seigniorage than other EC countries because of a combination of higher inflation rates and higher required reserve ratios. For Italy and Spain, whose inflation rates are only about 3-4 percentage points above those of the more stable EMS countries, most of the required adjustment comes from the reduction in reserve requirements, which might actually lead to a negative cash flow of seigniorage for the years up to 1992. However, since these two countries pay substantial interest on reserves, the loss in terms of interest payments on public debt that arises when required reserves have to be substituted by other securities that bear a full market interest rate, is more limited and most of the loss appears only towards 1992.

For countries that currently still have double digit inflation rates, such as Portugal and Greece, the total adjustment required is larger, but since the starting point (1987) is much higher the cash flow from seigniorage, which drops by about 2 percentage points of GDP, remains always positive. However, even in this case the loss of interest rate savings arises only gradually as inflation is reduced towards 1992.

The EMS and financial market integration can be expected to lead to a loss of seigniorage in some countries, however, from an economic point of view the loss should only be minor for Italy and Spain, whereas it could become substantial for Portugal and Greece.

Data Sources and Definitions

The cash flow definition of seigniorage was calculated using equation (4) for the past (1982-87) and using equation (6) for the projections up to 1992. The variables needed in equation (4) and the data sources used are:

Change in currency divided by GDP: the change in line 14a, IFS (currency outside DMBs) divided by line 99b (gross domestic product);

Percentage change in reserves: reserves were calculated as the difference between line 14 IFS (reserve money) and line 14a, the percentage change was set equal to $(RR_t - RR_{t-1})/RR_t$;

Ratio of reserves to GDP: (line 14 IFS -line 14a)/line 99b, interest on reserves: from a variety of national sources.

The opportunity cost definition of seigniorage was calculated using equation (5) with the same sources as above for currency, reserves and GDP. The only additional variable used was the interest rate on government debt, for which line 61 IFS (government bond yield) was used.

For a number of countries IFS does not contain line 61 or line 99b. For Germany line 99b. was missing line 99b.c (also called GDP) was used instead. Line 61 does not exist for a sufficient number of years for several countries, the following data was used in this case: For Portugal lines 60 and 60c; for Greece the average of lines 601 and 60p; and for Spain line 60c.

Further specific adjustment for individual countries are:

Greece: Greece represented the only case of considerable private sector deposits with the central bank, reserves were therefore calculated as line 14 minus line 14a minus line 14d. Data on the interest rate paid on reserves was obtained from the Bank of Greece.

Ireland: According to sources at the Bank of Ireland, close to market rates are paid on the primary reserve requirement and the secondary reserve requirements is in treasury bills, the interest rate on reserves was therefore set equal to line 61 IFS minus 2.

Italy: The interest rate paid on required reserves is published in the Relazione Annuale--Appendice of the Bank of Italy, it has been equal to 5.5 percent since 1970, starting 1982 a higher interest rate (9.5 percent) is paid on reserves against certificates of deposits, however, since these certificates of deposit constitute only a minor fraction (in 1987 about 10 percent) of total deposits this was not taken into account and the interest rate on reserves was set equal to 5.5 percent throughout.

Spain: Since there were considerable discrepancies between Bank of Spain data on reserve money and IFS line 14 the national source was used for reserve money, line 14a IFS was used for currency in circulation since for this variable there was no discrepancy between national sources and IFS. Interest on reserves was calculated using national sources (boletín estadístico, sections on tipos de interés and coeficientes legales).

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