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Trust vs Illusion: What is driving Demonetization in Russia?

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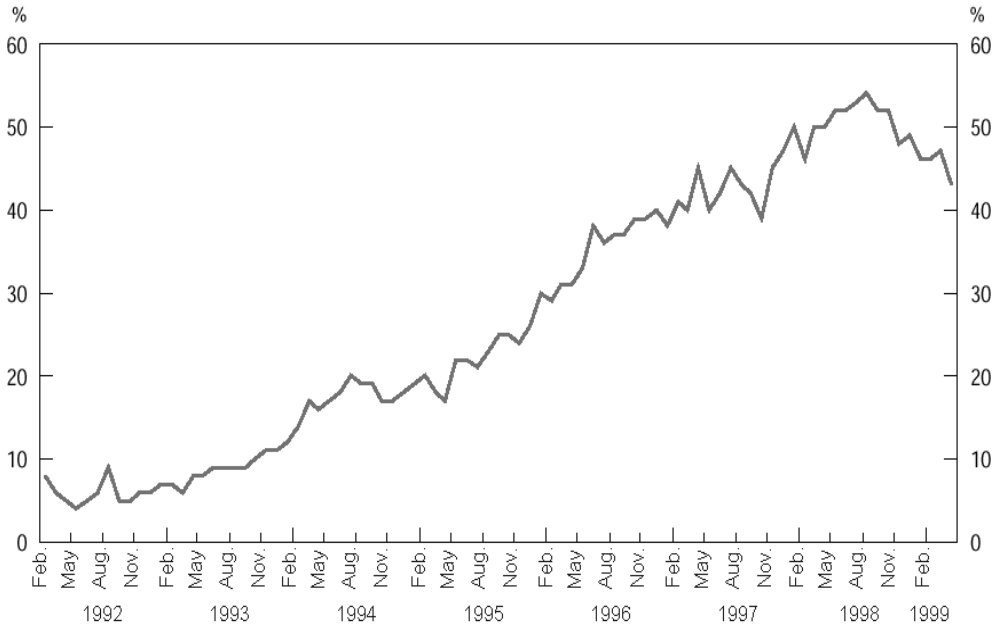
Abstract

The virtual economy argument for Russia suggests that barter allows the parties to pretend that the manufacturing sector is producing value added by enabling this sector to sell its output at a higher price than its market value. We confront this prediction with the actual pricing behavior of industrial sectors in Ukraine in 1997. Based on pricing data of 165 barter deals we find no systematic difference in the pricing behavior in non-cash transactions across sectors. What appears to matter for the pricing behavior is whether the firm is on the selling or buying end of the barter transaction. We offer a model which sees this pricing behavior as a mechanism to deal with the absence of trust and liquidity in the economy.

1 Introduction

Demonetization has become one of the dominant features of the Russian transition to a market economy. Different estimates suggest that the share of non-cash payments made 60 percent of sales in 1998 in Russia and 50 percent of sales in Ukraine in 1997.[1] The survey of 200 firms by the Russian Economic Barometer since 1992, in turn, suggests that non-cash payments rose steadily from 8 percent in 1992 to 54 percent in mid-1998. Since the financial crisis in August of 1998 barter and other money surrogates have started to decline accounting for 43 percent of receipts of industrial firms. A similar picture emerges from a Goskomstat survey among 2000 large firms which reveals a share of non-cash payments of around 70 percent in early 1998 and a subsequent decline to 60 percent in 1999.

Figure 1 The Pattern of Demonetization in Russia



Source: Russian Economic Barometer.

[1]See Commander and Mummsen 1998 for Russia , Marin, Kaufmann, Gorochowskij 2000 for Ukraine.

This time pattern of the process of demonetization is particularly puzzling. Barter started to rise after macroeconomic stabilization and has started to decline when macroeconomic instability set in after the August financial crisis. How can this time pattern of demonetization in the Russian economy be explained?

In this paper I look at the empirical validity of one of the most influential explanations of demonetization in Russia - the virtual economy argument.[2]The argument claims that by allowing to change the prices of the goods exchanged in a hidden way barter helps different groups in the economy to keep the illusion that the manufacturing sector is producing valuable output while in fact it is not. Based on a unique deal-specific data set of 165 barter deals in Ukraine in 1997 we have information on the price differential between the cash and barter prices for the individual goods exchanged in barter deals. Thus, we can put the virtual economy argument to an empirical test. We find that illusion is not what is driving the actual pricing behavior in barter deals. We then proceed to offer a stylized model of how the observed pricing behavior in barter deals can be explained. The model sees the non-cash economy as an institutional response to the lack of trust and liquidity in the Russian economy. We test the price predictions of the model with actual price data and find that the data do not reject the trust view of the non-cash economy.

Why does it matter whether the "illusion-view" or the "trust-view" is better able to describe the actual development in Russia? The two views differ with respect to their policy implications of how to remonetize the Russian economy. If the "illusion-view" is correct, the main source of the problem lies in the real sector of the economy and barter is a "bad" thing because it allows the manufacturing sector to avoid restructuring and thus to avoid to get rid of the distortions in the real sector. If the "trust-view" is the correct description, then the main source of the problem lies in the financial sector of the economy and barter is a "good" thing because it allows the real sector to finance production when the banking sector does not fulfill its role of intermediation to channel private savings to finance investment in the real sector. According to both views barter helps to maintain production. The "illusion view" sees barter to help maintain an inefficient output by pretending that it is valuable. The "trust view" sees barter to help maintain a valuable output by overcoming a financial and input shortage which otherwise would lead to the collapse of output.

In a final section the paper concludes by discussing how a model based on trust can explain the evolution of barter over time in Russia and by discussing what can be done to remonetize the Russian economy.

[2]See Gaddy and Ickes 1998, for the empirical validity of other explanations, see Marin, Kaufmann, and Gorochowskij 2000.

