The First Stage of the Transition in the Economies of the Former USSR: Asymmetric Shocks, Macroeconomic Imbalances and Seigniorage *

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1. Introduction

Among the new independent republics of the former USSR, the transition from a planned to a decentralized market economy has often witnessed harsh political competition to obtain the responsibility for implementing the institutional reforms which are urgently required. The heterogeneous regions of this vast territory must adapt their economies to completely new models of development; in comparison to the preceding, highly integrated system, this is being achieved in a spontaneous and mostly uncontrolled manner.

The economies in transition are losing their previous monolithic structure and are assuming more diversified features, both in the sphere of production and in the monetary field. The components of this transformation (microeconomic reforms, privatization patterns, availability of stabilization policies) assume a different timing and gain characteristic features across the 15 new independent states born from the former Union; for a better understanding of their evolution it is thus necessary to ascertain the relative importance of the initial conditions (economic structure, access to foreign markets, vulner-

ability to terms of trade movements) in order to evaluate the likely impact of the policies adopted (and more often suffered).

Accordingly, the paper pursues two objectives. It presents a brief overview of the impulses which have rapidly affected the area; the focus is on inter-state differences, centered not on Russia, but on the smaller economies on her border.[1] Moreover, this work gives an estimate of the seigniorage in the area, assessing the inflation tax on money holders implicit in the very high growth rates of prices in 1992. The order of magnitude of seigniorage is shown to be important; there also exist broad asymmetries regarding its distribution across the economies concerned. The last part of the paper concludes.

2. A look at the macroeconomic imbalances and their cross-country differences

In the former Soviet Union, the annual average loss of real GNP, according to the (partially estimated) data published by the IMF *World Economic Outlook* of May 1994, was 11.6% in 1991 and 18.2% in 1992, and close to 12 percentage points also in 1993. This sharp and prolonged output fall[2] is aggravated by high inflation: the annual average growth of consumer prices in the area was some 1,300%; it did not change much, on average, in 1993 (1,226%).

Macroeconomic variables differ widely across countries (Table 1): the real GNP loss in 1992 varied from −5% in Turkmenistan to

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[1] See Nuti and Pisany-Ferry (1992), Giustiniani and Rebecchini (1994), among others, for recent works on the Russian economy. Papers on regional patterns in the former USSR were presented at the 33rd Annual Meeting of the European Regional Science Association in Moscow, August 1993, and are listed in the references.

[2] As is well known, statistics on output contraction in the economy as a whole are difficult to assess; due to different dynamics across sectors, available data tend to overstate the loss when referring mainly to the state firms and do not take into account the potentially growing, newly liberalized sectors, which however have still a limited importance. Moreover, the quality of available data is made more uncertain by the heterogeneity of the statistical sources and of the economies considered in this paper, not to mention the statistical difficulties related to the (in most of the republics) still uncompleted passage from the national accounts, based on the definition of net material product, to western standards.

TABLE 1

REPUBLICS OF THE FORMER USSR: ECONOMIC INDICATORS
(per cent, annual averages)

| | Real GNP changes | | | | Inflation (consumer prices) | | | | Government budget balance/GNP | | |
	1990	1991	1992	1993	1990	1991	1992	1993	1991	1992	1993
Russia	−2.0	−12.9	−18.5	−11.5	5.6	92.7	1353	896	−16.4	−18.8	−9.3
Ukraine	−3.4	−11.9	−17.0	−17.0	4.2	91.2	1445	4928	−15.8	−28.7	−15.0
Belarus	−3.0	−1.9	−11.0	−11.7	4.5	83.5	969	1188	1.2	−5.7	−11.8
Moldavia	−1.5	−18.0	−21.3	−15.0	5.6	162.0	1276	1340	–	−26.0	−6.1
Lithuania	−5.0	−13.1	−37.7	−16.2	8.5	224.7	1020	410	2.8	0.6	−0.2
Latvia	−0.2	−8.3	−33.8	−10.1	10.5	124.4	951	109	6.3	−1.5	0.9
Estonia	−3.6	−11.3	−19.3	−3.5	17.2	210.6	1069	89	4.6	0.6	0.2
Azerbaijan	−11.7	−0.7	−26.8	−14.4	7.8	105.6	611	798	2.6	−26.8	−14.4
Georgia	−12.4	−20.6	−45.6	−30.0	3.3	78.5	888	1480	−3.5	−35.1	−40.0
Armenia	−8.5	−11.8	−52.0	−28.0	5.6	100.0	790	2500	−1.9	−34.8	−52.0
Uzbekistan	4.3	−0.9	−9.5	–	3.5	105.0	528	761	−5.5	−13.0	−15.7
Kazakhstan	−0.4	−13.0	−14.0	−10.0	4.2	147.0	2568	2147	−7.9	−7.3	−2.9
Tajikistan	−0.6	−8.7	−30.0	−30.0	5.6	111.6	1157	1870	3.4	−37.0	−37.0
Kyrgyzstan	4.0	−5.0	−19.1	−16.4	4.2	85.0	855	1209	4.8	−14.8	−8.2
Turkmenistan	1.8	−4.7	−5.3	8.5	5.6	102.5	493	1860	4.0	14.1	−7.0
Former USSR	−2.2	−11.6	−18.2	−11.9	5.4	98.4	1292	1226	–	–	−18.5

Source: FMI, *World Economic Outlook*, May 1993 and 1994; partially estimated data.

