The Vanishing Rouble

Barter Networks and Non-Monetary Transactions in Post-Soviet Societies

Edited by
PAUL SEABRIGHT

PUBLISHED BY THE PRESS SYNDICATE OF THE UNIVERSITY OF CAMBRIDGE
The Pitt Building, Trumpington Street, Cambridge, United Kingdom

CAMBRIDGE UNIVERSITY PRESS
The Edinburgh Building, Cambridge CB2 2RU, UK www.cup.cam.ac.uk
40 West 20th Street, New York, NY 10011-4211, USA www.cup.org
10 Stamford Road, Oakleigh, Melbourne 3166, Australia
Ruiz de Alarcón 13, 28014 Madrid, Spain

First published 2000

Printed in the United Kingdom at the University Press, Cambridge

Typeface *Times* System *3B2*

A catalogue record for this book is available from the British Library

Library of Congress Cataloguing-in-Publication Data

The vanishing rouble: barter networks and non-monetary transactions in post-Soviet societies / edited by Paul Seabright.
p. cm.
ISBN 0-521-79037-9 – ISBN 0-521-79542-7 (pbk.)
1. Barter–Former Soviet republics 2. Informal sector (Economics)–Former Soviet republics. 3. Former Soviet republics–Commerce. I. Seabright, Paul.

HF3626.5.V34 2000
330–dc21 00-036103

ISBN 0 521 79037 9 hardback
ISBN 0 521 79542 7 paperback

Contents

Figures

Tables

Boxes

1 Some lasting thing: barter and the value of money

JAYASRI DUTTA

> And thus came in the use of Money, some lasting thing that Men might keep without spoiling, and that by mutual consent Men would take in exchange for the truly useful, but perishable Supports of Life. (John Locke, *The Second Treatise on Government*, Section 47)

1 Introduction

Much of the work reported in this volume reflects interest in the growing phenomenon of trading in barter, often multilateral barter, in Russia in the 1990s. To monetary theorists, the timing is more than a little ironic. In the same decade, we have seen an explosion of theoretical research on the emergence of money as a medium of exchange.[1] Among other predictions, this theory suggests that a transition from barter to money is likely to be self-fulfilling, because a medium of exchange is all the more desirable if many others accept it; the process can be hastened by making money legal tender; its universal acceptability is then common knowledge among all participants in economic activity. Money is more efficient in exchange than barter, because it mediates possible failures of the double coincidence of wants; it follows, from this, that monetisation is an important component of the transition to a modern capitalist system. It is likely to happen of itself; the legalisation of money helps smooth the transition.

All of this makes perfect sense: it is unfortunate, then, that facts contradict such a reasonable theory. Russia, since 1989, has often been viewed as part of a great economic experiment of transition to modern capitalism. All the more vexing, then, that one part of the experiment has gone so wrong: with regard to the medium of exchange, we observe an

I am grateful to Elena Loukoianova for providing the facts, quantitative or otherwise.

[1] Ostroy and Starr (1974); Jones (1976) report early research on these issues; section 2 reports on more recent approaches.

apparent U-turn. In this chapter, I argue that the rise of barter in Russia, or similar societies, is relatively simple to understand if we think of money as a *store of value*, in addition to a medium of exchange. First, money can function as a medium of exchange only if it is a reasonable store of value; second, civil governments have an implicit agreement to guarantee the value of money. When governments, or their central banks, are in breach of promise, private individuals are well-advised not to keep to their part of the agreement, and accept otherwise worthless notes and coin in exchange for their produce. Enforcing the legal status of money is likely to hurt, rather than help, in such situations. The functioning of money as a medium of exchange is often traced to Walras, Wicksell, or even Hume. The principle underlying money as a store of value derives from Locke, quoted in the epigraph to this chapter. In the specific context of Russia, money has become an unsafe store of value, even as the need to store it has diminished. In response, private individuals prefer to do business in 'the perishable supports of life'. Indeed, the natural question is the reverse: in the circumstances why does the private sector agree to hold money at all?

Locke deduces the origins of money from its nature, and it may be useful to review the argument: it is actually far more transparent in our world than in his. There are three universal characteristics of money: it is *portable*, with low carrying costs; not immediately *perishable*; and not truly *useful* – i.e. it has little or no intrinsic worth. The first is important if money is to be used as a medium of exchange, the second if it is to be a store of value. The third is not strictly necessary for its functioning in either role. It does, however, allow monetary transactions to be efficient. Seed used as money is neither eaten nor planted, which is surely undesirable. Gold or silver or pieces of paper have little use otherwise, and can be used for the purpose of storage at negligible cost to society. Efficiency requires that money should be intrinsically useless but, paradoxically, be universally acceptable. This is why it needs to be part of a perpetual social contract. To be sure, consensus can make such a thing acceptable for the moment. To function as money, it must be acceptable, and valuable, in the near future, and commonly believed to be so. This argument applied again and again to each such future implies that money must be valued in perpetuity, as futures cumulate without end. The knowledge that it will not be acceptable to some generation to come leads to the logical certainty that it is worthless today.[2]

How, then, does the present consensus of money enforce itself in the future? If we have already agreed to allow a government to rule, in

[2] This is of course the 'Hahn problem' (Hahn, 1965).