2 Some Stylized Facts

We conducted a survey among 55 enterprises in Ukraine in 1997 from three cities Kyiv (50 percent), Zaporioshje (30 percent), and Dnipropetrovsk (20 percent). From this survey we obtained deal-specific information on 165 barter deals. Each barter deal includes information on the selling firm and the buying firm and the type of goods exchanged. We distinguish the "sale" side of the barter deal and the "goods payment". Since the firms interviewed where very well informed about the firms they traded with we have firm level information for about 100 firms (depending on the respective information).

Table 1 identifies the type of firms involved in barter deals. The table illustrates that the non- cash economy is not an exclusive phenomenon of state owned enterprises. In 29.7 percent of the deals the selling firm is a state enterprise and in 20.6 percent a private firm. 4.2 percent of the sample consist of barter deals with workers. On the buying end of the barter transaction the picture looks similar. In 29.5 percent of the deals the buying firm is a state owned enterprise and in 25.2 percent of the deals a private firm.

Table 1 Ownership and the Non-Cash Economy

	selling firm in percent	buying firm in percent
domestic state or state controlled enterprise	29,70	29,45
domestic private firm	20,61	25,15
foreign firm	0,0	2,45
leaseholder/ cooperative	1,82	4,29
worker	4,24	0,0
the government	0,0	4,29
collective owned enterprise	33,94	29,45
GUS firm	4,24	4,29
joint-venture	5,45	0,61
total	100,00	100,00

Source: Survey of 165 barter deals in Ukraine in 1997

Table 2 looks at the sectoral pattern of these 165 barter deals. Two things appear from the table. First, there is not much difference in the sectoral pattern between the "sale" side of the barter transaction and the "goods payment" side. Second, barter dominates in food and beverages, in the basic sector, and in machinery and vehicles.

Table 2 Sectoral Pattern

	"sale" in percent	"goods payment" in percent
natural resources	28,48	30,30
textile & leather	7,88	5,45
wood & paper	2,42	4,24
machinery & vehicles	16,97	23,03
food & beverages	16,36	22,42
chemicals	13,33	9,09
services	14,55	0,61
others	0,0	4,85
total	100,00	100,00

Source: Survey of 165 barter deals in Ukraine in 1997

Table 3 gives the terms of trade effect of the non-cash economy. From our survey data we have information on the percentage price difference between the barter price and the cash price for each of the 165 barter deals of the sample. We have this information for both sides - the "sale" and the "goods payment" of each deal so that we can calculate the net terms of trade effect of barter. SCASH is the percentage price difference between the barter price and the cash price on the "sale" side of the barter deal. PCASH is the percentage difference between the barter price and the cash price on the "goods payment" of the barter deal. TOT measures the net terms of trade of barter and is calculated by TOT = SCASH - PCASH.[3] It appears from the table that on the "sale" side of the deal the prices charged in barter are inflated

[3]We obtained this information from the following question. "What is the percentage price difference between the price you charge/you are charged for this particular good in this barter deal as compared to the typical price you charge/you are charged for the same product in cash deals? "

by up to 50 % compared to cash deals. This happened in 23.3% of the cases while in 73.6 % of the deals there was no difference between the two prices charged. In 3.1% of the cases the firms involved discounted the price on the "sale" by up to 17%. In order to calculate who benefits from demonetization one has to look also at the pricing behavior on the "goods payment" side of the deal. Here it appears that in 25.9 percent of the cases the firms discounted the price for the barter good compared to what they typically charge in cash deals by as much as 50% . In 62.9% of the deals there was no discounting or inflating on the barter prices for the goods payment. In 11.1% of the deals the barter prices were inflated by as much as 200%. Because of these differences in the pricing behavior between barter and cash deals, the net terms of trade effect of barter appears to be quite substantial ranging between -200% and 50%. As a result the non-cash economy appears to lead to a substantial shift in the terms of trade compared to the cash-economy. In almost 45 percent of the deals barter shifts the terms of trade towards the "sale" side of the transaction. In those cases the "real" barter price of the "sale" is inflated by up to 50% compared to the cash price for the same goods.

What explains this shift in the terms of trade of the non-cash economy? Why does barter lead to an increase of the real price for the "sale"? Who benefits from this shift and who loses? In the next two sections we look at two possible explanations for this shift in the terms of trade.

Table 3 The Terms of Trade of the Non-Cash Economy

differential between barter and cash price[1)]			
"sale"		"goods payment"	
-17% - 0%	3,07	-50% - 0%	25,93
0%	73,62	0%	62,96
0% - 50%	23,31	0% - 200%	11,11
total	100,00	total	100,00

terms of trade	
-200% - 0%	10,49
0%	45,06
0% - 50%	44,44
total	100,00

Source: Survey of 165 barter deals in Ukraine in 1997
1) in percent of cash price

3 "Illusion" and the Non-Cash Economy

The virtual economy argument of Gaddy and Ickes (1998) rests on the assumption that the manufacturing sector does not produce valuable output and important groups in the economy (like the government and firms in different sectors) have an interest to pretend that this is not the case. According to this argument barter - a payment in goods or money surrogates rather than cash - is a way for these participants to keep the illusion of a value-creating manufacturing sector by allowing the latter sector to sell its output at a higher price than its market value and the value-adding natural resource sector to accept this overpricing out of lack of other opportunities. This way the manufacturing sector survives by drawing resources from the natural resource sector. According to the argument, keeping up the illusion of a value-adding manufacturing sector is highly costly for the Russian economy at large because this cross-subsidizing from the value-adding natural resource sector to the value-subtracting manufacturing sector prevents the manufacturing sector from moving into valuable activity. But if

the natural resource sector is producing valuable output, why has the sector nothing better to do than to subsidize the manufacturing sector? In fact, the natural resource sector is supposed to have significant bargaining power in the interaction with other sectors when it is producing goods which the market values highly. Why then does the sector end up subsidizing the rest of the economy? The argument does not make much economic sense. However, the argument appeals to experts of central planning and policy observers in transition economies, because the practice of cross-subsidizing across different activities in the economy was a widespread feature of central planning. Therefore, let us pretend for a moment that the virtual economy argument does make economic sense and let us see whether it is actually true.