−46% in Georgia and −52% in Armenia, two countries plagued by wars; in the same year, inflation ranged from around 500% (Uzbekistan and Turkmenistan) to 2,500% (Kazakhstan). In 1993, inflationary conditions worsened in Ukraine (4,900%, on an annual average), the country which has been closest to hyperinflation.[3]

The contraction in production has been greatest in the republics with a higher level of per capita consumption; the rural areas have registered a lower than average output loss. Also, inflation rates are positively related to the developments indicators; they have been lower in the poorest countries (and agricultural relative prices have fallen in the course of the transition).[4] On cross-country data, inflation and the output fall are uncorrelated; instead, the relationship between budget deficits and the growth rate of prices (with the exception of the Baltic countries) tend to confirm the role of monetary financing in the dynamics of the inflationary process.[5]

Russia, Belarus and Ukraine have an economic structure centered on industrial production, which in 1990 was estimated to represent more than half of real GNP. Also, the three Baltic republics and a small Caucasian state, Armenia, are highly industrialized; the share of industry varied in the same year betweeen 71% (Armenia) and 49% (Lithuania).[6] The productive contraction has been aggra-

[3] The very rapid price level growth witnessed by Ukraine is not yet hyperinflation in a technical sense, at least if Cagan's (1956) definition (based on a monthly rate of 50%) is adopted. At the time of writing, monthly price increases were higher than 50% only in January 1993 and January 1994.

[4] It must be noticed that, at the start of the transition period, the geographical differences in living standards and real per capita income were already large; for instance, in 1988 (based on former national accounts and the definition of net material product) real per capita consumption in the Baltic countries was about 30% higher than the Union average (and the production of consumption goods was around twice the mean); in Central Asian countries, real per capita consumption levels were lower: the poorest republic, Tajikistan, was some 60% of the Union average (see Chumachenko 1993).

[5] However, budget deficit data must be supplemented with an estimate of the financial needs of the large firms in the state sector; a straightforward comparison with western definitions is not adequate (on the severe limitations of the concept of budget deficit in transitional economies, see Tanzi 1993).

[6] In these countries, the widespread presence of monopolistic and oligopolistic industrial conglomerates biases the reaction of the industrial sector to the main impulses of the transition period: the liberalization of prices and the decentralization of decision-making processes. While in the case of the small firms, mainly in the service sector, privatization is gaining momentum, for the large industrial structures the process is much slower, due to the difficulties linked to the huge stock of existing intra-firm debt, high labour force redundancies, the difficulties of determining a fair selling price and its redistributive effects, and concerns about management replacements.

vated by the disappearance of the usual commercial relationships, by the rapid modifications in the terms of trade which have determined the introduction of export controls, and by confused monetary conditions which initially almost paralysed the payments system. The trade collapse in the area has had particularly harmful consequences on the small open economies which were producing intermediate and manufacturing goods.

In the former USSR in 1990, the primary sector represented about 25% of real GNP; in many respects, agriculture has a more pronounced importance than in western countries with comparable levels of development. Indeed, the economic and social context in five countries is strictly linked to agriculture: in the same year, Moldavia, Azerbaijan, Tajikistan, Turkmenistan and Georgia had a labour force working in the primary sector of more than 20% of total employment, against 14% of the CIS (Commonwealth of Independent States) average and 10.4% of Russia (Petukhova 1993). However, among the republics with a narrower industrial base, it is necessary to distinguish the regions without sizeable natural resources (Moldavia, Tajikistan and Georgia) from countries with developed energy and extractive sectors (Kazakhstan, Azerbaijan, Turkmenistan, partially Uzbekistan). In the former, strong separatist and social tensions have determined armed conflicts, contrasting Moldavia and Trans-Dnestr territories, Georgians and Abkhazians, Tajiks and the other ethnic groups. The output drop in these regions has also been determined by the worsening of terms of trade between agricultural goods and production inputs which followed the abandonment of planned prices. Relative price movements have instead favoured the vast territories of the Far East and Central Asia, with their endowment of strategic commodities.[7]

[7] However, in these areas the stock of natural resources which can be extracted with traditional methods is diminishing; moreover, in the Russian Far East both the social context and the tertiary sectors were dependent on the presence of military bases and are suffering due to the drastic fall in defence expenditure (Mikheeva 1993).

3. The role of trade interdependence and of relative prices

The abrupt temporal divergences in the pattern of price liberaliz-
ation have caused unexpected movements in the wage and price
structures among different regions of the former USSR; these wide
variations in the terms of trade have harmed the traditional com-
mercial ties. It is useful to examine these aspects in more detail.

The previous degree of openness of those countries, both within
the former Union and outside the ruble area, was linked to an
allocation of production which privileged mainly scale economies. In
1988, the sum of exports and imports inside the area as a ratio of
preliminary estimates of GNP (Banca d'Italia 1991) was equal to or
higher than 45% in the Baltic states, Moldavia and Belarus, against
21% for the former Soviet average and 13% in Russia. By contrast,
Russia had the highest degree of openness with regard to trade
outside the ruble area (9.4% of GNP). Consequently, the ratio of
internal (regional) and external (international) trade was equal to 73%
in Russia and 26% in Ukraine, to reach low and uniform values in the
other 13 republics, comprised between 17.6% (Estonia) and 12.1%
(Armenia). These data vividly describe both the high regional inte-
gration of these economies and their relative isolation towards foreign
countries. The drastic reduction in traditional trade linkages has
worsened the productive contraction; in fact, the degree of regional
openness in 1988 was positively correlated to the output fall in
1990-93.