exchange for which it will enforce our rights to private property, it is natural to extend its reponsibilities to that of maintaining the value of money. One of the important ways by which governments maintain the acceptability of money is by taking it in settlement of dues from private individuals. The European Central Bank (ECB) will not change our euros into beef, wine, or washing machines; fortunately, the treasuries of Germany or France will accept them in settlement of income taxes, highway tolls, or speeding penalties. If these governments were not very good at collecting their dues, and were to abandon the tax collection altogether, their promises about the value of the euro would not be worth quite as much. In Locke's world, we would have to deduce the impact of political instability or government failures on money; lesser political philosophers among us might accept payment in the king's coin even in the midst of a civil war. In today's world, there is a far more direct link between inefficient government and the value of money. Governments, or monetary authorities, possess the right to issue fiat money, and can print it at will to finance their expenditures if taxes are difficult to collect. Of course, this results in inflation, which erodes the value of money, and with it the government's command over real resources. If money continually loses its worth, private individuals are likely to turn to other stores of value, and index and even conduct their trades in it. If, as in the Russia of 1994, inflation were running at 311 per cent, a rouble would be worth half as much in six month's time. If I had meat to sell, to a distiller who makes vodka, it stands to reason that I would take his produce, as vodka will not depreciate by nearly as much as that. If, at the same time, the distiller has a much lower output today than normally (being one of many who have experienced an output shock of −21per cent), he has little reason to save from his income, and is thus happier to accept goods he can consume in exchange for his produce. The fact that his life expectancy has fallen to 58 years can only strengthen his resolve to cut back on savings and accept 'the perishable supports of life'.

Once barter begins to supplant money as a trading institution, inflation is likely to rise further. First, because the reduced demand for money lowers its price. Second, and perhaps more importantly in this environment, barter transactions are difficult to tax, or even account for. Falling tax revenues, and yet further increases in money supply to pay the government's obligations, makes demonetisation self-fulfilling. The likely cost of barter is in terms of seed, or shoes, or vodka neither consumed nor invested because they are held for the settlement of dues. At the same time, enforcing the legal acceptability of money is likely to be counterproductive, as the private cost of unreliable legal tender may add up to more than the social costs of barter.

2 Barter vs. money: the theory

I shall start by summarising what we understand about money and barter as competing forms of trade. As the theoretical research on the foundations of money as a medium of exchange is large and still growing, I will restrict attention to those aspects which are relevant to demonetisation and the rise of barter. Even then, as we see, virtually every insight has been discovered at least twice: I have made no attempt to be comprehensive. Most often, these theories are intended to explain the *emergence of money as a medium of exchange*, rather than being intended as realistic descriptions of prevalent institutions of trade. They do, nevertheless, have implications for the existence, and desirability, of barter. In developing these implications, I denote 'barter' to mean the trade of goods for goods, which includes the possibility of what is often called 'commodity money': the use of a single, or small number of designated goods for the purpose of exchange.

Why is fiat money – intrinsically worthless pieces of paper or coin, whose value fluctuates partly at the whim of governments and central banks – accepted in exchange for goods in every modern society? The first answer to this appeals to an underlying consensus. I accept money in exchange for my services because I can then exchange it for goods which I find useful: I take money because the grocer does. In other words, any one of us finds money acceptable because all others do. How does such an agreement come to pass, and is it always and everywhere desirable?

In answering this question, a theory must contemplate counterfactuals, of alternatives to money both historical and imagined. At a minimum, we should be able to imagine that human societies have the alternative of trading goods for other goods which is barter, or goods for promises to pay in the future (credit).

We begin by imagining a society populated by different kinds of people, who certainly differ in what they produce, and possibly in what they prefer to consume. A typical individual does not produce all the goods she would like to consume, and so must trade with others. An understanding of how they meet and trade may shed light on what they trade. So, suppose that there are three goods – meat, vodka and potatoes – produced by butchers, brewers and farmers, respectively. Individuals may also differ in the goods they like to consume: among this population, there are some vegetarians, and teetotallers. Meat-eaters prefer meat to potatoes.

Townsend (1980) considers a society where individuals live in different places. They meet when they travel, but may never meet again; indeed, they cannot make binding promises, so goods cannot be traded against

promises. Suppose that most butchers are teetotal. This puts meat-eating brewers at a disadvantage; carrying their produce, they are likely to run across brewers who have vodka, but which they are unwilling to exchange for meat. This is, of course, the lack of 'double coincidence of wants', in Jevons' celebrated phrase. If barter were the accepted method of trade, many meat-eating brewers would trade and consume potatoes, being uncertain of whether they could trade their produce for meat. Money mediates more efficient trade in such situations, because they can buy meat for money which they have previously acquired by selling vodka to farmers. Nothing, so far, dictates what form this money takes. Indeed, we would expect that potatoes, being universally consumed, may emerge as commodity money. While this outcome is perfectly feasible, it may lead to inefficiently high levels of production (and/or too little consumption) of potatoes; the introduction of fiat money, as a legally enforceable medium of exchange, may be desirable (Engineer and Bernhardt, 1991). The assumption that no promises are binding is too stringent; we may reasonably expect to see some trades made against promises – between neighbours, say – and others in barter. Money, when introduced, replaces barter, and eventually coexists with credit as a trading mechanism (Bernhardt, 1990).

The form of money, or the medium of exchange, is examined more carefully in Kiyotaki and Wright (1989)[3] in contexts where individuals search for trading opportunities. The cost of transactions is measured by the delays induced by search, and these delays are the outcome of individual decisions and the institutions of trade. One of the important findings of this research is that agreement on a medium of exchange does not entail its efficiency in that role.

Suppose we know that potatoes are universally accepted in exchange for meat or vodka. Then, every individual would accept potatoes, possibly in anticipation of further exchange. Now, this could also be true of vodka, or of meat. If the costs of storage, or degree of perishability, are different, it may be that one (say, vodka) is the most efficient medium of exchange, and that this is yet inferior to fiat money. No one individual finds it in their interest to refuse a good which all others accept in trade; the choice of trading institutions may thus suffer from coordination failure, because the value of participating in such an institution depends on others' choices, irrespective of the social efficiency.

