The Tchervonetz:
An Illustration in Discriminatory Monetary Policy*

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I. Introduction

A variety of policies have been proposed and implemented throughout history to stabilize inflation (for surveys, see *Végh* (1992) and *Siklos* (1990)). Only a few of these attempts have included the introduction of a parallel currency. One of the least studied but most interesting attempts is the tchervonetz[1] episode, a parallel currency to the rouble introduced by the Soviets during the early 1920s.

Interest in parallel currencies has been stimulated recently in part because of their reappearance in several of the former Soviet republics (e.g., the Ukraine). As with other attempts to reform monetary systems, it is natural to inquire about the conditions under which the introduction of a parallel currency will moderate inflation in the existing

[1] In what follows I use the term tchervonetz to describe the parallel currency introduced by the Soviets in 1922. Several different spellings exist such as chervontzi, chervonets (the singular of the plural chervontsi), chervontsy, to name but three. The spelling used in this paper is the one used by *Yurovsky* (1925) in his study of the monetary history of the Soviet Union during the period in question, English language documents of the State Bank of the USSR, and *Sokolnikov* (1931).

medium of exchange or have the opposite effect. Also of interest is the impact that the presence of a parallel currency has on the real side of the economy on the road to stabilization. *Rostowski* (1992), *Sturzenegger* (1994), and *Siklos* (1995), deal with the impact of the introduction of the tchervonetz on inflation while *Rostowski* (1992) and *Siklos* (1995) address the real economic consequences of the Soviet parallel currency experiment.[2]

This paper suggests that the development and impact of the tchervonetz parallel currency experiment can also be understood as a deliberate attempt by Soviet policy makers to exploit seigniorage opportunities via price discrimination in monetary policy. The model by *Bryant* and *Wallace* (1984) is the framework used to explain how the tchervonetz was employed as a legal restrictions device to extract seigniorage from the private sector in part to benefit the growing State-run sector. The Soviets exploited seigniorage opportunities by introducing a parallel currency with a store-of-value function in theory highly sensitive to inflation. This enabled the Soviets to divert resources to finance the emerging State-run sector as well as accelerate the "debauchery" of the rouble, that is, the destruction of private financial wealth. Eventually this policy was less than entirely successful, for reasons which shall be discussed below, but the tchervonetz episode does offer some useful historical lessons about parallel currency systems.[3]

The following section outlines some of the relevant theoretical issues surrounding parallel currencies. Section 3 describes the introduction and evolution of the tchervonetz. In section 4, I provide some econometric evidence consonant with the phenomenon alluded to by *Bryant* and *Wallace* (1984). The paper concludes with a summary section 5.

II. Theoretical Issues

Although the paper argues that monetary policy in the Soviet Union in 1922 - 24 can be understood in terms of the price discrimination analysis of *Bryant* and *Wallace* (1984), it is useful, in a discussion of a hyperinfla-

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[2] *Vaubel* (1978) is an exhaustive study of parallel currencies as it pertains to the possibility of European monetary union.

[3] A referee has suggested that one of the motivations for introducing the tchervonetz was as a precondition to make the New Economic Policy (see Section 3 below) a success. In this narrow sense the tchervonetz was a success (also see *Bernholz* 1996). However, the Soviet government's need for seigniorage revenues, as we shall see, remained.

tionary episode and in order to understand some of the empirical evidence to be presented later, to begin with a brief discussion of alternative approaches to money demand in which parallel currencies can play a role.

1. Alternative Approaches

Cagan's (1956) demand for money model remains the starting point for most analyses of hyperinflation. Under the assumption substitutability between domestic and other (usually foreign) currencies, and a flexible exchange rate between the parallel currencies, the introduction of a second currency relatively stable in value would simply decrease the demand for the domestic or inflating currency and accelerate its depreciation.[4] These assumptions allowed Cagan to estimate money demand functions in terms of the domestic or inflating currency alone.

Sturzenegger (1994) takes a different approach. He formulates a utility function for two parallel currencies in which transactions costs are incurred when attempting to obtain additional currency. In the context of a monetary system with parallel currencies, there are transactions costs arising from conversions between the two circulating currencies. His model is in the tradition of the Baumol-Tobin inventory-theoretic model of money demand in which utility from consumption and the liquidity services of money are separable.[5] *Sturzenegger* (1994) goes on to show that if the original currency becomes less "essential" (in marginal utility terms) with the introduction of a "backed" second currency, because the new currency is a close substitute, then a fall in the rate of increase in inflation takes place in the unbacked currency. This means that a smaller increase in inflation in the pre-existing currency is required in order to abandon this currency.[6] *Sturzenegger* (1994) offers

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[4] *Calvo* and *Végh* (1992) make clear the distinction between currency substitution and the phenomenon known as "dollarization" in which a foreign currency serves as a store of value or a unit of account but not necessarily as a medium of exchange. In the present study, I consider the implications for inflation and monetary policy when both currencies are issued by the same monetary authority. In the case of the successor states of the Soviet Union the monetary authority continues to be Russia's central bank with some governments or quasi-monetary authorities issuing their own script.

[5] The cross-partials with respect to both currencies are negative. In other words, with a fixed total money stock, the increase in the marginal utility of holdings of one currency should be offset by a fall in the marginal utility resulting from the fall in the holdings of the parallel currency.

[6] It is hard to see, however, with a given stock of money, how this could take place without inflation.

as empirical evidence the tchervonetz experiment considered in this paper, as well as Argentina's most recent experience with hyperinflation. *Siklos* (1995) argues, based on historical evidence, that the tchervonetz served primarily a store of value function, so that models which assume that the circulating currencies are media of exchange may be inappropriate under the circumstances prevailing for the tchervonetz. In addition, he presents statistical evidence to the effect that inflation in the rouble did eventually accelerate once again into hyperinflation as Cagan's model hypothesizes (see also section 4 below).

Bernholz (1996) finds that the tchervonetz quickly displaced the ruble. Nevertheless, the estimated elasticity of substitution reported is low and he suggested that this may be because of some of the technical features of the tchervonetz note issue (see the next section). This aspect of the question is indeed an important consideration in understanding this particular episode in monetary history.