We can answer this question from our survey data, since we have information on the percentage price difference between the barter and cash prices for each of the 165 barter deals in the sample. We have this information for both sides (the "sale" and the "goods payment") of each barter deal so that we can calculate to whose favor the terms of trade shifts in non-cash transactions. As Table 3 illustrates the terms of trade shifts quite substantially in non-cash transactions. Thus, the virtual economy argument has the potential of explaining some of the variation in the terms of trade of barter.

If the virtual economy argument is valid, we expect that the manufacturing sector (like textiles, leather, machinery, and vehicles) is overpricing its output in barter compared to cash deals for the same product and pays less than the market value for natural resources (like gas and electricity). Furthermore, we expect this pricing distortion to be more pronounced for less efficient sectors.

In order to test these hypotheses we have to distinguish whether the sector is on the buying or selling end of the barter transaction. The reason is that overpricing the "sale" will benefit the sector which is on the selling end of the barter transaction and hurt the sector which is on the buying end of the same transaction. Similarly, discounting the price for the "goods payment" will benefit the sector which is on the buying end and hurt the sector which is on the selling end. TOT measures the net terms of trade and is calculated by TOT = SCASH - PCASH. Thus, when the sector is on the selling end and TOT takes a positive value, barter benefits this sector by shifting the terms of trade in its favor. Similarly, when the sector is on the buying end and TOT takes a positive value, then barter hurts this sector by shifting the terms of trade in its disfavor.

We are now ready to put the virtual economy argument to an empirical test. Table 4 examines whether differences in the pricing behavior across sectors can be identified. The table aggregates the 165 barter deals into 8 sectors and looks at their pricing behavior in non-cash deals compared to cash deals. The table distinguishes whether the sector is on the selling or buying end of the transaction. From Table 4 it

appears that there is no systematic difference in the pricing behavior across sectors in non-cash transactions (the F-test of the Analysis of Variance (Anova) is not statistically significant at conventional levels). Take the example of machinery and vehicles. When this sector is on the selling end of the transaction, it overprices its output on average by 3.66 percent compared to cash deals and it is overpriced on the goods payment by 0.91 percent on average, so that the sector's net benefit from barter is 2.75 percent (in terms of its cash price).[4] So far so good. But the same appears to be true for the natural resource sector like electricity and gas. This sector's net benefit from barter is 4.12 percent (in terms of its cash price). What seems to matter here for the pricing behavior in non-cash transactions is not the sector, but whether the sector is on the selling or buying end of the transaction. Take again the example of machinery and vehicles. When this sector is on the buying end of the barter deal, it pays more for the "sale" by 3.46 percent on average and sells its "good payment" at a 5.06 percent discount compared to cash deals, so that the sector's net loss from barter is 8.52 percent on average. This net loss from non-cash transactions appears to be happening in all the other sectors as well except for electricity and gas, when the sector is a buyer rather than a seller. It appears then that the sectors gain from barter when they sell and they loose from barter when they buy. The only sector that seems to be gaining from barter independent from its buying or selling status appears to be the natural resource sector electricity and gas. This is just the opposite from what we would have expected if we believed in the virtual economy argument of Russia's non-cash economy.

[4]The average percent price differential between barter and cash appear to be low from table 4. These averages hide the actual variation in the price differentials, because in 45 percent of the deals the non-cash and cash prices were equal. For the distribution of the price differentials see Table 3.

Table 4 Pricing Behavior of Sectors

		selling sector			buying sector		
		scash[1]	pcash[2]	tot[3]	scash	pcash	tot
electricity & gas	mean	0,00	-4,12	4,12	3,78	7,42	-3,64
	std. dev.	0,00	8,52	8,52	8,80	45,06	42,11
	N	17	17	17	18	18	18
coke & petroleum	mean	5,48	1,45	4,03	1,13	-1,31	2,44
	std. dev.	14,45	10,28	8,37	5,50	6,54	6,57
	N	13	13	13	16	16	16
metal ores & other non-metallic minerals	mean	5,00	-1,29	6,29	2,50	0,58	1,92
	std. dev.	10,16	6,05	10,05	8,09	17,02	18,29
	N	17	17	17	18	18	18
food & beverages	mean	2,64	1,00	1,64	3,03	-2,47	5,51
	std. dev.	6,53	38,45	35,75	9,45	15,38	14,09
	N	27	27	27	36	36	36
textiles & leather	mean	1,86	0,26	1,61	5,21	-4,17	9,38
	std. dev.	8,46	6,86	9,99	7,11	7,93	9,66
	N	16	16	16	12	12	12
machinery & vehicles	mean	3,66	0,91	2,75	3,46	-5,06	8,52
	std. dev.	7,41	10,64	13,51	7,67	9,96	11,40
	N	28	28	28	30	30	30
chemicals	mean	6,08	-3,60	9,68	7,19	0,07	7,12
	std. dev.	9,49	12,50	11,18	9,47	12,01	8,59
	N	22	22	22	15	15	15
services	mean	2,83	-4,04	6,86	0,00	-10,00	10,00
	std. dev.	6,54	17,72	16,27	,	,	,
	N	23	23	23	1	1	1
total	mean	3,43	-1,16	4,59	3,52	-1,21	4,73
	std. dev.	8,30	18,63	18,07	8,26	19,66	18,86
	N	163	163	163	146	146	146
Anova	F-test	1,08	0,33	0,52	0,76	0,77	0,93
	sign. level	(0,382)	(0,937)	(0,817)	(0,619)	(0,614)	(0,489)

[1] difference between the barter price and the cash price in percent of the cash price in the "sale" side of the barter deal.
[2] difference between the barter price and the cash price in percent of the cash price in the "goods payment" of the barter deal.
[3] tot = scash - pcash