An important source of diversification of economic patterns
inside the area concerns the likely impact of replacing the traditional
structure of planned prices with the relative prices prevailing in the
international markets. Goskomstat (the central statistical office of the
former USSR) calculated the ratio between international and internal
prices for 1990, before the "big bang" policy of rapid price liberaliz-
ation pursued by Russia.[8] The comparison is valid, as a first approxi-
mation, only with reference to fairly homogeneous goods (primary

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[8] See the data reported by Orlowski (1993, p. 1003) and Dukhene and Senik-
Leygonie (1993, p. 138). In 1990, the official exchange rate used by Goskomstat was 0.6
old rubles to the dollar; the assumption of an approximate parity of traded goods price
level is static; recently the real exchange rates in the area have been subjected to wide
fluctuation and, overall, the *real* exchange rate has recently appreciated, with the partial
exception of Ukraine.

commodities, standardized manufacturing products); given a ratio of
foreign to domestic prices of 0.97 at the official exchange rates,
however, these data give a useful account of the previous, different
price structure, conditional on an approximate parity of the overall
terms of trade.

As is well known, in the former USSR the relative price of
energy products was greatly undervalued with respect to world levels;
the products of the extractive industry were relatively cheaper as
were, to a lesser extent, investment goods and transportation and
communication services. Symmetrically, there was an overvaluation of
the prices of agricultural and consumer goods, particularly in the case
of the food industry and light manufacturing. This relative price
structure was reflected in an implicit re-allocation of resources, from
the areas producing non-agricultural primary commodities and in-
vestment goods to those producing consumer and agricultural goods.
In the opposite direction, there was a flow of direct transfers to
finance the investment requirements of extractive industries and to
assure the presence of a sufficient wage gap to incentivate the
allocation of the labour force (Orlowski 1993).

Several authors have estimated and compared the trade balances
(as a ratio of GNP) evaluated on the basis of domestic and inter-
national prices, for determining the gains or losses (at predetermined
volumes, thus abstracting from price elasticities and income counter-
effects), as a percentage of regional products, due to the complete
adoption of the relative international price structure. These different
estimates (Banca d'Italia 1991, Senik-Leygonie and Hughes 1992,
Orlowski 1993, Tarr 1994) based on partially diverse methodologies
and reference years (in 1990 the world relative price of energy was
high and this fact clearly affects the estimates) achieve results which
are similar in many respects.

Given the different endowments of natural resources and the
varying degrees of regional specialization of production, the impact of
adopting the international price structure would be negative and
particularly severe for five small open economies in the European
area: Belarus, Moldavia, Estonia, Latvia and Lithuania. These reper-
cussions are instead more differentiated in the Central Asian area
which would be less affected, as a whole, due to both the presence of
natural resources and fewer manufacturing industries (on the other
hand, this region has suffered most from the loss of direct transfers

from the Union's budget). In the case of Turkmenistan, the energy sector would provide a higher gain, as a ratio of GNP, than Russia's; the impact of the relative international prices would also be beneficial for Turkmenistan and Kyrgyzstan. Instead, two Asian countries, Tajikistan and Uzbekistan, would be subjected to a loss; this negative trade shock is, however, estimated to be potentially offset by the favourable effects on trade outside the area.

Symmetrically, the gain for the most diversified economy, the Russian Federation, can be evaluated between 12% and 18% of GNP (respectively at 1988 and 1990 prices) on the total (outside and inside the area) trade, close to 4-5 percentage points regarding regional exchanges.

An important contribution by Senik-Leygonie and Hughes evaluates the consequences on trade of regional production with negative value added.[9] The lowest "implicit profit rates" computed at world prices are concentrated in the republics producing mostly consumer goods (Belarus, Ukraine, the Baltic states), while value added is higher in areas producing agricultural and extractive commodities, where integration would be more immediate. Furthermore, applying as a corrective proportion the amount of exports given by industries with negative value added at world prices, a negative impulse would be suffered by some Asian countries (particularly Uzbekistan), Moldavia and the Baltic states.[10]

In any case, a common limitation of the methodologies considered in this section concerns the implausibility that the technical coefficients crystallized in the existing input-output tables, for 1987-90, remain unaffected by the wide movements of relative prices and overall terms of trade. Moreover, the restrictive assumption of a

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[9] The notion has been introduced by McKinnon (1991). In the planned economies, the widespread use of artificial prices, which were far from the actual costs of production, have favoured the adoption of technologies that, evaluated at international prices, would remain unprofitable at any exchange rate. The use of uneconomical productive processes means a high consumption of primary inputs; price repercussions on costs would determine an output contraction.

[10] These estimates are made more uncertain, however, by the high sectoral concentration of negative, or close to zero, value added which is almost completely recorded in one sector, the food industry (see Table 1, p. 360 in Senik-Leygonie and Hughes 1992). In economies with underdeveloped tertiary sectors, where costs of productive services are imputed to industry, it is difficult to distinguish between production and distribution in a western definition, and the problem may be partially overestimated. Instead, the downgrading of the Central Asian area is mainly due to the low profitability of the local textile industry; the producing countries were exporting the primary commodities (wool, cotton) to Russia, Belarus and the Baltic states, with much higher industrial capacity.

"small open economy", a price taker on world markets, is applied to an area with a population of 290 million and ample endowments of natural resources, infrastructures and human capital; the *ceteris paribus* conditions implicit in these empirical exercises are thus mainly conjectural.