Are there forces, so far unexplored, which drive societies towards the choice of intrinsically worthless objects as media of exchange? One sort of

[3] See also Jones (1976); Diamond (1984); Oh (1989); Kiyotaki and Wright (1993) among others.

force derives from Gresham's law, that 'Bad money drives out good'. Williamson and Wright (1994) and Banerjee and Maskin (1996) evaluate the implications. Imagine that meat perishes fast, and is not a viable medium of exchange. Vodka and potatoes could both function as commodity money. Potatoes are of uniform quality, whereas vodka can be good or bad. Bad vodka, which looks the same as good vodka, is worth very little to a consumer. A teetotaller cannot tell good vodka from bad at the time of exchange. Suppose, now, that vodka is the current medium of exchange and a teetotal butcher is about to accept it in exchange for meat. He does not know whether this is good or bad, but is prepared to accept it in anticipation of, and at the rate appropriate to, further exchange. He can, however, deduce that a distiller who has both qualities of vodka in store is likely to give him the lower quality, keeping good vodka for her own consumption, or for trade with a discerning customer. As a result, he will accept it only at the price for low-quality vodka, and the brewer will give him only the low-quality brew. We have, then, a situation where bad vodka can function as a medium of exchange; while good vodka is bought, sold and consumed by informed traders, who trade it at its appropriate premium. This society can sustain quite another outcome, where potatoes are a medium of exchange, because they are of uniform quality. The former is a better choice of money, as the good which is used as a medium of exchange has little or no intrinsic worth.[4]

Suppose, now, that bad vodka is the chosen medium of exchange and, further, that it can be produced at negligible cost. Private producers are likely to produce it in very large quantities is indeed, until its price equals its marginal cost. If this marginal cost is small, private monies are likely to be produced in excessive quantities, driving the price level – the price of goods in money terms – to very high levels. Individuals must incur the cost of carrying these very large quantities of money for each purchase. The inefficiency of commodity money takes a slightly different form, that of excessive price levels (Shi, 1995; Trejos and Wright, 1995).

It is desirable, then, to have a more explicit social contract: that money should be intrinsically worthless, that it should be legal tender, but that its quantity should be restricted. In present contexts, the last is better understood as controls on the rate of growth of money rather than its quantity. Fiat money has negligible carrying costs; there are opportunity costs of holding it, which depend on inflation rather than the price level.

[4] Notice that this argument starts from a premise similar to Akerlof (1970) but reaches quite a different conclusion. Asymmetric information may help rather than hurt in choosing a medium of exchange, because efficiency is declining in its worth.

Suppose fiat money exists, and its quantity can be increased or decreased by the government. An increase in the quantity of money will increase the price level, and reduce the rate of return on money. If individual participants accept money for goods, the private sector as a whole must hold money over time. If the value of money declines rapidly, no individual will want to hold it over any length of time. Ideally, then, the value of money should keep pace with other assets that individuals could hold: this is often called the 'Chicago Rule' that the nominal interest rate should be zero (i.e. that the rate of price deflation equals the real interest rate).

Hayashi and Matsui (1996) evaluate this prescription in a society where fiat money functions as a medium of exchange. Individuals have the option of trading in barter if they wish. They find that the Chicago Rule is necessary for efficiency: money functions as both medium of exchange and store of value if inflation rates are low, and close to efficient. As inflation rates increase, money is no longer a good store of value, and more and more trades are made in barter. Eventually, if the growth rate of money is excessive, money no longer functions even as a medium of exchange. In the appendix (p. 28), I develop a particularly simple model which explores the switch from monetary trade to barter as inflation rates increase. This simplicity is achieved at the cost of economising on the specification of 'who trades what when and with whom'. I can only urge the interested reader to consult Hayashi and Matsui (1996), which spells out most of the relevant details.[5]

3 The facts

Table 1.1 summarises some of the macroeconomic facts of Russia in the period which saw the rise of barter. It is not a pretty story. This is clearly a society in a state of upheaval, as much political as economic. While miseries undoubtedly add up, some of them may cause others. Some of these facts are reasonably assumed exogenous to the monetary or trading system, but are nevertheless important in explaining its dysfunctions. Among these is the dramatic rise in adult (male) mortality, and the decline in output and productivity as part of a chaotic transition of the economic and the political system, reported in lines 1–5. It would be miraculous if tax, and other revenues of government, did not fall just as sharply at the same time. No such miracle occurred: from line 10 and

[5] They assume joint symmetry of preferences and technology to solve the model; unfortunately, this rules out the relative price effects of inflation which are an important component of the case in hand.

Table 1.1 *The facts: Russia 1992–1997*

Year	1992	1993	1994	1995	1996	1997
Life Expectancy						
1 Men	62	59	58	58	59.8	60.8
2 Women	72	71	72	72.5	72.5	72.9
Growth rates, real annual per cent						
3 GDP	−14.5	−8.7	−12.7	−4.1	−3.5	0.8
4 Industrial output	−18.0	−14.1	−20.9	−3.3	−4.0	1.9
5 Wages	−34.0	6.1	−8.6	−26.4	13.5	4.5
6 Consumption	..	−5.5	−9.2	−5.5	−5.6	2.0
7 Investment	..	−25.8	−26.0	−7.5	−18.5	−5.0
8 Govt. Consn.	.	−7.2	−2.7	1.2	−1.5	−2.0
Government budget as per cent of GDP						
9 Expenditure	37.2	40.7	45.9	37.0	40.1	40.7
10 Revenue	33.1	36.5	36.0	31.3	31.8	33.3
Broad money						
11 Growth	642.6	416.1	166.4	125.8	30.6	28
12 As of GDP	37.4	21.4	16.0	13.9	13.1	14.2
Inflation rates, annual						
13 CPI	1526	875	311	198	48	15
14 PPI	1768	942	337	237	51	20
Nominal interest rates, annual						
15 Treasury Bill	–	121	172	162	86	26
16 Central Bank	60	144	178	186	110	32