Rostowski (1992) recognizes that money serves multiple functions and argues that the interest rate elasticity in Cagan's money demand model differs according to the size of the denominations in circulation as well as the type of asset included in the definition of money. Thus, smaller denominations of currency would be most sensitive to inflation because their value in transactions decreases as inflation accelerates. By contrast, large denominations retain a store of value characteristic longer and are thus less immediately sensitive to inflation. Presumably, there is a threshold beyond which even large denominations become the equivalent of "small change" but, as Rostowski develops no formal model, it is unclear at what point this threshold is reached.[7]

2. The Price Discrimination Hypothesis and its Relevance to the Tchervonetz Episode

This paper suggests that a different way of understanding the role of the tchervonetz, though not entirely inconsistent with *Sturzenegger* (1994), *Bernholz* (1996), or *Rostowski* (1992), is the price discrimination view of monetary policy. *Bryant* and *Wallace* (1984) propose an overlapping generations model for a government which raises revenues via the

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[7] *Fischer* and *Lee* (1993) review anecdotal evidence concerning the shortage of cash during hyperinflations and they suggest that such shortages arise because of imbalances in the distribution of currency with different denominations. This aspect of the problem is actually relevant to the historical episode studied here, as we shall see.

inflation tax. In their model, individuals are prohibited, because of legal restrictions, from issuing their own debt instruments. Such a model permits the coexistence of two government debt instruments despite the fact that one currency dominates the other in rate of return. In other words, the government can act as a price discriminating monopolist and thereby influence seigniorage revenues via legal restrictions on the issue of debt (here in the form of currency). This case is especially appropriate under the circumstances considered in this paper because Bryant and Wallace also assume that the government raises money only via seigniorage, a distinguishing characteristic of hyperinflationary episodes.

In the context of an economy with two circulating currencies issued by the same monetary authority, one of which is relatively more stable in value, and consequently dominates the other inflating currency[8] in rate of return, the legal restrictions model implies that a given deficit can be financed with a lower steady state rate of inflation. Alternatively, a larger deficit can be financed than would have been possible using a single unbacked currency issue only. This, of course, is because the price discrimination approach results in more revenues for the government in the form of seigniorage than it would under a single currency system. Note, however, that the legal restrictions view is crucial in obtaining this result. Otherwise, the situation degenerates into hyperinflation as in the currency substitution hypothesis. Again, these features are relevant to the understanding of the tchervonetz episode. As *Bryant* and *Wallace* (1984) suggest, a government motivated by the inflation tax would find price discrimination via legal restrictions an especially attractive way of exploiting differences in the types of liabilities it issues. It is argued below that, under the circumstances, the Soviet government's monetary policies can be understood in the light of the price discrimination view of monetary policy.

How were the restrictions generated or enforced in the Soviet example and for what reasons? The evidence, some of it anecdotal, suggests that by issuing large denomination notes, a possibility contemplated by *Bryant* and *Wallace* (1984), and by ensuring that the transactions costs for rouble-tchervonetz conversions were sufficiently high, the Soviets succeeded in introducing a relatively more stable currency thereby reducing the rate of inflation in the rouble, but only temporarily as we shall see. The high transactions costs stemmed essentially from two factors, one of which arose from the costs of obtaining foreign exchange when

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[8] In the present case, this means that the inflation tax is relatively lower for the tchervonetz than for the rouble.

holding tchervonetz. While anyone could exchange tchervonetz for rou-
bles only the latter could be used to purchase foreign currencies. But this
procedure simply increases the transactions costs of using tchervonetz. A
second factor was that most firms were guided by the previous day's
quotations of rouble-tchervonetz exchange rates sent by telegraph across
the country from Moscow (*Katzenellenbaum* (1925, p. 120)). These were
out of date during any given trading day due to the continuing high
inflation in the rouble. *Katzenellenbaum* (1925, p. 121) also reports "...a
small premium on Soviet notes"[9] as people, in rural areas especially,
were unwilling to accept tchervonetz thus obliging transactions first
from tchervonetz into roubles. Only when the overissue of the tchervo-
netz, necessitated by the demands of an ever growing deficit,[10] led to the
inevitable inflation, and rendered previously high denominations useful
for transactions purposes did price discrimination cease to be effective.[11]
These outcomes are reflected in seigniorage revenues which remained
stable in the rouble but fell in terms of the tchervonetz (see Figure 3).
The situation quickly led to the resumption of hyperinflation in the
rouble. The rouble was eventually replaced in a monetary reform which
resulted in the introduction of a new rouble and the implementation of
the rigid Stalinist central planning regime. The empirical evidence below
is also suggestive of a temporary fall in expected inflation followed by
an acceleration.

There were apparently two possibly conflicting motivations for the
tchervonetz policy. Some in the Soviet government saw that the dream of
a moneyless economy was a failure and that recovery from war and revo-
lution necessitated a stable backed currency. Others in the government
did not disagree but persisted in the view that such an approach should
only be a temporary one. Moreover, these individuals saw in the tchervo-
netz an opportunity to destroy private financial wealth at the expense of
the State-run sector which was emerging and, in any event, was destined
to dominate economic activity (see *Arnold* 1937, 113ff., and *Siklos* 1995).

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[9] *Katzenellenbaum* adds: "..., the official quotations were not generally
accepted" (op. cit., p. 120). As a consequence a premium was added to the official
rate.

[10] According to *Sokolnikov* (1931), it was not until 1924 that the Soviet govern-
ment was even in a position to draw up reliable estimates for a Budget. See, how-
ever, *Katzenellenbaum* (1925, p. 69) for deficit estimates for the 1914 - 21 period
and Association Financière for guesses about deficits for the years 1922 - 24.

[11] *Bernholz* (1996) notes that inflation in the tchervonetz eventually made them
more substitutable and so his estimates of currency substitution are biased
upward. Ultimately, the seigniorage needs of the government led to inflation in
the tchervonetz although it was much more moderate than rouble inflation.