However, there is actually a danger that, in the complete absence of protectionist measures, a rapid import substitution at the expense of local production in the consumer goods sectors could determine a progressive "kuwaitization" of the former Soviet economies; the existing structure of world prices would allow them only to export energy and extractive resources.[11]

In the longer run, the increasing degree of openness to external trade can promote the adjustment of relative costs of factors of production toward an equilibrium. The fast movement of prices toward international levels would give the firms a correct signal and promote their adaptation.[12] In practice, however, relative prices are distorted by high inflation, and complete integration could signify the loss of the market by the national firms. The rapid liberalization of external trade recently implemented by these transitional economies is thus a courageous choice. Another unresolved question concerns the global effects of their re-orientation of external trade. Actual integration would require the removal of the existing barriers which, albeit formally banned, are often maintained in a non-explicit manner. The existence of ample comparative advantages makes the resort to protectionist practices more likely; for instance, in 1992 the European Community imposed limitations on the import of steel

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[11] The problem already exists (Kaminski-Yeats 1993, Granberg-Suslov 1993); with reference to the former USSR in 1991, exports outside the ruble area denoted a sectoral concentration towards the energy (54%) and extractive (14%) sectors, while the agricultural and food production sectors' quotas were around 10% and those of manufacturing only 17%. The degree of concentration is higher if referred to commodities; the main goods exported represented more than 50% of non-energy goods exports outside the area. These products are four minerals (silver, aluminium, nickel and copper), three agricultural goods (wood, fish and cotton) and three manufacturing goods (precious stones, road motor vehicles and metal products).

[12] A crucial impulse is given by the rise of energy prices. The adjustment to world market levels is still incomplete; this implies an implicit subsidy on energy inputs, which is, however, diminishing because, after peaking in the second half of the 1980s, oil production in the former USSR later contracted. The main oil producer, the Russian Federation, has tried to maintain the quota of exports in convertible currencies, determining a rationing on regional trade; Ukraine and the Baltic states, among others, have augmented their dependence on nuclear sources.

from Hungary, Poland and former Czechoslovakia.[13] These problems require time, and a considerable amount of political skill, to reach a solution.

4. Empirical results on the impact of inflation on money velocity and on the distribution of seigniorage in the ruble area

The lack of coordination on price deregulation has generated remarkable contrasts among the republics concerned. The Baltic states liberalized prices in 1991, before the CIS; in 1992, following the implementation of shock therapy, the Russian Federation abruptly moved the terms of trade to her advantage. Moreover, in the time span of two and a half years, two drastic monetary reforms have changed equilibria in the area.[14] Because old rubles circulated in 1992 in most of the former Soviet republics, the second reform can be interpreted as a corrective measure for enhancing discipline in the area and reaching a *de facto* reappropriation of monetary sovereignty, excluding the peripheral countries from the common currency.

Given the incomplete diversification of production and the former orientation of trade, it is possible to distinguish (in a pragmatic manner, due to the rapid changes in both the political and institutional frameworks) between the states most closely linked to the ruble area and the economic policies of the leader country, the Russian Federation (Belarus, Kazakhstan, Uzbekistan, Tajikistan, Armenia) which, following the monetary reform of July 1993, were authorized to use old rubles until the eventual reconstruction of the currency union; Ukraine, which is pursuing an independent economic

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[13] A recent analysis of the main aspects of EEC protectionist policies with respect to these countries in transition is given by Mastropasqua and Rolli (1993).

[14] The first, in January 1991, concerned the introduction of restrictive measures on deposit withdrawals and annulled large denomination banknotes (then, 50 and 100 rubles). The second was in July 1993 when, following the disappearance of the former Soviet institute of emission, the new Russian central bank invalidated cash money issued before 1993. Citizens were only granted the possibility of changing up to 100,000 old rubles with new banknotes (initially those measures were still more severe). Rubles in excess were deposited in bank accounts made compulsorily illiquid for a semester, and their real value quickly vanished.

policy and can influence the equilibria in the area due to both her dimension and degree of industrialization (a population of 52 million, a real GNP of about a quarter of Russia's); finally, the small open economies that have speedily introduced their own money, or are on the way and seem more inclined to follow autonomous policies (Lithuania, Latvia, Estonia, Georgia, Moldavia, Azerbaijan, Kyrgyzstan, Turkmenistan).

The loss of financial control which has followed the attempts to decentralize the economy requires an evaluation of the macroeconomic aspects concerning seigniorage; high inflation rates have facilitated an implicit reallocation of resources across countries.

As is well known, the programme of reforms translates into the virtual loss of the planned system's traditional mechanisms of implicit taxation, based on the reallocation of the surplus of state firms. The contraction of revenues brought about by relative price movements, by the diminishing weight of the state sector and the collapse in production has been partly compensated by a reduction of subsidies, the introduction of fiscal requirements on international transactions, and by energy price rises (an important source of indirect taxation). All this notwithstanding, the budget deficits in transitional countries have risen rapidly as a ratio of GNP.[15]

According to Bailey's (1956) classical contribution, seigniorage is defined as the hidden taxation on money holders (cash and bank deposits) due to inflation; its appropriation depends, for the newly independent states, on the introduction of an own currency.

In order to reach a quantitative evaluation, albeit approximate, Fischer's (1982) formulation of seigniorage as a ratio of national product can be applied:

$$1) \qquad \frac{\text{Seigniorage}}{\text{GNP}} = \frac{dM}{Y} = \frac{dM}{M} \cdot \frac{M}{Y}$$

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[15] The removal of disequilibria related to fiscal origins requires the strengthening of the firms' budget constraints, in order to assign specific costs and benefits to each producer. In the meantime, the systemic risks of the formerly planned economies are still high; the difficulties of the state firms affect each other due to the existence of a complex network of credit relationships linked to trade transactions and to the repercussions of huge overdue payments, which are however declining in real terms (see Sarcinelli 1992, on the recent Eastern European experience).