We now examine whether this result depends on the level of aggregation of sectors. In Table 5 we aggregate the sectors to a natural resource sector (including electricity and gas, coke and petroleum, metal ores and other non-metallic minerals) and to a manufacturing sector (including textiles, leather, machinery, vehicles, and chemicals). We construct a variable which we call virtual economy 1 which includes all deals in which the natural resource sector was on the selling end of the transaction and the manufacturing sector on the buying end. If the virtual economy argument is valid then we expect to see a discount on the "sale" price and a mark-up over the cash price on the "goods payment" leading to a net terms of trade shift in favor of the manufacturing sector. A look at Table 5 reveals that the opposite is the case. The natural resource sector lives at the expense of the manufacturing sector who suffers a loss in the terms of trade of 6.88 percent on average when the natural resource sector is the seller and manufacturing the buyer in the transaction. Can the manufacturing sector draw on the resources of the natural resource sector when he is selling to this sector rather than buying from it? This case is captured by the variable virtual economy 2 which includes all deals in which manufacturing is the seller and the natural resources sector the buyer in the transaction. The table reveals that in this case both sectors are overpricing their output in non-cash transactions compared to cash leading to a slight terms of trade gain for the manufacturing sector of 1.13 percent. Moreover, the constellation of the manufacturing sector as the seller and the natural resource sector as the buyer in barter has been taking place in 23 deals only out of a total of 165 deals. These numbers are much too small to plausibly explain the enormous shift towards non-cash transactions in Russia. Furthermore, the F-tests reject the hypothesis that there is any difference in the pricing behavior for both constellations.

We turn now to the second prediction of the virtual economy argument. The bottom part of Table 5 examines whether the price distortions between non-cash and cash deals are more pronounced for less efficient firms. If the virtual economy argument is valid we expect this to be the case, because firms with lower productivity will need to inflate their prices by more or get bigger discounts for the barter goods in order to pretend to produce value added. From the table it appears that there is no statistical significant relation between the price distortions and the efficiency of the firm. If at all, it appears to be the firms with productivity levels in the middle range who show the largest price differentials between non-cash and cash transactions.[5]

[5]Moreover, Marin, Kaufmann, Gorochowskij (2000) show that the firm's barter exposure does not increase for less efficient firms.

Table 5 Is Russia's Economy Virtual ?

% price differential on

	"sale" [1]		"goods payment" [2]		"terms of trade" [3]		
	mean	std. dev.	mean	std. dev.	mean	std. dev.	N
virtual economy 1							
seller: natural resources[4] buyer: manufacturing[5]	1,47	4,24	-5,41	9,24	6,88	9,30	17
other	3,66	8,63	-0,66	19,39	4,32	18,84	146
total	3,43	8,30	-1,16	18,63	4,59	18,07	163
Anova F-test		1,06		0,99		0,31	
sign. level		(0,306)		(0,321)		(0,581)	
virtual economy 2							
seller: manufacturing[5] buyer: natural resources[4]	1,43	5,85	0,30	12,91	1,13	14,20	23
other	3,76	8,61	-1,40	19,44	5,15	18,62	140
total	3,43	8,30	-1,16	18,63	4,59	18,07	163
Anova F-test		1,55		0,16		0,98	
sign. level		(0,215)		(0,686)		(0,324)	
firm's efficiency[6]							
low	3,13	7,78	-0,13	11,21	3,27	12,26	57
medium	2,76	7,07	-4,88	10,60	7,64	12,24	60
high	2,91	10,11	1,16	33,96	1,75	31,29	36
total	2,93	8,08	-1,69	19,03	4,62	18,58	153
Anova F-test		0,03		1,45		1,38	
sign. level		(0,969)		(0,239)		(0,255)	

[1] difference between the barter price and the cash price in percent of cash price in the "sale" side of the barter deal, denoted scash.

[2] difference between the barter price and the cash price in percent of cash price in the "goods payment" of the barter deal, denoted pcash.

[3] terms of trade = scash - pcash

[4] includes electricity & gas, coke & petroleum and metal ores & other non- metallic minerals.

[5] includes textiles & leather, mashinery & vehicles, and chemicals.

[6] output per employee. Low : 1,000 to 7,500 US$, medium: 7,100 to 15,000 US$, high: 15,100 to 140,000 US$.

In Table 6 we look at the distribution of the terms of trade of barter for two leading sectors: manufacturing and electricity & gas. The first three columns of the table give the pricing behavior of electricity & gas when the sector is on the selling end of the transaction. It can be seen from the table that the sector charges the same price as in cash deals when it sells electricity & gas and receives in more than 20 percent of the deals a discount of up to 50% for the goods he is paid with so that the terms of trade shifts in more than 20% of the deals in favor of the electricity & gas sector. The table shows no single case in which this sector has been subsidizing an other sector when doing a barter deal. The next three columns of the table look at the pricing behavior of electricity & gas when this sector is on the buying end of the transaction. In this case the sector buys in more than 16% of the deals an overpriced good from other sectors (the price is inflated by up to 50%) and gives a discount on electricity and gas of up to 50% when selling it to other sectors so that the sector ends up with a terms of trade loss of up to 50% in 33% of the deals. When this terms of trade loss of the electricity & gas sector is compared to the terms of trade loss of the manufacturing sector as a buyer (as can be seen in the last column of the same table) the latter sector has to suffer a loss in 53.6% of the deals (compared to 33% of electricity & gas).

To conclude, the virtual economy argument is virtual and has no basis in the data. Who benefits from the non-cash economy does not depend on the sector, as the argument claims, but is exclusively driven by the selling or buying status of firms. But why would the selling or buying status of firms determine in who's favor the terms of trade shifts in barter? Or to put it differently, why are frequently prices for the "sale" inflated and prices for the "goods payment" discounted in barter transactions? I turn to an answer to this question in the next section.[6]

[6]The fact that the terms of trade is shifting in 45% of the deals towards the "sale" side of the barter deal casts further doubts on the explanation that barter is driven by tax motives. As Table 3 shows it is only in 10.5% of the deals in which firms could potentially hide some of their profits lowering their tax base. This number corresponds roughly to the number of cases in which the interviewed firms gave taxes some importance for undertaking a barter deal, see Marin, Kaufmann, Gorochowskij (2000).