III. The Tchervonetz and the Rouble[12]

Beginning in 1918, Soviet economic policy aimed to nationalize the entire economy, as well as doing away with a monetary economy, by replacing it with a centralized allocation system. It was envisaged that the monetary economy would be replaced with a mixture of barter and requisitions by the State. As is well known, the proposed system utterly failed because the peasants in the vital agricultural sector were unwilling to accept the centrally planned system.[13] The flight from the rouble accelerated into hyperinflation as individuals sought alternative media of exchange and stores of value or, as *Sokolnikov* (1931, p. 23 - 4) noted, "...capitalist insurance against socialist finance". Figure 1 shows the rapid fall in the real value of the rouble circulation from 1916 to the end of 1922, and demonstrates that the "debauchery" of the currency was well within reach by the time the tchervonetz was introduced.[14] In terms of pre-war (1913) roubles, the purchasing power of the rouble note issue fell dramatically during the revolutionary period as a consequence of accelerating inflation. Figure 2 plots the monthly rate of inflation annualized (i. e., 1200 ($\log P_t - \log P_{t-1}$)), where P is an index of Moscow prices. The tchervonetz era is indicated by the area to the right of the vertical bar in the Figure. The inflation rate does experience a sharp drop soon after the introduction of the tchervonetz. By May 1923, however, the inflation rate resumes its course toward hyperinflation.[15] It was the rapidly falling seigniorage revenues from the rouble issue, as shown in Figure 3 (A), in the months preceding the introduction of the tchervonetz which prompted the Soviets to introduce a new currency, called the tchervonetz, as a reminder of the gold coins of the same name in exis-

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[12] Descriptions of the relevant events are available in greater detail in several sources, including *Zaleski* (1962), *Mood* (1930), *Horsman* (1988), *Garvy* (1977), *Young* (1925), *Katzenellenbaum* (1925), and *Arnold* (1937).

[13] "While in 1920 and 1921 the peasant refused to produce, in 1923, although he had grown a fair harvest, he could get nothing in exchange for it. The whole exchange of commodities between town and country had broken down." *Soviet Union: Financial and Economic Condition of,* circulated by direction of Secret Service for Foreign Affairs, Public Records Office (hereafter PRO), CAB 181 (1925), p. 11.

[14] An appendix provides details about the data sources.

[15] Suspicions about the quality of the data are inevitable. Nevertheless, different price indices, from different sources, tell the same story about price movements in Russia during the period studied here. In addition, the data from sources used in this study also appear to be consistent with British estimates. For example, see PRO T160/190, p. 107, *Clarke* (1939), *Clarke* (1972), and *Commercial Yearbook of the Soviet Union 1925*.

tence during the last years of Tsarist Russia.[16] In an environment where expenditures were rising, revenues continued to be insufficient to rebuild the economy from the combined effects of the Revolution and World War I. The introduction of the tchervonetz took place in 1922, following a decree dated 11 October 1922 (*Zaleski* 1962, p. 23).

It is difficult to find in the literature explanations about what determined the exchange rate of the tchervonetz[17], apart from the conjecture of this paper, namely the importance of denomination size as a legal restriction. The Soviets decided that the tchervonetz issue would bear some relation to the value of gold with one tchervonetz equalling 10 of the old Tsarist gold roubles (Commercial Yearbook (1925, p. 342).[18] However, the State Bank would only back up to one quarter of the currency issue with not only its gold reserves, but its reserves of precious metals (including silver and platinum), and foreign currencies. While plans were made to make the tchervonetz convertible into gold and foreign currencies, these plans were never carried out nor was the tchervonetz formally pegged to the US dollar or the British pound (*Drummond*, undated). The introduction of the tchervonetz did provide seigniorage revenues for a time, as seen in Figure 3 (B), but except for temporary reversals, these would continue to fall and would become largely insignificant by the time the new Soviet rouble was introduced in 1924. The Soviets, who had initially been apparently determined not to overissue the tchervonetz did so shortly after its introduction.[19] This feature of the tchervonetz is clearly reflected in the "exchange rate" between the ten gold rouble coin and the tchervonetz, as shown in the Table below:

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[16] It is interesting for what follows to note that the State Bank, a newly formed quasi- central bank, would be responsible for the issue of tchervonetz while the Treasury retained the monopoly over the issue of roubles.

[17] Much of the relevant literature consulted in this respect was written by Russians whose work was translated into English or Hungarian. The late Ian Drummond's notes, based on his reading of the literature in Russian, were also invaluable.

[18] Why the tchervonetz were not "registered" in some fashion to emphasize the separation from the rouble is unclear unless, in the chaos of the period in question, this was not feasible for some reason.

[19] *Carr* (1954) suggests that the Soviets initially gave the illusion of stability to the tchervonetz by backing it with gold but, subsequently, showed no hesitation in changing the gold content of the tchervonetz (also confirmed by *Drummond*, undated).

Figure 1: Real Balances in Soviet Roubles (Sovsnak): 1916 - 1922*
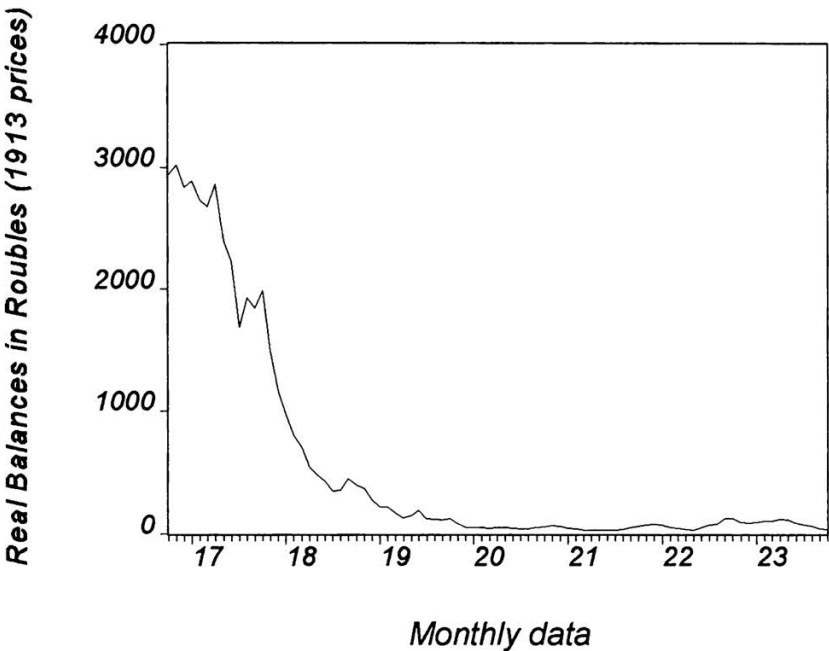
*Sources: See appendix.