Sources: Goskomstat Yearbook 1998; Russian Economic Trends 1998.

line 3, the decline in real government revenues are about 30 per cent over this five-year period. Faced with declining income, a government can attempt to reduce its spending, or raise funds by seigniorage – i.e. printing money and issuing nominal liabilities. The facts leave little doubt about which of these happened in Russia: real government consumption fell by relatively little, amounting to a little over 12 per cent, as reported in line 8, leaving a large deficit to be covered. The quantity of money in the economy increased substantially, by factors of six or four in the early years. The stage was set for runaway inflation; for the clear perception that money is an unreliable store of value and that other, government-backed, nominal assets are scarcely better, as their interest payments fall far short of actual inflation.

Broadly speaking, this is a scenario where rational individuals should refuse to accept money in exchange for goods. A public sector employee has little option other than to be paid their wages in legal tender. Producers of meat and shoes and sealing-wax do have the option of barter, and are likely to exercise it. There are some details here which are particularly relevant to the advent of barter. First, the rates of inflation far exceeded the rate of growth of money supply. Second, the rate of inflation of the producers' price index (PPI), is always and everywhere larger than that of the consumers' price index (CPI). The fable which follows offers an explanation. It is specialised, and simplified, to imagine how transitions from money to barter may happen.

4 A fable

Imagine a world where the population produces, and consumes, two kinds of goods, meat and vodka. Butchers produce meat and sell this to finance their vodka consumption; brewers produce vodka and similarly sell some of their produce to buy meat. They are similar because both need time to produce: a typical butcher can produce meat every month, but would like to eat and drink every week. Similarly for brewers, who are a little luckier. Vodka, too, takes time to produce but unlike meat it does not rot and can be put away for future consumption. There are costs to storing vodka, including seepage. A litre's worth put away this week may yield less than a litre next week, but there is certain to be some left. Imagine too, that it is a nomadic world where promises are worth nothing: a distiller who sells a litre of vodka in exchange for a promise of a pound of meat next week may never see or hear from his trading partner again.

In this world, we claim, some amount of trading will take place. Suppose I am a butcher with 40 pounds of fresh meat to dispose of right now; I know, too, that the next time I will have a cow to slaughter is still four weeks away. Other butchers will sell meat in the intervening weeks. I should decide how much meat to consume this week (let's say 10 lb), and exchange the rest for vodka. Suppose I obtain 30 litres, because the price ratio is 1 : 1; I can store this in my cellar, and trade vodka for meat the next three weeks, until I have fresh meat again to sell. This, of course, is barter, where a storable good, vodka, is effectively used as a *store of value* and hence the *medium of exchange*. It is acceptable in trade because it is a good: other butchers drink it, much as I do.

We notice, then, that vodka is bought for consumption and for storage. This means that our society will not consume all the vodka it produces; put another way, the price of vodka will be relatively high in order to

discourage its consumption. If vodka depreciates by 25 per cent per year, and 1,000 litres are used for storage purposes every week, this represents a net loss to society of 250 litres per year.

Suppose, now, that a butcher, called M, has the idea of introducing currency, or fiat money into this society. This money consists of a number of little pieces of paper, which is to function as a medium of exchange. Butchers and brewers alike can sell their goods for money, store this without cost and use their money to buy goods in times of need. Society will benefit, she says, because there will be more vodka to drink and just as much meat to eat. Any fears that this money may not be acceptable are misplaced. To prove this, M stands ready to sell her own produce in exchange for money at the going rate. So far, so good, and all butchers agree that this would be an excellent thing. What of brewers?

There is a little problem here. True, there will be more vodka to go around. But this will surely lower the price of vodka and brewers, whose real income depends on the purchasing power of vodka, will stand to lose from this. A long period of negotiations follows. M eventually convinces the chief distiller, V, that both groups can benefit. Remember, she says, that vodka depreciates by 25 per cent a year. Money will hold its value, so you, and your constituency, stand to gain this higher yield on your savings. After many calculations, V agrees on the social contract, that brewers will permit and cooperate in the use of money *provided* money holds its value, and yields a rate of return significantly larger than vodka. The moral of the fable is that fiat money, as an institution, may not be universally preferred. To achieve this, it must be a reliable store of value. Much as governments serve by social consensus if they are not too malignant, money mediates trade provided it is not too unreliable. Moreover, and this is the rest of the story, it is significantly easier to be rid of unreliable money than it is to remove malignant governments.