This definition can be easily adapted to the empirical work and permits a new contribution to this literature. From the quantity identity MV=Y, considering that dM/M=dY/dV (for dY, dV equal or higher than unity) and substituting, yields:

$$2) \qquad \frac{\text{Seigniorage}}{\text{GNP}} = \frac{dY}{dV} \cdot \frac{M}{Y}$$

The amount of seigniorage is positively linked to the variation of nominal income (dY), to the "base" of the inflation tax (M/Y, money as a ratio of GNP) and inversely related to velocity changes (dV). *Ceteris paribus*, in a country with an underdeveloped financial system, money as a ratio of GNP can be high and seigniorage potentially more widespread; moreover, the inflation tax goes up in the presence of money illusion or as a consequence of the lack of adequate monetary substitutes.

Seigniorage can be estimated, given the variation in nominal income, the previous monetary levels and adopting (to offset the incompleteness of country data) a working hypothesis on the behaviour of money velocity, which can be assumed to depend positively on the expected inflation rate:

$$3) \qquad V_t = f(\pi^e_t, X_t)$$

If economic agents forecast a high future inflation rate π^e_t, they will try to escape the inflation tax by lowering money holdings and increasing velocity. X_t is a vector of other explanatory variables which potentially have additional influence on money as a ratio of GNP: the difficulties in the payments system and the widespread resort to barter, variations in the propensity to save (in monetary form),[16] the possibilities of currency substitution, the accumulation of large amounts of uncollectable credits on behalf of intra-firm trade.

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[16] In the former USSR, from the second half of the 1980s, the (involuntary) savings of the population increased at a rapid pace, due to the "repressed inflation" linked to an insufficient supply of consumer goods. Savings were in monetary form, given the absence of financial markets and the scarce alternatives present in the real economy. Recently, the rapid price level growth has eliminated the previous "monetary overhang", but at high social costs.

Regarding the expectations formation mechanism, two alternatives can be applied:

$$4a) \qquad \pi^e_t = \pi_{t-1}$$

$$4b) \qquad \pi^e_t = E(\pi_t | I_{t-1})$$

In (4a) the expected inflation at time t is simply the inflation rate at time t−1; in (4b) agents form expectations rationally, on the basis of the information set available in the previous period. In the econometric application, the explanatory variable is predetermined (the lagged inflation rate) in the first case; in the second, the instrumental variables estimation proposed by McCallum can be applied (Chow 1983, chapter 11), introducing as a regressor the inflation rate at time t and as instruments the variables of the information set potentially known at time t−1. In both cases the estimators will be consistent.

A very relevant aspect concerns the appropriate definition of money. Evaluations of seigniorage usually employ concepts of "high powered money", more directly controlled by the central bank (currency and bank reserves). In the case of the former USSR, it is more relevant to apply a broader definition, which includes both cash and bank deposits (in rubles).[17] Indeed, due to the presence of highly negative interest rates in real terms, seigniorage on money deposits is not only appropriated by the central bank or the government but by the entire system of commercial banks, and transmitted to their clients (mainly large state firms). This implies the persistence of a redistributive policy across regions, sectors and firms and the diffusion, within the monetary union, of the impulses of the price-liberalization process by exporting the inflation tax.

The empirical estimates concerns data on consumer price inflation and money velocity for nine countries of the former USSR, based on partially estimated IMF figures, which pool together to sum 46

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[17] This broad definition recalls the original contribution of Bailey (1956, p. 104: "[...] if the banks do not, in fact, charge the economic rate of interest on their loans and pay no interest on deposits' [...] the government's share of the total 'tax' on cash balances is only the share of currency in the total money supply. The balance of the tax is appropriated by people who are fortunate enough to get bank loans"). However, it can be applied to seigniorage in 1992, not later; in the course of 1993, interest rates in the area were progressively raised; in the last quarter in Russia, they became positive in real terms.

quarterly observations. The countries and periods considered are:[18] Armenia (92.I-92.III), Moldavia (91.IV-92.III), Azerbaijan (91.IV-92.III), Kazakhstan (91.I-92.IV), Latvia (91.I-91.IV), Lithuania (91.I-92.IV), Ukraine (91.IV-92.IV), Belarus (91.IV-92.IV) and Russia (91.IV-93.IV). The sample in the case of the two Baltic states include the year 1991 because they anticipated the price liberalization.

Considering initially the first differences of the variables $V = \log (Y/M)$, $\pi = \log (dP/P)$, the following pooled regression[19] is estimated (quarterly inflation is expressed at an annual rate):

5a) $$dV = 0.169 \quad +0.128 \; d\pi \; (L1)$$
$$t \quad (3.97) \quad (9.63)$$
$$t_w \quad (4.08) \quad (9.46)$$

$T=37 \quad {}_cR^2=0.718 \quad SER=0.259 \quad DW=2.472 \quad LM(4.31)= 1.552$
$$(0.21)$$

JB= 0.485   BPL= 0.371   BPE= 3.453   ARCH= 0.019   RESET= 9.435
(0.79)   (0.54)   (0.06)   (0.89)   (0.06)

Since the diagnostic tests detect a moderate degree of hetero-skedasticity (at the 6% level), we have also computed White's con-

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[18] Money data (currency and deposits in rubles) are end of period figures, obtained from the statistical appendixes of nine issues of *IMF Economic Review* (April-September 1993; see the references); recent IMF data on the Russian Federation has been obtained by courtesy of A. Giustiniani from the Bank of Italy Research Department. Velocity has been computed using consumer prices because analogous observations on GNP deflators are unavailable; annual real GNP data have been converted to quarterly observations using as a proxy the available indicators of industrial production. Instead, average money holdings as a ratio of GNP in 1991 (M/Y, the reciprocal of velocity) for all the 15 republics are taken from Aleksashenko (1992, p. 449): they are compatible with the available data from the IMF.