Table 6 Trading Sectors: Manufacturing vs. Gas & Electricity

% differential between barter and cash price

	seller gas & electricity			**buyer** gas & electricity		
	scash[2]	pcash[2]	tot[2]	scash	pcash	tot
< 0%	0,0	23,53	0,0	0,0	22,22	5,56
0%	100,00	76,47	76,47	83,33	72,22	61,11
> 0%	0,0	0,0	23,53	16,67	5,56	33,33
missing	0,0	0,0	0,0	0,0	0,0	0,0
total	100,00	100,00	100,00	100,00	100,00	100,00

	seller manufacturing[1]			**buyer** manufacturing[1]		
	scash	pcash	tot	scash	pcash	tot
< 0%	4,48	20,90	10,45	1,45	26,09	5,80
0%	62,69	68,66	40,30	66,67	63,77	39,13
> 0%	31,34	8,96	47,76	31,88	8,70	53,62
missing	1,49	1,49	1,49	0,0	1,45	1,45
total	100,00	100,00	100,00	100,00	100,00	100,00

Source: Survey of 165 barter deals in Ukraine in 1997

1) manufactoring: textiles & leather, wood & paper, machinery & vehicles, and chemicals

2) scash: % differential between barter and cash price on "sale"; pcash: % differential between barter and cash price on "goods payment"; tot: % differential on the terms of trade, tot = scash-pcash

4 "Trust" and the Non-Cash Economy

If the virtual economy argument has no empirical basis, how can we explain that the seller is overpricing the "sale" and the buyer is discounting the price for the "goods payment" in non-cash transactions? If hiding a valueless output is not the reason, what else motivates such pricing behavior? We turn now to a model for an answer.

4.1 A Stylized Model[7]

Consider a good which requires n steps of production to become a final good. Each production step is carried out by a different firm. After n steps of refinement the intermediate good becomes a final good. Each buyer along the chain can negotiate only with his supplier. This leads to n bargaining problems along the chain. At each of these steps we assume Nash bargaining with both parties equally sharing the joint surplus. The value of the surplus is denoted by $v > 0$. Intermediate goods are assumed to have zero value when sold outside the production chain.

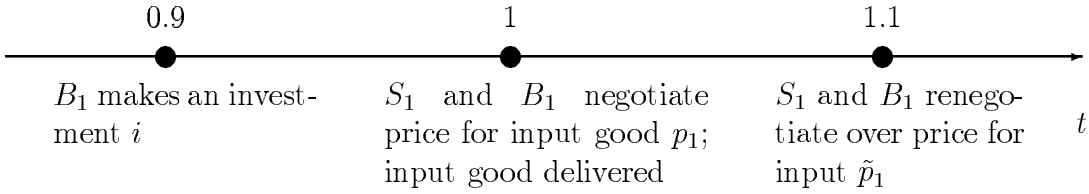
Lets looks at the first production chain in more detail. Consider a supplier of the original input good, S_1, and the buyer B_1. We assume that B_1 makes a relationship specific investment i at date 0.9. This investment can be thought of as the time and money B_1 spends in order to find an adequate supplier. At the time of this investment, the two firms are assumed not to be able to write a contract which commits S_1 to deliver the input good for a particular price in the future. Thus, B_1 must first invest and only then - when the investment costs are sunk- can bargain over the input price. This leads to a hold up problem in the bargaining of the price when the input good is actually delivered.

At date 1, the two parties can negotiate about the delivery of S_1's input good and about the price. v_1 denotes the value of the input good to B_1. We assume that B_1 cannot pay cash at the time of delivery of the input good because he is liquidity constraint. Thus, S_1 has to deliver the input good on a credit basis, if at all. B_1 will be able to pay when he is paid v_1 by the next firm in the production chain. We assume that enforcing credit repayment to be difficult in transition economies and thus S_1 has to incur some fixed cost x to enforce repayment of p_1. This cost could be thought of as the cost of using the courts and lawyers fees and potential bribes for judges or other public officials or the cost of private enforcement like the use of Mafia etc.

At date 1.1 after delivery of the input good B_1 can try to default on some of his payment. Let $\tilde{p}_1$ denote the price paid by B_1 at this date. Figure 2 summarizes the time sequence of the bargaining at production step 1.

[7]This section follows Marin and Schnitzer (2000).

Figure 2: Bargaining at the production step 1



Let us solve production step 1 recursively. Recall that at date 1, when S_1 delivers the input good, B_1 has no cash to pay for the input. Thus, once the input supplier delivers the input, the bargaining power reverses and shifts to B_1. Now the input supplier has to worry of being paid. At date 1.1, after realizing his profits from selling the input to the next firm, B_1 has enough cash to pay but if he does not do so voluntarily S_1 has to incur cost x to enforce payment of p_1. Suppose B_1 holds up now the input supplier and refuses to pay the full price p_1 on which the two parties agreed at date 1, but offers to pay $\tilde{p}_1 = p_1 - x$ instead. If this happens, S_1 can either accept this payment or enforce p_1 at cost x. In equilibrium he will accept B_1's reduced payment.

At date 1, the two parties have to agree on a price p_1. Since B_1's investment i is already sunk at this date, it is not taken into account in the bargaining over the input price. Thus, B_1 might not invest in finding a supplier relationship because these costs are not covered by the price. This is what constitutes the hold up problem of buyer B_1. However, the two parties anticipate at date 1 that B_1 will exploit his position after delivery of the input good and pay a reduced price at date 1.1. Assuming Nash bargaining whenever possible this implies that a price p_1 is chosen such that

$$v_1 - (p_1 - x) = p_1 - x \leftrightarrow p_1 = \frac{v_1}{2} + x \tag{1}$$

i.e., in anticipation of B_1's future price reduction, S_1 marks up p_1 in the first place, if this is possible.