M, for all her faults, keeps her word on the value of money. Unfortunately, she is less good at looking over her shoulder, and is overthrown by her erstwhile deputy, B. He, too, is a butcher, but one who feels no obligation to keep to that ancient social contract. Indeed, he discovers, that he has acquired the monopoly rights to print these little pieces of paper, and can actually buy vodka as well as meat with them. And so he does ... as he prints more and more money, inflation ensues, and money keeps losing its value. Brewers are the first to see the unfairness of this. At first, when the rate of inflation is still under 33 per cent,[6]

[6] This follows from the fact that purchasing power depreciates according to $\frac{\text{infl}}{1+\text{infl}}$ and $\frac{0.33}{1.33} \simeq 0.25$.

they still accept money and store it rather than vodka, and ruminate in brewers' meetings in underground cellars that their great-grandfathers were much better off, even though they worked no harder and produced no more. Once inflation exceeds 33 per cent, butcher and distiller agree that B's money is just about worth the paper it is printed on, and that it is better to store their savings in vodka. As the word spreads, more and more brewers insist on being paid in meat, and butchers are happy to exchange their perishable goods in exchange for a durable. During this process of transition to a barter economy, the value of money must fall faster than the rate at which B prints it, because it is accepted in fewer and fewer transactions every time. At the same time, the price of vodka must rise *relative* to that of meat: in other words, the prices of storable goods inflate faster than those of perishables, and this exceeds the rate of growth of money supply. The loss of confidence in money fuels hyperinflation, because money becomes the proverbial hot potato which keeps changing hands faster and faster. In the end, this society will be back to where it started; unless, of course, B realises, like every other monopolist, that his gains are maximised by restricting his output, and that printing money faster than 33 per cent will leave his coffers empty.

It is reasonable to assume that intermediate or production goods are more storable than many consumption goods, and that their relative inflation rates are reflected in that of the two price indices. If so, the analysis suggests first, that barter in and of itself is not a bad thing, at least for individuals in a dysfunctional economy. It reflects a rational and desirable response by the private sector to extreme policy failures.

5 Further issues

The appendix sets out a formal model exploring these issues. The important elements are as before: political failures led, on the one hand, to declining income and even life expectancy. On the other, and more directly, the failure of government machinery contributed to the ability to raise adequate revenues, by taxation or sales of public output. The government was either unable or unwilling to reduce its expenditures to the same extent. The latter led to rampant growth in money supply, the former to reduced demand for real balances. Together, these provide more than adequate reasons for extremely high inflation rates, which were quick to follow. Once prices started to rise, and the purchasing power of money to fall with it, private individuals, including firms, found money – more specifically, roubles – a continually worsening store of value. As some moved to other ways of settling their trades, acceptability of the rouble plummeted and its velocity increased. In

response, inflation rates began to outpace even the substantial rates of money growth. An important element of this story has the price of durables increasing faster than non-durables; this is likely to be reflected in the differential inflation rates of producers' and consumers' price indices.

There are several elements which I have omitted, which may well contribute to explaining exact details of the events.

Dollarisation

When the local currency becomes unreliable, private individuals may look to trade in some more reliable foreign currency, such as dollars or deutschmarks. This undoubtedly happened, and contributed in much the same way as barter to the acceleration of inflation. There is then a natural question of why all trades were not made in dollars rather than barter. One may be in more flagrant violation of the law than the other: a public sector employer may pay employees partly in claims to goods. More importantly, the supply of dollars or deutsche marks in circulation is likely to vary across regions. I would expect the extent of trading in foreign currency to be high in Moscow and St Petersburg, and barter to be more prevalent in Siberia or more remote areas. This may be thought of as a partial liquidity crisis.

Tax evasion

Inflation is one form of taxation; it is inefficient in its effects, but may be the only feasible instrument available to a state which is fast losing control of its administrative machinery. It is self-limiting, and barter is one of the mechanisms by which the effects of inflation are contained. Firms or individuals who trade in goods rather than money may lose less value by it. In effect, they insure themselves against the 'inflation tax'. At the same time, barter trades are more easily hidden from tax authorities; they are also more difficult to tax as governments find it costlier to attach the contents of my cellar than the contents of my bank account. On the one hand, the reliability of governments maintains the value of money; on the other, the functioning of the monetary system greases the wheels of governments. We observe, then, a failure of one reinforcing the failure of the other.

Barter networks and credit

The failure of money may encourage barter. It may also encourage transactions in promises, or credit. Groups of individuals or firms who accept each other's goods in settlement of dues form a chain, or network.

Once such a network is formed, it is feasible to accept payments in goods spread over time: heating fuel supplied in January can be repaid in steel rivets produced in September. One imagines that a major part of the cost of transactions is the formation of such networks in the first place; once part of a network, it is possible to make credible promises to pay back debt. Indeed, default is made particularly costly by the threat of losing the connections of the network. Hyperinflation increases the benefits of forming such networks; once the setup costs are sunk, these networks may continue, possibly as informal credit groups, even when inflation falls to more normal levels.

Unsustainable policies

What next, one may ask? Clearly, if governments were run by rational economic agents, they would be able to see that runaway inflation actually raises less, rather than more, revenues, and limit themselves to drawing their 'monopoly rents' from seigniorage. As we note, the rate of money growth slowed to 28 per cent in 1997, and to a yet lower 15 per cent in 1998. Inflation rates fell, indeed were lower than money growth rates. This last suggests an underlying 'remonetisation', and it would be of interest to verify whether the microeconomic evidence supports this view. There is a somewhat different aspect of this of interest to economists. We can deduce that the situation of 1991–6 could not persist. Undoubtedly, Russians knew this; and many economic decisions are likely to be affected in response to such temporary policy failures. Among others, decisions to produce, or sell, are likely to be postponed until the crisis is over – which, of course, deepens the nature of crisis.