[19] In the regressions (5a) and (5b) first differences are computed on the actual vector of lagged observation (thus losing nine observations, one for each country). The regional dummies are not significant (considered both together and individually) and have been dropped. The diagnostic statistics are as follows: SER is the standard error of regression, LM is Godfrey's test for autocorrelation based on Lagrange multipliers (the test is applied to four lags); JB is Jarque-Bera statistics for error normality, BPL and BPE are Breusch-Pagan tests for heteroskedasticity (linear and exponential), ARCH is Engle's test for autoregressive heteroskedasticity, RESET is Ramsey's specification test (Judge *et al.* 1985). Reported p-values are in parentheses.

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sistent t-statistics (t_w). With McCallum's procedure based on instrumental variables, we obtain:[20]

5b) $$dV = 0.185 \; +0.117 \; d\pi$$
$$t \quad (3.51) \quad (7.02)$$
$$t_w \quad (3.60) \quad (6.48)$$

$T=37 \quad {}_cR^2=0.570 \quad SER=0.320 \quad DW=2.287 \quad$ (IV estimates)

Inflation is highly significant: the magnitude of the coefficients is close in the two equations. The high degree of precision attached to the estimated constant indicates the presence of a trend in the levels of the dependent variable; of course, given the composite nature of the time series and the short time period available, it cannot be ascertained whether this growth process is stochastic or deterministic. In the second case, adding the country dummies, we have:

6a) $V = 0.205 \quad -0.498 \; MOL \quad -1.760 \; AZE \quad -1.463 \; KAZ \quad -3.594 \; LET$
$\quad t \quad (1.26) \quad (-3.03) \quad\quad (-8.86) \quad\quad (-5.96) \quad\quad (-11.87)$
$\quad t_w \quad (1.46) \quad (-2.61) \quad\quad (-10.78) \quad\quad (-6.68) \quad\quad (-16.13)$

$-3.533 \; LIT \quad -4.840 \; UCR \quad -5.135 \; BIE \quad -6.706 \; RUS \quad +0.159 \; TREND$
$(-9.20) \quad\quad (-9.89) \quad\quad (-9.01) \quad\quad (-9.85) \quad\quad (9.55)$
$(-12.07) \quad\quad (-13.49) \quad\quad (-12.07) \quad\quad (-12.82) \quad\quad (12.89)$

$+0.142 \; \pi \; (L1)$
(9.03)
(13.94)

$T=46 \quad {}_cR^2=0.898 \quad SER=0.200 \quad DW=2.049 \quad LM(4.31)= 1.762$
$$(0.16)$$

JB= 1.336   BPL= 21.101   BPE= 3.685   ARCH= 1.452   RESET= 0.696
(0.51)   (0.02)   (0.96)   (0.23)   (0.51)

The introduction of a linear trend (higher polinomials are not significant) in the levels of the variables improves the specification: in particular, the regression now passes the RESET test. The linear growth of velocity proxies for the joint contribution of several systematic factors (the unobservable variables of vector X_t): the wide

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[20] Instruments are the constant, the regional dummies, inflation lagged one and two months, a linear and a squared time trend. Under IV, available diagnostic tests are fewer than with OLS; however, using OLS estimates, results are very close to those based on instrumental variables.

diffusion of barter due to the lack of stable prices and the difficulties of the payments system; the spreading of enterprise arrears. With instrumental variables, we have:

6b) V = 0.357   −0.609 MOL   −1.915 AZE   −1.634 KAZ   −3.897 LET
  t   (1.69)   (−2.91)   (−7.58)   (−5.17)   (−10.14)
  t_w (1.85)   (−2.41)   (−8.41)   (−5.83)   (−13.29)

  −3.809 LIT   −5.169 UCR   −5.514 BIE   −7.116 RUS   +0.168 TREND
  (−7.76)   (−8.22)   (−7.55)   (−8.15)   (7.86)
  (−10.82)   (−11.76)   (−10.61)   (−11.43)   (11.63)

  +0.124 π
  (6.19)
  (7.34)

T=46 $_cR^2$=0.833   SER=0.256   DW=1.969   (IV estimates)

Overall, the close similarity of the coefficients estimated both in levels and first differences is an indication of a reliable specification.[21] As a further check on stability, it is possible to separate the Russian Federation from the rest of the sample. In the ruble area outside Russia, we estimate:

7a) V = 0.290   −0.696 MOL   −2.100 AZE   −1.923 KAZ   −4.280 LET
  t   (1.25)   (−3.09)   (−7.11)   (−4.94)   (−8.74)
  t_w (1.53)   (−2.83)   (−9.15)   (−6.48)   (−12.66)

  −4.345 LIT   −6.339 UCR   −5.870 BIE   +0.193 TREND   +0.126 π
  (−6.74)   (−6.53)   (−7.07)   (6.70)   (5.56)
  (−10.40)   (−10.10)   (−11.24)   (10.41)   (6.58)

T=37 $_cR^2$=0.845   SER=0.264   DW=1.969   (IV estimates)

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[21] For instance, if the "true" model is Y_t = 0.2 (TREND) + 0.1 (X_t) + e_t, we have $Y_t − Y_{t-1}$ = 0.2 + 0.1 $(X_t − X_{t-1})$ + $e_t − e_{t-1}$. The coefficients on X and dX must be equal; the estimation of the model in first differences, however, will not be efficient (due to the presence of a unit root in the errors' moving average).