However, inflating the input price in anticipation of the price reduction at date 1.1 will not always be possible. B_1's liquidity constraint - the cash he gets when he himself sells the good to the next buyer, i.e. v_1 - puts an upper bound on the maximum payment that can be enforced at cost x. Thus, in order to fully capture the subsequent price reduction S_1 may want to inflate the price by more than can credibly be enforced as payment at date 1.1, since even at cost x, B_1 cannot be forced to pay more than he has in his pockets at date 1.1. Thus,

$$p_1 = \min(\frac{v_1}{2} + x; v_1) \tag{2}$$

If x is sufficiently large, i.e. $x > v_1/2$, B_1's liquidity constraint becomes binding which will make it impossible for S_1 to pass on these costs to him. B_1's cash from the sale to the next firm will simply not be enough to fully cover these costs. In this case, B_1 can exploit the fact that he is liquidity constrained to prevent to be held up by the input supplier. This will, however, only work when enforcement costs x are just right. When x is low, i.e. $x < v_1/2$, then S_1 is able to pass on x in the price mark-up. In this case, the buyer's liquidity constraint does not prevent an equal sharing of the surplus. When x becomes too large, i.e. $x > v_1$, then B_1 captures the entire surplus and S_1 cannot guarantee himself a positive payoff. Thus, in order for the liquidity constraint to alleviate B_1's hold-up problem we have

$$\frac{v_1}{2} < i \leq x < v_1 \tag{3}$$

Without a liquidity constraint and enforcement costs, B_1's payoff would be $v_1/2$, i.e. half the value of production at the first production step, and if $i > v_1/2$ then no production would take place at all, because the surplus does not cover B_1's investment costs i. However, if enforcement costs are sufficiently high, B_1 can exploit this fact to capture more than one half of the production value. Thus, B_1's ex-post bargaining power has to be sufficiently large to cover his ex-ante investment, i.e. $i \leq x$ in order for production to take place. Since S_1 needs a positive profit in order to participate in the deal, enforcement costs may not be too high either; i.e. $x < v_1$.

We have just seen that S_1 may not be willing to deliver the input good if the credit problem is too severe, i.e. if $x > v_1$. Thus, if the buyer has no cash and the legal system to enforce payment is poorly developed a potentially valuable transaction does not take place. Can barter - a trade credit in goods rather than cash - help under these circumstances?

Suppose B_1 can produce one unit of a barter good, but only after date 1. Let w denote the value of the barter good and let k denote B_1's production cost. If B_1 sells this barter good to someone outside the production chain he does so at a cash price $p^c = (w + k)/2$, assuming again Nash bargaining. This would give B_1 a payoff of $(w - k)/2$. However, B_1 can also use this barter good as a collateral to improve his creditworthiness. In this case, B_1 promises to deliver the barter good to S_1 when credit repayment is due. The price for this barter good, p^B, is fixed together with p_1 before S_1 decides about his input delivery. The two parties negotiate prices p_1 and p^B such that they split the surplus of both transactions equally, taking into account the renegotiation on p_1 at date 1.1. This means that the inclusion of the barter trade allows B_1 to shift some profit back to S_1 by discounting the price of the barter good p^B. Note, however, that p^B cannot be chosen arbitrarily small because B_1 cannot be forced to deliver the barter good as promised, but has to be induced to do so voluntarily. If B_1 cheats on S_1 and refuses to deliver, all S_1 can do, given that B_1 has signed a contract that promises delivery of the barter good, is to try to prevent

a sale of the barter good to someone else. We assume that S_1 suceeds with such an attempt with probability $(1-\pi)$ which reduces B_1's potential payoff from selling the barter good to $\pi(w-k)/2$, where $\pi < 1$. This effectively means that barter creates a hostage of a given size z, where

$$z = (1-\pi)\frac{(w-k)}{2} \tag{4}$$

Note first, that the size of the hostage z created by barter depends on two things. First, the value of the hostage increases with the value of the good offered as a means of payment in barter. This is given by the payoff $(w-k)/2$ when the good is sold independently of barter. Second, the value of the hostage declines with B_1's cheating payoff when he defaults on payment which is expressed by $\pi(w-k)/2$. The difference between these two payoffs is determined by the parameter π and captures the commitment value which B_1 achieves by agreeing to repay the trade credit in goods rather than cash. By doing so, B_1 reduces his chances to sell the barter good to someone else than S_1. $(1-\pi)$ is the probability of being caught when B_1 cheats on repayment and sells the barter good to someone else than S_1. The parameter π can be thought of as a measure of how well the input seller can label the barter good as his property. The smaller π, the less "anonymous" the means of payment and the smaller B_1's cheating surplus from defaulting on payment. Thus, the smaller π, the larger the commitment value of barter and the larger the hostage z. B_1 uses the barter contract as a commitment not to exploit his bargaining power and to shift some profit back to S_1 in order to make him participate in the deal when his profit from the input transaction is too low due to large credit enforcement cost x. In this sense, barter creates a deal-specific collateral that helps to alleviate the hold-up problem when credit enforcement is prohibitively costly.

What does the model imply for the pricing behavior in barter transactions? We need to evaluate how the hold-up problem and the credit problem just described will be reflected in the terms of the barter contract. We have just argued that the hold-up problem in the input deal can be alleviated if the input buyer faces a credit constraint and barter is used if credit enforcement becomes too costly for the input seller. Thus, we expect this problems to be reflected in the prices chosen in non-cash transactions as compared to prices in cash deals where no such problems are present.

Recall from equation (2) that the price for the input good in barter is

$$p_1 = \min(\frac{v_1}{2} + x; v_1) \tag{5}$$

Compare this price with the cash price for the same input with no such problems. Without the hold-up problem the price for the input will reflect the fact that B_1 has undertaken an investment, because in this case the investment cost i can be

contracted on before B_1's investment takes place. Furthermore, the input price will not reflect the credit enforcement cost x, because in this case B_1 has no liquidity constraint and thus there are no enforcement costs x. Splitting the surplus implies a cash price p_1^c

$$p_1^c = \frac{(v_1 - i)}{2} \tag{6}$$

Comparing (5) and (6) shows that within barter the price for the "sale" side of the deal will be inflated compared to the cash price for the same input, because the cash price will take into account B_1's investment cost i (because there is no hold up problem) and will not include a mark-up for the credit enforcement cost x (because there is no credit problem).