Date	Exchange Rate*
January 1, 1923	1.42
Feb. 1	1.31
Mar. 1	1.06
April 1	1.28
May 1	1.64

* Calculated as the ratio of the rouble/gold coin exchange rate divided by the rouble/tchervonetz exchange rate in the "free market". Data from *The State Bank of the USSR 1921 - 26* (Finance and Economic research Bureau, Moscow).

Thus, we see that while the value of the tchervonetz and the gold rouble initially showed a tendency to converge, this pattern was quickly reversed by April 1, 1923 when the gold rouble began to become much more valuable in terms of ordinary roubles than the tchervonetz.

Figure 2: *Annualized Rouble Inflation Rate: 1916 - 1923**
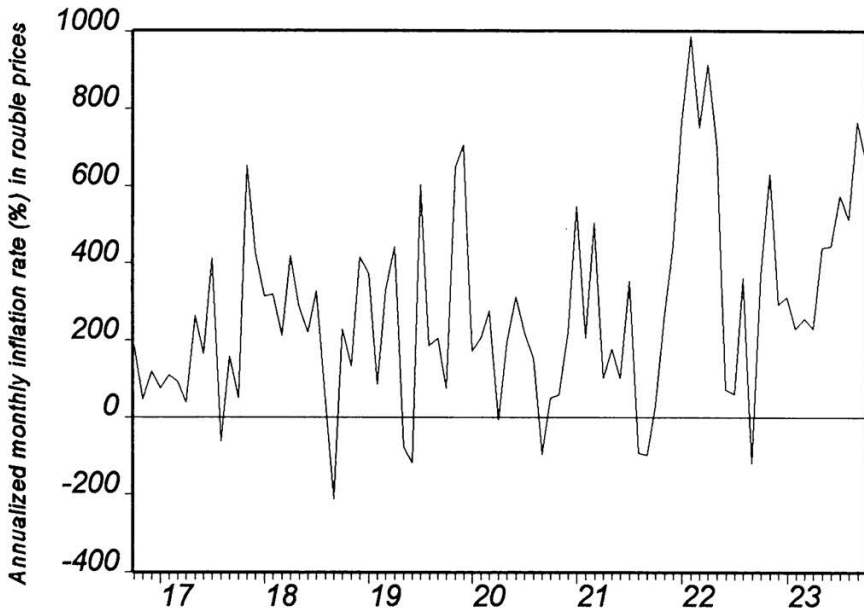
Source: See Appendix. Calculated as 1200 (log P_t − log P_{t-1}).

It is also important to recognize that the tchervonetz experiment took place around the same time as the Soviets implemented a major change in economic policy more generally. The New Economic Policy, or NEP, adopted in 1921 represented a dramatic reversal in Soviet policy. It is important to recognize, however, that the original aims of the Soviet government remained unchanged. The NEP was viewed, at best, as a temporary setback by the Soviets. The grand vision of a moneyless economy was to be suspended only temporarily to enable agricultural production to rise through the reestablishment of markets. *Siklos* (1995) discusses the NEP's impact on economy-wide output. Suffice it to say that output in agriculture alone rose by approximately 57 % even before the tchervonetz was introduced.[20] While the NEP solved, temporarily at least, the Soviets' production problems their monetary problems remained. Despite the resort to some fiscal prudence, economic conditions were far from adequate to support a stable currency.

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[20] The comment made previously about the quality of the data applies here as well.

Figure 3: Seigniorage*

(A) Rouble Seigniorage, 1916 - 1923

Introduction of
tchervonetz   >

Monthly data
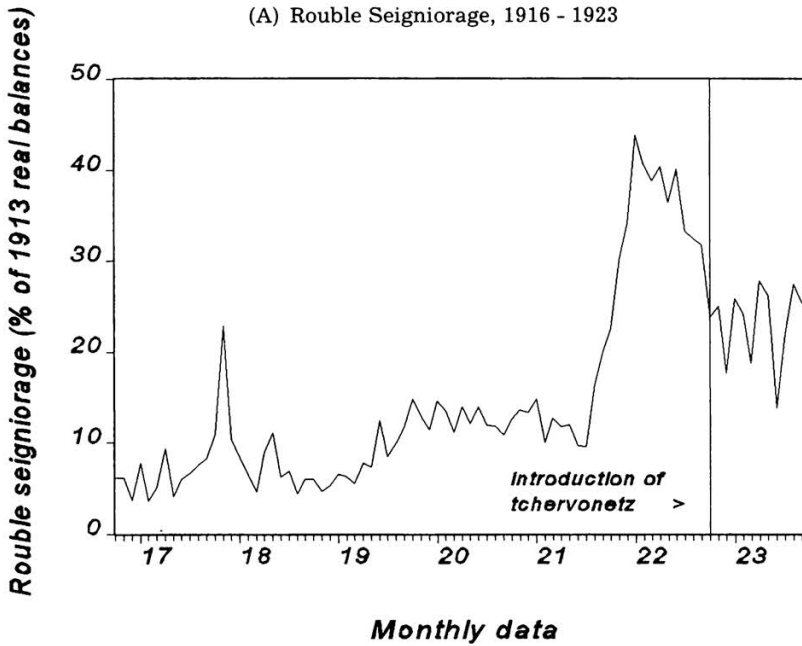
(B) Tchervonetz Seigniorage, 1923 - 1926