Analogous results for the Russian Federation (fairly indicative, since they are based on nine quarterly observations only) are:

7b) V = −5.129 RUS +0.132 TREND +0.109 π
  t   (−4.01)   (4.59)   (2.70)
  t_w (−4.74)   (6.16)   (5.26)

T=9 $_cR^2$=0.809   SER=0.220   DW=2.274   (IV estimates)

The estimated magnitudes: 0.193(t) + 0.126(π); 0.132(t) + 0.109(π) give a range sufficiently wide for calculating the velocity variations and consequently the amount of seigniorage in the area (of course the trend, like inflation, must also be annualized). This range has been used for computing the change of velocity between 1991 and 1992 in ten former Soviet republics. Annual averages of V_t in both years are instead available by IMF data for Russia, Ukraine, Belarus, Lithuania and Kazakhstan. These estimates are preliminary, however, given the likely presence of measurement errors and the paucity of available observations. On the other hand, the high variability of these series is likely to improve the precision of the estimated coefficients.[22]

These figures (Table 2) permit (for the first time, to the author's knowledge) an approximate overall evaluation of seigniorage in the entire ruble area, before the abandonment of the common currency. The order of magnitude of the inflation tax in 1992 was very high: in

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[22] This point merits a brief discussion. Following, for instance, an example by Judge *et al.* (1985, p. 709), given a linear relationship $Y_t = \beta X_t + e_t$, suppose that instead of the "true" variable X_t the econometrician observes or measures $Z_t = X_t + u_t$, where u_t is the measurement error. With one explanatory variable, we have:

$$\text{plim } (\hat\beta − \beta) = \frac{−\beta\,\sigma_u^2}{\sigma_z^2} = \frac{−\beta\,\sigma_u^2}{\sigma_x^2 + \sigma_u^2}$$

Because of the presence of measurement errors, OLS estimates are biased downward, as is the impact of inflation on velocity. Due to wide macroeconomic imbalances which occur, however, the explanatory variables (both observed and "true") present an ample variance, both cross-country and over time, and the bias is thus not likely to be high (the result, however, holds only asymptotically).

TABLE 2

ESTIMATES OF THE DISTRIBUTION OF SEIGNIORAGE ON MONEY HOLDERS ACROSS FORMER SOVIET REPUBLICS

	Real dGNP (%) 1992	Inflation (%) 1992	Nomin.dY (91=1) 1992	dV (91=1) 1992	Estimated dV a 1992	Estimated dV b 1992	M/Y91	Seigniorage % Y92 1992	Distrib. S/Y (area=100) a 1992	Distrib. S/Y (area=100) b 1992
Russia	−18.5	1353	11.03	2.50	−	−	0.896	27.7	73.08	74.73
Ukraine	−17.0	1445	11.99	3.05	−	−	0.834	20.4	16.43	16.80
Belarus	−11.0	969	8.62	4.01	−	−	0.679	9.1	1.37	1.40
Moldavia	−21.3	1276	10.04	−	3.03	3.98	0.814	18.7-12.4	1.00	0.67
Lithuania	−37.7	1020	6.35	3.11	−	−	0.748	12.3	0.55	0.56
Latvia	−33.8	951	6.30	−	2.94	3.83	0.775	14.1-7.9	0.42	0.24
Estonia	−19.3	1069	8.63	−	2.97	3.89	0.778	17.1-11.0	0.40	0.26
Azerbaijan	−26.8	611	4.47	−	2.80	3.63	0.750	10.0-3.9	0.32	0.13
Georgia	−45.6	888	4.83	−	2.91	3.80	0.861	11.7-4.8	0.35	0.15
Armenia	−52.0	790	3.79	−	2.88	3.75	1.362	11.4-0.4	0.15	0.01
Uzbekistan	−9.5	528	4.78	−	2.75	3.56	0.954	14.7-6.8	0.93	0.45
Kazakhstan	−14.0	2568	22.09	−	−	−	1.167	9.9	3.83	3.91
Tajikistan	−30.0	1157	8.10	7.71	3.00	3.93	0.911	19.1-11.9	0.44	0.28
Kyrgyzstan	−19.1	855	6.92	−	2.90	3.78	0.926	18.5-11.1	0.44	0.27
Turkmenistan	−5.3	493	4.67	−	2.73	3.53	1.361	20.6-9.4	0.29	0.14

Estimated elasticities: ^{a} log V=0.109 log (dP/P) + trend; ^{b} log V=0.126 log (dP/P) + trend.
Consider, for instance, Russia: In 1991, given V=1.116 (the reciprocal of 0.896) suppose nominal Y=100. In 1992 we have Y = 1103 e V = (1.126 · 2.50) = 2.79. Money M = Y/V is implicitly equal to 89.6 in 1991 and 395.3 in 1992. A broad definition of seigniorage is S/Y92 = dM/Y92 = 27.7%.

Russia, it is about 28% of nominal GNP.[23] In the case of Ukraine, seigniorage is 20% of GNP; in the largest republics (Belarus, Kazakhstan and Uzbekistan) it can be evaluated at about 10%. It is still high in the smaller states of Moldavia, Estonia, Tajikistan, Kyrgyzstan and Turkmenistan.

The distribution of seigniorage in the area (as a ratio of nominal GNP in 1992) shows the existence of important asymmetries within the former currency union; the share of the Russian Federation is close to three quarters of the total; for Ukraine it is between 16% and 17%, for Kazakhstan it is close to 4%. In the remaining areas it is comprised between 1.4% (Belarus) and some 0.2% (Armenia).