Money and value

In building an economic hypothesis, I have stressed that money cannot function as a medium of exchange unless it is a reasonable store of value. The view that money is a store of value has been the basis of different theories of money, starting with Samuelson (1958).[7] It is one thing to say that efficiency requires that money yield the same return as other assets (the 'Chicago Rule'). It is quite another, one may say, to claim that this is true in reality. We have seen virtually no instances of major deflation in the post-war world, which would be necessary if money were to compete

[7] This can be extended to explain a precautionary motive for holding money in the presence of uncertainty, as in Bewley (1980); Dutta and Polemarchakis (1990); Dutta and Kapur (1998); among others.

with bonds or equity. The natural deduction is that money does not function as a reasonable store of value, and is held by rational individuals only because they are forced to, because it is legal tender and because they are obliged to pay for some transactions in currency.[8] The deduction is entirely correct as a matter of logic; its prediction – that individuals, or firms, hold no more money than they need for transactions – would appear to be false,[9] suggesting that some households or sectors hold part of their savings in cash. Clearly, this demand is likely to be particularly sensitive to inflation, even if barter were unavailable.

Appendix: a formal model

Imagine an economy spread over infinite, discrete time, with $t = 0, 1, 2, \ldots$. There are two goods x and y which are consumed every period. Individuals produce and consume these goods. A typical individual can produce one of these goods, costlessly, and consumes both. We assume that individuals are infinitely lived and have the same preferences, written as the utility function

$$(1 - \beta) \sum_{t=0}^{\infty} \beta^t U(x_t, y_t)$$

where the period utility, or felicity function is

$$U(x, y) = \frac{1}{2} \ln x + \frac{1}{2} \ln y;$$

and β their common subjective discount factor, $0 \leq \beta < 1$. Individuals would like to consume both goods every period and discount future consumption at the rate β.

Individuals differ in what they produce, and when they produce it. Some produce good x, and others produce y. Production occurs every other period. Some producers, of each type, get output in even periods, starting with period 0, and others produce in odd periods, starting with period 1. There are thus four types of individuals: types X_0, X_1 produce good x, and types Y_0, Y_1 produce good y, in even and odd periods, respectively. Production is costless, and capacity levels constant over time. Assume, for simplicity, that the aggregate output level of each

[8] This forms the starting point of the 'cash-in advance' hypothesis, (for example, Lucas and Stokey, 1987).

[9] For example, Dutta and Weale (1997), where we show that the household sector holds five or six times more cash than can be reasonably explained by the transactions motive.

type is Z. Thus, aggregate output in *each* period is Z units of x and Z units of y.[10]

Good x is perishable. Good y can be stored, but depreciates by the factor δ. If S_{yt} amount of y is stored, this yields $(1-\delta)S_t$ units of y next period. I assume that it is impossible to borrow or lend.[11] I assume further, that goods markets are competitive at each t: each producer observes current price levels, knows the rate of return on alternative forms of saving and chooses how much to sell and what to consume. Demand equals supply in every market, which determines the relative price, q_t of y relative to x. Indeed, this price must be as follows. All individuals have the same preferences, and spend equal amounts on x and y every period. Aggregating over individual demands, we have $q_t y_t^d = x_t^d$. Good x is perishable, and aggregate supply is $x_t^s = Z$. Good y may be stored. If S_{yt} is the total amount of y stored in period t, its aggregate supply is $Z + (1-\delta)S_{y,t-1}$; total demand is $y_t^d + S_{yt}$. Its relative price satisfies

$$q_t = \frac{Z}{Z + (1-\delta)S_{y,t-1} - S_{yt}}. \tag{A.1}$$

The total amount stored is, of course, a consequence of individual decisions and the nature of trading institutions.

A.1 Barter trades

Suppose, first, that there is no such thing as money in this society. However, it is known that good y is storable, and individuals who wish to save store the appropriate amount of y. When, and how much, will an individual save?

Consider first an individual who has just produced. She will not be able to produce anything next period, and must save in order to finance her consumption next period. An individual in an unproductive phase could also save, to augment her income next period. This is never desirable, as future income is greater than current holdings, and individuals prefer to

[10] Many of these assumptions are immaterial, but simplify the presentation. The model is similar to that of Grossman and Weiss (1983) and Scheinkman and Weiss (1986), who assume that all consumption goods are perishable. If individuals themselves are finitely lived, the economy can be studied much as in Samuelson (1958).

[11] This is often deduced from more primitive considerations, such as individuals perpetually travelling in different directions on a turnpike, and so unable to make binding commitments to meet again (for example, Townsend, 1980). See also Kiyotaki and Wright (1989); Engineer and Bernhardt (1991).
This assumption has an unpleasant implication: individuals of type 1 have zero consumption in period 0. From this point on, the statements are exact for $t \geq 1$.

discount future consumption – i.e. $\beta(1-\delta) < 1$. As a result, individuals will save only every other period, and choose savings levels to smooth consumption. The optimal consumption savings decisions are as follows. An individual will save every other period, and this savings is equal to proportion $\beta/(1+\beta)$ of her income: call this σ, the individual (and aggregate) savings rate. She will spend equal amounts on each good, as before. With x as the numeraire, aggregate savings in period t are

$$S_t = \frac{\beta}{1+\beta} Z(1+q_t) \equiv \sigma Z(1+q_t).$$

All savings are stored in y; thus, $S_{yt} = S_t/q_t$. Along with (A.1), we can deduce the dynamic behaviour of the relative price of storables over time. This price will converge to a stationary value, which is

$$\bar{q}_B = \frac{1+\sigma\delta}{1-\sigma\delta}.$$

This price is obviously greater than 1, and increasing in both β and δ. As we see next, the fact that $\bar{q}_B$ exceeds 1 is entirely owing to its transactions demand. Savings are increasing in β, and this raises q_t. It is increasing in δ, the rate of depreciation because of a supply effect, as the supply of durable goods decreases with the depreciation rate.