Introduction of
tchervonetz   >

Monthly data
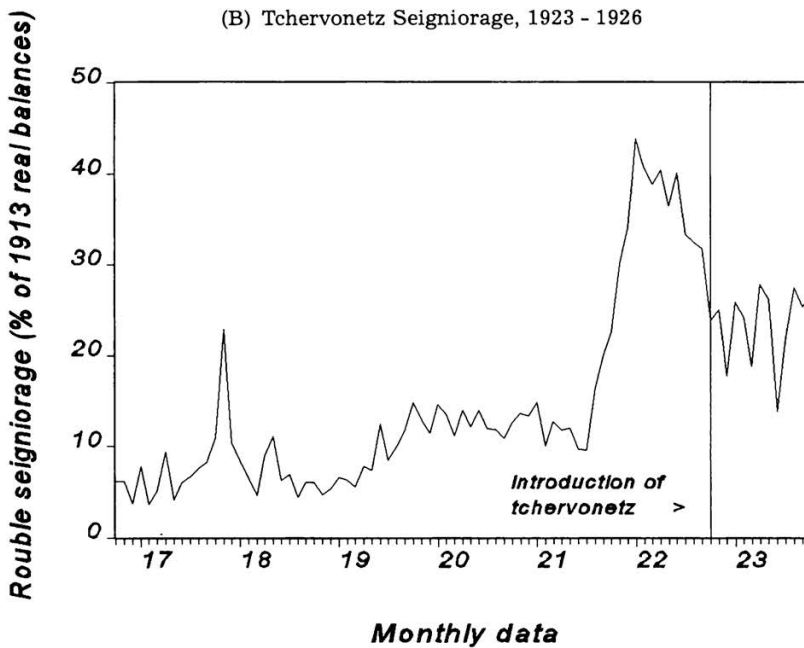
Source: See Appendix. Seigniorage is calculated as $[(M_t - M_{t-1})/P_t]/m_{1913}$, where M is the nominal money supply and m is real balances at 1913 prices and P is the price index.

IV. Empirical Evidence

It is difficult, of course, to empirically implement the suggestion made by *Bryant* and *Wallace* (1984). The approach followed here is to report some econometric evidence which is suggestive of the price discrimination view of monetary policy. We begin by showing the limitations of an alternative approach, such as *Cagan's* (1956), in attempting to understand the implications of the introduction of the tchervonetz. It is instructive first to consider the evolution of the relationship between inflation and real balances for the rouble in the period Jan. 1919 to Feb. 1923. This is accomplished by estimating a version of Cagan's model which, in logarithmic form, can be written as

$$(4.1) \qquad m_t - p_t = \alpha_0 + \alpha_1 \pi_t^e + \alpha_2 y_t + e_t$$

where m is a measure of the money stock in roubles, p is the price level, π^e is expected inflation proxied here by the lagged actual inflation rate[21], and y is a measure of output. All variables, except π^e, are in log levels and the Appendix provides data sources. Notice that, unlike Cagan's original specification, an output term is added to capture the impact stemming from the NEP.[22] Figure 4 plots estimates of α_1 for every possible sub-sample, beginning in 1916 and throughout the tchervonetz period. Recursive least squares was used to generate coefficient estimates in (4.1) by sub-sample, that is, by estimating the regression from some initial sample (Jan. 1916 - Feb. 1917) and then reestimating the regression by adding one observation at a time and, each time, generating a new estimate for α_1. The elasticity estimates begin to fall sharply by April 1923 signalling a sharp fall in holdings of roubles. This outcome is not inconsistent with Cagan's model in which individuals exchange old roubles for tchervonetz. However, the impact of the tchervonetz's introduction is hardly noticeable statistically. It would seem, therefore, that a formulation such as (4.1) is not likely to be very informative about the impact of the tchervonetz.[23]

To illustrate the legal restrictions possibility, Figure 5 plots available data which shows the proportion of the total tchervonetz note issue by

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[21] Other variants were considered (i.e., a longer lag, combination of lags) with no impact on the conclusions.

[22] See n. 28 below for a discussion of some of the statistical properties of equations such as (4.1).

[23] There may be, of course, other explanations such as the relative brevity of this episode, measurement problems, alternative estimation strategies, to give just three examples.

Figure 4: Recursive Estimates of Inflation Elasticity of Rouble Demand, 1917 - 1923*

Monthly data
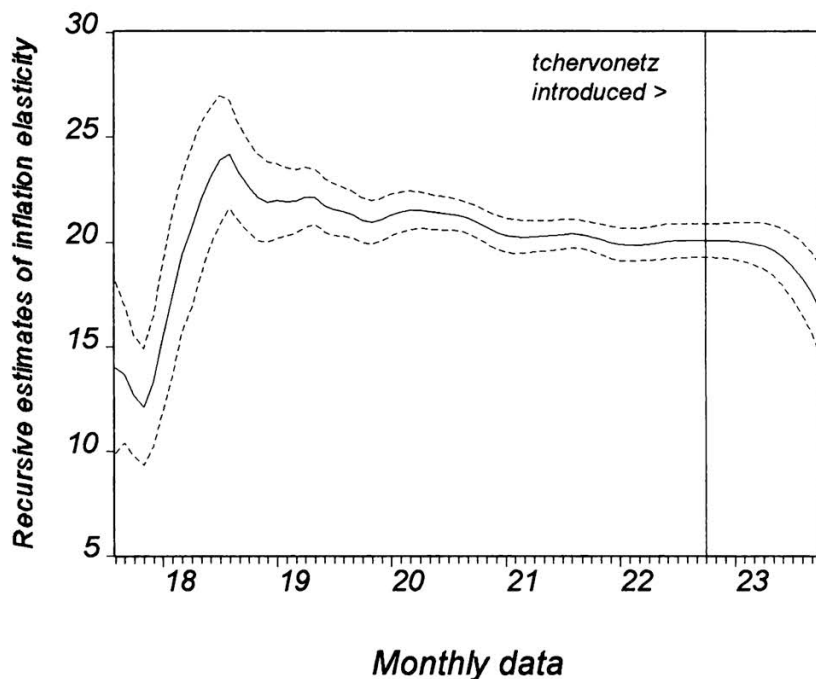
* Recursive estimates of α_1 in (4.1).

denomination size.[24] Thus, we see that the share of the note issue was increasingly in the form of large denomination notes, less practical for transactions purposes, while lower denominations were rapidly becoming less important as a percent of the total.[25] These too were deemed to be impractical for many transactions. It is difficult to provide a measure of the value of the tchervonetz in terms of someone's wages or a dollar equivalent as the relevant prices were not set in open markets. Available exchange rate data reveal that one tchervonetz was worth between $4.59 US and $5.42 US during the period December 1922 to October 1924 (*Katzenellenbaum* 1925) and so it is unlikely that even the smallest denominations were not particularly useful for transactions purposes.