Consider, for instance, the small central Asian republic of Kyrgyzstan; the order of magnitude of seigniorage can be estimated to lie between 20% and 10% as a ratio of GNP, but only between 0.4 and 0.3 percentage points in terms of share of the whole former USSR. The introduction of its own currency gives this country the possibility of appropriating a large amount of inflation tax, without significantly affecting the rest of the area.[24]

5. Conclusions

Notwithstanding the repeatedly noted difficulties in measuring, comparing and estimating the actual magnitudes involved, the quantitative information which has been discussed so far contributes to a more detailed description of the transition process and stresses its diversification. A more general approach, however, would include a cost-benefit analysis on the effects of the movement from a currency

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[23] This estimate is close to the figure (around 31%) recently calculated at the World Bank (Easterly and Vieira da Cunha 1994, pp. 13-14 and 39), notwithstanding some differences in the methodology (the authors compute the inflation tax on monthly monetary holdings and subtract the interest paid on banking deposits). Since only annual observations are available for most of the republics, we preferred not to pursue a higher frequency computation of seigniorage, so as to give comparable data in Table 2. Given the wide range of variation of velocity (from 2.5 for Russia to 7.7 in Kazakhstan) in any single republic the change in velocity may not coincide with the estimated average value in the area; moreover, the impact of inflation is mainly concentrated in the first quarter of 1992 (when Russia liberalized prices); due to the unavailability of detailed quarterly data, it is not possible to consider this.

[24] An interesting model with externalities in the "production" of seigniorage is Aizenman's (1992): countries take advantage of it, without considering the adverse consequences of their behaviour on the currency union as a whole. An application to the ruble area must take into account the existing asymmetries; the peripheral economies' contribution to the inflation tax is marginal.

union based on the ruble to a different monetary regime. However, there is no consensus among economists on the optimal characteristic of the trade-off between a *de facto* loss of monetary sovereignty (by adhering to the ruble area) and a decentralization of the responsibilities regarding macroeconomic adjustment (following the introduction of national currencies). Monetary independence in the newly created republics is seen as a corollary of political sovereignty and thus has no immediate economic roots.[25] The debate on the costs and potentials of a currency union has not reached definitive results[26] and thus only permits the elaboration of some basic arguments concerning the nature of the constraints and opportunities linked to the new monetary equilibria.

A first criterium is based on the available adjustment tools. As is well known, in the presence of a common currency, offsetting an exogenous impulse requires adequate flexibility of wage and price levels across areas, or a compensatory variation of quantities (output and employment) or, as a last instance, the mobility of factors of production (labour force migration); relatively young economies, with a sufficient amount of flexibility, could take advantage of the economies of information, transaction and scale associated with a common currency. On the other hand, labour mobility in the past has been a characteristic of the Slav and Caucasian populations, which provided specialized industrial workers. In the case of central Asian republics, with high demographic patterns and an oversupply of unspecialized labour (Marnie 1993), the population has always resisted, also for cultural reasons, migration towards industrial districts. In nations like Uzbekistan, the introduction of an independent currency can thus give an alternative opportunity to mass migration.

A second argument concerns the probability of asymmetric shocks related to the low diversification of the economy and the spreading of systemic risks. If the exchange rate constitutes an additional instrument for compensating differentials in macroeconomic fundamentals, a practical limitation derives from the lack of credibility, which may suggest following a leader country, or by the

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[25] The supremacy of a political, rather than economic, significance of a monetary union is well represented by the experience of the German unification. The parity exchange of western and eastern marks within the area was initially unfavoured by most economists (due to the existence of a productivity gap not compensated, in a monetary union, by adequate differentials in wage levels).

[26] On this subject see, among others, Cesarano (1992).

difficulties of policy coordination; this justifies the choice of some of the poorest republics (for instance, Tajikistan) of remaining linked to a country with a totally different structure of production and economic potential.

The extension of external disequilibria, and of the corrections necessary to compensate them, influences the shock-absorber role of the exchange rate (augmenting the possibilities of overshooting from macroeconomic fundamentals) and affects the degree of segmentation of national economic policies. It is generally agreed that the openness of the economy increases the "demand" for a monetary union; the extent of economic integration is positively correlated to the economies of transaction of the common currency; also, openness strengthens the automatic stabilizers (import demand, variations in relative prices of traded goods) which contribute to bring the economy back to equilibrium without relying on exchange-rate adjustments. Major openness of the economy explains the initial permanence in the ruble area of Belarus, while in the case of the small open Baltic economies the choice of monetary independence is closely linked to their prospective reallocation of trade toward Northern Europe.

The nature, temporary or irreversible, of the narrowing of the ruble area sums up the overall transition uncertainties. It is difficult to indicate possible paths of developments for the republics, necessitating the availability of up-to-date information on their present orientation regarding fiscal, monetary and trade issues.[27] This empirical work has discussed the origin of the main shocks and evaluated how the high inflation in the area has modified money velocity and represented an involuntary source of financing through seigniorage: its order of magnitude is high. Due to the lack of coordination on price-liberalization decisions and to the violence of the impulses, these economies have rapidly reached the inefficient segment of Bailey's curve (1956) and abandoned their common currency.

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[27] The resort to the inflation tax is obviously not a lasting solution to the problem of budget deficit financing in the republics; in the short run the "Tanzi-Oliveira" effect applies; a cost of inflation (which must be opposed to the gains from seigniorage) is given by the delays in obtaining the fiscal revenue and consequently by their reduction in real terms. In perspective, the existence of other currencies and the credibility problems tend to reduce the monopolistic gains on money-creation inside the area and impose a constraint on future seigniorage. In the meantime, the process of learning by economic agents reduces monetary holdings and the base of the inflation tax; the reallocation of resources connected to seigniorage is likely to be a temporary event, and is not expected to prevail in the later stages of the transition.

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