Finally, the stationary utility levels of X, and Y producers are

$$V_{BX} = \ln Z - \frac{1}{2}\ln q_B + \sigma \ln(1-\delta)$$

and

$$V_{BY} = \ln Z + \frac{1}{2}\ln q_B + \sigma \ln(1-\delta).$$

A.2 Money and prices

Suppose now that money is introduced for the purpose of trade. Money consists of pieces of paper issued (only) by a designated authority. The number of pieces of paper, or quantity of money, is M_t. These amounts are decided by the monetary authority.[12] The nominal price level is P_t (the money price of good x), determined as follows. Suppose M_t is the quantity of money, and μ_t the degree of monetisation – i.e. the proportion of trades carried out in money; in this world, sellers who have accepted money in exchange for their produce hold it till the next period.

[12] I assume that goods bought with newly minted money are part of government consumption.

Total money holdings are $\mu_t P_t S_t$, which must equal the stock of money:

$$P_t = \frac{M_t}{\mu_t S_t}. \tag{A.2}$$

Savings are, as earlier:

$$S_t = \sigma Z(1 + q_t). \tag{A.3}$$

Relative prices q_t respond to μ_t, as non-monetary savings represent demand for y, and $S_{yt} = (1 - \mu_t)S_t/q_t$ This modifies the price equation (A.1), to

$$q_t = \frac{Z}{Z + \sigma(1-\delta)(1-\mu_{t-1})\dfrac{1+q_{t-1}}{q_{t-1}} - \sigma(1-\mu_{t-1})\dfrac{1+q_t}{q_t}}. \tag{A.4}$$

These three equations entirely determine the evolution of real variables – the relative price, savings and consumption, as well as the inflation rate, in response to changes in the monetary environment, M_t, μ_t.

A.3 The value of money

The degree of monetisation cannot be entirely exogenous: private producers accept money provided it is better than the alternative. Specifically, the yield of money is $P_{t+1}/P_t = 1/1 + \pi_{t+1}$, with π_t the inflation rate. If this is greater than the yield from storage – i.e. $\pi_{t+1} < \delta/1 - \delta = \bar{\pi}(\delta)$ – sellers would accept money rather than goods in exchange for their produce. This is true for all if it is for one; hence,

$$\mu_t = 1 \quad \text{whenever} \quad \pi_{t+1} < \bar{\pi}(\delta).$$

By a similar argument,

$$\mu_t = 0 \quad \text{whenever} \quad \pi_{t+1} > \bar{\pi}(\delta).$$

We notice, then, that barter and money can coexist in the long run if, and only if. $\pi_t = \bar{\pi}(\delta)$.

This puts a precise meaning to the phrase 'money must hold its value': to be acceptable in exchange, the *rate of inflation should not exceed the depreciation rate of physical storage*. Thus, the introduction of money can work only if monetary authorities can make a credible promise to hold inflation down to less than $\bar{\pi}(\delta)$. How, we may ask, can they do this, as many of the factors affecting inflation are beyond their control? We note, from (A.2), that

$$1 + \pi_t = \frac{M_t}{M_{t-1}} \frac{\mu_{t-1} S_{t-1}}{\mu_t S_t}.$$

As it happens, acceptance of money has a positive feedback effect which

allows for self-fulfilling monetisation. Solving (A.2), (A.3) and (A.4), we obtain

$$\mu_t \geq \mu_{t-1} \Rightarrow \mu_t S_t \geq \mu_{t-1} S_{t-1} \Rightarrow \pi_t < \frac{M_t - M_{t-1}}{M_t}.$$

Once the acceptance of money starts to increase (i.e. if the degree of monetisation increases over time), the rate of inflation cannot exceed the rate of growth of money supply. This is entirely within the control of the monetary authorities. If they hold the rate of growth of money supply at or below $\bar{\pi}(\delta)$, money becomes acceptable to all, and a gradual transition to 100 per cent monetisation can occur. It is important that the growth rate be kept sufficiently low at all times: individuals with rational expectations will agree to hold money at time t only if they believe that

$$\pi_{t+k} \leq \bar{\pi}(\delta)$$

at every future instance $k \geq 0$. An inflation rate exceeding this at $t + 10$, say, will make money unacceptable at $t + 9$, because individuals prefer to store in goods which yield more. As a result, μ_{t+9} is very small (nearly zero), and P_{t+9} very large (nearly infinite), which means, of course, that inflation rates are high and that money is not accepted in $t + 8$, and so on. Monetisation unravels by the backward iteration of inflationary expectations.

A.4 Agreeable money

Money is acceptable if the inflation rate is kept at or below $\bar{\pi}(\delta)$. That is not to say that this is an agreeable rule for every individual or group of individuals. We recall that monetisation reduces q, the price of storables. From (A.4), $q_t = 1 < q_B$ whenever $\mu_t = \mu_{t-1} = 1$. The stationary utilities of individuals in a monetary economy are

$$V_{XM}(\pi) = \ln Z - \sigma \ln(1 + \pi);$$
$$V_{YM}(\pi) = \ln Z - \sigma \ln(1 + \pi);$$

as $\ln q_m = 0$. We note that $V_{YB} > V_{YM}(\bar{\pi}(\delta)) = V_{XM}(\bar{\pi}(\delta)) > V_{XB}$: producers of durables suffer income losses with the introduction of money. To achieve a social consensus on money, promised inflation rates must be yet lower than $\bar{\pi}$, possibly even negative. Specifically, this says that demonetisation may not be Pareto-inferior to monetary outcomes, as it is likely to change relative prices and thus incomes.[13]

[13] This is similar to the finding of Diamond (1965) that the 'golden Rule' of zero inflation is not always Pareto-superior to the equilibrium of a non-monetary economy. In this framework, the Golden Rule is universally desirable if individuals are sufficiently patient – i.e. β is close to 1.