If p_1 cannot be increased anymore because it reaches its upper bound v_1, then we expect the price for the "goods payment" to be discounted. When the liquidity constraint is binding and thus S_1 cannot inflate the price for the "sale", barter allows B_1 to shift some of the profit back to S_1 by giving a discount on the "goods payment". Thus, we expect that the hold-up problem and the credit problem both shift the terms of trade in favor of the input supplier, either by an increase of p_1 as compared to p_1^c or when this is not possible by a decrease of p^B as compared to the cash price for the barter good or both.

Table 7 **TERMS OF TRADE OF NON-CASH TRANSACTIONS**

	scash					pcash					tot				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
scomplex	0,206	0,196	0,201	0,196	0,201	-0,110	-0,081	-0,107	-0,081	-0,108	0,316	0,277	0,308	0,277	0,308
	(0,020)	(0,031)	(0,026)	(0,032)	(0,027)	(0,160)	(0,282)	(0,181)	(0,284)	(0,183)	(0,004)	(0,010)	(0,006)	(0,011)	(0,006)
parrears	0,004	0,004	0,003	0,005	0,003	-0,024	-0,026	-0,024	-0,025	-0,024	0,028	0,030	0,027	0,030	0,027
	(0,599)	(0,548)	(0,689)	(0,476)	(0,691)	(0,000)	(0,000)	(0,001)	(0,000)	(0,001)	(0,002)	(0,001)	(0,004)	(0,001)	(0,004)
sresources		-1,432		-0,749			2,097		2,842			-3,529		-3,591	
		(0,523)		(0,769)			(0,271)		(0,189)			(0,186)		(0,237)	
smanuf		-0,697		-0,744			6,248		6,196			-6,944		-6,940	
		(0,792)		(0,779)			(0,007)		(0,007)			(0,029)		(0,031)	
presources			-1,155		-0,542			-0,387		-0,997			-0,769		0,455
			(0,644)		(0,845)			(0,864)		(0,689)			(0,802)		(0,893)
pmanuf			0,273		0,273			-0,502		-0,502			0,775		0,775
			(0,901)		(0,902)			(0,800)		(0,801)			(0,774)		(0,774)
virtual 1				-1,553					-1,696					0,142	
				(0,566)					(0,458)					(0,965)	
virtual 2					-2,299					2,288					-4,587
					(0,597)					(0,559)					(0,389)
R^2adj.	0,058	0,034	0,033	0,023	0,021	0,185	0,259	0,159	0,254	0,149	0,210	0,246	0,187	0,234	0,184
N	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64

source : survey of 165 barter deals in Ukraine in 1997.
p-values in paranthesis.

4.2 Empirical Evidence

We are now ready to put the model to an empirical test to see whether the incentive problems just described can indeed explain some of the observed pricing behavior in non-cash transactions.

For the regression analysis we will use SCASH, PCASH, and TOT as the indepentent variables. Recall that TOT is defined as the difference of SCASH and PCASH, where SCASH and PCASH are the percentage differences between the barter price and the cash price for the input good (the "sale") and the barter good (the "goods payment"), respectively. First, we have to find proxies for the incentive problems described in the previous section. We measure the severety of the hold up problem on the input good by the complexity index suggested by Blanchard and Kremer 1997. We construct a deal-specific complexity measure for the input good SCOMPLEX. SCOMPLEX is an index that takes the value of zero if the "sale" is produced with one input only and approaches one when the "sale" good uses several inputs from other sectors. The number of inputs required for the "sale" good to be produced stands here for the number of bargaining problems B_1 faces. We matched the ISIC sectors of the "sale" good with the sector of the complexity index given by Blanchard and Kremer 1997. We use as a measure for the credit problem (a measure for x) the input buyer's B_1 outstanding firm arrears PARREARS. The idea is that the more B_1 is indebted already the less likely it is that he will repay the trade credit and thus the lower his creditworthyness.

Table 7 shows the regressions explaining SCASH, PCASH, and TOT with these two incentive problems. The more complex the "sale" good the more severe is the hold-up problem in the input deal and thus the larger the barter price p_1 relative to the cash price p_1^c. Thus, we expect a positive sign on the complexity variable SCOMPLEX in the SCASH regressions (given in columns 1 - 5 of the table).[8] We have no prediction for SCOMPLEX in the PCASH regressions (given in columns 6 - 10 of the table). Because of the positive effect of SCOMPLEX on SCASH we expect also a positive sign for SCOMPLEX in the TOT regressions (given in columns 11 - 15). This is supported by the results of the table. The input specific complexity measure is positive and significant in all the SCASH and TOT regressions. Thus, the "real" prices for the "sale" appears to be inflated because of the presence of a hold-up problem in the input deal.

Turning to the credit problem we expect PARREARS to have a positive effect on SCASH, since S_1 will inflate the barter price for the input p_1 relative to the cash price p_1^c to cover the anticipated credit enforcement costs x. Furthermore, we expect a

[8]Note that the estimated coefficient on the complexity index can be used to test whether the hold up problem is on the buyer's or on the seller's side. A positive coefficient indicates that the buyer is held up by the seller rather than the other way around.

negative sign for the PARREARS variable in the regressions for PCASH, since barter is undertaken to shift some of the profit back to the supplier by discounting the price for the barter good. Because of these effects on barter prices on both sides of the transaction, we expect PARREARS to have a positive effect on TOT. Turning to the results, we see that PARREARS is insignificant in the SCASH regressions which suggests that the supplier is not able to pass on the credit enforcement costs to the buyer. PARREARS turns out to be highly significant and negative in the PCASH regressions. These results for the PARREARS variable in the SCASH and PCASH regressions support the story given by the model of the previous section. Barter is needed to save the deal exactly when the supplier is unable to pass on the enforcement costs to the buyer and as a result does not expect to have a positive profit from the transaction. Discounting the price for the barter good is then a way to make the deal go through by shifting back part of the profit to the supplier. This explains why the prices for the "goods payment" are predominantly discounted compared to cash prices for the same goods.