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[24] Tchervonetz bank notes were issued in denominations of 1, 2, 3, 5, 10, 25, and 50 tchervonetz.

[25] On June 1, 1923, for example, one tchervonetz commanded 580,000,000 roubles (*Arnold* (1937, p. 181)). "Owing to the comparatively big denomination of the chervonetz (sic), ..., there arose a great need for small money." (Commercial Yearbook (1925, p. 344)).

Figure 5: Tchervonetz Circulation by Denomination, 1923 - 1925*
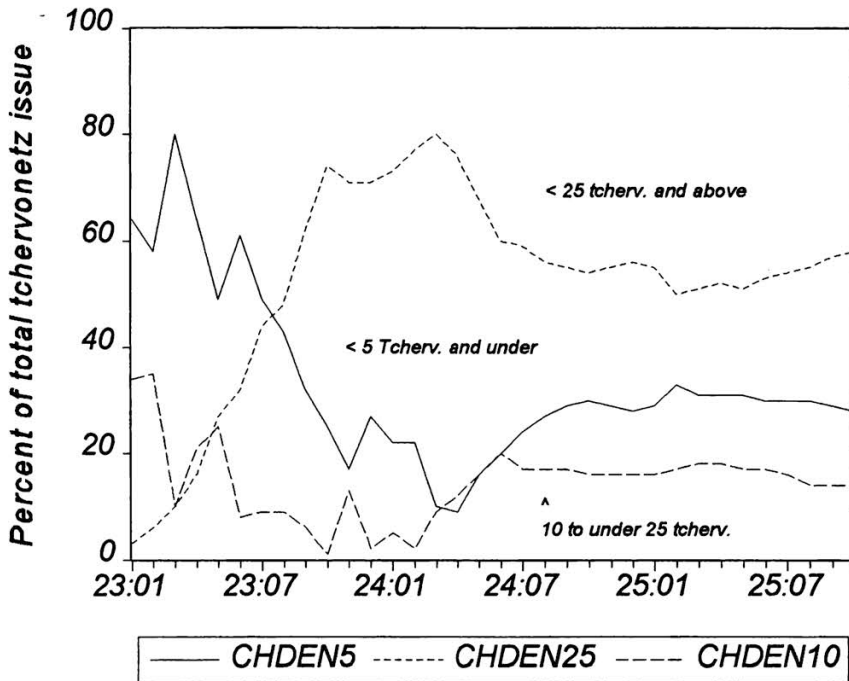
This process lasted at least until 'new' roubles were introduced and inflation was administratively eliminated, that is, when central planning and the Stalinist economic regime were imposed on the country. *Atlasz* (1951) speaks of a "penury" of small change in tchervonetz (see also *Dobb* (1928, p. 225)), while *Sokolnikov* (1931, p. 91) states that the issue of high denomination tchervonetz notes was deliberate "...so as not to discredit too rapidly the Soviet money token" (also see *Sokolnikov* (op.cit., p. 110)). The patterns displayed in Figure 5 during the 'old' rouble era are not entirely consistent with the view that the tchervonetz was a perfect substitute for the "old" rouble but may instead be suggestive of the phenomenon considered by *Bryant* and *Wallace* (1984). Only when hyperinflation in the 'old' rouble, also called the sovsnak, became such that it ceased to be a viable medium of exchange, combined with inflation in the tchervonetz prices which rendered previously large denominations now useful for transactions purposes, did the tchervonetz

finally take on a medium of exchange role. Indeed, years after the new rouble was introduced[26] the purchasing power of the tchervonetz rose, a sign of its continued usefulness as a store of value.[27]

Other evidence dealing with the question of the likely degree of substitutability between the sovsnak and the tchervonetz, as well as whether the introduction of the tchervonetz moderated inflation in the sovsnak is also available. Table 1 presents estimates of several error correction models of the demand for roubles (top portion) and the tchervonetz (bottom portion) during the sovsnak and tchervonetz periods, separately. Ideally, it would have been preferable to estimate the demand for the two currencies jointly but there are too few observations to estimate such a relationship via, say, a vector autoregression. Thus, Table 1 presents reduced form estimates of the first difference in real balances in either the sovsnak or the rouble as a function of the change in inflation, the error correction term, lagged real balances in tchervonetz, as well as a proxy for the transaction costs of converting sovsnak or old roubles into tchervonetz.[28] This proxy is the proportion of the tchervonetz note issue of either small (5 gold roubles or less), medium (5 to 10 gold roubles) or large (above 10 gold roubles) denominations measured in terms of their gold rouble equivalent. While the results should be viewed with some caution due to the relatively small

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[26] The reform process began in February 1924 when the State Bank was empowered to issue new small denomination roubles. On March 8, 1924 exchange rates between old and new roubles (50,000 to 1 or 50 million pre 1921 roubles to 1) as well as between old roubles and the tchervonetz (500,000 to 1) were announced. See *Carr* (1954, p. 133). Previously, as has been emphasized by many authors (e.g., *Katzenellenbaum* (1925, p. 118)), there was no exchange rate as such between the Soviet rouble and the tchervonetz.

[27] The tchervonetz officially ceased to be a transactions medium with the rouble reform but was used as a store of value by enterprises in particular until the late 1920s.