A.5 Barter and demonetisation

From our previous arguments, it should be clear that the reverse transition – from money back to barter – is likely to occur if actual or expected inflation exceeds $\bar{\pi}(\delta)$. Certainly, this is likely if the rate of growth of money supply exceeds $\bar{\pi}(\delta)$. However, demonetisation may start far below that. Recall, from (A.2), that

$$1 + \pi_{t+1} = \frac{M_{t+1}}{M_t} \frac{\mu_t S_t}{\mu_{t+1} S_{t+1}}.$$

We saw earlier that a 'virtuous circle' of monetisation may start from the fact that inflation rates decline with monetisation. For exactly that reason, it can start a vicious circle of demonetisation. Specifically,

$$\mu_{t+1} < \mu_t \Rightarrow \pi_{t+1} > \frac{M_{t+1} - M_t}{M_t};$$

once individuals start accepting goods rather than money in trade, the rate of inflation will exceed the growth rate of money. In such a circumstance, a high but acceptable growth rate of money, close to $\bar{\pi}(\delta)$, no longer suffices to prevent demonetisation.

Finally, as we have noted before, demonetisation may respond to expectations of future inflation. Again, from (A.2), this may be expectations about rising money growth, or about the declining real balances. In the model, π_{t+1} declines with savings. From (A.3), $S_t = \sigma(1 + q_t)Z$. If individuals expect a decline in real incomes, or in savings propensities owing to, say, greater mortality, they are likely to expect greater inflation even if money growth rates are not expected to rise.

References

Akerlof, G. (1970). 'The Market for Lemons: Quality Uncertainty and the Market Mechanism', *Quarterly Journal of Economics*, 84, 488–500

Banerjee, A. and E. Maskin (1996). 'A Walrasian Theory of Money and Barter', *Quarterly Journal of Economics*, 11, 955–1005

Bernhardt, D. (1990). 'Money and Loans', *Review of Economic Studies*, 56, 89–100

Bewley, T. (1980). 'On the Optimum Quantity of Money', in J. Kareken and N. Wallace, (eds.) *Models of Monetary Economies*, Minneapolis, Federal Bank of Minneapolis, 169–210

Diamond, P.A. (1965). 'National Debt in a Neoclassical Growth Model', *American Economic Review*, 55, 1126–50

(1984). 'Money in Search Equilibrium', *Econometrica*, 52, 1–20

Dutta, J. and S. Kapur (1998). 'Liquidity Preference and Financial Intermediation', *Review of Economic Studies*, 65, 551–72

Dutta, J. and H. Polemarchakis (1990). 'Asset Markets and Equilibrium Processes', *Review of Economic Studies*, 57, 229–54

Dutta, J. and M. Weale (1997). 'Consumption and the Means of Payment: An Empirical Analysis for the United Kingdom', *National Institute for Economic and Social Research, Discussion Paper*, 97–23, forthcoming in *Economica*

Engineer, M. and D. Bernhardt (1991). 'Money, Barter, and the Optimality of Legal Restrictions', *Journal of Political Economy*, 99(4), 743–70

Grossman, S. and L. Weiss (1983). 'A Transactions-based Model of the Monetary Transmission Mechanism', *American Economic Review*, 73, 871–80

Hahn, F.H. (1965). 'On Some Problems of Proving the Existence of a Monetary Equilibrium', in F. Hahn and F.P.R. Brechling (eds.) *The Theory of Interest Rates*, London, Macmillan.

Hayashi, F. and A. Matsui (1996). 'A Model of Fiat Money and Barter', *Journal of Economic Theory*, 68, 111–32

Jones, R.A. (1976). 'The Origin and Development of Media of Exchange', *Journal of Political Economy*, 84, 757–76

Kiyotaki, N. and R. Wright (1989). 'On Money as a Medium of Exchange' *Journal of Political Economy*, 97, 927–54

(1993). 'A Search-theoretic Approach to Monetary Economics', *American Economic Review*, 83, 63–77

Lucas, R.E. and N. Stokey (1987). 'Money and Interest in a Cash-in Advance Economy', *Econometrica*, 55, 491–513

Oh, S. (1989). 'A Theory of a Generally Acceptable Medium of Exchange and Barter', *Journal of Monetary Economics*, 23, 101–19

Ostroy, J. and R. Starr (1974). 'Money and the Decentralization of Exchange', *Econometrica*, 42, 1093-1113

Ritter, J. (1995) 'On the Transition from Barter to Fiat Money', *American Economic Review*, 85, 134–49

Samuelson, P. (1958). 'An exact Consumption-loan model of Interest with or without the Social Contrivance of Money', *Journal of Political Economy*, 66, 467-82

Scheinkman, J. and L. Weiss (1986). 'Borrowing Constraints and Aggregate Economic Activity, *Econometrica*, 54, 23–45

Shi, S. (1995). 'Money and Prices: A Model of Search and Bargaining', *Journal of Economic Theory*, 67, 467–96

Townsend, R. (1980). 'Models of Money with Spatially Separated Agents', in J. Kareken and N. Wallace (eds.) *Models of Monetary Economies*, Minneapolis, Federal Reserve Bank of Minneapolis

Trejos, A. and R. Wright (1995). 'Search, Bargaining, Money, and Prices', *Journal of Political Economy*, 103, 118–41

Williamson, S. and R. Wright (1994) 'Barter and Monetary exchange under Private Information', *American Economic Review*, 84, 104–23