Finally, we include several sectoral dummies (smanuf, pmanuf, sresources, presources, virtual1 virtual2) to test whether those have any explanatory power for the pricing behavior in non-cash transactions. None of these variables are significant at conventional levels except for the variable SMANUF in the PCASH and TOT regressions. The positive and significant sign of the estimated coefficient for SMANUF in the PCASH regressions and its negative and significant effect in the TOT regressions suggests, however, that the manufacturing sector suffers losses in the terms of trade by being overpriced on the "goods payment" even when the sector is a seller in barter transactions. Thus, the manufacturing sector is the only sector that appears to never gain from non-cash transactions. This is just the opposite of what the virtual economy argument suggests. Note that this finding of the regression analysis is somewhat not consistent with the results in Table 4 of section 3 in which the manufacturing sector as a seller gains from barter. A closer look at Table 4 reveals, however, that the manufacturing sector like textiles, leather, machinery, vehicles is gaining the least as a seller in barter transactions compared to the rest of the economy. For example, the sectors textiles and leather are gaining 1.6 percent on average as a seller compared to a gain of 6.3 percent of metal ores and of 4.6 percent when all selling sectors are aggregated (given in the bottom of Table 4). These averages hide the distribution of the mark-ups on the "sale" which the regression analysis takes into account. This is the reason why Table 4 gives a small gain for manufacturing as a selling sector while the regression analysis indicates a loss from barter for this case.

5 Conclusion

In this paper I explore an influential explanation for Russia's non-cash economy, the virtual economy argument, based on deal-specific price data of 165 barter deals in

Ukraine. I find that the argument is not consistent with the actual pricing behavior in barter deals. First, there appears to be no statistically significant difference in the pricing behavior across sectors. Second, the only sector which appears to suffer a loss from the non-cash economy is the manufacturing sector.

I then proceed to offer a model based on the lack of trust and liquidity. The pricing predictions from this model are then put to an empirical test. It turns out that real prices on the "sale" side of the barter transaction are inflated, because they reflect a trust problem and a credit problem between input suppliers and producing firms. Input suppliers are exploiting the fact that there are only a few suppliers around and thus switching suppliers is costly and charge higher prices for their inputs in barter deals compared to cash deals (this is how the trust problem materializes). If this price mark-up for inputs would happen in cash deals firms would refuse to buy those expensive inputs and prefer not to produce. Furthermore, input suppliers have to incur costs of enforcing payment (they have to involve the Mafia or legal firms) which they want to be covered by the deal. If these credit enforcement costs become very large (which happens when legal institutions do not work properly or when firms are already very indebted) then input suppliers will refuse to deliver the inputs in cash deals because they cannot expect a positive profit . Thus, in a cash economy the lack of trust and liquidity prevent many profitable trades from taking place.

In a non-cash economy the deal can go through by choosing the "right" prices for the "sale" and the "goods payment", because of two reasons. First, by introducing a second profitable transaction in the form of the "goods payment" the producing firm can buy an inflated input and still make a profit.[9] Second, the input supplying firm gets a discount on the barter good which allows her to cover the credit enforcement cost. Thus, the non-cash economy helps to maintain output which otherwise would collapse due to imperfect input and credit markets. The imperfections of input and credit markets are reflected in a shift in the terms of trade of barter. Through the inflated price for the "sale" and the price discount on the "goods payment" the deal is actually saved by guarantying both parties a positive profit. The shift in the terms of trade is the mechanism by which the non-cash economy accomplishes to maintain ouput which otherwise would collapse in a cash economy.

How can this story explain the time pattern of demonetization in Russia given in Figure 1? In 1992 firms have accumulated substantial debt among each other due to a refusal of the banking sector to provide credit. Firms turned to other firms for trade credits when bank credit was not available. Accumulated arrears reached a critical level in 1995 at which production was unsustainable due to prohibitively large credit enforcement costs. At this point firms refused to extend further trade credit (in cash)

[9]The model actually predicts that in equilibrium the hold up problem is "solved" and thus input prices will not be inflated. A look at Table 3 reveals that in 73.6 % of the deals this was actually the case.

to each other out of the worry of not being paid. Barter then stepped in as the only way to maintain production. At this point barter started to substitute for the non active banking sector as well as for trade credits in cash which explains the explosive increase. Why then has barter started to decline with the financial crisis in 1998? Since the August crisis in 1998 the value of the rubel depreciated by more than 50 percent. This made Russian exports relatively inexpensive in international markets which led to an export boom and earned Russian firms some cash in these markets. The exchange rate induced creation of liquidity loosened some of the financial squeeze enabling firms to finance some of their inputs with internal cash flow.[10]

Given this story of the role of barter in the FSU what follows for policy? One obvious candidate is a monetary expansion to overcome the liquidity shortage in the economy. As I have argued in Marin (2000) a monetary expansion might make things worse. In a non-cash economy expansionary monetary policy can easily have perverse effects. The reason is that reducing firm debt by fusing liquidity into the economy will eliminate input buyer's bargaining power thereby robing the instrument to deal with the trust problem between input suppliers and producing firms. In order to remonetize the economies of the former Soviet Union we suggest to introduce a German-type banking system.[11]

[10] see Ahrend, Aukutsionek, and Parilova (2000) and OECD (2000) who make a similar point.

[11] For the argument see Huang, Marin, Xu (2000). The reason why a monetary expansion will not work is similar to the argument by Murphy, Shleifer, and Vishny (1992) why partial reform might make things worse in an overall distorted economy.

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