[28] From a statistical standpoint proper estimation requires that the data be stationary. A common approach to satisfy this requirement is to difference the series provided that they contain a unit root. An error correction term is necessitated by the fact that there is the possibility that the unit root in the individual series are common suggesting cointegration. Cointegration is the statistical equivalent of the long-run in economics (which need not, of course, be a long period of time). If the cointegration property holds then any short-run relationship is subject to the additional restriction of an error correction term. Tests reveal the presence of a unit root in the series considered as well as cointegration between the variables in (4.1) which describes long-run money demand. For example, see *Engle* and *Granger* (1987) and *Johansen* and *Juselius* (1990) for a fuller description of the test procedures and properties of cointegrating regressions. The Appendix summarizes the unit root and cointegration test findings.

sample a number of interesting conclusions can be drawn from an examination of Table 1. Lagged inflation and the lag in the demand for the sovsnak are not statistically significant, at least at the 10 percent level. Interestingly, real balances in tchervonetz are only significant, at the 10% level, when a measure of the size of the circulation of small denomination notes is included. This result is in contrast to *Sturzenegger* (1994) who claims a negative relationship between the demand for tchervonetz and the sovsnak. Part of the reason may be that his sample is not restricted to the tchervonetz period alone. The positive sign suggests that, as the small denomination note issue of the tchervonetz rises in relative terms, holdings of the sovsnak fall. Thus, the presence of small denomination notes in the relatively stable currency prompts individuals to get rid of the depreciating currency which is consistent with the "good money driving out bad money" hypothesis. A second notable result from the sovsnak period is that the elasticity with respect to different denominations of the tchervonetz are consistent with the notion that, while smaller denominations displaced the sovsnak (the *tcher* variable is negative in column (1)), higher denominations tchervonetz actually had the effect of raising the demand for sovsnak. This result provides some empirical support for the conjecture proposed by *Rostowski* (1992). Turning to estimates of the demand for tchervonetz (the bottom portion of Table 1) it is found to be positively related to the relative size of the small and medium denomination note issues, but negatively related to issues of large denominations. These results indicate that the implied transactions costs of using tchervonetz of different denominations versus the sovsnak currency was a significant determinant of the demand for tchervonetz. Moreover, the error correction term is statistically significant and correctly signed which is suggestive of the existence of an equilibrium relationship between real balances and inflation over the entire sample. Finally, while inflation in the tchervonetz reduces the demand for the parallel currency, and there is persistence in such effects as evidenced by the statistically significant lagged dependent variable, the absolute size of the coefficients are small. Transactions costs considerations appear to be a quantitatively more important factor than opportunity cost considerations alone. A word of caution is in order here. The relatively short span of the sample makes it difficult to conclude with certainty that the econometric results are robust. Nevertheless, the conclusions are suggestive of the proposed interpretation for this historical experiment with a parallel currency.

Was the tchervonetz policy at the time of its introduction a deliberate one as proponents of the legal restrictions view would argue? As pointed out earlier, the introduction of the tchervonetz could have reflected Soviet policy makers' desire to stabilize inflation and increase the chances of the NEP's success. But there was disagreement within the regime about the ultimate motives of the NEP and the government's seigniorage problem did not disappear with the introduction of the new currencies. Unfortunately, not much is known about the payments system at the time. What is known, however, is that the Soviets believed that the demand for tchervonetz could be enhanced by virtue of its scarcity and the fact that it had limited use as a transactions medium. Moreover, we also know that while the State Bank granted loans in tchervonetz part of the proceeds were paid in sovsnak (i.e., roubles) and only state-owned enterprises had privileged access to such credits (*Goldenweiser* (1925)). Transactions between large enterprises then were in tchervonetz while other transactions, with the public or smaller firms, were in sovsnak. Unfortunately, there appear to be no data on the relative size of credits in sovsnak and tchervonetz (recall that there existed separate institutions of issue). One can only surmise that, since State enterprises were receiving tchervonetz and were encouraged to settle accounts with each other in this currency, seigniorage revenues were in effect being transferred from the non State-owned sector to the State-owned sector. This might also explain the pattern of seigniorage revenues shown in Figure 3. Rouble seigniorage stops falling after the introduction of the tchervonetz.

V. Conclusions

The impact from the introduction of a parallel currency very much depends on the intrinsic qualities of the newly created currency. In this paper I argue that the tchervonetz episode in early Soviet history can be understood as an attempt to exploit seigniorage opportunities in order to assist the growing State-controlled sector, primarily at the expense of the private rouble holding sector. To the extent that it always was the aim of the Soviets to economically subdue the private sector the tchervonetz fulfilled Soviet goals. However, when restrictions on the tchervonetz as a transaction medium were no longer effective hyperinflation in the rouble quickly resumed necessitating other, more orthodox, efforts at price stabilization.

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Table 1: Estimates of Money Demand

Dependent Variable: Log Change in Real Balances

Independent Variables	(1)-small denom Tcher		(2)-med denom Tcher		(3)-large denom Tcher	
	Coefficient (t-ratio)	Significance level	Coefficient (t-ratio)	Significance level	Coefficient (t-ratio)	Significance level
			DEMAND FOR SOVSNAK[1]			
Constant	2.70 (3.71)	.03	.20 (.48)	.67	3.61 (3.82)	.03
$\Delta m(-1)$	-.55 (1.42)	.25	-.84 (1.39)	.26	.60 (1.83)	.17
$\Delta \pi$	-.001 (5.77)	.01	-.0003 (1.22)	.34	-.003 (4.74)	.02
$\Delta \pi(-1)$	-.0002 (1.32)	.28	.0001 (.26)	.81	-.001 (3.43)	.04
EC (-1)	.13 (3.69)	.04	.04 (1.63)	.20	.25 (3.79)	.03
TCHER	-.01 (3.28)	.05	.01 (2.30)	.11	.03 (3.42)	.04
$\Delta m_T(-1)$	.25 (2.31)	.10	.43 (.21)	.13	-.20 (2.08)	.13
$\bar{R}^2$	.91		.85		.92	
F (6,3)	16.27 (.02)		9.65 (.05)		17.47 (.02)	
SC (1)	.69 (.41)		.14 (.71)		4.28 (.04)	
H (1)	.001 (.97)		.19 (.67)		.02 (.88)	

Table 1: (continued)

Dependent Variable: Log Change in Real Balances

DEMAND FOR TCHERVONETZ[2]

Independent Variables	(1)-small denom Tcher		(2)-med denom Tcher		(3)-large denom Tcher	
	Coefficient (t-ratio)	Significance level	Coefficient (t-ratio)	Significance level	Coefficient (t-ratio)	Significance level
Constant	.16 (1.40)	.17	.38 (4.46)	.00	.56 (4.90)	.00
π	-.001 (3.58)	.001	-.0004 (2.24)	.03	-.0004 (2.94)	.01
π(-1)	-.001 (4.29)	.00	-.001 (4.27)	.00	-.001 (4.53)	.00
π(-2)	-.0003 (2.39)	.02	-.0004 (2.43)	.02	-.0003 (2.52)	.02
TCHER	.005 (2.65)	.01	.001 (.35)	.73	-.003 (2.06)	.05
EC(-1)	-.03 (2.83)	.01	-.05 (3.55)	.00	-.04 (3.73)	.00
$\bar{R}^2$	.63		.54		.60	
F(5,27)	12.10 (.00)		8.55 (.00)		10.67 (.00)	
SC(1)	7.99 (.79)		12.78 (.39)		7.92 (.79)	
H(1)	.0003 (.99)		.35 (.55)		.03 (.86)	

Legend:
Δm = log change in real balances (sovsnak)
Δm_T = log change in real balances (tchervonetz)
$\Delta \pi$ = first difference in monthly inflation rate (annualized)
EC   = error correction term. Lagged residuals from the cointegrating regression of real balances on inflation and output for sovsnak (i. e., equation 4.1).
TCHER   = proportion of tchervonetz note issue equivalent to 5 roubles or less (column (1)), 5 - 10 roubles (column (2)), or greater than 10 roubles (column (3)).
$\bar{R}^2$ = adjusted R_2; F = F-statistic of the joint significance of all independent variables; SC = LM (Breusch and Godfrey) test for serial correlation of order one in the residuals; H = White's heteroskedasticity test in the residuals.

Notes: 1. Sample is 1916.10 - 1923.10. Data are monthly.
         2. Sample is 1922.10 - 1926.01. Data are monthly.

DATA APPENDIX: Definitions and Sources

SERIES Equation (4.1) symbols	DETAILS
KMS (m)	Money Supply: Notes in circulation (millions of roubles). In 1916, the money supply consisted of credit notes, gold, silver, and copper coins. Katzenellenbaum (1925, p. 51) identifies different periods in Russian monetary history. The figures are for the beginning of the month. The data are from Katzenellenbaum (1925, pp. 56 - 7). Cross-checked with Economic Statistics of the Soviet Union (1928) and State Bank of the USSR, various issues.
GOSPM (p)	1913 = 1.00. Data are from the Gosplan (i. e., the State Planning Commission) and represent prices in Moscow. Data are from Katzenellenbaum (1925, pp. 74 - 75).
KCHERV (m_T)	Tchervonetz notes in circulation. Data are from Katzenellenbaum (1925, p. 104) and Arnold (1937, p. 226) who seems to have different figures for 1925 especially. The January 1923 observation reported in Katzenellenbaum seems to be incorrect according to every other publication I have examined. See, for example, Commercial Yearbook 1925, p. 346.
IECREV	Price index for Tchervonetz (1913=1.00), revised. See Arnold (1937, pp. 168 - 9). These are data compiled by the Institute for The Study of Economic Conditions.
INFL1 (π, π^e)	Inflation in GOSPM. Calculated as 1200 [log GOSPM$_t$ − log GOSPM$_{t-1}$].
YS (y)	Monthly output proxy. Estimated from: $$y = c + \alpha_0 t + \alpha_1 t^2 + \alpha_2 \text{UNEM rate}$$ Y derived from annual production in agriculture data; and where t, t$_2$, t$_3$, are a time trend, square of t, cube of t, respectively, and UNEM rate is the unemployment rate proxy. Source: Siklos (1995).

RESULTS APPENDIX

TABLE A1: Unit Root Test

Series	Sample[1]	ADF Statistic[2]	
		one unit root	two unit roots
Real Sovsnak (m)	1916.10 - 1922.10	−1.81	
Real Tchervonetz (m)	1922.10 - 1926.01	−3.93[@]	
Inflation (π)	1916.10 - 1922.10	−1.49	−4.95*

Notes:

[1] Before differencing and lags.
[2] Augmented Dickey-Fuller (ADF) test. The autoregressive correction factor was selected according to Hall's (1994) k-max criterion. Data are monthly. m is logarithms of the levels; π is in percent.
* signifies rejection of the null hypothesis of a unit root at the 1 % level; @ at the 5 % level.

TABLE A2: Cointegration Test

Cointegrating regression: equation (4.1)

ADF test on residuals e_t: −4.21*

* signifies rejection of the null of a unit root in the residuals at the 1 % level of significance.

Summary

The Tchervonetz:
An Illustration in Discriminatory Monetary Policy

This paper interprets the parallel currency experiment in the Soviet Union during the 1920s as an illustration of price discrimination in monetary policy. Using *Bryant* and *Wallace's* (1984) framework, I argue that the introduction of high denomination notes by the Soviets was akin to imposing legal restrictions on their use as a transactions medium. Some econometric evidence is also present to support the implications of the theoretical approach followed. (JEL C 22, E 31, E 58)

Zusammenfassung

Der Tscherwonez:
Eine Illustration diskriminatorischer Währungspolitik

Dieser Beitrag interpretiert das parallele Währungsexperiment in der Sowjetunion in den 1920er Jahren als eine Möglichkeit zur Darstellung von Kursdiskriminierung in der Währungspolitik. Unter Verwendung des Rahmens von *Bryant* und *Wallace* (1984) behaupte ich, daß die Einführung von Banknoten mit hoher Stückelung durch die Sowjets der Einführung von gesetzlichen Beschränkungen der Verwendung solcher Noten als Transaktionsmedium nahe kam. Es gibt auch gewisse ökonometrische Beweise, welche die Auswirkungen des befolgten theoretischen Ansatzes stützen.

Résumé

Le TCHERVONETZ:
une illustration de politiques monétaires discriminatoires

Cet article interprète l'expérience de la monnaie parallèle faite en Union Soviétique pendant les années 20 comme une illustration de la discrimination des prix par la politique monétaire. Sur base du modèle de *Bryant* et *Wallace* (1984), l'auteur soutient que l'introduction de billets de grandes coupures équivalait à imposer des restrictions légales sur leur utilisation comme moyen de transaction. Des résultats économétriques pour appuyer les implications de l'approche théorique suivie sont également présentés.